

Samsung Wireless Enterprise Access Point Controllers (APC) WEC8500 & WEC8050 Operation Manual



Disclaimer

Every effort has been made to eliminate errors and ambiguities in the information contained in this document. Any questions concerning information presented here should be directed to SAMSUNG ELECTRONICS AMERICA, 1301 E. Lookout Dr., Richardson, TX. 75082 telephone (972) 889-6700. SAMSUNG ELECTRONICS AMERICA disclaims all liabilities for damages arising from the erroneous interpretation or use of information presented in this manual

Publication Information

SAMSUNG ELECTRONICS AMERICA reserves the right without prior notice to revise information in this publication for any reason. SAMSUNG ELECTRONICS AMERICA also reserves the right without prior notice to make changes in design or components of equipment as engineering and manufacturing may warrant

Copyright 2015

Samsung Electronics America.

All rights reserved. No part of this manual may be reproduced in any form or by any means-graphic, electronic or mechanical, including recording, taping, photocopying or information retrieval systems – without express written permission of the publisher of this material.

Trademarks

Product names mentioned in this manual may be trademarks and/or registered trademarks of their respective companies.

INTRODUCTION

Purpose

This manual describes the overview, management, and setup of Samsung Wireless Enterprise Access Point Controllers (APC) models WEC8500 & WEC8050.

This manual is written for WEC8500 version 3.1.8R, WEC8050 version 3.1.8R.

Document Content and Organization

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

CHAPTER 1. Access Point Controller System Overview

This chapter describes the main functions, network configuration, external configuration and service scenario of APC.

CHAPTER 2. Basic System Configuration

This chapter describes how to configure using Command Line Interface (CLI) and Web UI.

CHAPTER 3. Data Network Function

This chapter describes how to set up the data network such as interface, Virtual Local Area Network (VLAN), L3, or Quality of Service (QoS), etc. of APC.

CHAPTER 4. AP Connection Management

This chapter describes the connection management function of APC and Samsung Wireless Local Area Network (WLAN) Access Point (AP).

CHAPTER 5. WLAN Management

This chapter describes how to set up the Wireless Local Area Network (WLAN) of APC.

CHAPTER 6. Wi-Fi Configuration

This chapter describes how to configure the APC, QoS, and country code.

CHAPTER 7. WLAN Additional Service

This chapter describes how to set up additional WLAN services available in the APC.

CHAPTER 8. Security

This chapter describes how to set up security related setting such as the Remote Authentication Dial-In User Service (RADIUS) server available in the APC, unauthorized AP detection and blocking functions, guest access, WEB pass-through, Network Address Translation (NAT), firewall functions, etc.

CHAPTER 9. IP Application

This chapter describes the Internet Protocol (IP) application functions available in the APC such as Domain Naming Service (DNS), Network Time Protocol (NTP), File Transfer Protocol (FTP)/sFTP, and Telnet/SSH.

CHAPTER 10. System Management

This chapter describes the various system management functions available in the APC.

ANNEX A. CLI Command Structure

Command structure available in the CLI of APC.

ANNEX B. Open Source Announcement (WEC8500/WEC8050)

Open source list used in the APC and its license notices.

ANNEX C. Open Source Announcement (WEA300/WEA400 Series)

Open source list used in the Samsung Wireless Enterprise WLAN 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

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
7.1	07. 2015	Updated for North America to support software v3.1.8R
7.0	03. 2015	<ul style="list-style-type: none"> - Updated the content overall in the accordance with the software package version 3.0.0 1.4, 2.2, 3.1, 3.9, 3.10, 4.1, 4.2, 5.1, 5.3 6.1, 6.2, 6.4, 7.3, 7.5, 7.9, 7.10, 7.12, 7.16 8.1, 8.2, 8.3, 8.7, 8.8, 9.1, 10.10, 10.12 Annex A CLI Command structure Annex B Open Source Announcement (WEC8500/WEC8050) Annex B Open Source Announcement (WEA300/WEA400)
6.0	12. 2014	Updated the content overall in accordance with the package version 2.4.0
5.2	02. 2015	Updated for US Market to support software V2.4.19R
5.1	08. 2014	Updated for US Market
5.0	05. 2014	Updated the content overall in accordance with the package version 2.0.0
4.0	01. 2014	<ul style="list-style-type: none"> - Changed contents • 1.3.1 WEC8500 Configuration and Functions • 4.2.6.3 Tech Support Information
3.0	10. 2013	<ul style="list-style-type: none"> - Updated the content overall in accordance with the package version (WEC8500 version 1.4.4, WEC8050 version 1.0.0) - Added contents for WEC8050
2.0	06. 2013	<ul style="list-style-type: none"> - 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

TABLE OF CONTENTS

INTRODUCTION	3
Purpose	3
Document Content and Organization	3
Conventions.....	5
Console Screen Output	5
Revision History.....	6
 CHAPTER 1. Access Point Controller System Overview	 22
1.1 APC Overview	22
1.2 Network Configuration	24
1.3 APC Configuration and Functions	27
1.3.1 WEC8500 Configuration and Functions.....	27
1.3.2 WEC8050 Configuration and Functions.....	31
1.4 APC Application Configuration and Service Scenario	33
1.4.1 Basic Configuration	33
1.4.2 Configuration of Multiple APC for Redundancy.....	34
1.4.3 Clustering Configuration using Multiple APC (WEC8500)	35
1.4.4 Configuration of Multiple Sites Consisting of Headquarters and Branches.....	38
1.5 NAT Configuration between AP and APC	40
 CHAPTER 2. Basic System Configuration	 41
2.1 Basic System Configuration	41
2.1.1 CLI Connection.....	41
2.1.2 Managing Operator Accounts	42
2.1.3 APC Management Port Configuration	43
2.1.4 SNMP Community Configuration	43
2.1.5 CLI Basic Usage.....	43
2.2 Using Web UI	46
2.2.1 Web UI Connection.....	46
2.2.2 WEC Main Window.....	47
2.2.3 Managing Operator Accounts	48

2.3	Initial Setup Wizard	49
2.3.1	Overview	49
2.3.2	Connecting	49
2.3.3	How to Use	50
CHAPTER 3.	Data Network Function	53
3.1	Port Configuration	53
3.1.1	Port management	53
3.2	Interface Configuration	57
3.2.1	Interface management	57
3.2.2	Managing Interface Groups	60
3.3	VLAN Configuration	62
3.3.1	VLAN	62
3.3.2	Bridge	64
3.3.3	Spanning Tree	67
3.4	Layer 3 Protocol Configuration	71
3.4.1	IP Address Configuration	71
3.4.2	Static Routing Configuration	71
3.4.3	IP Multicast Routing Configuration	72
3.4.4	PIM Configuration	73
3.4.5	OSPF Configuration	73
3.4.6	VRRP Configuration	111
3.4.7	Configuring IPWATCHD	114
3.5	QoS	115
3.5.1	ACL Configuration	115
3.5.2	Class-map Configuration	119
3.5.3	Policy-map Configuration	120
3.5.4	Service Policy Configuration	121
3.5.5	Time Profile	122
3.5.6	OS-AWARE	125
3.6	Multicast to Unicast	128
3.7	IP Multicast Configuration	128
3.7.1	IP Multicast Routing Configuration	128
3.7.2	PIM Configuration	128
3.8	IGMP Snooping	131
3.9	Deep Packet Inspection	134
3.9.1	Configuring Profile and Application Rule	134
3.9.2	Configuring Application Group	136

3.9.3	Checking Statistics by Category	137
3.10	mDNS Snooping	145
CHAPTER 4. AP Connection Management		148
4.1	APC Management	148
4.1.1	Managing APC List	148
4.1.2	Management Interface Configuration	150
4.1.3	CAPWAP Configuration	151
4.1.4	AP Registration (Auto Discovery) Configuration	153
4.1.5	Managing AP File Transmission	154
4.1.6	APC Redundancy Configuration	154
4.2	AP Management	160
4.2.1	AP Group Configuration	160
4.2.2	Configuring Remote AP Group	181
4.2.3	AP Time Synchronization per Group	187
4.2.4	AP Configuration	189
4.2.5	Information Management	201
4.2.6	Outdoor AP Configuration	204
4.2.7	AP Package Upgrade	205
4.2.8	Remote AP Package Upgrade	210
CHAPTER 5. WLAN Management		219
5.1	WLAN Configuration	219
5.1.1	Basic WLAN Configuration	219
5.1.2	WLAN Additional Configuration	222
5.1.3	WLAN-based ACL Configuration	224
5.1.4	Managing Root Services	225
5.1.5	MCS Configuration Management by WLAN	229
5.2	Local Switching	232
5.3	Security and Authentication	235
5.3.1	Initialization of WLAN Security Function	235
5.3.2	WPA/WPA2 PSK Configuration	237
5.3.3	WPA/WPA2 802.1x Configuration	240
5.3.4	Static WEP Configuration	244
5.3.5	Dynamic WEP Configuration	246
5.4	DHCP Configuration	249
5.4.1	DHCP Server	249
5.4.2	DHCP Relay	257

5.4.3	DHCP Proxy	258
5.4.4	Option 82 Configuration	259
5.4.5	Primary/Secondary Server Configuration	261
5.5	Radio Service Configuration	264
CHAPTER 6.	Wi-Fi Configuration	266
6.1	802.11a/b/g/n/ac Radio Property	266
6.1.1	802.11a/b/g Configuration	266
6.1.2	802.11n Configuration	272
6.1.3	802.11ac Configuration	274
6.2	Wi-Fi QoS Configuration	277
6.2.1	QoS Configuration of Wireless Terminal	277
6.2.2	QoS Configuration of AP	279
6.2.3	Configuring QoS Profile of a Specific Terminal	282
6.2.4	Voice Optimization Configuration	284
6.3	802.11h Configuration	286
6.4	Country Code	288
CHAPTER 7.	WLAN Additional Services	292
7.1	Managing Wireless Terminal	292
7.1.1	Information Retrieval Functions	292
7.1.2	Connection History Configuration	293
7.2	Handover Management	294
7.2.1	Connection History Information	294
7.2.2	AirMove Configuration	294
7.2.3	Inter APC Handover Configuration	296
7.3	Call Admission Control (CAC) Configuration	297
7.3.1	SIP ALG Configuration	297
7.3.2	Voice CAC Configuration	299
7.3.3	Video CAC Configuration	301
7.4	Radio Resource Management (RRM)	304
7.4.1	RRM Configuration	304
7.4.2	DPC Configuration	305
7.4.3	DCS Configuration	307
7.4.4	CHDC Configuration	309
7.4.5	Sleeping Cell Detection	313
7.4.6	Energy Saving Groups	316
7.4.7	Energy Saving Auto Classification	317

7.5	Location Tracking	320
7.5.1	Configure Location Tracking	320
7.5.2	Configure Location Tracking Scan	320
7.5.3	Configure Location Tracking Scan	321
7.6	Spectrum Analysis	322
7.6.1	Retrieving Spectrum Analysis Data	322
7.6.2	Spectrum Analysis Configuration	325
7.6.3	Interference Type Configuration	327
7.7	Controlling Usage per User	328
7.8	Remote Packet Capture	330
7.9	Clustering	332
7.10	Limiting the Number of Connected Users	336
7.10.1	Limiting Connections per Radio	336
7.10.2	Connection Limitation per WLAN	338
7.11	Voice Statistics and Communication Failure Detection	340
7.11.1	Voice Statistics Function	340
7.11.2	Detecting WLAN-based Communication Failure	342
7.12	Voice Signal and Media Monitoring	343
7.12.1	Checking Voice Related Wireless Information	343
7.12.2	Checking Voice Related Quality Information	351
7.13	Multicast Stream Admission Control	354
7.13.1	Configuring Admission Control	354
7.14	Wi-Fi Band Steering	357
7.14.1	Activating Band Steering Function	357
7.15	Wi-Fi Load Balancing	360
7.15.1	Activating Load Balancing Function	360
7.16	Station-based Adaptive Load Balancing	362
7.16.1	Basic Setting of Station-based Adaptive Load Balancing	362
7.16.2	Setting AP Group Parameter	363
7.16.3	Setting AP Parameters	365
CHAPTER 8.	Security	367
8.1	RADIUS Server Configuration	367
8.1.1	External RADIUS Server	367
8.1.2	Internal RADIUS Server	373
8.2	Unauthorized AP/Terminal Detection and Blocking	377
8.2.1	Enabling Detection Function	377

8.2.2	Detection	378
8.2.3	Enabling Blocking Function	398
8.2.4	Blocking.....	398
8.3	Captive Portal	402
8.3.1	Configuring Web Authentication User.....	402
8.3.2	Configuring Pre-Auth ACL.....	404
8.3.3	Configuring Web Authentication	406
8.3.4	Configuring Web Authentication on MAC Authentication Failure	409
8.3.5	Configuring Web Pass-through	411
8.3.6	Configuring One Time Redirection	413
8.3.7	Redirection Address Format.....	415
8.3.8	Captive Portal Web Page Configuration.....	415
8.3.9	Captive Portal Web Service Configuration	416
8.3.10	Captive Portal Authentication Cache List	416
8.4	NAT and Firewall Configuration	417
8.4.1	Firewall Configuration.....	417
8.4.2	Access List Configuration.....	418
8.4.3	NAT Configuration	419
8.5	MAC Filter	423
8.6	Operator Authentication through Interoperation with TACACS+ Server	427
8.6.1	Configuring External TACACS+ Server	427
8.6.2	Configuring Authentication Type of Operator Account.....	430
8.7	Role Based Access Control.....	431
8.7.1	Configuring Role Profile	431
8.7.2	Configuring Derivation Profile.....	432
8.7.3	Configuring ACL Profile	436
8.7.4	Configuration Synchronization (Remote AP Group)	440
8.8	External BYOD Server.....	443
8.8.1	Configuring External BYOD Server	443
8.8.2	Captive Portal Configuration	445
CHAPTER 9.	IP Application	447
9.1	DNS	447
9.1.1	DNS Client Configuration	447
9.1.2	DNS Proxy Configuration	448
9.2	NTP	450
9.3	FTP/sFTP.....	453

9.4	Telnet/SSH	456
9.5	Utilities.....	458
CHAPTER 10.	System Management	459
10.1	SNMP Configuration	459
10.1.1	SNMP Community	459
10.1.2	SNMP Trap	460
10.2	System Management	462
10.2.1	Retrieving System Information.....	462
10.2.2	System Reboot.....	467
10.3	System Resource Management.....	469
10.3.1	Retrieving System Status.....	469
10.3.2	Retrieving and Configuring Threshold	472
10.4	Managing Alarm and Event.....	474
10.4.1	Retrieving Current Alarm	475
10.4.2	Retrieving History	476
10.4.3	External Transmission Configuration	478
10.4.4	Alarm Filter and Level Configuration	478
10.5	Managing Traffic Performance	480
10.5.1	Managing History Information.....	480
10.5.2	Managing Real-time Information Collection	481
10.6	Managing License Key	482
10.6.1	Managing SLM License (Activation) Key	482
10.6.2	Managing Old License Key.....	485
10.7	Syslog Configuration.....	488
10.8	Upgrade	490
10.8.1	Checking Package Version.....	490
10.8.2	System Upgrade.....	490
10.9	Configuration Management	493
10.10	Configuration Synchronization	495
10.11	Debug and Diagnosis	500
10.11.1	Process.....	500
10.11.2	Retrieving Crash Information.....	502
10.12	File Management.....	505
10.12.1	Retrieving Configuration of Current Directory	505
10.12.2	Retrieving Directory List.....	506
10.12.3	Revising File	507

10.12.4 Retrieve File Content	507
10.12.5 File Download and Upload	508
10.12.6 Package File	508
10.12.7 Retrieving Storage Media	510
10.12.8 Managing File in Web UI	511
10.12.9 Statistics Function	514
ANNEX A. CLI Command Structure	555
A.1 configure	555
A.2 show	593
A.3 clear	609
A.4 debug	611
A.5 file	613
A.6 Etc	613
ANNEX B. Open Source Announcement (WEC8500/WEC8050)	614
ANNEX C. Open Source Announcement (WEA300/WEA400 Series)	642
ABBREVIATION	669

LIST OF FIGURES

Figure 1. System Structure for Wireless Enterprise Solution	23
Figure 2. Wireless Enterprise Network Configuration	24
Figure 3. WEC8500 Interface-Front/Back	27
Figure 4. System LED Configuration.....	27
Figure 5. Management Port Configuration	28
Figure 6. Optic port configuration.....	29
Figure 7. Power module configuration	30
Figure 8. WEC8050 interface-Front/Back	31
Figure 9. Status LED configuration	31
Figure 10. Ethernet Port Configurations.....	32
Figure 11. Basic Configuration of Wireless Enterprise Wireless LAN System.....	33
Figure 12. Example of System Configuration for Redundancy	34
Figure 13. Example of System Configuration for Distributed Clustering Service.....	36
Figure 14. Example of System Configuration for Centralized Clustering Service.....	37
Figure 15. Example of System Configuration for Multiple Sites consisting of Headquarters and Branches	38
Figure 16. AP-APC NAT Environment Configuration Diagram	40
Figure 17. Web UI Connection Window	46
Figure 18. WEC Main Window	47
Figure 19. Operator Account Management Window	48
Figure 20. Operator Account Addition Window	48
Figure 21. Initial Setup Wizard Welcome Screen.....	50
Figure 22. Move to the setup step of the initial setup wizard	50
Figure 23. Port Management Window.....	55
Figure 24. Port Configuration Change Window.....	56
Figure 25. Interfaces Window (1)	58
Figure 26. Interfaces Window (2)	58
Figure 27. Interfaces Window (3)	59
Figure 28. Interface Group Window (1).....	60
Figure 29. Interface Group Window (2).....	61
Figure 30. Spanning Tree Configuration Window (1)	69
Figure 31. Spanning Tree Configuration Window (2)	70
Figure 32. Spanning Tree Configuration Window (3)	70
Figure 33. Static Routing Configuration Window.....	72
Figure 34. OSPF Configuration Window	74

Figure 35. VRRP-Operation Window	113
Figure 36. VRRP-Circuit Failover Window (1)	113
Figure 37. VRRP-Circuit Failover Window (2)	113
Figure 38. IPWATCHD Configuration Window.....	114
Figure 39. ACL Configuration Window.....	116
Figure 40. Window where a Time Profile is Applied to ACL	116
Figure 41. ACL Interface Configuration Window (1).....	117
Figure 42. ACL Interface Configuration Window (2).....	117
Figure 43. Admin ACL Configuration Window	119
Figure 44. Time Profile Configuration Window (1)	122
Figure 45. Time Profile Configuration Window (2)	123
Figure 46. Applying to ACL	124
Figure 47. IP Multicast Configuration Window	128
Figure 48. PIM-SM Configuration Window (1)	129
Figure 49. PIM-SM Configuration Window (2)	129
Figure 50. PIM-SM Configuration Window (3)	130
Figure 51. PIM-SM Configuration Window (4)	130
Figure 52. IGMP Snooping Config Window	132
Figure 53. IGMP Snooping Mroute Creation Window (1).....	132
Figure 54. IGMP Snooping Mroute Creation Window (2).....	132
Figure 55. IGMP Snooping Mroute Creation Window (3).....	133
Figure 56. IGMP Snooping Mroute Creation Window (4).....	133
Figure 57. Profile Creation Screen	135
Figure 58. Profile Configuration Screen.....	135
Figure 59. Application Group Creation Screen	136
Figure 60. Application Group Configuration Screen.....	137
Figure 61. WLAN/Device Statistics Screen.....	142
Figure 62. WLAN Statistics Screen.....	143
Figure 63. Device Statistics Screen	144
Figure 64. mDNS Snooping Activation Window.....	146
Figure 65. mDNS Snooping Service Configuration.....	146
Figure 66. mDNS Snooping Profile Configuration	147
Figure 67. mDNS Snooping Profile Service Configuration	147
Figure 68. WLAN mDNS Snooping Profile Object Configuration.....	147
Figure 69. mDNS Snooping Profile Configuration	147
Figure 70. APC List Management Window	149
Figure 71. Management interface configuration	150
Figure 72. AP Registration Method Setup Window.....	153
Figure 73. Redundancy Configuration Window	157

Figure 74. AP retrieving window.....	158
Figure 75. AP redundancy Configuration Window.....	159
Figure 76. AP groups configuration Window	161
Figure 77. AP Group Addition Window	161
Figure 78. General Configuration Window for AP Group	164
Figure 79. AP Add/Remove Window for AP Group	166
Figure 80. WLAN Add/Remove Window for AP Group.....	167
Figure 81. 802.11a/n/ac Window for AP Group	168
Figure 82. 802.11b/g/n Window for AP Group	170
Figure 83. AP Group SSL Configuration	178
Figure 84. Advanced Configuration Window for AP Group.....	180
Figure 85. Remote AP Group Add/Remove Window.....	182
Figure 86. Local Authentication Configuration Window for Remote AP Group.....	183
Figure 87. Window for Configuring Tunneling Forwarding of Remote AP Group	185
Figure 88. Window for Configuring Local Bridging Forwarding of Remote AP Group	186
Figure 89. AP Time Synchronization Configuration Options.....	188
Figure 90. Adding Access Points.....	189
Figure 91. AP Profile Setting (1).....	194
Figure 92. AP Profile Setting (2).....	196
Figure 93. AP mode configuration	197
Figure 94. AP CLI Account Add/Remove Window	198
Figure 95. AP SNMP v1/v2c Community Configuration Window.....	200
Figure 96. AP v3 User Configuration Window	200
Figure 97. AP Ports window	202
Figure 98. AP Ports detail information window	202
Figure 99. AP Tech Support Information Receiving Window	203
Figure 100. Outdoor AP Create Window	205
Figure 101. AP upgrade	208
Figure 102. AP upgrade-global	208
Figure 103. AP upgrade-individual	209
Figure 104. AP upgrade-advanced	210
Figure 105. Remote AP Group Upgrade Activation_1	211
Figure 106. Remote AP Group Upgrade Activation_2	212
Figure 107. Checking Master AP Configuration	213
Figure 108. Checking Master AP Configuration	213
Figure 109. AP Package Configuration	215
Figure 110. Starting AP Upgrade.....	216
Figure 111. Restarting and Upgrading AP	218
Figure 112. WLAN basic configuration (1)	221

Figure 113. WLAN basic configuration (2)	221
Figure 114. WLAN-based ACL configuration	225
Figure 115. Root service management (1).....	227
Figure 116. Root service management (2).....	228
Figure 117. MCS by WLAN: 802.11a/n/ac Configuration Management window	230
Figure 118. MCS by WLAN: 802.11b/g/n Configuration Management window	231
Figure 119. Local Switching Configuration Window of WLAN.....	233
Figure 120. Split ACL Configuration Window of WLAN Allocated to AP	234
Figure 121. VLAN/ACL/Pre-Auth.ACL Configuration Window of WLAN Allocated to AP	234
Figure 122. Initialization of WLAN security function.....	236
Figure 123. WPA/WPA2 PSK configuration	239
Figure 124. WPA/WPA2 802.1x Configuration (1)	242
Figure 125. WPA/WPA2 802.1x Configuration (2)	243
Figure 126. Static WEP configuration	245
Figure 127. Dynamic WEP Configuration Window	247
Figure 128. DHCP server configuration.....	249
Figure 129. DHCP Pool (1).....	255
Figure 130. DHCP Pool (2).....	255
Figure 131. DHCP Relay	257
Figure 132. DHCP Proxy	258
Figure 133. Option 82 configuration (1)	260
Figure 134. Option 82 configuration (2)	260
Figure 135. Primary/Secondary server configuration (1)	262
Figure 136. Primary/Secondary server configuration (2)	262
Figure 137. Primary/Secondary server configuration (3)	263
Figure 138. Radio service configuration	265
Figure 139. 802.11a/b/g/n radio (1)	269
Figure 140. 802.11a/b/g/n radio (2)	270
Figure 141. 802.11a/n/ac DataRates	271
Figure 142. 802.11b/g/n Operational Type & OptionsWindow	273
Figure 143. 802.11b/g/n MCS SettingWindow	273
Figure 144. 802.11a/n/ac Operational Type & OptionsWindow	275
Figure 145. 802.11a/n/ac MCS SettingWindow	275
Figure 146. QoS configuration of a wireless terminal (1).....	278
Figure 147. QoS configuration of a wireless terminal (2).....	278
Figure 148. QoS configuration of AP (wireless section).....	281
Figure 149. Configuring QoS profile of a specific terminal.....	283
Figure 150. Configuring voice optimization by radio.....	284
Figure 151. Configuring voice optimization by each AP Group.....	285

Figure 152. Configuring voice optimization by each AP	285
Figure 153. Configuring 802.11h	287
Figure 154. Country code window (1)	290
Figure 155. AP Country Code Configuration	291
Figure 156. AP Group Contry Code Configuration	291
Figure 157. Information viewing window	293
Figure 158. Handover window	296
Figure 159. SIP ALG configuration window	298
Figure 160. Admission control configuration of 802.11a/n	300
Figure 161. 802.11a/n Admission Control Configuration Window	302
Figure 162. RRM configuration window	305
Figure 163. DPC settings	306
Figure 164. DCS settings	309
Figure 165. CHDC settings	312
Figure 166. Spectrum Analysis Data	325
Figure 167. Controlling Usage per User	329
Figure 168. Clustering window	335
Figure 169. Clustering addition window	335
Figure 170. Configuring connection limitation per radio	337
Figure 171. Configuring connection limitation per AP Group	337
Figure 172. Configuring connection limitation per AP	337
Figure 173. Configuring connection limitation per WLAN	338
Figure 174. Voice statistics	341
Figure 175. Detecting WLAN-based communication failure	342
Figure 176. VoIP Stations Retrieval Screen	347
Figure 177. Active Call Retrieval Screen	348
Figure 178. Complete Calls Retrieval Screen	348
Figure 179. 802.11a/n Admission Control Configuration Window	355
Figure 180. Band Steering Function On/Off and Band Setting	359
Figure 181. Configuring Load Balancing Function	361
Figure 182. RADIUS server configuration	369
Figure 183. RADIUS Server MAC Authentication Configuration Window	372
Figure 184. Wireless Intrusion General Configuration Window	377
Figure 185. Managed Rule Configuration Window	379
Figure 186. Managed Addition Window	379
Figure 187. Unmanaged Rule Configuration Window	381
Figure 188. Unmanaged Rule Addition Window	381
Figure 189. List Window to Manually Change Classification	383
Figure 190. Classification Change Window in AP Detail Screen	383

Figure 191. List Window to Manually Remove.....	385
Figure 192. Manual Remove Change Window in AP Detail Screen	386
Figure 193. Configuration Window for Unauthorized AP Detection Option	388
Figure 194. Configuration Window for Unauthorized Station Detection Option.....	389
Figure 195. Configuration Window for Channel Validation.....	391
Figure 196. AP blacklist Configuration Window	392
Figure 197. Managed AP Window	393
Figure 198. Station blacklist Search/Configuration Window	393
Figure 199. Managed Station Search Window.....	394
Figure 200. Managed SSID Window	395
Figure 201. Managed/Neighbor AP Search/Configuration Window	395
Figure 202. Managed/Neighbor AP List Addition Window.....	396
Figure 203. Station Allowed Limit Configuration Window.....	397
Figure 204. Wireless Intrusion Containment General Configuration Window	398
Figure 205. List Window for Blocking AP	399
Figure 206. List Window for Blocking Station.....	400
Figure 207. Automatic Blocking Configuration Window	401
Figure 208. Web Certification User Configuration Window.....	403
Figure 209. Web Ceertification User List Window	403
Figure 210. Access List Addition Window	405
Figure 211. Access List Entry Addition Window	405
Figure 212. WLAN Web Policy Configuration Window	408
Figure 213. WLAN Layer 2 Security Configuration Window	410
Figure 214. WLAN Web Policy Configuration Window	410
Figure 215. Web Pass-through Configuration Window	412
Figure 216. One Time Redirection Configuration Window.....	414
Figure 217. Firewall configuration (1)	417
Figure 218. Firewall configuration (2)	418
Figure 219. Access-list configuration	419
Figure 220. NAT configuration (1).....	421
Figure 221. NAT configuration (2).....	422
Figure 222. MAC configuration	425
Figure 223. MAC entry configuration window(1)	425
Figure 224. MAC entry configuration(2).....	426
Figure 225. MAC entry configuration(3).....	426
Figure 226. TTACACS+ Server Configuration Window	429
Figure 227. Operator Account Authentication Type Configuration Window	430
Figure 228. Role Profile Configuration.....	432
Figure 229. Role Profile Add Configuration	432

Figure 230. Derivation Profile Configuration	433
Figure 231. Derivation Profile Add Configuration	433
Figure 232. Derivation Profile Configuration	434
Figure 233. Derivation Profile Add Configuration	434
Figure 234. Wlan Derivation Profile Configuration	435
Figure 235. Wlan Derivation Profile Configuration	436
Figure 236. Acl Profile Configuration.....	437
Figure 237. Acl Profile Add Configuration	438
Figure 238. Acl Profile Edit Configuration	438
Figure 239. Remote Ap Group-Alc Profile Configuration.....	439
Figure 240. ACL Configuration Synchronization - All.....	441
Figure 241. ACL Configuration Synchronization - Remote Group.....	441
Figure 242. ACL Configuration Synchronization - Remote AP	442
Figure 243. External BYOD Server Configuration Window	444
Figure 244. DNS client.....	448
Figure 245. DNS proxy	449
Figure 246. NTP client configuration.....	452
Figure 247. FTP/SFTP server configuration.....	455
Figure 248. Telnet/SSH server configuration.....	457
Figure 249. Adding SNMP community	460
Figure 250. SNMP trap configuration	461
Figure 251. System information	465
Figure 252. Reboot (APC)	467
Figure 253. Reboot (AP)	468
Figure 254. Configuring SNMP alarm threshold.....	473
Figure 255. Current alarm	475
Figure 256. History.....	477
Figure 257. Configuring alarm filter and level	479
Figure 258. SLM License Search and Configuration Window	484
Figure 259. Old License Installation Check Window	487
Figure 260. Syslog window	489
Figure 261. Package upgrade (APC)	492
Figure 262. DB Backup/Restore	494
Figure 263. Configuration Synchronization Role Configuration	497
Figure 264. Add Sync. Members Window	497
Figure 265. DB Backup/Restore/Periodic-Upload Window	499
Figure 266. File management window	511

CHAPTER 1. Access Point Controller System Overview

1.1 APC Overview

The Samsung Access Pointer Controller (APC) comprehensively manages the 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. There are two models depending on the AP capacity; WEC8500 and WEC8050. 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 APC is typically installed at a position where it can be connected to a backbone switch, core switch, or router in a enterprise network environment. The APC controls a wireless LAN AP and provides the functions for Wireless LAN (WLAN) services such as handover and QoS, security/authentication, etc. The Samsung WEC8500 provides its services up to 500 APs. It can provide its services up to 10,000 connected user devices. Meanwhile, the WEC8050 can accommodate a maximum of 200 APs and provides service to a maximum of 1500 user devices.

The APC 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 to be able to be used in wireless device such as a smart phone, tablet PC, or notebook.

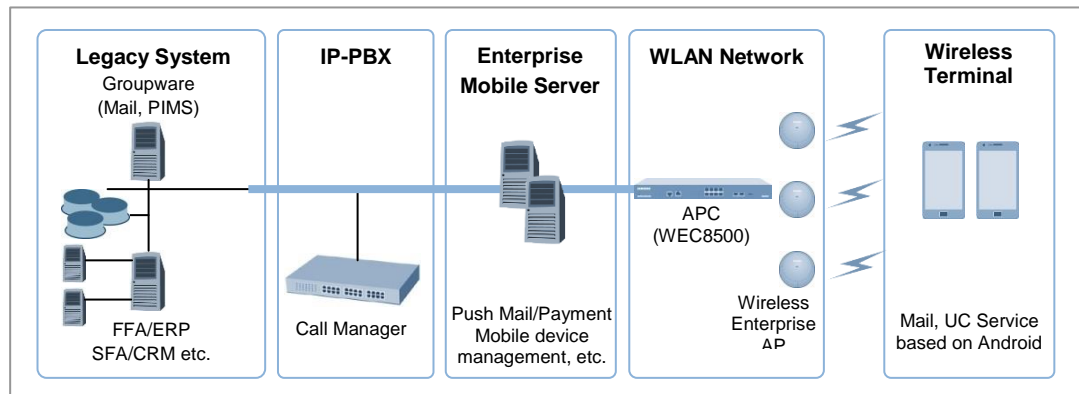


Figure 1. System Structure for Wireless Enterprise Solution

The Samsung Wireless Enterprise solution, as shown in figure 1, comprehensively includes various enterprise applications which are provided by wired and wireless infrastructure products and wireless terminals. The WLAN network, a wireless infrastructure solution that provides mobility in an enterprise environment consists of Wireless Enterprise WLAN Access Points (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, WEC8500/WEC8050 and APC commonly represent Samsung Access Point Controllers. In addition, AP commonly refers to a Samsung Wireless Enterprise WLAN Access Point.

1.2 Network Configuration

The network configuration of Samsung Wireless Enterprise solution that includes APC is shown below.

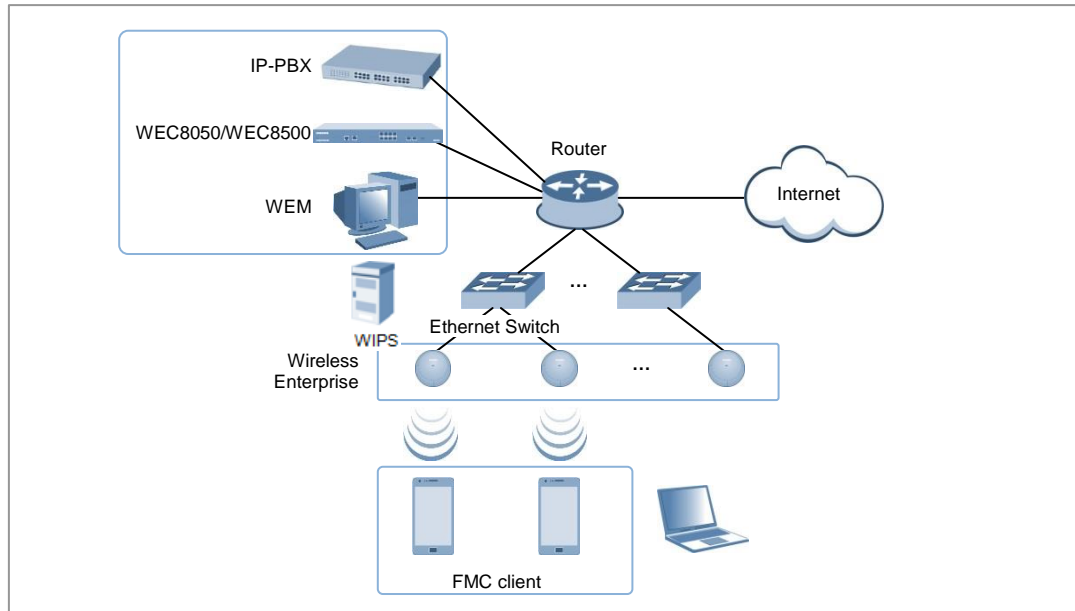


Figure 2. Wireless Enterprise Network Configuration

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/WEC8050)

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 (Wireless Enterprise Manager)

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 WLAN 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 Voice over IP (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.

WES (Wireless Enterprise Security) (WIPS Solution)

It monitors the properness of the implementation of the wireless network infrastructure by detecting penetration via unauthorized wireless equipment installed in the internal network, the detoured gateway segment of the internal officers and employees who illegally connect to the commercial WLAN service, etc. and provides the wireless network invasion detection which implements the safe and effective wireless network environment by detecting security vulnerabilities.

1.3 APC Configuration and Functions

1.3.1 WEC8500 Configuration and Functions

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

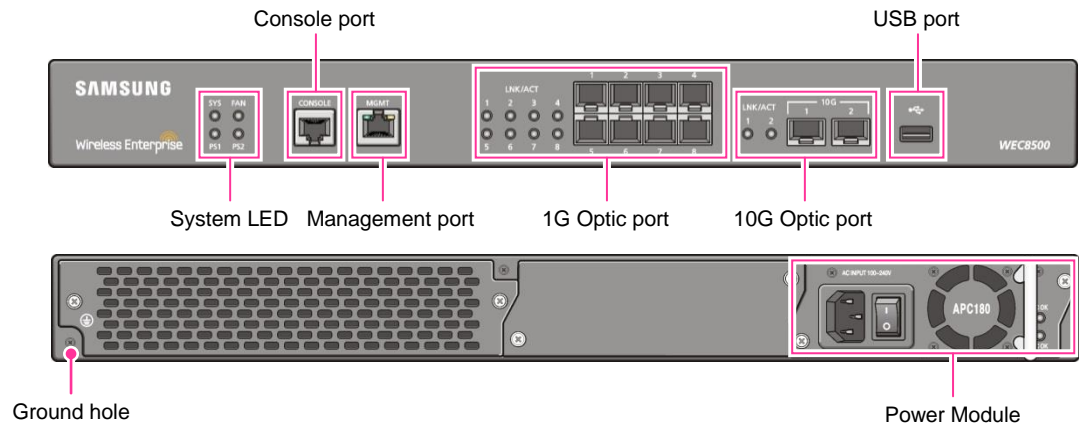


Figure 3. WEC8500 Interface-Front/Back

System LED

System LED indicates the various statuses of system. Each LED displays the following information.

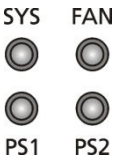


Figure 4. System LED Configuration

LED	Status	Description
SYS	Green	The system is operating normally
	Orange	The system is now booting
	Red	Preparing the system for booting
FAN (fan module)	Green	The installed FAN module is operating normally
	Orange	The system is now 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.
PS2 (power module 2)	Green	Normal operation of installed power module 2

LED	Status	Description
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 (1 GE UTP)

The WEC8500 provides a 10/100/1000BASE-T 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.

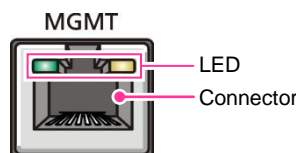


Figure 5. Management Port Configuration

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.

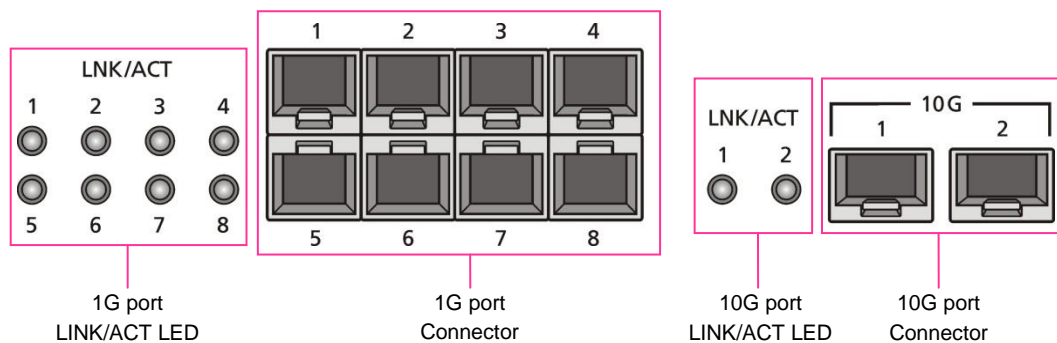


Figure 6. Optic port configuration

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

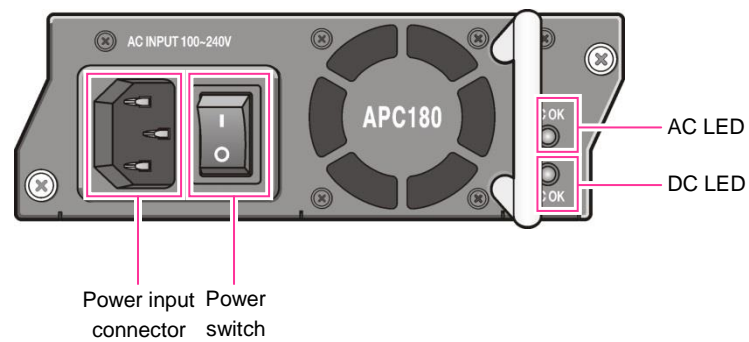


Figure 7. Power module configuration

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.

1.3.2 WEC8050 Configuration and Functions

The configuration and the purpose of each item of WEC8050 are as follows:

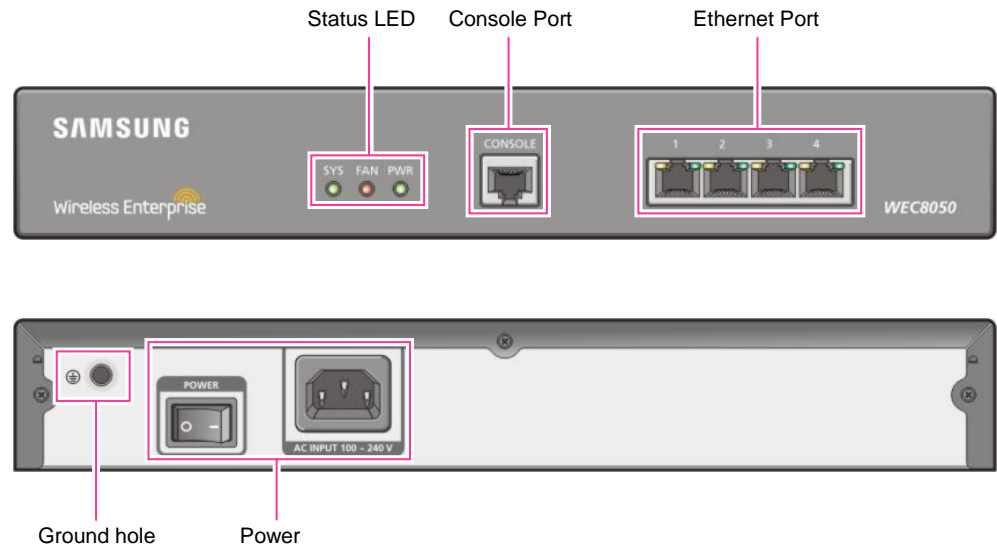


Figure 8. WEC8050 interface-Front/Back

Status LED

This LED indicates the various statuses of system. Each LED displays the following information.



Figure 9. Status LED configuration

LED	Status	Description
SYS	Green	The system is operating normally
	Orange	The system is now booting
	Red	Preparing the system for booting
FAN	Green	The installed FAN module is operating normally
	Orange	The system is now booting
	Red	Fan fault
PWR	Green	The power is supplied normally
	Off	The power is turned off or not supplied

Console port (RS232C)

A console port is provided to check the operational status of WEC8050 or for input through the CLI.

Its basic requirements are as follows:

- Default baud rate: 115200 bps
- Character size: 8 Characters
- Parity: None
- Stop bit: 1, Data bit: 8
- Flow control: None

Ethernet port

It has 4 10/100/1000 Base-T ports.

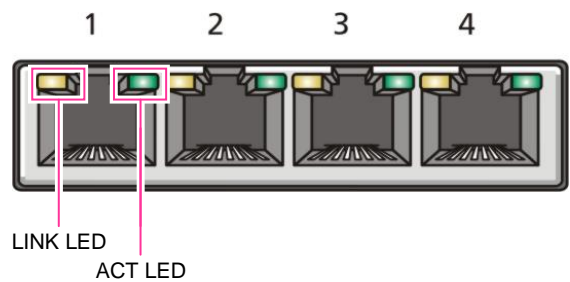


Figure 10. Ethernet Port Configurations

LED	Status	Description
ACT	Orange blinking	Blinking while data exchanging
	Off	No data exchanging
LINK	Green	Link connection display
	Off	No link connection

1.4 APC 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 APC 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. The configuration diagram is based on Samsung APC (WEC8500).

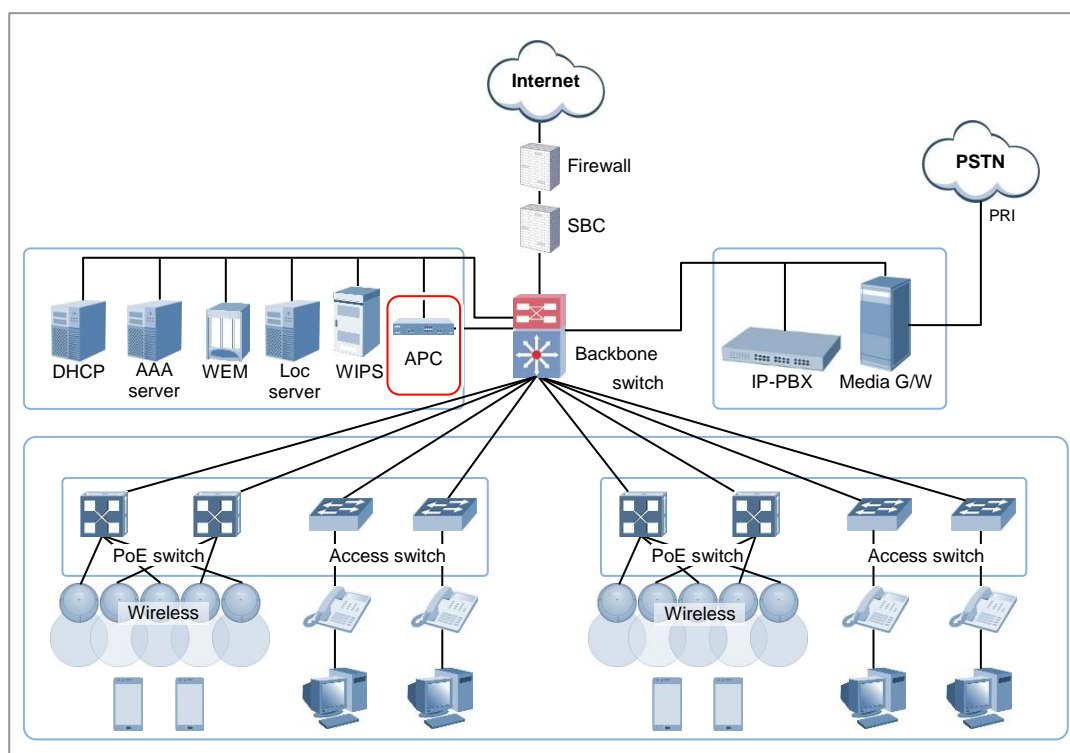


Figure 11. Basic Configuration of Wireless Enterprise Wireless LAN System

The basic Wireless Enterprise wireless LAN network configuration is a centralized structure where all the wireless user traffics go through tunneling between APC 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 APC is connected.

This provides the following advantages during network configuration and setup.

- Installing the APC 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 APC 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 APC 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 APC for Redundancy

The APC 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.

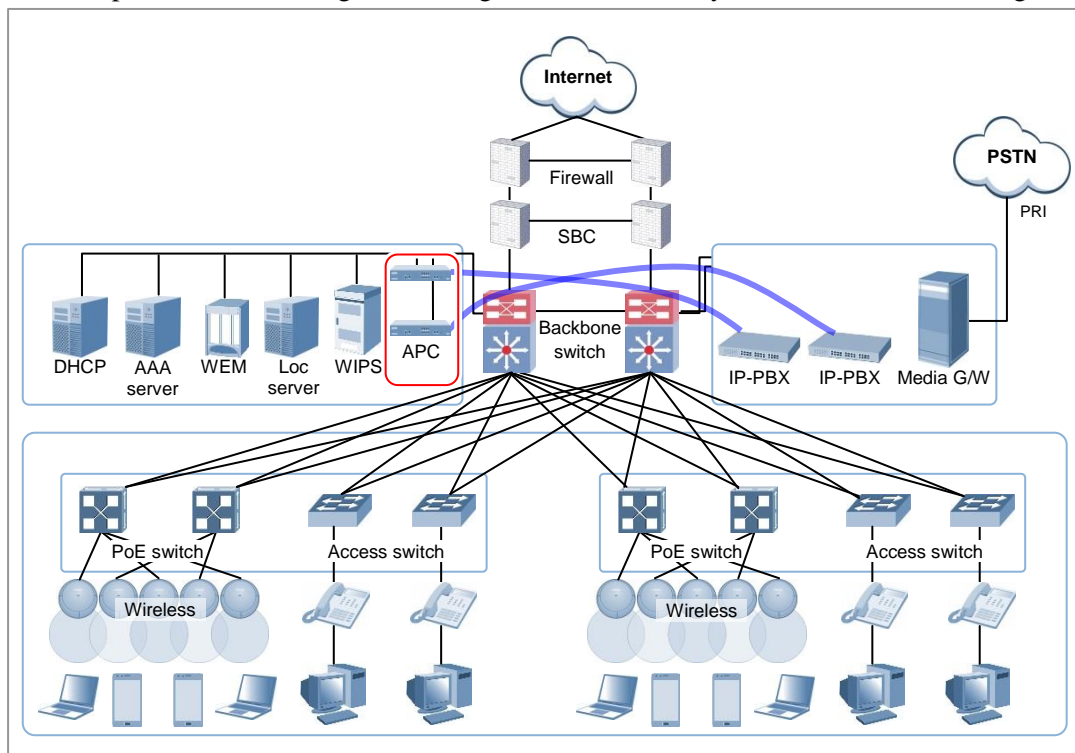


Figure 12. Example of Wireless Enterprise Wireless LAN System Configuration for Redundancy

In this configuration, several APC s are used to minimize service disruption caused by a disconnected APC and to enhance service sustainability. Basically, two or more APC s 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 APC s and redundancy level.

**NOTE****Configuration Synchronization between Multiple APCs**

When providing service with multiple APCs in redundancy configuration, all service settings except network settings, etc. must be identical across all APCs. Therefore, the service configuration synchronization function is provided to eliminate the inconvenience of having to repeat the same configuration across all individual APCs.

When service settings are changed on the master controller, the settings are automatically applied to the connected slave devices. The service configuration synchronization function currently supports two APCs only.

For more information on service configuration synchronization, see [10.10 Service Configuration Synchronization].

1.4.3 Clustering Configuration using Multiple APC (WEC8500)

The Wireless Enterprise environment has various area sizes, user density and number of users. If only a single APC is required for service and management, the complexity of network configuration or management is not high. However, if the capacity of a single APC is not sufficient, multiple APC s must be installed for service. The WEC8500 is a Samsung APC model providing the clustering environment.

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.

**NOTE****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 12 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.

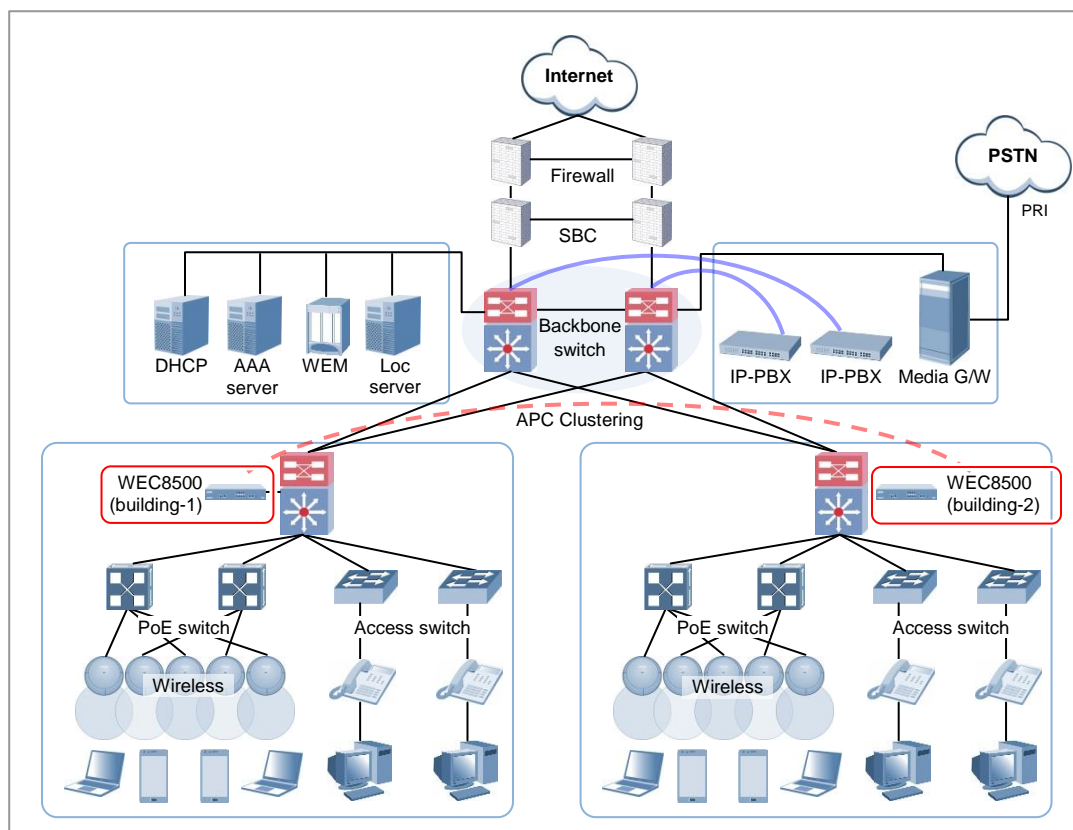


Figure 13. Example of Wireless Enterprise Wireless LAN System Configuration for Distributed Clustering Service

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.

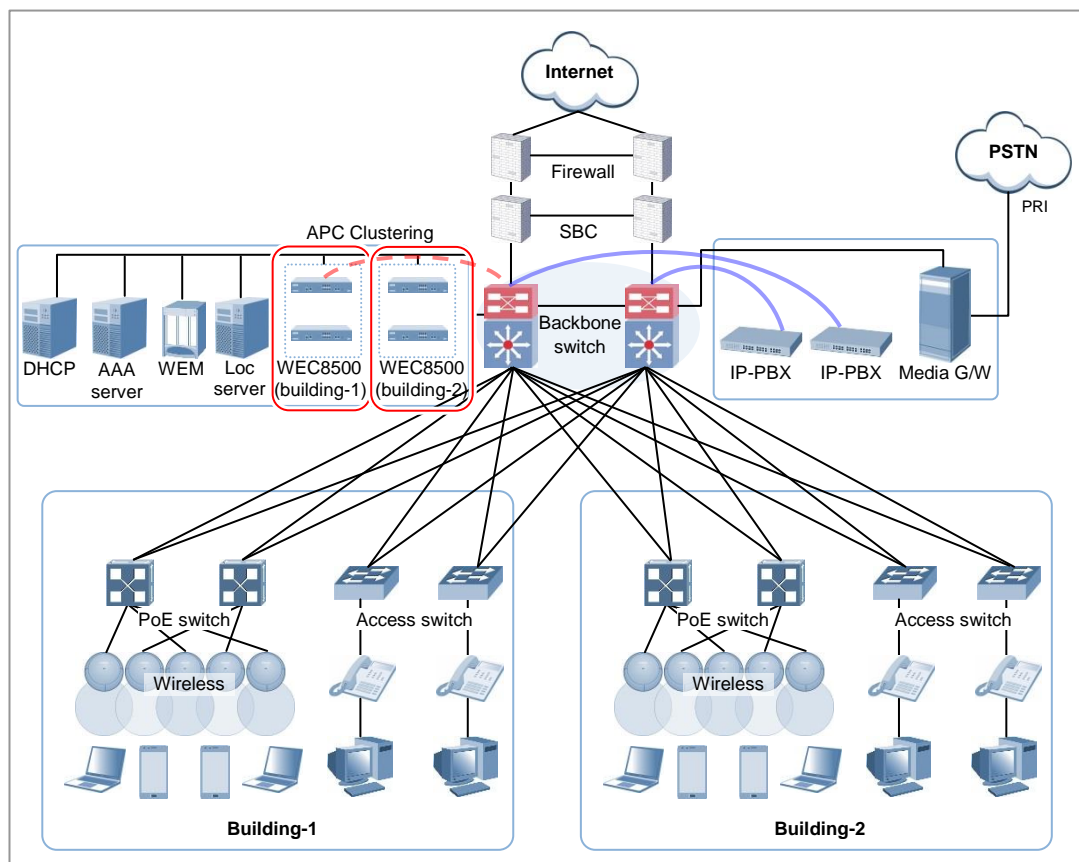


Figure 14. Example of Wireless Enterprise Wireless LAN System Configuration for Centralized Clustering Service

1.4.4 Configuration of Multiple Sites Consisting of Headquarters and Branches

The Wireless Enterprise wireless LAN network environment usually consists of one headquarters and several branches.

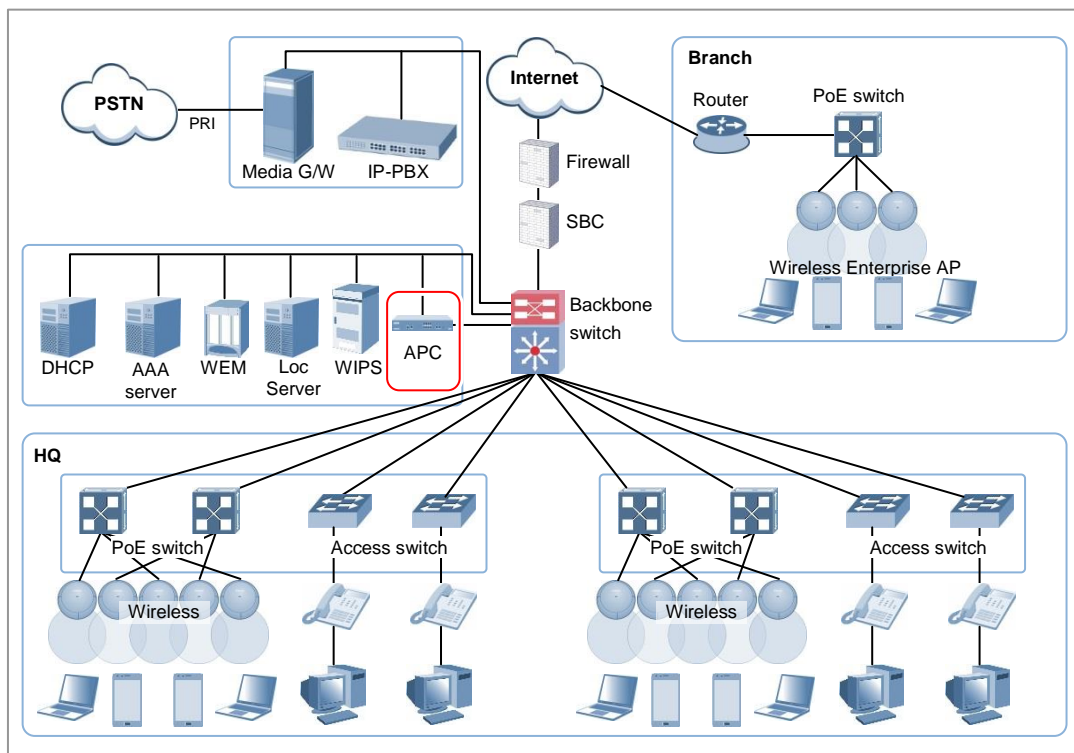
In this case, there are two types of network configuration.

- Hierarchical type: An APC is installed in a branch as well as headquarters.
- Branch AP type: An APC is installed only in a headquarters 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 headquarters 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 headquarters provides a wireless LAN service in the headquarters building and also provides a wireless LAN service to a remote Wireless Enterprise wireless LAN AP installed in a branch. As the APC in headquarters 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. Example of Wireless Enterprise Wireless LAN System Configuration for Multiple Sites consisting of Headquarters and Branches

If user traffic is concentrated on a single centralized APC when there are many branches or they are far from headquarters, 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 headquarters and branches.

In other words, the local Wireless Enterprise wireless LAN AP in a headquarters 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 headquarters manages all the Wireless Enterprise wireless LAN APs and users.

1.5 NAT Configuration between AP and APC

The APC system provides the same services even when the APC or AP is in a NAT environment.

If the APC system is in a NAT environment and obtaining a public IP address is difficult, the APC can be configured to use a private IP address by enabling port mapping on the existing NAT equipment, so that it can provide services to APs on the public IP network and APs existing under other NAT networks.

Using this feature requires that the NAT equipment be applied with the following port settings:

Service	TCP Port	UDP Port	Description
General	20, 21	-	FTP Server
	22	-	Secure Shell
	23	-	Telnet
	80, 443	-	HTTP Web Server
	123	123	NTP
AP-APC Connection	-	5246, 5247	CAPWAP

An example of service configuration diagram for the NAT environment is illustrated below.

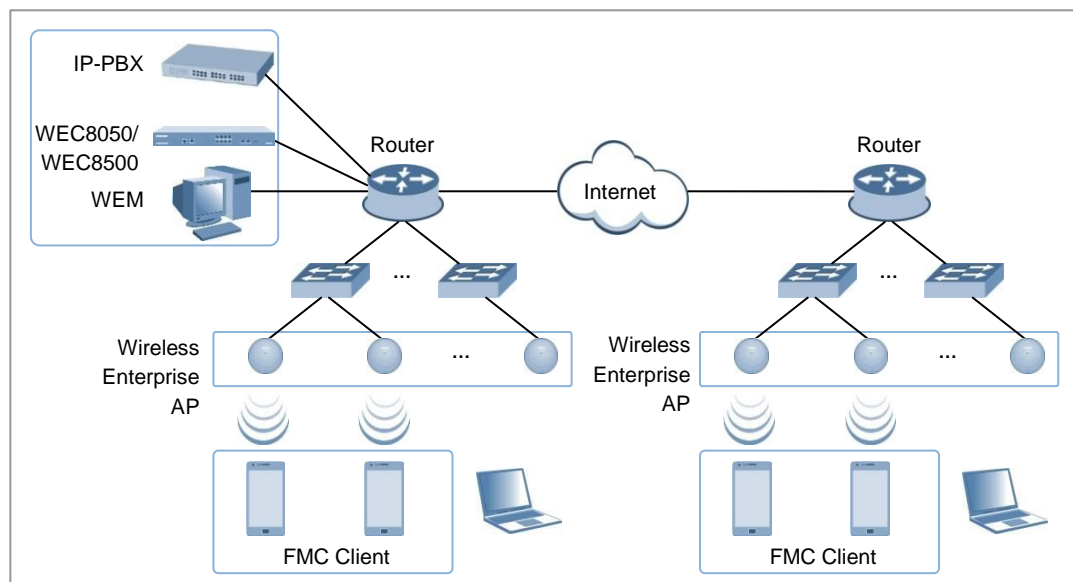


Figure 15. AP-APC NAT Environment Configuration Diagram

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 APC using CLI is as follows:

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

When the booting of APC 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.



NOTE

The default ID of APC is set to 'samsung' that has an administrator privilege.

2.1.2 Managing Operator Account

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

To set up operator 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] [USERLEVEL] description [DESCRIPTION]`: Adds a user
- `no mgmt-user [USERNAME]`: Deletes a user

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

```
WEC8050/configure# mgmt-user test 1 description "test account"

PASSWORD          : *****
CONFIRM PASSWORD   : *****
USER(test) CREATED.

WEC8050/configure# no mgmt-user test
user(test) deleted.
```

Retrieving account information

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

Changing Password

Use the 'password' command to change the password for your account.

The 'password' command must be executed in the highest user mode.

```
WEC8500# password
CURRENT PASSWORD   : *****
NEW PASSWORD       : *****
CONFIRM NEW PASSWORD : *****
```

2.1.3 APC Management Port Configuration

To connect to the APC 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 APC, it is necessary to add Simple Network Management Protocol (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 APC system, the IP address of ethernet port must be set up. When connecting to the IP address of APC ethernet port in a web browser, the below login window is displayed. Log in using a default connection account 'samsung'.

After the first login, you go through the course of changing the password. If you have changed the password by connecting to the CLI, you don't have to go through the course of changing the password.



Samsung WLAN Controller

User ID ☐ Save User ID
Password
Language

Best viewed with MicroSoft Explorer 9.0 and 1280*1024 resolution.

Figure 16. Web UI Connection Window

2.2.2 WEC Main Window

The WEC Main window consists of menu bar, sub-menus, and detail windows of each menu.

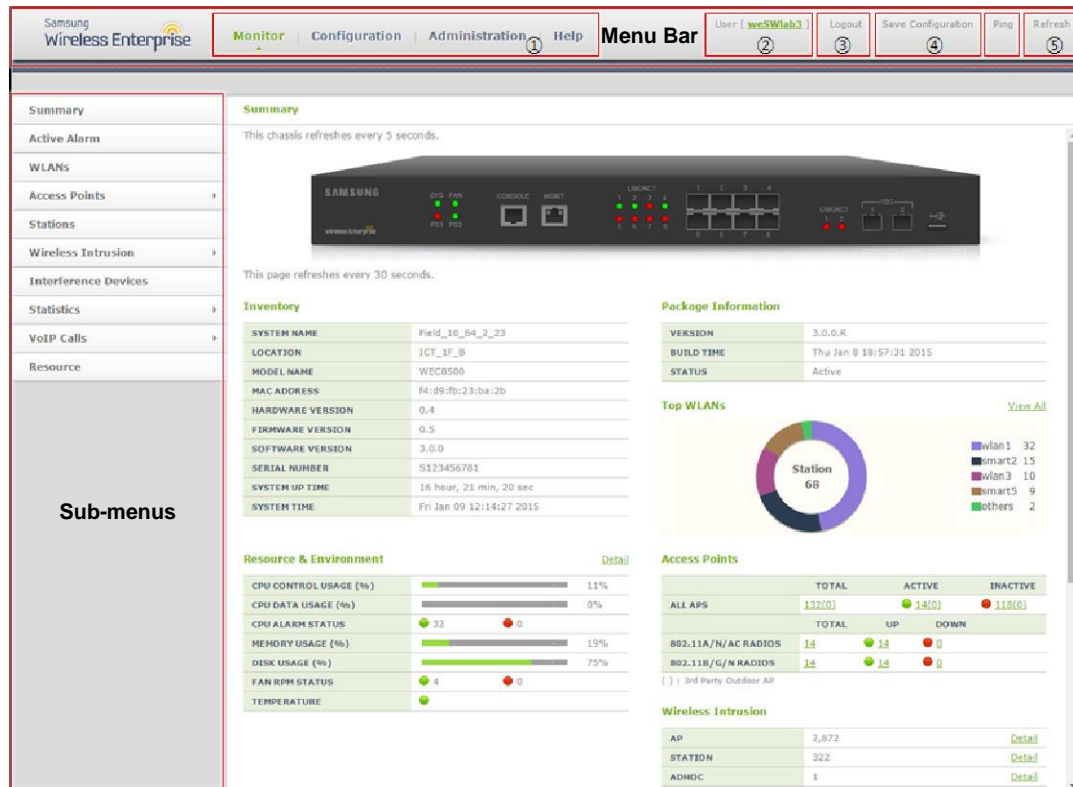


Figure 17. WEC Main Window

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

This provides the detail menus for Monitor, Configuration, Administration, or Help in the menu bar.

2.2.3 Managing Operator Account

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

In the menu bar of <WEC Main window>, select <Administration> and then select <Local Management Users> menu in the sub menu. The subtree shows the <APC> and <AP> menu items. Select <APC>.

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

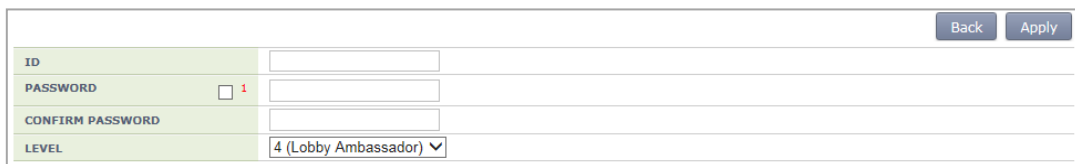


The screenshot shows a window titled 'Operator Account Management Window'. At the top right are 'Add' and 'Delete' buttons. Below them is a table with columns 'NO.', 'ID', and 'LEVEL'. The first row shows '1' under 'NO.', 'samsung' under 'ID', and 'Administrator' under 'LEVEL'. A checkbox is visible to the left of the first row. At the bottom right, it says 'Total Entry : 9'.

NO.	ID	LEVEL
1	samsung	Administrator

Figure 18. Operator Account Management Window

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



The screenshot shows a form titled 'Operator Account Addition Window'. It has fields for 'ID', 'PASSWORD', 'CONFIRM PASSWORD', and 'LEVEL'. The 'LEVEL' field is a dropdown menu showing '4 (Lobby Ambassador)'. There are 'Back' and 'Apply' buttons at the top right.

ID	
PASSWORD	
CONFIRM PASSWORD	
LEVEL	4 (Lobby Ambassador)

Figure 19. Operator 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 (Administrator): Administrator privilege that allows to execute all the commands
 - 2 (Operator): Can change system configuration.
 - 3 (Monitor): Can retrieve system status.
 - 4 (Lobby Ambassador): Temporary user

2.3 Initial Setup Wizard

2.3.1 Overview

The initial setup wizard aims to finish the basic settings by guiding the settings required for the basic WLAN service in order when the APC is installed. It supports only the basic settings to operate the WLAN service and the settings which are additional or are not frequently used are not supported here. They must be made through the general WEC screen.

2.3.2 Connecting

Connecting condition

If connected to the WEC via web UI at the factory reset state or while there is no WLAN, the APC system is connected to the Initial Setup Wizard instead of the general WEC screen.

Connecting at the factory reset state

The connection at the factory reset state is available through the management port.

- 1) Connect the Ethernet cable to the management port and then to the PC.
- 2) The default IP address of the management port is 192.168.1.2. After configuring the IP address of the PC fit for the bandwidth, open the web browser.
- 3) Enter 192.168.1.2 in the address bar of the browser to access.

Access while the IP address is set

If the IP address of the APC is set, check whether the APC and the PC are networked and then open the web browser before accessing the IP address.

2.3.3 How to Use

If the access to the APC is made through the web browser, follow the login procedure as shown in '2.2.1 Web UI Connection'. After that, you can see the Welcome message by connecting to the wizard.

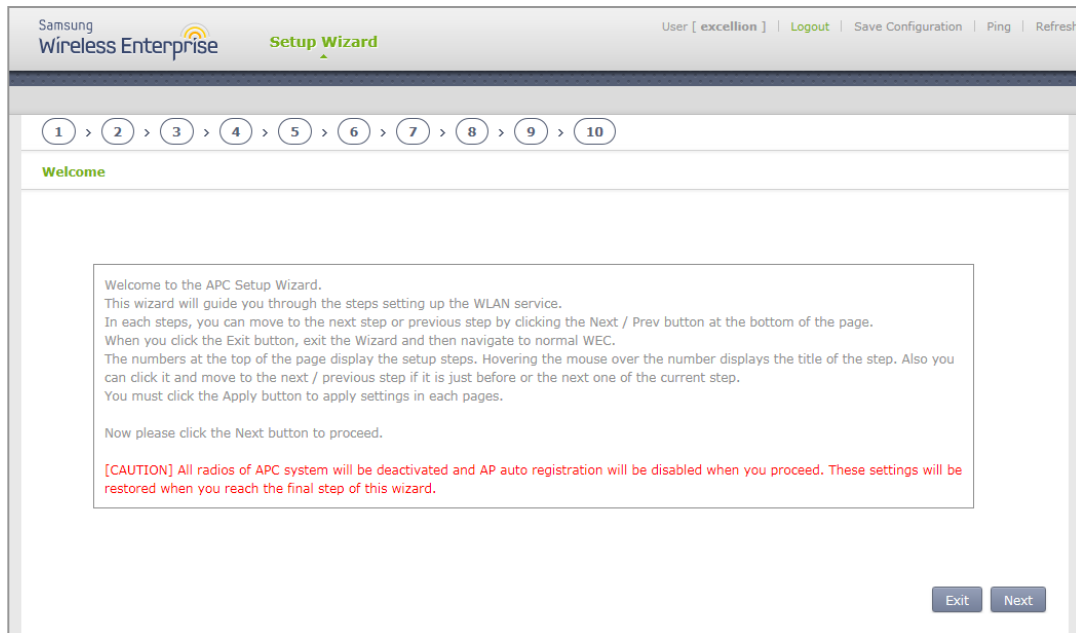


Figure 20. Initial Setup Wizard Welcome Screen

Press the Next button to move to the configuration step 1 and then start the basic settings. Press the Exit button to close the wizard and then move to the general WEC screen. Start the wizard and then deactivate all wireless communications of the APC system as well as the function of automatically registering the AP. The settings are recovered at the last step of the wizard.

Description on the Screen

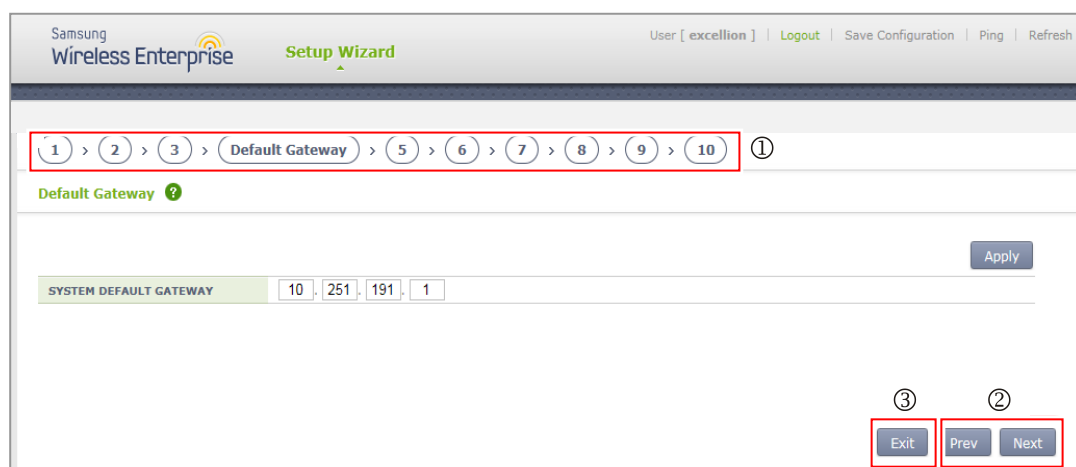


Figure 21. Move to the setup step of the initial setup wizard

- ①: Show the current setup step and the whole setup step by being located on the top of the screen. When you hover the mouse over each number, it shows the name of the step and you can click to move to the step just before or after the current step.
- ②: When you press the Next button, you move to the next setup step and when you press the Prev button, you return to the previous setup step.
- ③: Press the Exit button to close the wizard and then move to the general WEC screen. In the case, you cannot return back to the initial setup wizard screen. If the APC restarts while the WLAN is not created, you can go to the wizard screen again.

Setup Step

The initial setup wizard consists of the following setup steps: After setting up the description desired on each screen, click the Apply button to apply the modifications to the system.

1) General setup:

- Set up basic information including the name, location, contact number, etc. of the system.
- Set up the basic country code and the basic environment.
- Set up the system time and the time zone. Click the PC TIME button to change the time of the APC by setting to the time of the PC.

2) Interfaces:

- Create interfaces. For more information, refer to '3.2.1 Interface Management' and '3.3.1 VLAN'.

3) Interface groups:

- Create interface groups and assign the interfaces created at the previous step.
- For more information, refer to '3.2.2 Managing Interface Group'

4) Default Gateway:

- Set up a default gateway of the system. The default gateway is a default path to be used when the APC communicates with another equipment on the TCP/IP network.

5) WLAN:

- Create a WLAN. For more information, refer to '5. WLAN Management'.
- If the L2 Security Type corresponds to one of the following conditions, move to the step of setting up a RADIUS server. For more information on creating a RADIUS server, refer to '8.1.1 External RADIUS Server'.

(1) 802.1x

(2) Static WEP + 802.1x

(3) +WPA2 and enabled 802.1x

6) DHCP proxy:

- When an external DHCP server is used, configure settings of proxy or relay.

7) DHCP internal server:

- Configure a DHCP internal server. For more information, refer to '5.4.1 DHCP Server'.

8) DNS:

- The APC gets DNS information from a DNS server and provides the DNS relay function that relays the DNS server and a client. If a DNS server is connected to the APC and a UE connected to the APC configures the DNS server as the APC, the DNS service can be received.

9) NTP:

- If the APC is configured as a NTP client, it receives the Coordinated Universal Time (UTC) information from the configured NTP server and synchronizes the local time.

10) Finish:

- Finish the basic settings to configure the WLAN of the APC and then close the wizard.

CHAPTER 3. Data Network Function

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

3.1 Port Configuration

The APC port is configured with a physical interface.

- Physical interface of 11 ports except WEC8500 console port
- Physical interface of 4 ports except WEC8050 console port

3.1.1 Port 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. In case of WEC8050, there is no management (mgmt0) port, connect the Ethernet cable to the port in one of ports ge1 to ge4,

Configuration using CLI

To configure the port related function, enter into the interface mode by entering the 'interface [INTERFACE_NAME]' command in the configure mode.

An example of entering into the interface setup mode of the management port is shown below.

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

The port related CLI commands are as follows:

[auto-nego, speed, duplex]

The commands used to configure an auto-nego, speed, and duplex addresses are shown below. To delete the configuration, enter the 'no' parameter.

```
WEC8500/configure/interface ge1# speed-duplex ?
 10-full      Set 10Mb/s full-duplex
 10-half      Set 10Mb/s half-duplex
 100-full     Set 100Mb/s full-duplex
 100-half     Set 100Mb/s half-duplex
 1000-full    Set 1000Mb/s full-duplex
 1000-half    Set 1000Mb/s half-duplex
 auto-nego    Set auto negotiation speed/duplex
```

[admin status]

This is a command that makes the port not working. The 'no' parameter is used to restart the port.

```
shutduown
no shutdown
```

[flow control]

This is a command that operates flow control to the port. The 'no' parameter is used to stop the flow control.

```
flowcontrol on
no flowcontrol on
```

[switch port]

This is a command that changes the port to the L2 mode. The 'no' parameter is used to change it to the L3 mode.

```
switchport
no switchport
```

[ip address]

This is a command that configures a static IP address. To delete the configuration, enter the 'no' parameter.

- 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}

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <Ports> menu in the sub-menus. Operator can configure the ports.

The Ports initial window is shown below.

Operator can check the current status of each port.

Controller > Ports

INTERFACE NAME	ADMIN STATUS	LINK STATUS	SWITCH PORT	CABLE TYPE	AUTONEGO	PHYSICAL STATUS	FLOW CTRL	MTU SIZE	SFP PORT TYPE
ge1	Up	Down	Disable	Optic	Disable	100 bps	Enable	1500	1G_Service
ge2	Up	Down	Disable	Optic	Disable	100 bps	Disable	1500	1G_Service
ge3	Up	Down	Enable	Copper	Disable	100 bps Full duplex	Disable	1500	1G_Service
ge4	Up	Down	Enable	Optic	Disable	100 bps	Disable	1500	1G_Service
ge5	Up	Down	Enable	Optic	Disable	100 bps	Disable	1500	1G_Service
ge6	Up	Down	Enable	Optic	Disable	100 bps	Disable	1500	1G_Service
ge7	Up	Down	Enable	Optic	Disable	100 bps	Disable	1500	1G_Service
ge8	Up	Down	Enable	Optic	Disable	100 bps	Disable	1500	1G_Service
xe1	Up	Down	Enable	Optic	Enable	Auto Full duplex	Disable	1500	10G_UpLink
xe2	Up	Down	Enable	Optic	Enable	Auto Full duplex	Disable	1500	10G_UpLink
mant0	Up	Up	Disable	Copper	Disable	100 bps	Disable	1500	Unspecific

Figure 22. Port Management Window



NOTE

The auto-nego, speed, or duplex can be configured only when the cable type is Copper.

They cannot be configured if the cable type is Optic (The auto-nego should always be enabled whether the cable type is copper or optic).

[Port Configuration Change]

- 1) In the Ports initial window, click the <INTERFACE NAME> button to go to port configuration change window.
- 2) In the port configuration change window, the auto-nego, speed, duplex, admin status, flow control, mtu size, switch port, or ip address, etc. can be configured.

Controller > Ports > **Edit**

Back Apply

INTERFACE NAME ge5

General

LINK STATUS	Down
CABLE TYPE	Optic
AUTO NEGOTIATION	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
SPEED	100 ▾
DUPLEX	None ▾
ADMIN STATUS	<input checked="" type="radio"/> Up <input type="radio"/> Down
FLOW CTRL	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
MTU SIZE	1500
SFP PORT TYPE	1G_Service

Switch Port Information

SWITCH PORT STATE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
BRIDGE MODE	<input type="radio"/> Bridge Group <input type="radio"/> LAG --- ▾
STORM CONTROL MODE/LEVEL	Disable ▾ 0

IP Address

IP ADDRESS	0 0 0 0
NETMASK	0 0 0 0

Figure 23. Port Configuration Change Window

3.2 Interface Configuration

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

- Physical interface of 11 ports except console port
- 1024 virtual interfaces using VLAN

There are two types of WEC8050 interface as shown below; physical interface and virtual interface.

- Physical interface of 4 ports except console port
- 128 virtual interfaces using VLAN

3.2.1 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.

						Add	Delete
<input type="checkbox"/>	INTERFACE NAME	VLAN ID	IP ADDRESS	ADMIN STATUS	OPER STATUS		
<input type="checkbox"/>	lo	-	1.1.1.1	up	up		
<input type="checkbox"/>	VLAN0010	10	10.10.10.3	up	down		
<input type="checkbox"/>	lo	-	127.0.0.1	up	up		
<input type="checkbox"/>	mgmt0	-	192.168.5.132	up	up		
						1	

Figure 24. 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.

		Back	Apply
INTERFACE NAME	<input type="text" value="123"/>		
VLAN ID	<input type="text" value="123"/>	<input type="text" value="2 ~ 4094"/>	

Figure 25. 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.

BackApply

INTERFACE NAME	123		
VLAN ID	123		
ADMIN STATUS	<input checked="" type="radio"/> Up <input type="radio"/> Down		

Physical

PORTS	MODE	HYBRID EGRESS_TAGGED
ge1	Trunk	Service Disable
ge2	Trunk	Service Disable
ge3	Not Used	Service Disable
ge4	Not Used	Service Disable
ge5	Not Used	Service Disable
ge7	Not Used	Service Disable
ge8	Not Used	Service Disable
xe1	Not Used	Service Disable
xe2	Not Used	Service Disable

Address

IP ADDRESS	123	123	123	1
NETMASK	255	255	255	1

DHCP

GLOBAL USE	<input type="checkbox"/>
PRIMARY DHCP SERVER	192168221
SECONDARY DHCP SERVER	1111
OPTION 82 STATE	Disable
OPTION 82 TYPE	AP-MAC

Access Control List

ACL NAME	-----
----------	-------

Figure 26. 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.

3.2.2 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]

This command 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]

This command adds an interface to an interface group being configured. Use 'no' parameter to delete an interface.

- add-if[INTERFACE_IP_ADDRESS]
- no add-if[INTERFACE_IP_ADDRESS]

[Retrieving Interface Group Status]

This command 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.




			<div>AddDelete</div>
<div></div>	GROUP NAME	GROUP DESCRIPTION	IF COUNT
<div></div>	ifg_01		1
<div></div>	ifg_03		4
1			

Figure 27. 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 information on GROUP NAME and GROUP DESCRIPTION and then add or delete an interface to or from an interface group.

The screenshot displays the 'Interface Group Window (2)' with the following elements:

- GROUP NAME:** ifg_01
- GROUP DESCRIPTION:** (empty text field)
- INTERFACE COUNT:** 1
- Buttons:** 'Back' and 'Apply' in the top right corner.
- Interface Lists:**
 - Selected:** A list containing 'vlan1.130'.
 - All:** A list containing 'vlan1.1', 'vlan1.110', and 'vlan1.120'.
- Navigation:** '>>' and '<<' buttons between the two lists.

Figure 28. Interface Group Window (2)

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

3.3 VLAN Configuration

3.3.1 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]

This command creates VLAN. The 'no' parameter is used to delete VLAN.

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

[switchport access vlan]

This command 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]

This command configures 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]

This command configures 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]

This command configures 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]

This command 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 '3.2.1 Interface Management'.

3.3.2 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]

This command 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]

This command 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]

This command 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

Parameter	Description
	- rstp: RSTP

[clear mac address-table]

This command 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]

This command 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]

This command 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]

This command retrieves bridge information.

- show bridge

[show interface switchport bridge]

This command 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]

This command 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

3.3.3 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]

This command 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]

This command 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]

This command 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]

This command 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]

This command configures the maximum allowed number of hops of a Bridge Protocol Data Unit (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]

This command 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]

This command 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]

This command 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]

This command 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]

This command 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 MSTP 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.



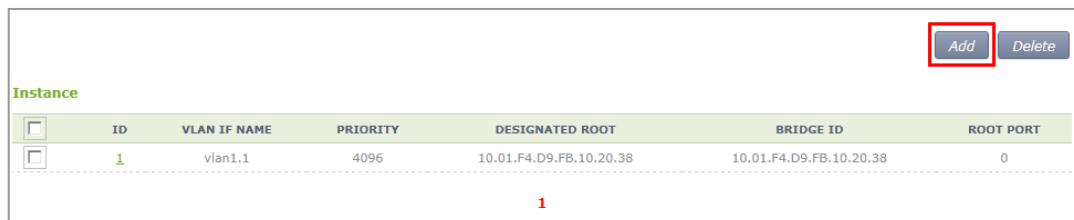
REGION	Default
REVISION	0

Apply

Figure 29. 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.

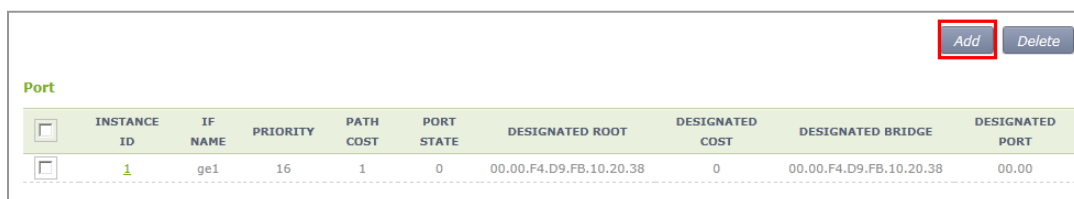


Instance						
ID	VLAN IF NAME	PRIORITY	DESIGNATED ROOT	BRIDGE ID	ROOT PORT	
1	vlan1.1	4096	10.01.F4.D9.FB.10.20.38	10.01.F4.D9.FB.10.20.38	0	

Figure 30. 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.



Port									
INSTANCE ID	IF NAME	PRIORITY	PATH COST	PORT STATE	DESIGNATED ROOT	DESIGNATED COST	DESIGNATED BRIDGE	DESIGNATED PORT	
1	ge1	16	1	0	00.00.F4.D9.FB.10.20.38	0	00.00.F4.D9.FB.10.20.38	00.00	

Figure 31. Spanning Tree Configuration Window (3)

3.4 Layer 3 Protocol Configuration

This provides the IP address configuration and static/dynamic routing configuration of an interface. The APC provides the Open Shortest Path First (OSPF) routing protocol.

3.4.1 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
```

3.4.2 Static Routing Configuration

Configuration using CLI

- 1) Go to the configure mode of the 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.

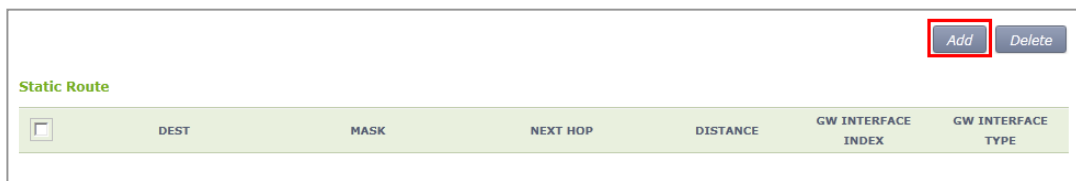


Figure 32. Static Routing Configuration Window

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.

3.4.3 IP Multicast Routing Configuration

- 1) Go to the configure mode of the 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.

3.4.4 PIM Configuration

The procedure for Protocol Independent Multicast (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
```

3.4.5 OSPF Configuration

3.4.5.1 General settings

Configuration using CLI

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

```
WEC8500# configure terminal
WEC8500/configure# router ospf
WEC8500/configure# router ospf ?
  1 - 10                OSPF process ID
```

- 2) Configure the process ID from 1 to 10.

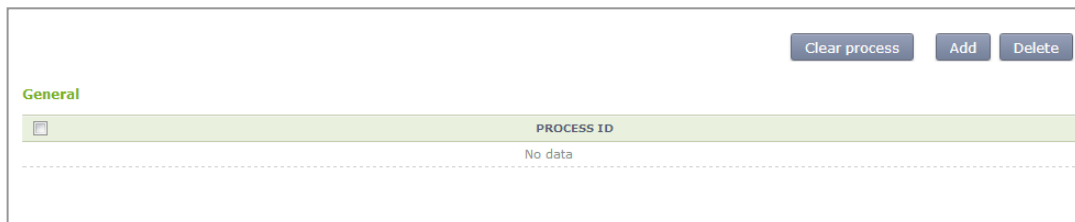
```
WEC8500/configure# router ospf ?
  1 - 10                OSPF process ID
WEC8500/configure# router ospf 2
WEC8500/configure/router/ospf 2#
```

Parameter	Description
OSPF process ID	Configure the process ID from 1 to 10.

Configuration using Web UI

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

The OSPF initial window is shown below.



The screenshot shows the OSPF Configuration Window. At the top right are three buttons: 'Clear process', 'Add', and 'Delete'. Below them is a 'General' tab. Under the 'General' tab, there is a table with one header row labeled 'PROCESS ID' and one data row labeled 'No data'.

Figure 33. OSPF Configuration Window

Click the <Add> button and configure the PROCESS ID to 1-10 in the below screen.



The screenshot shows the OSPF Configuration Window after clicking the 'Add' button. The 'PROCESS ID' field is now active, and a range '1 ~ 10' is displayed next to it. At the top right, there are two buttons: 'Back' and 'Apply'.

Configuration using CLI

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

```
WEC8500# configure terminal
WEC8500/configure# router ospf
WEC8500/configure# router ospf ?
1 - 10                OSPF process ID
WEC8500/configure# router ospf 2
WEC8500/configure/router/ospf 2#
```

2) The detail configuration items of a process ID are as follows:

```
WEC8500/configure/router/ospf 2# ?

area                OSPF area parameters
auto-cost           Calculate OSPF interface cost according
to bandwidth
capability          Enable specific OSPF feature
compatible          OSPF compatibility list
default-information Control distribution of default
information
default-metric      Set metric of redistributed routes
distance            Define an administrative distance
distribute-list     Filter networks in routing updates
```

exit	Exit from router mode
host	OSPF stub host entry
max-concurrent-dd	Maximum number allowed to process DD
concurrently	
maximum-area	Maximum number of ospf area
neighbor	Specify a neighbor router
network	Enable routing on an IP network
ospf	OSPF specific commands
overflow	Control overflow
passive-interface	Suppress routing updates on an interface
redistribute	Redistribute information from another
routing protocol	
router-id	Router-id for the OSPF process
summary-address	Configure IP address summaries
timers	Adjust routing timers

3) Router ID configuration

Enter an IP address to use.

```
WEC8500/configure/router/ospf 2# router-id ?
A.B.C.D                OSPF router-id in IP address format
WEC8500/configure/router/ospf 2# router-id 10.10.0.1 ?
<cr>
```

Parameter	Description
OSPF router-id in IP address	Enter an IP address.

4) AUTO COST configuration

Enter an OSPF cost value (1-4294967) to use.

```
WEC8500/configure/router/ospf 2# auto-cost ?
reference-bandwidth    Use reference bandwidth method to assign
OSPF cost
WEC8500/configure/router/ospf 2# auto-cost reference-bandwidth ?
1 - 4294967           The reference bandwidth in terms of
Mbits per second

WEC8500/configure/router/ospf 2# auto-cost reference-bandwidth 200 ?
<cr>
WEC8500/configure/router/ospf 2# auto-cost reference-bandwidth 200
```

Parameter	Description
reference-bandwidth	Enter a value from 1-4294967.

5) CAPABILITY OPAQUE configuration

Enter the capability opaque.

```
WEC8500/configure/router/ospf 2# capability ?
      opaque                Opaque LSA
WEC8500/configure/router/ospf 2# capability opaque ?
      <cr>
WEC8500/configure/router/ospf 2# capability opaque
```

Parameter	Description
Capability opaque	Enabled when the CLI is entered.

6) COMPATIBLE RFC configuration

Enter the compatible rfc1583.

```
WEC8500/configure/router/ospf 2# compatible ?
      rfc1583                Compatible with RFC 1583
WEC8500/configure/router/ospf 2# compatible rfc1583 ?
      <cr>
WEC8500/configure/router/ospf 2# compatible rfc1583
```

Parameter	Description
compatible rfc1583	Enabled when the CLI is entered.

7) DEFAULT METRIC configuration

Enter the DEFAULT METRIC (1-16777214) to use.

```
WEC8500/configure/router/ospf 2# default-metric ?
      1 - 16777214          Default metric
WEC8500/configure/router/ospf 2# default-metric 3 ?
      <cr>
WEC8500/configure/router/ospf 2# default-metric 3
```

Parameter	Description
Default metric	Enter a value from 1-16777214.

8) MAX CONCURRENT DD configuration

Enter the MAX CONCURRENT DD (1-65535) to use.

```
WEC8500/configure/router/ospf 2# max-concurrent-dd ?
      1 - 65535             Number of DD process
WEC8500/configure/router/ospf 2# max-concurrent-dd 2 ?
      <cr>
WEC8500/configure/router/ospf 2# max-concurrent-dd 2
```


9) MAXIMUM AREA configuration

Enter the DEFAULT METRIC (1-4294967294) to use.

```
WEC8500/configure/router/ospf 2# maximum-area ?  
  1 - 4294967294          Area limit  
WEC8500/configure/router/ospf 2# maximum-area 3 ?  
<cr>  
WEC8500/configure/router/ospf 2# maximum-area 3
```

10) SPF TIMER (MILLISECONDS) configuration

Configure the SPF TIMER (MILLISECONDS) value.

```
WEC8500/configure/router/ospf 2# timers ?  
  spf          OSPF SPF timers  
WEC8500/configure/router/ospf 2# timers spf ?  
  exp          Use exponential backoff delays  
WEC8500/configure/router/ospf 2# timers spf exp ?  
  0 - 2147483647 Minimum Delay between receiving a change  
to SPF calculation in  
                      milliseconds  
WEC8500/configure/router/ospf 2# timers spf exp 3 ?  
  0 - 2147483647 Maximum Delay between receiving a change  
to SPF calculation in  
                      milliseconds  
WEC8500/configure/router/ospf 2# timers spf exp 3 100 ?  
<cr>  
WEC8500/configure/router/ospf 2# timers spf exp 3 100
```

Configuration using Web UI

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

Click a PROCESS ID that user wants to configure. The OSPF configuration window is shown below.

Use the value configured in ‘Configuration using CLI’ as a user-defined value in the below screen.

		Back	Apply
PROCESS ID	2		
ROUTER ID	10 . 10 . 0 . 1		
AUTO COST	100		
CAPABILITY OPAQUE	Enable ▼		
COMPATIBLE RFC 1583	Disable ▼		
DEFAULT METRIC	<input checked="" type="checkbox"/> 1		
MAX CONCURRENT DD	5		
MAXIMUM AREA	20		
ABR TYPE	Cisco ▼		
SPF TIMER (MILLISECONDS)	500 ~ 50000		

The value configured in ‘Configuration using CLI’ is shown in the below screen.

		Back	Apply
PROCESS ID	2		
ROUTER ID	10 . 10 . 0 . 1		
AUTO COST	200		
CAPABILITY OPAQUE	Enable ▼		
COMPATIBLE RFC 1583	Enable ▼		
DEFAULT METRIC	<input type="checkbox"/> 1 3		
MAX CONCURRENT DD	2		
MAXIMUM AREA	3		
ABR TYPE	Cisco ▼		
SPF TIMER (MILLISECONDS)	500 ~ 50000		

3.4.5.2 Default Information Configuration of General Settings

Configuration using CLI

1) Detail configuration of OSPF default-information

```
WEC8500/configure/router/ospf 2# default-information ?
  originate          Distribute a default route
WEC8500/configure/router/ospf 2# default-information originate ?
  always            Always advertise default route
  metric            OSPF default metric
  metric-type       OSPF metric type for default routes
  route-map         Route map reference

<cr>
```

2) Configuration of default-information ALWAYS

```
WEC8500/configure/router/ospf 2# default-information originate ?

  always            Always advertise default route
  metric            OSPF default metric
  metric-type       OSPF metric type for default routes
  route-map         Route map reference

<cr>
WEC8500/configure/router/ospf 2# default-information originate always
?
<cr>
WEC8500/configure/router/ospf 2# default-information originate always

WEC8500/configure/router/ospf 2#
```

3) Configuration of default-information METRIC

Configure the OSPF metric (0-16777214) value.

```
WEC8500/configure/router/ospf 2# default-information originate metric
?
  0 - 16777214      OSPF metric
WEC8500/configure/router/ospf 2# default-information originate metric
3 ?
<cr>
WEC8500/configure/router/ospf 2# default-information originate metric
3
WEC8500/configure/router/ospf 2#
```

4) Configuration of default-information METRIC-TYPE

Configure the OSPF metric-type (1/2) value.

```
WEC8500/configure/router/ospf 2# default-information originate metric-
type ?
  1                               Set OSPF External Type 1 metrics
  2                               Set OSPF External Type 2 metrics
WEC8500/configure/router/ospf 2# default-information originate metric-
type 1 ?
  <cr>
```

5) Configuration of default-information ROUTE MAP

Enter the name of pointer to route-map entries.

```
WEC8500/configure/router/ospf 2# default-information originate route-
map ?
  <WORD>                          Pointer to route-map entries
WEC8500/configure/router/ospf 2# default-information originate route-
map AA

WEC8500/configure/router/ospf 2#
```

Configuration using Web UI

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

Click a PROCESS ID that user wants to configure. The OSPF configuration window is shown below.

Use the value configured in 'Configuration using CLI' as a user-defined value in the below screen.

Default Information	
STATE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
ALWAYS	Enable
METRIC	<input type="checkbox"/> 1 <input checked="" type="checkbox"/> 20
METRIC-TYPE	2
ROUTE MAP ²	BB

3.4.5.3 Distance Configuration of General Settings

Configuration using CLI

1) Detail configuration of OSPF distance

```
WEC8500/configure/router/ospf 2# distance ?
      admin                OSPF Administrative distance
      ospf                 OSPF Distance
```

2) Distance admin configuration

Enter the OSPF Admin distance value.

```
WEC8500/configure/router/ospf 2# distance ?
      admin                OSPF Administrative distance
      ospf                 OSPF Distance

WEC8500/configure/router/ospf 2# distance admin ?
      1 - 255              OSPF Administrative distance

WEC8500/configure/router/ospf 2# distance admin 100
```

The OSPF Admin distance is displayed as GENERAL in the Web UI.

3) Configuration of EXTERNAL distance ospf

Enter the OSPF EXTERNAL distance value.

```
WEC8500/configure/router/ospf 2# distance ospf ?
      external             External routes
      inter-area           Inter-area routes
      intra-area           Intra-area routes
WEC8500/configure/router/ospf 2# distance ospf external ?
      1 - 255              <1-255> Distance for external/inter-
area/intra-area routes
WEC8500/configure/router/ospf 2# distance ospf external 50
WEC8500/configure/router/ospf 2#
```

4) Configuration of INTER-AREA distance ospf

Enter the OSPF INTER-AREA distance value.

```
WEC8500/configure/router/ospf 2# distance ospf inter-area ?
  1 - 255                <1-255> Distance for external/inter-
area/intra-area routes

WEC8500/configure/router/ospf 2# distance ospf inter-area 50 ?
<cr>
WEC8500/configure/router/ospf 2# distance ospf inter-area 50

WEC8500/configure/router/ospf 2#
```

5) Configuration of INTRA-AREA distance ospf

Enter the OSPF INTRA-AREA distance value.

```
WEC8500/configure/router/ospf 2# distance ospf intra-area ?
  1 - 255                <1-255> Distance for external/inter-
area/intra-area routes

WEC8500/configure/router/ospf 2# distance ospf intra-area 50 ?
<cr>
WEC8500/configure/router/ospf 2# distance ospf intra-area 50

WEC8500/configure/router/ospf 2#
```

Configuration using Web UI

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

Click a PROCESS ID that user wants to configure. The OSPF configuration window is shown below.

Use the value configured in 'Configuration using CLI' as a user-defined value in the below screen.

Distance	
GENERAL	<input type="text" value="0"/>
EXTERNAL	<input type="text" value="0"/>
INTER-AREA	<input type="text" value="0"/>
INTRA-AREA	<input type="text" value="0"/>

3.4.5.4 Overflow Configuration of General Settings

Configuration using CLI

1) Detail configuration of OSPF overflow

```
WEC8500/configure/router/ospf 2# overflow ?

      database                Database

WEC8500/configure/router/ospf 2# overflow database ?
      external                External link states
      0 - 4294967294          Maximum number of LSAs

WEC8500/configure/router/ospf 2# overflow database
```

2) Overflow external configuration

Enter the maximum number of LSAs and time to recover (0 not recover) value.

```
WEC8500/configure/router/ospf 2# overflow ?

      database                Database

WEC8500/configure/router/ospf 2# overflow database ?
      external                External link states
      0 - 4294967294          Maximum number of LSAs

WEC8500/configure/router/ospf 2# overflow database external ?
      0 - 2147483647          Maximum number of LSAs

WEC8500/configure/router/ospf 2# overflow database external 3 ?
      0 - 65535               Time to recover (0 not recover)

WEC8500/configure/router/ospf 2# overflow database external 3 10 ?
      <cr>

WEC8500/configure/router/ospf 2# overflow database external 3 10
```

3) Configuration of maximum number of LSAs

Enter the maximum number of LSAs and hard limit value.

```
WEC8500/configure/router/ospf 2# overflow ?

      database                Database

WEC8500/configure/router/ospf 2# overflow database ?
      external                External link states
      0 - 4294967294          Maximum number of LSAs
```

```

WEC8500/configure/router/ospf 2# overflow database 100 ?
    hard                Hard limit; Instance will be shutdown if
exceed
    soft                Soft limit; Warning will be given if
exceed
    <cr>
WEC8500/configure/router/ospf 2# overflow database 100 hard ?
    <cr>
WEC8500/configure/router/ospf 2# overflow database 100 hard

```

Enter the maximum number of LSAs and soft limit value.

```

WEC8500/configure/router/ospf 2# overflow ?

    database            Database

WEC8500/configure/router/ospf 2# overflow database ?
    external            External link states
    0 - 4294967294      Maximum number of LSAs

WEC8500/configure/router/ospf 2# overflow database 100 ?
    hard                Hard limit; Instance will be shutdown if
exceed
    soft                Soft limit; Warning will be given if
exceed
    <cr>
WEC8500/configure/router/ospf 2# overflow database 100 soft ?
    <cr>
WEC8500/configure/router/ospf 2# overflow database 100 soft

```

Configuration using Web UI

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

Click a PROCESS ID that user wants to configure. The OSPF configuration window is shown below.

Use the value configured in 'Configuration using CLI' as a user-defined value in the below screen.

Overflow	
MAX LSA	<input checked="" type="checkbox"/> 1
LIMIT TYPE	Disable
EXTERNAL MAX LSA	<input checked="" type="checkbox"/> 1
EXTERNAL TIME TO RECOVER	<input checked="" type="checkbox"/> 1

3.4.5.5 Network Configuration

Configuration using CLI

Go to configure → ospf configuration mode of CLI.

WEC8500/configure/router/ospf 2# ?	
area	OSPF area parameters
auto-cost	Calculate OSPF interface cost according
to bandwidth	
capability	Enable specific OSPF feature
compatible	OSPF compatibility list
default-information	Control distribution of default
information	
default-metric	Set metric of redistributed routes
distance	Define an administrative distance
distribute-list	Filter networks in routing updates
exit	Exit from router mode
host	OSPF stub host entry
max-concurrent-dd	Maximum number allowed to process DD
concurrently	
maximum-area	Maximum number of ospf area
neighbor	Specify a neighbor router
network	Enable routing on an IP network
ospf	OSPF specific commands
overflow	Control overflow
passive-interface	Suppress routing updates on an interface
redistribute	Redistribute information from another
routing protocol	
router-id	Router-id for the OSPF process
summary-address	Configure IP address summaries
timers	Adjust routing timers
WEC8500/configure/router/ospf 2# network ?	
A.B.C.D	Network number
A.B.C.D/M	OSPF network prefix

Configuration using Web UI

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

The OSPF initial window is shown below.

				Add	Delete
Network					
<input type="checkbox"/>	PROCESS ID	ADDRESS	NETMASK	AREA ID	
No data					

3.4.5.6 Configuration of Network Details

Configuration using CLI

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

```
WEC8500# configure terminal
WEC8500/configure# router ospf
WEC8500/configure# router ospf ?
  1 - 10                OSPF process ID
```

- 2) Network configuration

Configure the ADDRESS, NETMASK, and AREA ID of a user-defined network.

```
WEC8500/configure/router/ospf 2# network ?
  A.B.C.D                Network number
  A.B.C.D/M              OSPF network prefix
WEC8500/configure/router/ospf 2# network 100.100.100.1 ?
  A.B.C.D                OSPF wild card bits(network mask)
WEC8500/configure/router/ospf 2# network 100.100.100.1 255.255.255.0 ?

  area                  Set the OSPF area ID

WEC8500/configure/router/ospf 2# network 100.100.100.1 255.255.255.0 ?

  area                  Set the OSPF area ID

WEC8500/configure/router/ospf 2# network 100.100.100.1 255.255.255.0
area ?
  0 - 4294967295        OSPF area ID as a decimal value

  A.B.C.D                OSPF area ID in IP address format
WEC8500/configure/router/ospf 2# network 100.100.100.1 255.255.255.0
area 3 ?
  <cr>
WEC8500/configure/router/ospf 2# network 100.100.100.1 255.255.255.0
area 3
```

Parameter	Description
NETWORK ADDRESS	Network number OSPF network prefix
NETMASK	OSPF wild card bits (network mask)
AREA ID	OSPF area ID as a decimal value/ OSPF area ID in IP address format

Configuration using Web UI

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

Enter the NETWORK ADDRESS, NETMASK, and AREA ID and click the <Apply> button.

Network	
PROCESS ID	2
NETWORK ADDRESS	10 . 10 . 10 . 1
NETMASK	255 . 255 . 255 . 0
AREA ID	10 . 10 . 10 . 0

Back Apply

3.4.5.7 Redistribute Configuration

Configuration using CLI

Go to configure → ospf configuration mode of CLI.

WEC8500/configure/router/ospf 2# ?	
area	OSPF area parameters
auto-cost	Calculate OSPF interface cost according
to bandwidth	
capability	Enable specific OSPF feature
compatible	OSPF compatibility list
default-information	Control distribution of default
information	
default-metric	Set metric of redistributed routes
distance	Define an administrative distance
distribute-list	Filter networks in routing updates
exit	Exit from router mode
host	OSPF stub host entry
max-concurrent-dd	Maximum number allowed to process DD
concurrently	
maximum-area	Maximum number of ospf area
neighbor	Specify a neighbor router
network	Enable routing on an IP network
ospf	OSPF specific commands
overflow	Control overflow
passive-interface	Suppress routing updates on an interface
redistribute	Redistribute information from another
routing protocol	
router-id	Router-id for the OSPF process
summary-address	Configure IP address summaries
timers	Adjust routing timers
WEC8500/configure/router/ospf 2# redistribute ?	
connected	Connected
static	Static routes
ospf	Open Shortest Path First (OSPF)
WEC8500/configure/router/ospf 2# redistribute	

Configuration using Web UI

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

The OSPF Redistribute initial window is shown below.

		Back	Apply
PROCESS ID	1		
TYPE	Connected		

Configuration using CLI

1) Connected configuration

The metric, metric-type, route-map, tag detail setting and default setting can be configured.

```
WEC8500/configure/router/ospf 2# redistribute ?
connected          Connected
static             Static routes
ospf               Open Shortest Path First (OSPF)
WEC8500/configure/router/ospf 2# redistribute connected ?

metric             OSPF default metric
metric-type        OSPF metric type for default routes
route-map          Route map reference
tag                Set tag for routes redistributed into
OSPF
```

2) Metric configuration

```
WEC8500/configure/router/ospf 2# redistribute connected ?

metric             OSPF default metric
metric-type        OSPF metric type for default routes
route-map          Route map reference
tag                Set tag for routes redistributed into
OSPF
<cr>
WEC8500/configure/router/ospf 2# redistribute connected metric ?
1 - 16777214       OSPF metric

WEC8500/configure/router/ospf 2# redistribute connected metric 3 ?
<cr>
WEC8500/configure/router/ospf 2# redistribute connected metric 3
```

Parameter	Description
metric	Enter a value from 1-16777214.

3) Metric-type configuration

WEC8500/configure/router/ospf 2# redistribute connected metric-type ?	
1	Set OSPF External Type 1 metrics
2	Set OSPF External Type 2 metrics
WEC8500/configure/router/ospf 2# redistribute connected metric-type 1	
?	
<cr>	
WEC8500/configure/router/ospf 2# redistribute connected metric-type 1	

Parameter	Description
metric-type	Select 1 or 2.

4) Route-map configuration

WEC8500/configure/router/ospf 2# redistribute connected route-map ?	
<WORD>	Pointer to route-map entries
WEC8500/configure/router/ospf 2# redistribute connected route-map a ?	
<cr>	
WEC8500/configure/router/ospf 2# redistribute connected route-map a	

Parameter	Description
route-map entries	Enter <WORD>.

5) Tag configuration

WEC8500/configure/router/ospf 2# redistribute connected tag ?	
0 - 4294967295	32-bit tag value
WEC8500/configure/router/ospf 2# redistribute connected tag 3 ?	
<cr>	
WEC8500/configure/router/ospf 2# redistribute connected tag 3	

Parameter	Description
Tag value	Enter a tag value from 0-4294967295.

Configuration using Web UI

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

Web UI configuration for Redistribute. The form shows PROCESS ID set to 1 and TYPE set to Connected. A dropdown menu for TYPE is open, listing options: Connected, Static, OSPF 1, OSPF 2, OSPF 3, OSPF 4, OSPF 5, OSPF 6, OSPF 7, OSPF 8, OSPF 9, and OSPF 10. Back and Apply buttons are visible in the top right corner.

After configuring Redistribute default, select a PROCESS ID for detail configuration.

Web UI configuration for Redistribute. The table shows two entries:

PROCESS ID	TYPE	METRIC	METRIC TYPE	TAG	ROUTE MAP
1	Connected	-	2	0	-
2	Connected	3	2	3	-

Red 1 is displayed below the table.

Configuring Redistribute details

Configure the details of metric, metric-type, route-map, or tag, etc. which is configured in CLI.

Web UI configuration for Redistribute details. The form shows PROCESS ID set to 2 and TYPE set to Connected. The METRIC is set to 3 (with a red 1 next to it). The METRIC TYPE is set to 2. The TAG is set to 3. The ROUTE MAP is blank (with a red 2 next to it). Back and Apply buttons are visible in the top right corner.

Foot Notes :

1. do not use
2. If the value is blank, this is not used

3.4.5.8 AREA Configuration

The Area configuration includes Stub, Not So Stubby Areas (NSSA), Virtual-Link, Range, or Detail.

1) Stub configuration

Configuration using CLI

```
WEC8500/configure/router/ospf 2# area 1 stub ?
no-summary          Do not inject inter-area routes into
stub
<cr>
WEC8500/configure/router/ospf 2# area 1 stub no-summary ?
<cr>
WEC8500/configure/router/ospf 2# area 1 stub no-summary
```

Parameter	Description
no-summary	Select Stub or No Summary.

Configuration using Web UI

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

Back

Apply

PROCESS ID	1
AREA ID	
STUB	<input checked="" type="radio"/> Stub <input type="radio"/> No Summary

In the Stub add page, configure the details and click the <Apply> button. Then, the initial window is changed as shown below.

Add

Delete

	PROCESS ID	AREA ID	STUB
<input type="checkbox"/>	1	10.10.10.1	Stub

1

2) NSSA configuration

Configuration using CLI

```
WEC8500/configure/router/ospf 2# area 1 nssa ?

    default-information-originate Originate Type 7 default into NSSA
area
    no-redistribution              No redistribution into this NSSA area
    no-summary                    Do not send summary LSA into NSSA
    translator-role               NSSA-ABR Translator role

<cr>
```

default-information-originate configuration CLI of NSSA

The metric, metric-type, no-redistribution, no-summary, or translator-role details can be configured.

```
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate ?

    metric                       OSPF default metric
    metric-type                  OSPF metric type for default routes
    no-redistribution            No redistribution into this NSSA area
    no-summary                  Do not send summary LSA into NSSA
    translator-role             NSSA-ABR Translator role

<cr>
```

Metric configuration of NSSA default-information-originate

```
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate metric ?
    0 - 16777214                OSPF metric

WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate metric 3

WEC8500/configure/router/ospf 1#
```

Parameter	Description
OSPF metric	Enter a value from 0-16777214.

Metric-type configuration of NSSA default-information-originate

```
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate metric-type ?
    1 - 2                      OSPF Link State type

WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate metric-type 2

WEC8500/configure/router/ospf 1#
```

Parameter	Description
OSPF metric-type	Select 1 or 2.

Configuring no-redistribution of NSSA default-information-originate

```
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate ?
    metric                      OSPF default metric
    metric-type                 OSPF metric type for default routes
    no-redistribution            No redistribution into this NSSA area
    no-summary                  Do not send summary LSA into NSSA
    translator-role             NSSA-ABR Translator role
    <cr>
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate no-redistribution ?
    <cr>
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate no-redistribution
```

Parameter	Description
no-redistribution	Enable/Disable Configuration

Configuring no-summary NSSA default-information-originate

```
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate no-summary ?
    <cr>
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate no-summary

WEC8500/configure/router/ospf 1#
```

Parameter	Description
no-summary	Enable/Disable Configuration

Configuring translator-role of NSSA default-information-originate

```

WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate translator-role ?
    always                Translate always
    candidate              Candidate for translator (default)
    never                  Do not translate
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate translator-role always ?
    no-redistribution      No redistribution into this NSSA area
    no-summary            Do not send summary LSA into NSSA
    <cr>
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate translator-role candidate ?
    no-redistribution      No redistribution into this NSSA area
    no-summary            Do not send summary LSA into NSSA
    <cr>
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate translator-role never ?
    no-redistribution      No redistribution into this NSSA area
    no-summary            Do not send summary LSA into NSSA
    <cr>
WEC8500/configure/router/ospf 1# area 2 nssa default-information-
originate translator-role never

```

Parameter	Description
always	Translate always
candidate	Candidate for translator (default)
never	Do not translate

After the configuration of each parameter is finished, enable or disable the no-redistribution or no-summary parameter.

Configuration using Web UI

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

The default window is shown below.

AddDelete

PROCESS ID	AREA ID
No data	

The default configuration screen is shown below.

BackApply

PROCESS ID	1
AREA ID	100.10.10.1

The NSSA window screen is shown as below after detail configuration is completed.

AddDelete

PROCESS ID	AREA ID
1	100.10.10.1

If you select a Process ID after NSSA default configuration, operator can do detail configuration.

BackApply

PROCESS ID	1
AREA ID	100.10.10.1
REDISTRIBUTION	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
SUMMARY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
TRANSLATOR ROLE	Always
ORIGINATE STATE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
ORIGINATE METRIC	<input checked="" type="checkbox"/> 1
ORIGINATE METRIC TYPE	2

Foot Notes :
1. do not use

3) Virtual-Link configuration

Configuration using CLI

```

WEC8500/configure/router/ospf 1# area 2 ?
    authentication      Enable authentication
    default-cost        Set the summary-default cost of a NSSA
or stub area
    filter-list         Filter networks between OSPF areas
    nssa               Specify a NSSA area
    range              Summarize routes matching address/mask
(border routers only)
    shortcut           Configure the area's shortcutting mode
    stub              Configure OSPF area as stub
    virtual-link       Define a virtual link and its parameters
WEC8500/configure/router/ospf 1# area 2 virtual-link ?
    A.B.C.D           ID (IP addr) associated with virtual
link neighbor
WEC8500/configure/router/ospf 1# area 2 virtual-link 10.10.10.1 ?
    authentication      Enable authentication
    authentication-key   Set authentication key
    dead-interval       Dead router detection time
    hello-interval      Hello packet interval
    message-digest-key   Set message digest key
    retransmit-interval  LSA retransmit interval
    transmit-delay      LSA transmission delay
<cr>

```

To configure the Virtual-Link, enter an ID (router ID of OSPF that is connected via Virtual) and configure the detail items. The detail items include authentication, authentication-key, dead-interval, hello-interval, message-digest-key, retransmit-interval, or transmit-delay, etc.

Authentication configuration

Operator can configure authentication and message-digest.

```

WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
authentication ?
    message-digest      Use message-digest authentication
<cr>
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
authentication message-digest ?
<cr>
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
authentication message-digest

```

Authentication-key configuration

Enter 8-character word to be used as an authentication key. Use the entered 8-character as an authentication key.

```
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
authentication-key ?
    <WORD>                               Authentication key (8 chars)
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
authentication-key aaaaaaaa

WEC8500/configure/router/ospf 2#
```

Dead-interval configuration

The default value of dead-interval is 4 times of hello-interval. Because the default hello-interval is configured to 10 sec., the dead-interval will be 40 seconds if the hello-interval is not configured. In addition, operator can change it to a value between 1 second and 65535 seconds.

```
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1 dead-
interval ?
    1 - 65535                               Seconds
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1 dead-
interval 50
WEC8500/configure/router/ospf 2#
```

Hello-interval configuration

The default hello-interval is 10 seconds. In addition, operator can change it to a value between 1 second and 65535 seconds.

```
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1 hello-
interval ?
    1 - 65535                               Seconds
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1 hello-
interval 50
WEC8500/configure/router/ospf 2#
```

Message-digest-key configuration

The message-digest-key configures a key ID between 1 and 255. After key ID configuration, configure the authentication key by using the md5 algorithm. Operator can enter maximum 16 characters.

When you enter an authentication key, the message-digest-key configuration is completed.

```
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
message-digest-key ?
    1 - 255                               Key ID

WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
message-digest-key 2 ?
    md5                                   Use MD5 algorithm
```

```

WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
message-digest-key 2 md5 ?
    <WORD>                               Authentication key (16 chars)
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
message-digest-key 2 md5 b

WEC8500/configure/router/ospf 2#

```

Retransmit-interval configuration

The default retransmit-interval is 5 seconds. In addition, operator can change it to a value between 1 second and 65535 seconds.

```

WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
retransmit-interval ?
    1 - 65535                               Seconds (default: 5)

WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
retransmit-interval

```

Transmit-delay configuration

The default transmit-delay is 1 second. In addition, operator can change it to a value between 1 second and 65535 seconds.

```

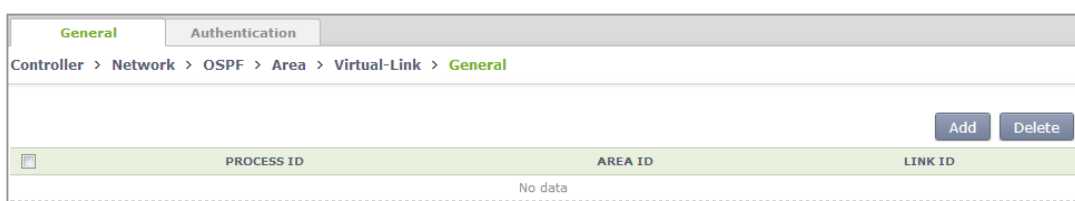
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
transmit-delay ?
    1 - 65535                               Seconds
WEC8500/configure/router/ospf 2# area 2 virtual-link 10.10.10.1
transmit-delay 5
WEC8500/configure/router/ospf 2#

```

Configuration using Web UI

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

The default window is shown below.



Unlike other configurations, there are two tabs at the top; General page and Authentication page.

Start configuration in the General page for the basic configuration of Virtual-Link.

Back

Apply

PROCESS ID	1
AREA ID	
LINK ID	

In the default configuration page, configure PROCESS ID, AREA ID, or LINK ID.
For detail configuration, select a PROCESS ID you want. Operator can do detail configuration for an item you select.

Add

Delete

	PROCESS ID	AREA ID	LINK ID
<input type="checkbox"/>	1	0.0.0.2	10.10.10.1
<input type="checkbox"/>	2	0.0.0.2	10.10.10.1

1

The detail configuration page is shown below.

Back

Apply

PROCESS ID	2
AREA ID	0.0.0.2
LINK ID	10.10.10.1
AUTHENTICATION	Authentication
AUTHENTICATION KEY ¹	aaaaaaaa
DEAD INTERVAL	<input checked="" type="checkbox"/> 2
HELLO INTERVAL	<input type="checkbox"/> 3 50
RETRANSMIT INTERVAL	<input type="checkbox"/> 4 100
TRANSMIT DELAY	<input type="checkbox"/> 5 5

Foot Notes :

1. If the value is blank, this is not used
2. use default value (hello interval * 4 second)
3. use default value (10 second)
4. use default value (5 second)
5. use default value (1 second)

The Authentication page of a Virtual-Link is shown below.

General

Authentication

Controller > Network > OSPF > Area > Virtual-Link > Authentication

Add

Delete

Authentication Message Digest

OSPF ID	AREA ID	VIRTUAL-LINK ID	DIGEST KEY	DIGEST AUTHENTICATION
No data				

Click the **<Select Virtual-Link>** button.

<input type="button" value="Back"/> <input type="button" value="Apply"/>	
Authentication Message Digest	
VIRTUAL-LINK	<input type="button" value="Select Virtual-Link"/>
OSPF ID	1 ▾
AREA ID	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
VIRTUAL-LINK ID	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
DIGEST KEY	<input type="text"/>
DIGEST AUTHENTICATION	<input type="text"/>

Select a PROCESS ID that you have selected in the General page.

And then, configure Digest Key or Digest Authentication.

Just like CLI configuration, select a digest key between 1 and 255 and enter a key whose length is 16-character or less for digest authentication.

<input type="button" value="Back"/> <input type="button" value="Apply"/>	
PROCESS ID	1 ▾
AREA ID	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
ADDRESS	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
PREFIX	<input type="text"/>
ADVERTISE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable

4) Range configuration

Configuration using CLI

To configure the Range detail items, start detail configuration after entering an Area range prefix value.

```
WEC8500/configure/router/ospf 2# area 2 range ?
  A.B.C.D/M                Area range prefix
WEC8500/configure/router/ospf 2# area 2 range 10.10.10.1/16 ?
  advertise                Advertise this range (default)
  not-advertise            DoNotAdvertise this range
  <cr>
WEC8500/configure/router/ospf 2# area 2 range 10.10.10.1/16
```

The detail items include advertise or no-advertise configuration
Configure whether to advertise to the range or not.

Configuration using Web UI

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

The configuration page is as follows:

					Add	Delete
	PROCESS ID	AREA ID	ADDRESS	PREFIX	ADVERTISE	
<input type="checkbox"/>	2	0.0.0.2	10.10.0.0	16	Disable	
<input type="checkbox"/>	1	10.10.0.1	64.0.0.0	2	Enable	

5) Detail configuration

Configuration using CLI

This is additional explanations for Area. Operator can configure authentication, default-cost, or shortcut.

```
WEC8500/configure/router/ospf 2# area 2 ?
    authentication      Enable authentication
    default-cost        Set the summary-default cost of a NSSA
or stub area
    filter-list         Filter networks between OSPF areas
    nssa                Specify a NSSA area
    range               Summarize routes matching address/mask
(border routers only)
    shortcut            Configure the area's shortcutting mode
    stub                Configure OSPF area as stub
    virtual-link        Define a virtual link and its parameters
```

Authentication configuration

Operator can select whether to use authentication or message-digest function.

```
WEC8500/configure/router/ospf 2# area 2 authentication ?
    message-digest      Use message-digest authentication
    <cr>
WEC8500/configure/router/ospf 2# area 2 authentication message-digest
?
    <cr>
WEC8500/configure/router/ospf 2# area 2 authentication message-digest
```

Default-cost configuration

Configure a value between 0 and 1677215 as a default-cost. However, operator can configure the default-cost value in AREA ID whether a stub or NSSA is configured. If you try to configure the default-cost in an ID where neither the two items are configured, the following error phrase is displayed.
 ‘% The area is neither stub, nor NSSA’

```
WEC8500/configure/router/ospf 2# area 0.0.0.1 default-cost ?
0 - 16777215                               Stub's advertised default summary cost
WEC8500/configure/router/ospf 2# area 0.0.0.1 default-cost 3 ?
<cr>
WEC8500/configure/router/ospf 2# area 0.0.0.1 default-cost 3
```

Shortcut configuration

For Shortcut configuration, operator can select one out of 3 selections including default, disable, and enable.

```
WEC8500/configure/router/ospf 2# area 0.0.0.1 shortcut ?
default                                     Set default shortcutting behavior
disable                                    Disable shortcutting through the area
enable                                    Enable shortcutting through the area
WEC8500/configure/router/ospf 2# area 0.0.0.1 shortcut enable

WEC8500/configure/router/ospf 2#
```

Configuration using Web UI

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

The configuration page is as follows:

						Default
<input type="checkbox"/>	PROCESS ID	AREA ID	AUTHENTICATION	DEFAULT COST	SHORT CUT	
<input type="checkbox"/>	1	0.0.0.0	Disable	-	Default	
<input type="checkbox"/>	1	0.0.0.2	Disable	-	Default	
<input type="checkbox"/>	1	10.10.0.1	Disable	-	Default	
<input type="checkbox"/>	1	10.10.10.1	Disable	1	Default	
<input type="checkbox"/>	1	100.10.10.1	Disable	1	Default	
<input type="checkbox"/>	2	0.0.0.0	Disable	-	Default	
<input type="checkbox"/>	2	0.0.0.1	Disable	3	Enable	

Select a PROCESS ID for detail configuration. As mentioned in the CLI, the Stub or NSSA must be configured to the PROCESS ID in a window where default-cost is selected. If a PROCESS ID without the configuration is completed, the detail configuration can not be performed. Therefore, the below default-cost configuration is available only when the Stub or NSSA is configured to the ID.

Back

Apply

PROCESS ID	2
AREA ID	0.0.0.1
AUTHENTICATION	Disable
SHORT CUT	Enable

Apply

DEFAULT COST	<input type="checkbox"/> 3
--------------	----------------------------

3.4.5.9 Summary Configuration

Configuration using CLI

```
WEC8500/configure/router/ospf 2# summary-address ?
A.B.C.D/M                IP summary prefix
WEC8500/configure/router/ospf 2# summary-address 1.1.1.1/16 ?
not-advertise            Suppress routes that match the prefix
tag                      Set tag

<cr>
WEC8500/configure/router/ospf 2# summary-address 1.1.1.1/16

WEC8500/configure/router/ospf 2#
```

Parameter	Description
summary-address	A.B.C.D/M

Operator can perform detail configuration only when you enter a summary-address.
The detail configuration includes advertise or TAG configuration.

- 1) Advertise Configuration
- The default is set to Enable. Therefore, if no-advertise is selected in the CLI, the configuration is changed to Disable.
- 2) Tag
- A tag is a user-defined 32-bit tag value between 0 and 4294967295. A tag also has a default value and it is 0.

```
WEC8500/configure/router/ospf 2# summary-address 11.1.1.1/16

WEC8500/configure/router/ospf 2# summary-address 11.1.1.1/16 tag ?
0 - 4294967295          32-bit tag value
WEC8500/configure/router/ospf 2# summary-address 11.1.1.1/16 tag 3
```

Configuration using Web UI

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

The configuration page is as follows:

						Add	Delete
Summary							
<input type="checkbox"/>	PROCESS ID	ADDRESS	PREFIX	ADVERTISE	TAG		
<input type="checkbox"/>	2	1.1.0.0	16	Enable	0		
<input type="checkbox"/>	2	11.1.0.0	16	Enable	3		

After default configuration, select a PROCESS ID for detail configuration.

The detail configuration includes advertise and TAG configuration mentioned in the CLI.

Unlike CLI, there is no no-advertise. A user can change the default Enable to Disable.

		Back	Apply
PROCESS ID	2		
ADDRESS	11.1.0.0		
PREFIX	16		
ADVERTISE	Enable ▼		
TAG	3		

3.4.5.10 Passive Interface Configuration

Configuration using CLI

```
WEC8500/configure/router/ospf 2# passive-interface ?
<WORD>                        Interface's name
WEC8500/configure/router/ospf 2# passive-interface ge2 ?
A.B.C.D                        Address of interface
<cr>
```

Parameter	Description
Interface Name	Enter the name of an interface to use directly.

A user directly enters an interface name for Passive-interface configuration. Also, a user can enter an address to the interface.

Configuration using Web UI

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

The configuration page is as follows:

PROCESS ID

1

INTERFACES

Select Interface

Back

Apply

After selecting a PROCESS ID that a user will use, select an interface to apply.

Select Interface

Back

NAME
ge1
ge2
ge3
ge4
ge5
ge6
ge7
ge8
xge1
xge2
mgmt0
lo
vlan1.1
vlan1.2

1

Among the interface items displayed on the screen, configure the interface that a user wants.

3.4.5.11 Interface General Configuration

Configuration using CLI

Unlike other OSPF configurations, the interface general does not enter into the OSPF mode. Perform related configuration at the interface that a user wants. Therefore, the CLI configuration is as follows:

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

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

- 2) The items for detail configuration are as follows:

```

WEC8500/configure/interface ge2# ip ospf ?
    address                Address of interface
    authentication          Enable authentication
    authentication-key       Authentication password (key)
    cost                    Interface cost
    database-filter          Filter OSPF LSA during synchronization
and flooding
    dead-interval           Interval after which a neighbor is
declared dead
    disable                 Disable OSPF
    hello-interval          Time between HELLO packets
    message-digest-key       Message digest authentication password
(key)
    mtu                     OSPF interface MTU
    mtu-ignore              Time between HELLO packets
    network                 Network type
    priority                Router priority
    retransmit-interval      Time between retransmitting lost link
state advertisements
    transmit-delay          Link state transmit delay

```

DISABLE OSPF configuration

```

WEC8500/configure/interface ge2# ip ospf disable ?
    all                    All functionality
WEC8500/configure/interface ge2# ip ospf disable all ?
    <cr>
WEC8500/configure/interface ge2# ip ospf disable all

```

MTU configuration

The default does not use Maximum Transmission Unit (MTU) configuration.

The range of MTU user configuration is 576-65535.

```

WEC8500/configure/interface ge2# ip ospf mtu ?
    576 - 65535
WEC8500/configure/interface ge2# ip ospf mtu 600
WEC8500/configure/interface ge2#

```

Network Type configuration

The network type includes 4 types, i.e. broadcast, non-broadcast, point-to-point, and point-to-multipoint. The Ethernet is broadcast configuration.

```

WEC8500/configure/interface ge2# ip ospf network ?
    broadcast              Specify OSPF broadcast multi-access
network
    non-broadcast          Specify OSPF NBMA network

```

```

point-to-point          Specify OSPF point-to-point network
point-to-multipoint     Specify OSPF point-to-multipoint network
WEC8500/configure/interface ge2# ip ospf network

```

Authentication configuration

This is CLI that selects whether to use user authentication.

```

WEC8500/configure/interface ge2# ip ospf authentication ?
message-digest          Use message-digest authentication
null                    Use null authentication
<cr>
WEC8500/configure/interface ge2# ip ospf authentication message-digest
?
<cr>
WEC8500/configure/interface ge2# ip ospf authentication null ?
<cr>
WEC8500/configure/interface ge2# ip ospf authentication null

```

OSPF Cost configuration

Enter a cost value between 1 and 65535.

```

WEC8500/configure/interface ge2# ip ospf cost ?
1 - 65535               Cost
WEC8500/configure/interface ge2# ip ospf cost 2 ?
<cr>

```

DATABASE-FILTER configuration

```

WEC8500/configure/interface ge2# ip ospf database-filter ?
all                     Filter all LSA
WEC8500/configure/interface ge2# ip ospf database-filter all ?
out                     Outgoing LSA
WEC8500/configure/interface ge2# ip ospf database-filter all out ?
<cr>
WEC8500/configure/interface ge2# ip ospf database-filter all out

```

Dead-interval configuration

The default value of dead-interval is 4 times of hello-interval. Because the default hello-interval is configured to 10 sec., the dead-interval will be 40 seconds if the hello-interval is not configured. In addition, operator can change it to a value between 1 second and 65535 seconds.

```

WEC8500/configure/interface ge2# ip ospf dead-interval ?
1 - 65535               Seconds

```

```
WEC8500/configure/interface ge2# ip ospf dead-interval 30 ?
<cr>
WEC8500/configure/interface ge2# ip ospf dead-interval 30
```

Hello-interval configuration

The default hello-interval is 10 seconds. In addition, operator can change it to a value between 1 second and 65535 seconds.

```
WEC8500/configure/interface ge2# ip ospf hello-interval ?
 1 - 65535                      Seconds
WEC8500/configure/interface ge2# ip ospf hello-interval 50 ?
<cr>
WEC8500/configure/interface ge2# ip ospf hello-interval 50
WEC8500/configure/interface ge2#
```

Retransmit-interval configuration

The default retransmit-interval is 5 seconds. In addition, operator can change it to a value between 1 second and 65535 seconds.

```
WEC8500/configure/interface ge2# ip ospf retransmit-interval ?
 1 - 65535                      Seconds (default: 5)
WEC8500/configure/interface ge2# ip ospf retransmit-interval 100 ?
<cr>
WEC8500/configure/interface ge2# ip ospf retransmit-interval 100
WEC8500/configure/interface ge2#
```

TRANSMIT DELAY configuration

The default transmit-delay is 1 second. In addition, operator can change it to a value between 1 second and 65535 seconds.

```
WEC8500/configure/interface ge2# ip ospf transmit-delay ?
 1 - 65535                      Seconds
WEC8500/configure/interface ge2# ip ospf transmit-delay 400
WEC8500/configure/interface ge2#
```

MTU IGNORE configuration

The default configuration is Disable. If you configure CLI, it is changed to Enable.

```
WEC8500/configure/interface ge2# ip ospf mtu-ignore ?
<cr>
WEC8500/configure/interface ge2# ip ospf mtu-ignore
WEC8500/configure/interface ge2#
```


PRIORITY configuration

The default OSPF Priority value is 1. A user can configure the priority between 1 and 255.

```
WEC8500/configure/interface ge2# ip ospf priority ?
0 - 255                                     Priority
WEC8500/configure/interface ge2# ip ospf priority 2
```

Configuration using Web UI

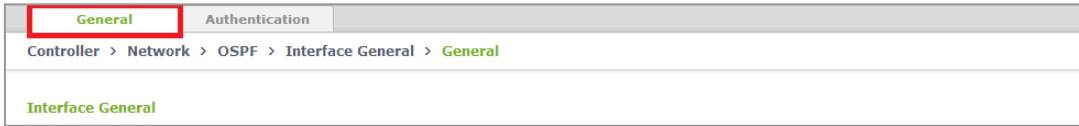
In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <Network> → <OSPF> → <Interface General> menu in the sub-menus.

The configuration page is as follows:
As shown in the below figure, the currently enabled interface items are displayed.
When you select an interface for detail configuration, operator can go to the detail item configuration page.
The Interface General item is also divided into General configuration and Authentication window as a tab.

Interface General	
INTERFACE	AUTHENTICATION
ge1	Disable
ge2	Authentication Null
ge3	Disable
ge4	Disable
ge5	Disable
ge6	Disable
ge7	Disable
ge8	Disable
xe1	Disable
xe2	Disable
mgmt0	-
lo	-
vlan1.1	-
vlan1.2	Disable

1

The General configuration screen is as follows:



The detail item configuration page is as follows:

When you select the name of an enabled interface, the below detail item configuration page is displayed.

Back Apply	
INTERFACE NAME	ge2
DISABLE OSPF	Enable
MTU	<input type="checkbox"/> 1 600
NETWORK TYPE	Broadcast
AUTHENTICATION	Authentication Null
AUTHENTICATION KEY ²	12345678
COST	0
DATABASE FILTER	Disable
DEAD INTERVAL	<input type="checkbox"/> 3 30
HELLO INTERVAL	<input type="checkbox"/> 4 50
RETRANSMIT INTERVAL	<input type="checkbox"/> 5 100
TRANSMIT DELAY	<input type="checkbox"/> 6 400
MTU IGNORE	Enable
PRIORITY	<input type="checkbox"/> 7 2

After entering a value that a user wants for the item configured in the above CLI, click the **<Apply>** button.

Authentication configuration

Just as General configuration, click the Authentication configuration in the tab.

Then, the page for authentication related detail configuration is displayed as shown below.

Select an interface that a user wants to configure, and enter the key string (1-255) of the configuration.

General	Authentication
Controller > Network > OSPF > Interface General > Authentication > Add	
Back Apply	
Authentication Message Digest	
INTERFACE NAME	Select Interface
KEY	<input type="text"/>
KEY STRING	<input type="text"/>

The verification page after configuration is as follows:

Add Delete			
Authentication Message Digest			
<input type="checkbox"/>	INTERFACE NAME	KEY	KEY STRING
<input type="checkbox"/>	ge2	2	1234
1			

3.4.6 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]

This command 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]

This command enables or disables the VRRP session.

- enable
- disable

[preempt-delay]

This command configures the preempt delay time.

- preempt-delay [DELAY_TIME]

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

[preempt-mode]

This command 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]

This command configures a priority.

- priority [PRIORITY]

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

[virtual-ip]

This command 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]

This command 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.

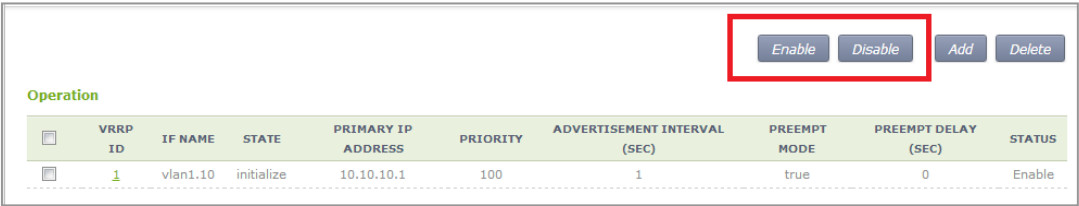


Figure 34. VRRP-Operation Window

[Circuit Failover]

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

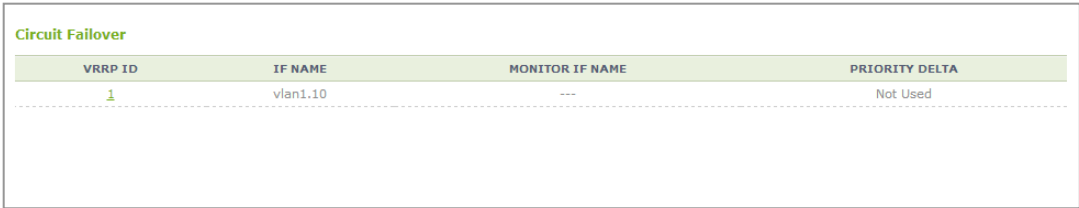


Figure 35. VRRP-Circuit Failover Window (1)

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



Figure 36. VRRP-Circuit Failover Window (2)

3.4.7 Configuring IPWATCHD

The IP WATCH Daemon (IPWATCHD) provides the function of detecting active or passive IP collision. Regardless of IP collision attacker or victim, the information including source ip/mac is transmitted as an evm fault event when the IP collision occurs. At the collision time, the Gratuitous Address Resolution Protocol (GARP) reply is transmitted 3 times to the unicast at every 1 second.

It supports the rate-limit function to deal with an intended ARP attack. Although ARP is entered from a host that is not in the same subnet, it generates GARP by recognizing it as a target if the host has the same APC IP.

Configuration using CLI

To configure the IPWATCHD function, enter into the configure mode of CLI.

Configure a TIMEOUT value (that a user wants) to detect an IP address collision.

Operator can enter a value between 10 and 300 seconds.

```
WEC8500# configure terminal
WEC8500/configure#
WEC8500/configure# ipwatch ?
    defend-interval          Ipwatch defend-interval configuration
WEC8500/configure# ipwatch defend-interval ?
    10 - 300                Ipwatch defend-interval value(seconds)
WEC8500/configure# ipwatch defend-interval 30
```

Parameter	Description
VALUE	Enter a defend-interval (10-300 sec).

The default TIMEOUT value for IP address collision detection is 30 seconds.

When the time is configured, the IPWATCHD daemon is restarted and a log and GARP is generated if there is an IP collision.

Configuration using Web UI

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

After entering a time value (10-300 seconds) that a user wants in the TIMEOUT FOR IP ADDRESS CONFLICT DETECTION window, click the <Apply> button. Then, the configuration is applied.

The default value before user configuration is 30 as shown in the below figure.

Figure 37. IPWATCHD Configuration Window

3.5 QoS

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

3.5.1 ACL Configuration

3.5.1.1 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.

```
APC# configure terminal
APC/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/URL] eq [eq_VALUE] [any/A.B.C.D A.B.C.D/URL] eq [eq_VALUE] os-aware [os-aware_VALUE] [[[dscp [*|[0-63]]|precedence [*|[0-7]]]]]]]

An example of entering a command is shown below.

- Creating Access list 'acl1':

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

- Deleting Access list 'acl1':

```
APC# configure terminal
APC/configure# fqm-mode
APC/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.

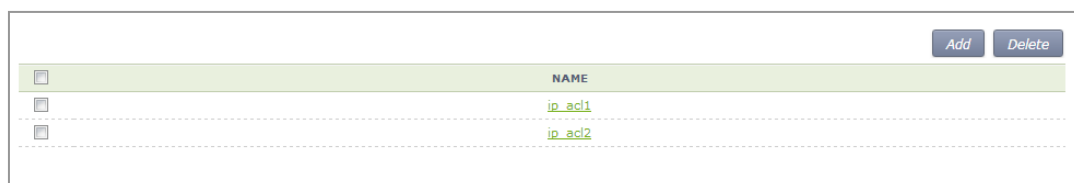


Figure 38. ACL Configuration Window

To change the configuration of ACL rule, click ACL NAME 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.

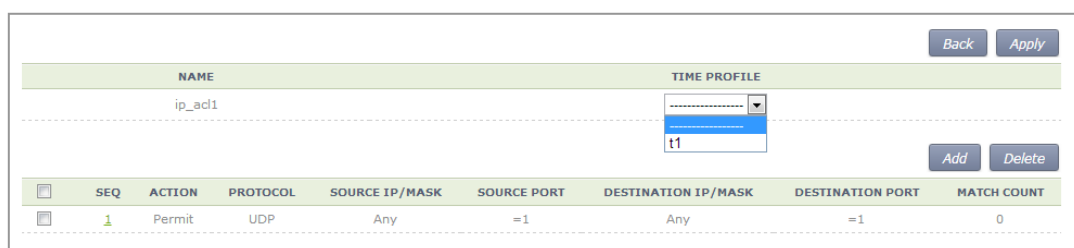


Figure 39. Window where a Time Profile is Applied to ACL

3.5.1.2 ACL Rule Configuration

Configuration using CLI

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

```
APC# configure terminal
APC/configure# interface [name]
APC/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)

Parameter	Description
ACL_NAME	ACL name to configure

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

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

- 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 40. ACL Interface Configuration Window (1)

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

Figure 41. 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.

3.5.1.3 WLAN ACL Configuration

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

```
APC# configure terminal
APC/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.

3.5.1.4 Admin ACL Configuring

Configuration using CLI

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

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

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

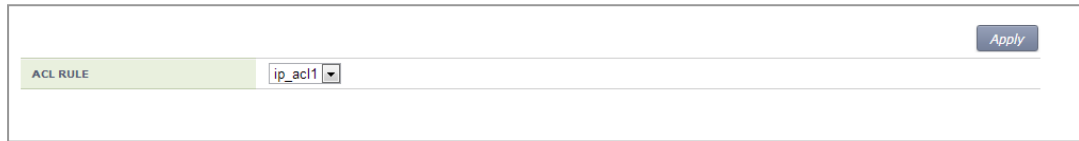
Parameter	Description
ACL_NAME	ACL name to configure

- 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.



The image shows a web-based configuration window titled 'Admin ACL Configuration Window'. It features a header bar with an 'Apply' button on the right. Below the header, there is a section labeled 'ACL RULE' with a dropdown menu currently set to 'ip_acl1'.

Figure 42. Admin ACL Configuration Window

3.5.2 Class-map Configuration

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

```
APC# configure terminal
APC/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.

3.5.3 Policy-map Configuration

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

```
APC# configure terminal
APC/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.

3.5.4 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.

```
APC# configure terminal
APC/configure# interface ge2
APC/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.

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

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

3.5.5 Time Profile

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

3.5.5.1 Time Profile Configuration

Configuration using CLI

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

```
APC# configure terminal
APC/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.

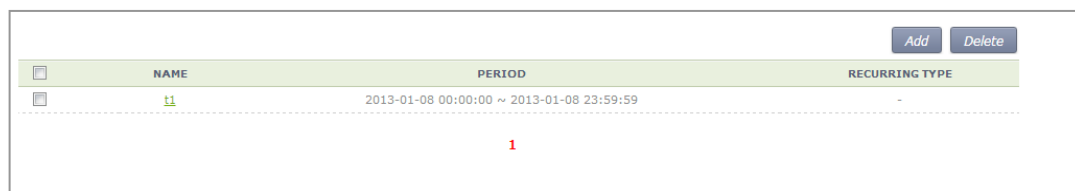


Figure 43. Time Profile Configuration Window (1)

Select an item in the list and perform detail configuration.

Back

Apply

NAME	t1					
TYPE	<input checked="" type="radio"/> Absolute <input type="radio"/> Periodic					
DATE START	2013-01-08	00	00	00		
DATE END	2013-01-08	23	59	59		

Figure 44. Time Profile Configuration Window (2)

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

3.5.5.2 Applying to ACL

Configuration using CLI

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

```
APC# configure terminal
APC/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.

```
APC# configure terminal
APC/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 ACL window is changed as shown below. After selecting a time profile, click the <Apply> button to apply the time profile to the ACL.

Figure 45. Applying to ACL

3.5.5.3 ACL (Time-Profile) Rule Configuration

Configuration using CLI

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

```
APC# configure terminal
APC/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'.

3.5.6 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.

3.5.6.1 OS-AWARE Configuration

Configuration using CLI

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

```
APC# configure terminal
APC/configure# os-aware
APC/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] dhcp-option [OPTION_NUM] eq[VALUE] os-type [OS_TYPE NAME]
 - delete os-aware [OS_AWARE NAME]
 - update os-aware [OS_AWARE NAME] dhcp-option [OPTION_NUM] dhcp-option [OPTION_NUM] eq [VALUE] os-type [OS_TYPE NAME]

Parameter	Description
OS_AWARE NAME	os-aware name to configure
SEQUENCE_NUM	Fingerprint pattern match sequence(1~255)
OPTION_NUM	dhcp option value (1~255)
VALUE	Fingerprint value(HEX)
OS_TYPE NAME	os-type name to configure(Unknown, android, ios, windows, mac)

os-aware 'window7' creation:

```
APC# configure terminal
APC/configure# os-aware
APC/configure/os-aware # os-aware window7 seq 5 dhcp-option 1 eq AA
os-type windows
```

os-aware 'window7' modification:

```
APC# configure terminal
APC/configure# os-aware
APC/configure/os-aware # os-aware window7 seq 8 dhcp-option 2 eq FF
os-type windows
```

os-aware 'window7' deletion:

```
APC# configure terminal
APC/configure# os-aware
APC/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
OS_TYPE
=====
=====
      1      window7  0      0      5      2      1234 windows
```

3.5.6.2 Applying to ACL

Configuration using CLI

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

```
APC# configure terminal
APC/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.

```
APC# configure terminal
APC/configure# fgm-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.

3.6 Multicast to Unicast

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

3.7 IP Multicast Configuration

3.7.1 IP Multicast Routing Configuration

Configuration using CLI

- 1) Go to the configure mode of the 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 46. IP Multicast Configuration Window

3.7.2 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.

The screenshot shows a web interface for PIM-SM configuration. At the top right, there are two buttons: 'Add' and 'Delete'. Below them is a table with two columns: 'IF NAME' and 'IP ADDRESS'. The table is currently empty, with a small square icon in the first row of the 'IF NAME' column.

Figure 47. 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.

The screenshot shows a web interface for selecting an interface. At the top right, there are two buttons: 'Back' and 'Apply'. Below them is a form with a label 'INTERFACE' and a button 'Select Interface'.

Figure 48. PIM-SM Configuration Window (2)

3) Select an interface to add.

[Back](#)

Select Interface

NAME	TYPE	MAC ADDRESS	IP ADDRESS	ADMIN STATUS	LINK STATUS
ge1	gigabit ethernet	00:7e:37:00:1f:08	0.0.0.0	up	down
ge2	gigabit ethernet	00:7e:37:00:1f:0a	0.0.0.0	up	down
ge3	gigabit ethernet	00:7e:37:00:1f:04	0.0.0.0	up	down
ge4	gigabit ethernet	00:7e:37:00:1f:06	0.0.0.0	up	down
ge5	gigabit ethernet	00:7e:37:00:1f:0b	0.0.0.0	up	down
ge6	gigabit ethernet	00:7e:37:00:1f:09	0.0.0.0	up	down
ge7	gigabit ethernet	00:7e:37:00:1f:07	0.0.0.0	up	down
ge8	gigabit ethernet	00:7e:37:00:1f:05	0.0.0.0	up	down
xe1	gigabit ethernet	00:7e:37:00:1f:03	0.0.0.0	up	down
xe2	gigabit ethernet	00:7e:37:00:1f:02	0.0.0.0	up	down
mgmt0	gigabit ethernet	00:7e:37:00:1f:00	192.168.5.132	up	up
lo	loopback	00:00:00:00:00:00	127.0.0.1	up	up
vlan1.1	vlan device	00:7e:37:00:1f:01	0.0.0.0	up	down
vlan1.10	vlan device	00:7e:37:00:1f:01	10.10.10.3	up	down
vlan1.100	vlan device	00:7e:37:00:1f:01	0.0.0.0	up	down

1

Figure 49. PIM-SM Configuration Window (3)

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

[Back](#) [Apply](#)

INTERFACE

vlan1.10

Select Interface

?

Do you really want to apply?

확인

취소

Figure 50. PIM-SM Configuration Window (4)

3.8 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]

This command 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]

This command enables or disables the Querier function. (Default: Enable status)

- ip igmp snooping querier
- no ip igmp snooping querier

[ip igmp snooping report-suppression]

This command 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]

This command 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 SUPPRESSION STATE, select Enable or Disable and click the <Apply> button.

VLAN IF NAME	STATE	FAST LEAVE STATE	QUERIER STATE	REPORT SUPPRESSION STATE
vlan1.1	Disable	Disable	Disable	Enable
vlan1.10	Disable	Disable	Disable	Enable
vlan1.100	Disable	Disable	Disable	Enable

Figure 51. 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.

VLAN IF NAME	IF NAME

Figure 52. IGMP Snooping Mroute Creation Window (1)

- 1) In the PIM-SM initial window, click the <Add> button.
- 2) Click the <Select Vlan> button.

VLAN IF NAME	IF NAME

Figure 53. IGMP Snooping Mroute Creation Window (2)

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

Back

Select Vlan

VLAN IF NAME	STATE	FAST LEAVE STATE	QUERIER STATE	REPORT SUPPRESSION STATE
vlan1.1	Disable	Disable	Disable	Enable
vlan1.10	Disable	Disable	Disable	Enable
vlan1.100	Disable	Disable	Disable	Enable

1

Figure 54. IGMP Snooping Mroute Creation Window (3)

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

BackApply

VLAN IF NAME

vlan1.10

Select Vlan

IF NAME

ge2

팝업 메시지의 메시지

Do you really want to apply?

확인취소

Figure 55. IGMP Snooping Mroute Creation Window (4)

3.9 Deep Packet Inspection

It supports QoS by application. It may allow drop, bandwidth contract, and DSCP marking and it provides statistics by detailed category. The application of DPI in a unit of WLAN is possible and it also provides a monitoring function.

3.9.1 Configuring Profile and Application Rule

A profile is a set of application rules and each rule includes the QoS settings of the application.

The profile must set at least one application rule.

Configuration using CLI

- 1) Enter the DPI Configuration mode.

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

- 2) Make a profile and add an application rule.

```
APC/configure/dpi# profile [NAME]
APC/configure/dpi/profile [NAME]# rule [APPLICATION]
APC/configure/dpi/profile [NAME]/rule [APPLICATION]# action permit
APC/configure/dpi/profile [NAME]/rule [APPLICATION]# mark [DSCP]
APC/configure/dpi/profile [NAME]/rule [APPLICATION]# bw-contract
upstream [BW_CNT]
APC/configure/dpi/profile [NAME]/rule [APPLICATION]# bw-contract
downstream [BW_CNT]
APC/configure/dpi/profile [NAME]# enable
```

Parameter	Description
NAME	Profile name
APPLICATION	Application name
DSCP	DSCP value
BW_CNT	Bandwidth Contract. Kbps

- 3) Designate a WLAN where the profile is applied.

```
APC# configure terminal
APC/configure# wlan [ID]
APC/configure/wlan [ID]# dpi-profile [NAME]
```

Parameter	Description
NAME	Profile name
ID	WLAN ID

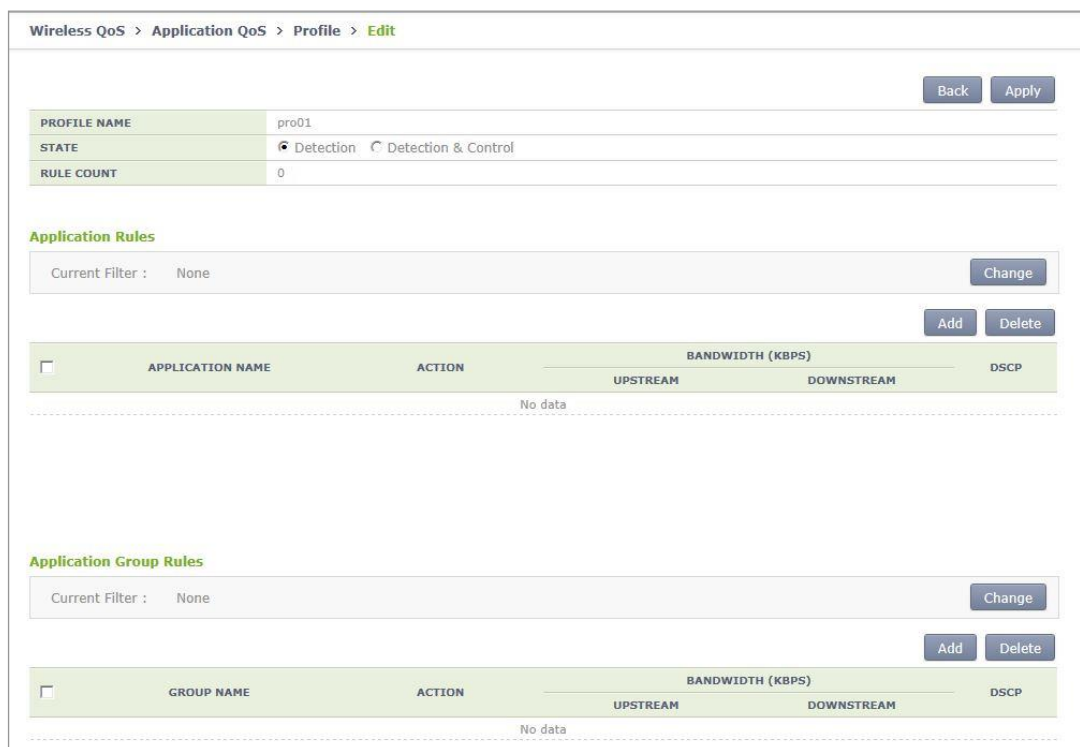
Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, and then select <Wireless QoS > Application QoS> in the submenus. Select <**Profile**>.



The screenshot shows the 'Profile Creation' screen in the Web UI. The breadcrumb navigation at the top reads 'Wireless QoS > Application QoS > Profile > Add'. Below the navigation bar are 'Back' and 'Apply' buttons. The main form contains two fields: 'PROFILE NAME' with an empty text input, and 'STATE' with two radio button options: 'Detection' (which is selected) and 'Detection & Control'.

Figure 56. Profile Creation Screen



The screenshot shows the 'Profile Configuration' screen. The breadcrumb navigation at the top reads 'Wireless QoS > Application QoS > Profile > Edit'. Below the navigation bar are 'Back' and 'Apply' buttons. The main form contains three sections: 1) Profile details with fields for 'PROFILE NAME' (containing 'pro01'), 'STATE' (with 'Detection' selected), and 'RULE COUNT' (containing '0'). 2) 'Application Rules' section with a 'Current Filter : None' and a 'Change' button. Below this is a table with columns: 'APPLICATION NAME', 'ACTION', 'BANDWIDTH (KBPS)' (subdivided into 'UPSTREAM' and 'DOWNSTREAM'), and 'DSCP'. The table currently shows 'No data'. 3) 'Application Group Rules' section, which has an identical layout to the 'Application Rules' section, also showing 'No data'.

Figure 57. Profile Configuration Screen

3.9.2 Configuring Application Group

Possible to configure one or more applications as a group.

Configuration using CLI

- 1) Enter the DPI Configuration mode.

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

- 2) Make a group and add an application.

```
APC/configure/dpi# app-group [NAME]
APC/configure/dpi/app-group [NAME]# application [APPLICATION]
```

Parameter	Description
NAME	Group name
APPLICATION	Application name

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, and then select <Wireless QoS > Application QoS> in the submenus. Select <**Application Group**>.

Wireless QoS > Application QoS > Application Group > Add

GROUP NAME

GROUP DESCRIPTION

Back Apply

Figure 58. Application Group Creation Screen

Wireless QoS > Application QoS > Application Group > [Edit](#)

Back

Apply

GROUP NAME

GRP01

DESCRIPTION

Current Filter : None

Change

Selected Applications

Total Entry : 0

☐

APPLICATION NAME

APPLICATION DESCRIPTION

No data

▽

△

Current Filter : None

Change

All Applications

Total Entry : 138

☐

APPLICATION NAME

APPLICATION DESCRIPTION

☐ BITTORRENT

☐ FTP_DATA

☐ TELNET

☐ TFTP

☐ VIMEO

Figure 59. Application Group Configuration Screen

3.9.3 Checking Statistics by Category

The category provides statistical information by application, WLAN, station, device-os-type, and group.

Configuration using CLI

- 1) Check the statistical information on all applications.

```
APC# show dpi stat application

Accumulated Application Stat
-----
-----
| ID | Application Name | Upstream Packet Count |
Upstream Byte | Downstream Packet Count | Downstream Byte |
| | * | |
Upstream Kbps | | Downstream Kbps |
| | ** | Drop |
Drop | Drop | Drop |
-----
-----
-----
```

	1	BITTORRENT	0
0		0	0
	3	FTP_DATA	0
0		0	0
	4	TELNET	0
0		0	0
	5	TFTP	0
0		0	0
	6	VIMEO	0
0		0	0
	7	YAHOO_MSG_VOIP	0
0		0	0
	8	YOUTUBE	1
54		2	220
	9	VSHARE	0
0		0	0
	10	FLASH_YAHOO	0
0		0	0
	11	BING	0
0		0	0
	12	DNS	0
0		0	0
	13	FLASH	0
0		0	0
	14	FTP	0
0		0	0
	15	GMAIL	0
0		0	0
	17	GOOGLE	0
0		0	0
	18	GOOGLE_EARTH	0
0		0	0
	19	GOOGLE_GROUPS	0
0		0	0
	20	GOOGLE_MAPS	0
0		0	0
	21	HTTP	0
0		0	0
	22	HTTP_SECURE	3
162		3	193
	23	TWITTER	0
0		0	0
	24	YAHOO_MAIL	0
0		0	0
	25	YAHOO_SEARCH	0
0		0	0
	26	ORKUT	0
0		0	0
	27	FACEBOOK	0
0		0	0
	28	LINKEDIN	0
0		0	0
	29	VOICETALKSIGNAL	0
0		0	0

0		30		KAKAOTALK_VOIP		0	
				0		0	
		51		COMMON_PATTERNS		0	
0				0		0	

Top 10 Applications							

	RANK		ID		Application Name		Upstream Packet Count
	Upstream Byte				Downstream Packet Count		
	Downstream Byte						

	1		22		HTTP_SECURE		3
162					3		
193							
	2		8		YOUTUBE		1
54					2		
220							

APC#							

2) Check the statistical information on specific applications.

APC# show dpi stat application HTTP_SECURE	
- "HTTP_SECURE"(ID: 22) Stat	
	Description
	""
	Upstream Packet Count
3	packets
	Upstream Byte
162	bytes
	Downstream Packet Count
3	packets
	Downstream Byte
193	bytes
	Upstream Packet Drop Count
0	packets
	Upstream Drop Byte
0	bytes
	Downstream Packet Drop Count
0	packets
	Downstream Drop Byte
0	bytes

```

| Top 10 Stations |-----1-----2--
--3-----4-----5-----6-----7-----8-----9---| %
| 1. 00:12:47:F3:CF:A4 100.00% 355 bytes
|||||
|
| Top 10 Stations(History) |-----1-----2--
--3-----4-----5-----6-----7-----8-----9---| %
|
| Top 10 WLANs |-----1-----2--
--3-----4-----5-----6-----7-----8-----9---| %
| 1. 1 100.00% 355 bytes
|||||
|
| Top 10 Device types |-----1-----2--
--3-----4-----5-----6-----7-----8-----9---| %
| 1. Samsung SM-P900 100.00% 355 bytes
|||||
|
| Top 10 OS types |-----1-----2--
--3-----4-----5-----6-----7-----8-----9---| %
| 1. Android 4.4.2 100.00% 355 bytes
|||||
APC#

```

Parameter	Description
APPLICATION	Application name

3) Check the statistical information on all WLANs.

```
APC# show dpi stat wlan
```

4) Check the statistical information on specific WLANs.

```
APC# show dpi stat wlan [ID]
```

Parameter	Description
ID	WLAN ID

5) Check the statistical information on all stations.

```
APC# show dpi stat station
```


- 6) Check the statistical information on specific stations.

```
APC# show dpi stat station [MAC]
```

Parameter	Description
MAC	Station MAC

- 7) Check the statistical information on all device-os-types.

```
APC# show dpi stat device-os-type
```

- 8) Check the statistical information on specific device-os-types.

```
APC# show dpi stat device-os-type [TYPE]
```

Parameter	Description
TYPE	Device of OS type name

- 9) Check the statistical information on all application groups.

```
APC# show dpi stat group
```

- 10) Check the statistical information on specific application groups.

```
APC# show dpi stat group [NAME]
```

Parameter	Description
NAME	Application group name

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select <Application> submenu.

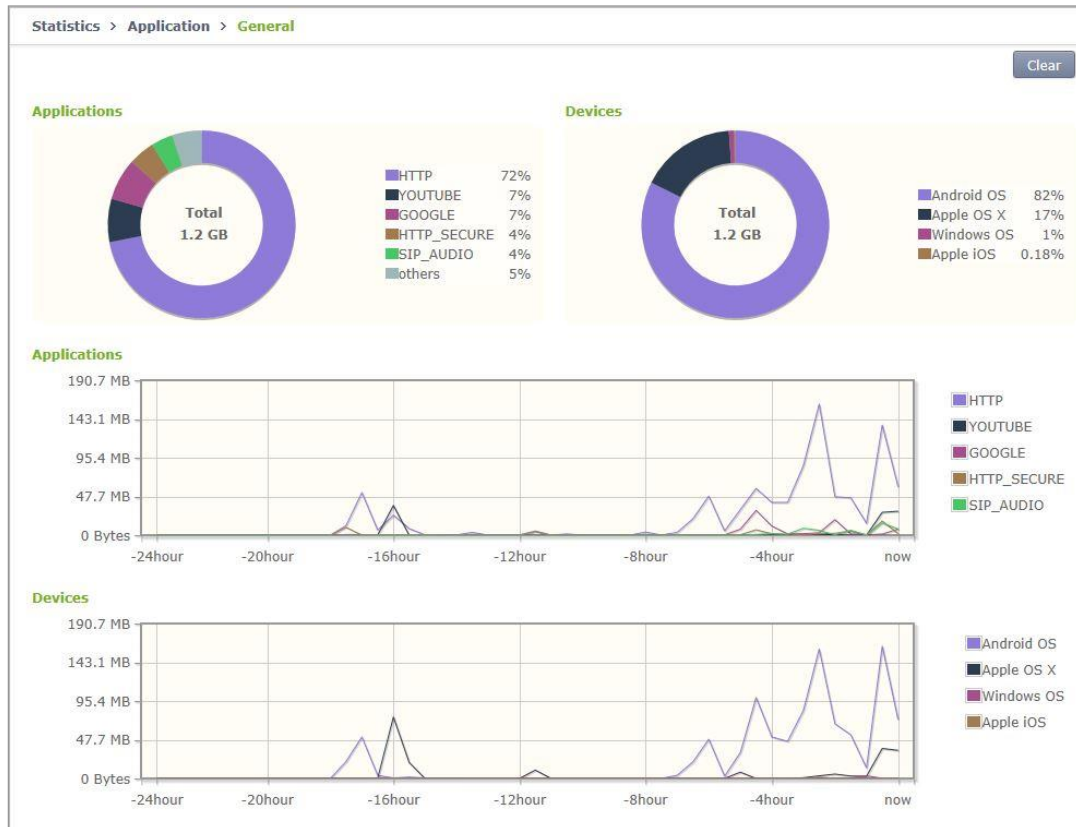


Figure 60. WLAN/Device Statistics Screen

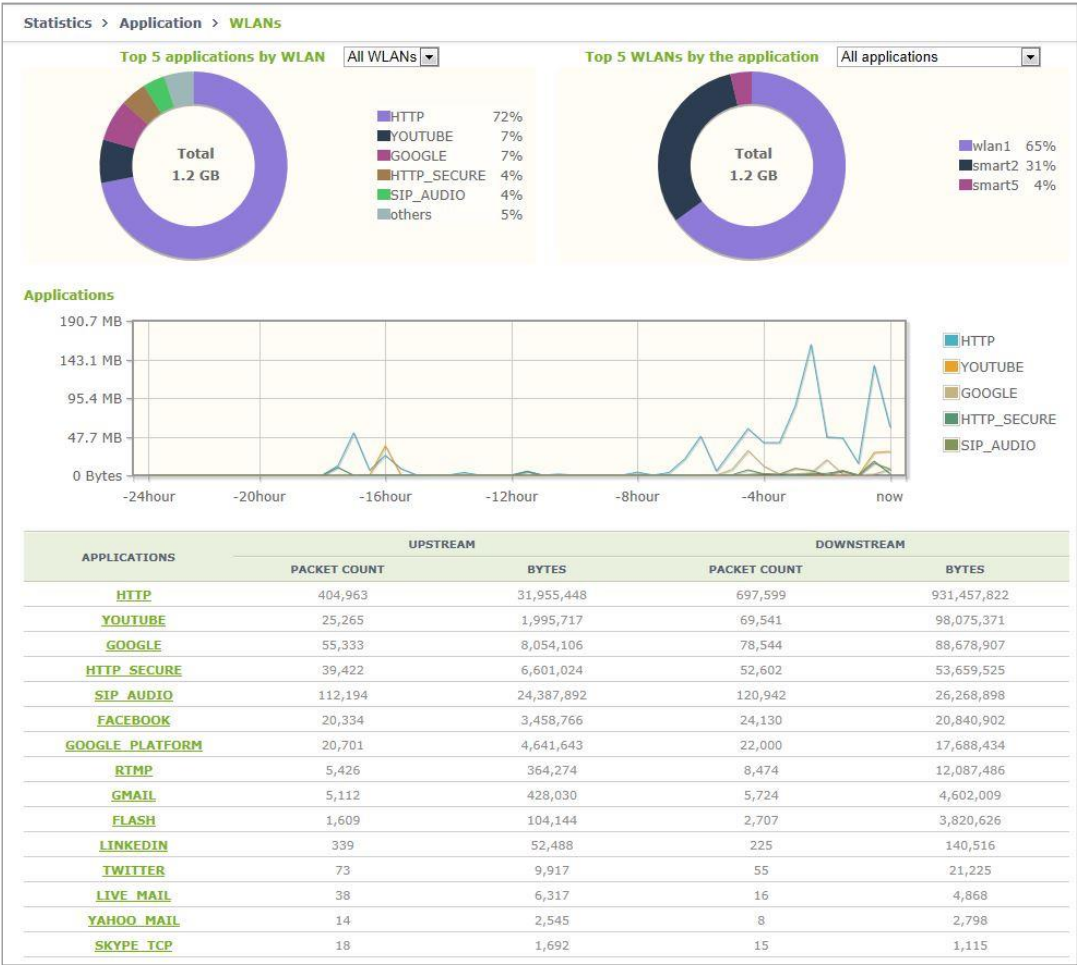


Figure 61. WLAN Statistics Screen

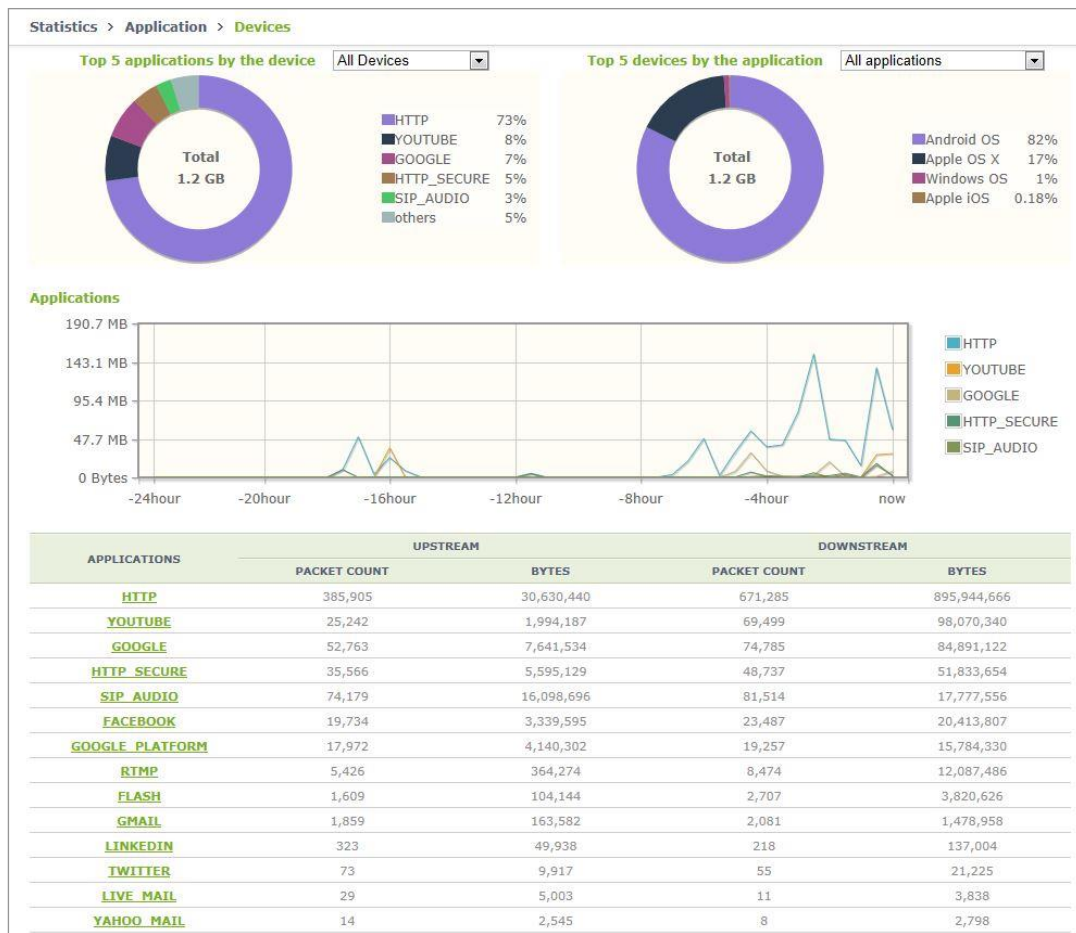


Figure 62. Device Statistics Screen

3.10 mDNS Snooping

Bonjour is a zero-configuration support protocol by Apple Inc. The Bonjour protocol supports service and device discovery in home networks.

To support the Bonjour protocol on enterprise networks, the APC mDNS snooping supports the following functions.

- Bonjour service support between wired and wireless devices connected to other VLANs
- Access control for the Bonjour service using service strings

Configuration using CLI

- 1) Enable the mDNS Snooping function in the APC system.

```
WEC8500/configure# ip mdns
WEC8500/configure/ip/mdns# snoop
WEC8500/configure/ip/mdns/snoop# enable
```

- 2) Add an mDNS snooping service object.

```
WEC8500/configure/ip/mdns# service AirPrint _ipp._tcp
WEC8500/configure/ip/mdns# service AirTunes _raop._tcp
WEC8500/configure/ip/mdns# service AppleTv _airplay.tcp
```

Parameter	Description
SERVICE_NAME	mDNS snooping service name
SERVICE_STRING	mDNS snooping service string

- 3) Create an mDNS snooping profile object and configure a service object.

```
WEC8500/configure/ip/mdns# profile mdnsprofile1
WEC8500/configure/ip/mdns/profile mdnsprofile1# service AirPrint
WEC8500/configure/ip/mdns/profile mdnsprofile1# service AirTunes
WEC8500/configure/ip/mdns/profile mdnsprofile1# service AppleTv
```

Parameter	Description
NAME	mDNS snooping profile name
SERVICE_NAME	Name of the mDNS snooping service object to set in the mDNS snooping profile

- 3) Configure the mDNS snooping profile object in the WLAN and the wired interface.
 - The Bonjour service configured in the mDNS snooping profile is forwarded to the configured WLAN and wired interface.

```
WEC8500/configure# wlan 1
WEC8500/configure/wlan 1# mDNS-snoop-profile mdns_p1
WEC8500/configure/wlan 1# exit
WEC8500/configure# interface vlan1.10
WEC8500/configure/interface vlan1.10# mDNS-snoop-profile mdns_p1
WEC8500/configure/interface vlan1.10# exit
```

Parameter	Description
NAME	mDNS snooping profile name

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <General> submenus.

- 1) Enable the mDNS Snooping function in the APC system.
In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <mDNS Snooping> → <General> submenus.

Figure 63. mDNS Snooping Activation Window

- 2) Add an mDNS snooping service object.

Figure 64. mDNS Snooping Service Configuration

- 3) Create an mDNS snooping profile object and configure a service object.
Select <Controller> → <mDNS Snooping> → <Profile>.



Figure 65. mDNS Snooping Profile Configuration

Click the <Add> button to create a new mDNS snooping profile object.

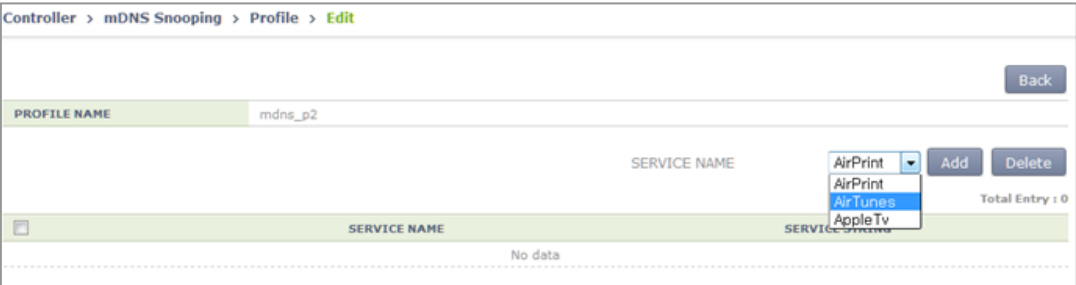


Figure 66. mDNS Snooping Profile Service Configuration

- 4) Configure the mDNS snooping profile object in the WLAN and the wired interface.
Select <Configuration> → <WLANs> → <Advanced>. Select the mDNS snooping profile object created in MDNS SNOOPING PROFILE for WLAN.



Figure 67. WLAN mDNS Snooping Profile Object Configuration

Select <Configuration> → <Interfaces>. Select the mDNS snooping profile object created in mDNS Snooping Profile for the wired interface.

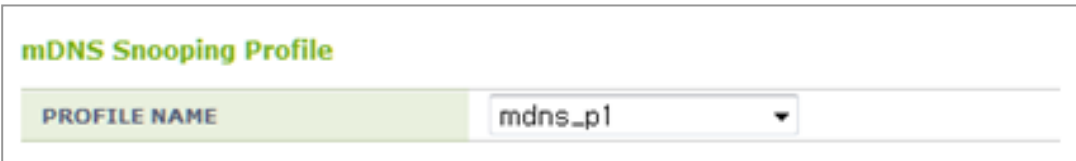


Figure 68. mDNS Snooping Profile Configuration

CHAPTER 4. AP Connection Management

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

4.1 APC Management

4.1.1 Managing APC List

To enable the APC system to provide cluster or redundancy service, several APC systems must be installed at a site and each APC must have the information of other APC systems.

Therefore, the APC system provides the function of managing the list of APCs that will provide the cluster or redundancy function. And the APCs added to the APC list are used during cluster or redundancy configuration.

One APC system that will be saved in the APC list consists of an APC name and Medium Access Control (MAC) information. For the MAC address of another APC system, enter the MAC address retrieved from the Monitor → Summary → Inventory → MAC Address menu of system WEC screen.

By default, its own system information is added to the APC list. For the APC, operator can only change its name, but cannot delete it forcibly or change its MAC address.

The maximum number of APC systems that can be registered per model is as follows:

APC Model	The maximum number of APC systems that can be registered
WEC8500	12
WEC8050	2

Configuration using CLI

The procedures for configuration are as follows.

- 1) Go to the configure mode of the CLI.

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

- 2) Go to the apc-list item of CLI.

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

- 3) Add, delete or change APC.
 - add-apc [APC_NAME] [MAC_ADDRESS]
 - del-apc [APC_NAME]
 - change-apc [CURRENT_APC_NAME] [NEW_APC_NAME]
 - change-mac [APC_NAME] [MAC_ADDRESS]

Parameter	Description
APC_NAME	APC name
CURRENT_APC_NAME	Current APC name (before change)
NEW_APC_NAME	APC name after change
IP_ADDRESS	APC MAC address (xx:xx:xx:xx:xx:xx) In the APC system, enter the system mac address output parameter value of 'show system info' command.)

- 4) To check the configured APC list, execute the 'show apc-list' command.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <APC Lists> menu in the sub-menus. Operator can add a new APC by clicking the <Add> button in the figure.



Figure 69. APC List Management Window

4.1.2 Management Interface Configuration

The APC can communicate 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 the configure mode of the CLI.

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

- 2) Configure a management interface.

- apc ap-mgmt-if [IP_ADDRESS]

Parameter	Description
IP_ADDRESS	IP address of APC 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.

Controller > General

AP Management

IP ADDRESS: 10.10.10.10 [Select]

AUTO REGISTRATION: ☐ Enable ☒ Disable

Repeater Service

SERVICE: ☒ Enable ☐ Disable

SIP ALG¹

SIP ALG (VOIP AWARE): ☒ Enable ☐ Disable

SIP ERROR RESPONSE: ☒ Enable ☐ Disable

SIP DETECT LONG DURATION CALL: ☒ Enable ☐ Disable

SIP NO ANSWER TIMEOUT (SEC): 600

SIP CONNECT TIMEOUT (SEC): 7200

SIP MONITORING PORT 1: 5060

SIP MONITORING PORT 2: 0

SIP MONITORING PORT 3: 0

Figure 70. Management interface configuration

4.1.3 CAPWAP Configuration

A secured tunnel is created between APC and Wireless Enterprise wireless LAN AP using Control And Provisioning Wireless Access Point (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 channel consists of control channel and data channel depending on the type of packet being transmitted/received. 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 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#
WEC8500# configure terminal
WEC8500/configure# apc
WEC8500/configure/apc/capwap#
```

- 2) Configure the CAPWAP function using the following commands.
 - add-multicast-if [VLAN_ID]: Configure a VLAN ID for multicast interface.
 - auto-discovery: Configures the function of automatically detecting and registering an AP.
 - auto-discovery-ap-group [AP_GROUP_ID]: Configures an AP group that will be working when an AP is automatically registered.
 - change-state-pending-timer [TIMER]: Configures the maximum waiting time until the APC receives the Change State Event Request message from an AP after transmitting the Configuration Status Response message to the AP (RFC 5415).
 - ctr-src-port [port]: Changes the CAPWAP Control port (RFC5415).
 - date-check-timer [TIMER]: Configures the maximum waiting time until the APC receives Data Channel Keep-alive (default: 30 seconds)
 - discovery-by-broadcast: Configures whether to allow connection to CAPWAP broadcast.

- **discovery-by-multicast**: Configures whether to allow connection to CAPWAP multicast. (The 'add-multicast-if' must be configured before configuring whether to allow multicast connection.)
- **discovery-del-timer**: If the Join message is not received after receiving a Discovery message, this configures the timeout to discard the previously received Discovery messages.
- **dtls-session-delete [TIMER]**: Configures the waiting time to disconnect DTLS when releasing the connection between an AP and CAPWAP.
- **retransmit-interval [INTERVAL]**: Configures the re-transmission interval of CAPWAP control packet retransmission.
- **max-retransmit [COUNT]**: Configures maximum number of retransmission when there is no answer for CAPWAP control packet transmission.
- **wait-dtls-timer [TIMER]**: Configures the maximum time until the AP waits without receiving the DTLS handshake message from the APC (RFC 5415) (default: 60 seconds)
- **wait-join-timer [TIMER]**: Configures the maximum time until the APC receives the Join message after finishing DTLS handshake (RFC 5415) (default: 60 seconds)
- **window-size [size]**: Configures the maximum number of packets that can be transmitted without response during CAPWAP control packet transmission.

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.

4.1.4 AP Registration (Auto Discovery) Configuration

The APC provides the AP auto-discovery function that automatically registers APs in the same network without having to configure any settings in advance. To configure the function, execute the following commands.

Configuration using CLI

- 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.

Configuration using Web UI

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

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

The screenshot shows the 'Controller > General' configuration page. It features two main configuration panels. The 'AP Management' panel on the left includes an 'IP ADDRESS' field set to '10.10.10.10' with a 'Select' button, and an 'AUTO REGISTRATION' section with radio buttons for 'Enable' and 'Disable'. The 'SIP ALG' panel on the right, marked with a red '1', contains several settings: 'SIP ALG (VOIP AWARE)', 'SIP ERROR RESPONSE', and 'SIP DETECT LONG DURATION CALL' each with 'Enable' and 'Disable' radio buttons; 'SIP NO ANSWER TIMEOUT (SEC)' set to '600'; 'SIP CONNECT TIMEOUT (SEC)' set to '7200'; and three 'SIP MONITORING PORT' fields (1, 2, and 3) all set to '0'. Each panel has an 'Apply' button at the bottom right.

Figure 71. AP Registration Method Setup Window

4.1.5 Managing AP File Transmission

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

4.1.5.1 Tech Support Information File

- 1) Go to configure → APC mode of CLI.

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

- 2) Configure 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.

4.1.6 APC Redundancy Configuration

An operator can add a backup APC to an AP to make the backup APC provide the service even when an APC fault occurs.

The maximum number of backup APCs that can be registered to one AP per model is as follows:

APC Model	The maximum number of APC systems that can be registered
WEC8500	3 (Primary Server, Secondary Server, Tertiary Server)
WEC8050	2 (Primary Server, Secondary Server)

If a fault occurs to the primary APC while an AP is connected to the primary APC, the AP is connected to the secondary APC. If a fault also occurs to the secondary APC, the AP is connected to the tertiary APC. For reference, the WEC8050 model does not support a tertiary APC.

Operator can also configure fallback to return to the original APC from the backup APC during the service. If the fallback operation is configured, the AP periodically performs health check to check whether the primary APC can be connected. When the connection is required, it can immediately perform fallback according to the fallback option or can perform fallback on a specified time. The reason why configuring fallback time zone is to minimize the service interruption due to fallback by making it happens when the load is low.

In an APC, operator can configure the primary and backup APCs of an AP in the following steps.

- 1) Register APCs to the APC list.
In the 'APC List Management', how to add the APC list is described.
- 2) Add the APCs in the APC list to redundancy.
If necessary, configure the fallback function.
And then, operator can configure the APCs added to redundancy as the primary, secondary, or tertiary server of an AP.
- 3) Configure a primary, secondary, and tertiary server per AP. To make an AP operate in redundancy configuration, configure the Discovery Type of the AP as 'APC Referral'.
Use the Multi-Set function of WEC to configure several APs at the same time.

Configuration using CLI

- 1) By referring to the 'AP List Management', add the APC list that will be used as a backup APC.
- 2) After entering into the configure → redundancy mode, add or delete the APCs in the APC list. If necessary, configure the fallback function.

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

- add-apc [APC_NAME] [IP_ADDRESS] [PORT]
- del-apc [APC_NAME]
- fallback-enable now
- fallback-enable at-time [FALLBACK START-END TIME]
- fallback-interval [INTERVAL]

Parameter	Description
APC_NAME	Name of an APC to be added or deleted to/from redundancy The APC must be an APC registered in the APC list.
IP_ADDRESS	IP address of an APC to add This address is an IP required by an AP to connect to the APC. Therefore, you must enter the AP Management IP address of the APC.

Parameter	Description
PORT	CAPWAP PORT number of the APC to add This port number is required by an AP to connect to the APC. If no port number is entered, it is set to 5246, the default port number of CAPWAP protocol. It is recommended not to use a different port number if it is specially required.
FALLBACK START-END TIME	Enter the time zone where an AP connected to the backup (secondary or tertiary) APC can do fallback. The input format is as follows: - Format: hh:mm-hh:mm - Example: 2:00-5:00 ← Fallback is available between 2pm and 5pm.
INTERVAL	Configures the interval that an AP connected to the backup (secondary or tertiary) APC attempts fallback (second). If a specific time is not entered, the default is 120 seconds. The minimum is 60 seconds and the maximum is 1800 seconds.

- 3) Enter into the configure → AP configuration mode of CLI and configure a primary, secondary, and tertiary server. To make an AP operate in redundancy configuration, configure the Discovery of the AP as 'apc-referral'.

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

- discovery apc-referral
- primary-apc [APC_NAME]
- secondary-apc [APC_NAME]
- tertiary-apc [APC_NAME]

Parameter	Description
APC_NAME	Enter the name of an APC registered to redundancy. - Primary apc: The first APC that the AP attempts to connect. It is usually configured with the currently connected APC. - Secondary-apc, tertiary-apc: APC that the AP attempts to connect when there is no response from the primary-apc.
DISCOVERY_TYPE	Discovery Type - ap-followed: Discovery type is set by AP. - apc-referral: Discovery type is set by APC using the backup APC lists. To apply the priority of APC to which the AP will be connected, operator needs to select the apc-referral. - DHCP: Discovery type is interoperating with the DHCP server. To use this mode, IP ADDRESS POLICY of the AP must be set to DHCP. - Auto: Discovery type is automatically changed by the AP for automatic connection to the APC.

- 4) To check the configured apc list, execute the ‘show apc summary’ command.
- 5) To check the redundancy information, execute the ‘show redundancy summary’ command.
- 6) To check the configured AP profile, execute the ‘show ap detail [AP_PROFILE_NAME]’ command.

Configuration using Web UI

By referring to the ‘APC List Management’, add the APC list that will be used as a backup APC.

- 1) In the menu bar of <WEC Main window>, select <Configuration> and then select the <Controller> → <Redundancy> menu in the sub-menus. Operator can add or delete the APC list that will be used for redundancy. If necessary, operator can configure the fallback function.

Fall Back

FALL BACK ☐ Enable ☒ Disable

TYPE ☒ Now ☐ At Time

TIME 00 : 00 : 00

INTERVAL (SEC) 120

Add Delete

Backup APC List

Total Entry : 2

APC NAME	MAC ADDRESS	IP ADDRESS	PORT	PUBLIC IP ADDRESS	PUBLIC PORT
WEC8500	00:7e:37:00:1e:80	100.100.100.1	5246	0.0.0.0	5246
BackAPC1	00:7e:37:00:13:89	165.213.66.252	5246	0.0.0.0	5246

Figure 72. Redundancy Configuration Window

Parameter	Description
APC NAME	Name of an APC to be added or deleted to/from redundancy The APC must be an APC registered in the APC list.
MAC ADDRESS	Because this is a MAC address configured during registration to the APC list, an operator does not have to enter this at the redundancy configuration stage.
IP_ADDRESS	IP address of an APC to add This address is an IP required by an AP to connect to the APC. Therefore, you must enter the AP Management IP address of the APC.
PORT	CAPWAP PORT number of the APC to add If no port number is entered, it is set to 5246, the default port number of

Parameter	Description
	CAPWAP protocol. It is recommended not to use a different port number if it is specially required.
PUBLIC_IP_ADD RESS	PUBLIC IP address of the APC to add This address is an IP required by an AP to connect to the APC. If the APC is in the NAT environment, you must enter an official IP configured in the NAT instead of the private IP of APC.
PUBLIC_PORT	PUBLIC CAPWAP PORT number of the APC to add This port number is required by an AP to connect to the APC. If the APC is under the NAT environment, you must enter the port number configured in the NAT instead of the actual CAPWAP port number of APC.
FALLBACK START-END TIME	Enter the time zone where an AP connected to the backup (secondary or tertiary) APC can do fallback. The input format is as follows: Format: hh:mm-hh:mm Example: 2:00-5:00 ← Fallback is available between 2pm and 5pm.
INTERVAL	Configures the interval that an AP connected to the backup (secondary or tertiary) APC attempts fallback (second). If a specific time is not entered, the default is 120 seconds. The minimum is 60 seconds and the maximum is 1800 seconds.

- 2) In the menu bar of <WEC Main window>, select <Configuration> and then select the <Access Points> menu in the sub-menus. Click the name of AP Profile to which the redundancy function will be applied. After configuring the DISCOVERY TYPE of AP to 'APC Referral', select the PRIMARY CONTROLLER NAME, SECONDARY CONTROLLER NAME, and TERTIARY CONTROLLER NAME. For the WEC8500 model, the TERTIARY CONTROLLER NAME is not shown in the menu.

Current Filter : None

Change

Multi Set

Enable

Disable

Add

Delete

Export

(e) : Edge AP, (r) : Remote AP

Total Entry : 1

<input type="checkbox"/>	AP PROFILE NAME	AP NAME	MAC	IP ADDRESS	ADMIN STATUS	OPER STATUS	MAP LOCATION	MODE	MODEL	VERSION
<input type="checkbox"/>	ap_1	AP_f4d9fb24cba0	f4:d9:fb:24:cb:a0	100.100.100.50	Up	Up		General AP(r)	WEA303i	1.4.3.R

Figure 73. AP retrieving window

AP PROFILE NAME	ap_1
AP NAME	AP_f4d9fb24cba0
AP GROUP NAME	default
REMOTE AP GROUP NAME	RemoteAPGroup_test
AP MODE ¹	General AP
MAC ADDRESS	f4:d9:fb:24:cb:a0
MAP LOCATION	
LOCATION	
IP ADDRESS	100.100.100.50
IP ADDRESS POLICY	<input type="radio"/> DHCP <input checked="" type="radio"/> AP Priority (AP Followed) <input type="radio"/> Static IP
IP ADDRESS	<input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/>
NETMASK	<input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/>
GATEWAY	<input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/>
DISCOVERY TYPE ²	APC Referral Current Discovery Type : Static
ADMIN STATUS	Up
OPER STATUS	Up
PRIMARY CONTROLLER NAME ³	WEC8500 (100.100.100.1)
SECONDARY CONTROLLER NAME ³	BackAPC1 (165.213.66.252)
TERTIARY CONTROLLER NAME ³	-----

Figure 74. AP redundancy Configuration Window

Parameter	Description
APC_NAME	Enter the name of an APC registered to redundancy. <ul style="list-style-type: none"> - Primary apc: The first APC that the AP attempts to connect. It is usually configured with the currently connected APC. - Secondary-apc, tertiary-apc: APC that the AP attempts to connect when there is no response from the primary-apc.
DISCOVERY_TYPE	Discovery Type <ul style="list-style-type: none"> - ap-followed: Discovery type is set by AP. - apc-referral: Discovery type is set by APC using the backup APC lists. To apply the priority of APC to which the AP will be connected, operator needs to select the apc-referral. - Auto: Discovery type is automatically changed by the AP for automatic connection to the APC. - DHCP: Discovery type is interoperating with the DHCP server. To use this mode, IP ADDRESS POLICY of the AP must be set to DHCP.

4.2 AP Management

4.2.1 AP Group Configuration

The APC manages the services provided to the AP by group. An operator can add or delete several APs to/from a group. It is also possible to add/remove WLANs to/from an AP group so that the same WLAN services can be provided for each group.

When the APC is installed for the first time, a 'default' group is created. When the AP information is created first time, the AP is automatically added to the 'default' group. If the 'auto-discovery' mode is enabled in the APC, an AP connected to the APC is automatically added to the 'default' group. For reference, operator can specify a specific AP group where an AP will be added during auto-discovery configuration.

An operator can manage the services per group by creating a new AP group and can move or a specific AP to another group or delete it in the original group. The APs deleted in a group are automatically moved to the 'default' group.

When a new AP group is created, it is possible to configure AP information for each group. If the Overwrite option is enabled for each setting, the respective setting is applied to all APs within the group.

Generally, up to 16 WLANs can be added to an AP group. However, if a root AP is contained in an AP group, only up to 15 WLANs can be added to the group.

If the AP group information is changed, i.e. if an AP moves to another group, the AP uses the WLAN of a new group. Therefore, some existing WLANs in the AP are deleted and some new WLANs can be added. The detail example is shown below.

(Example) Default group: Includes wlan1, wlan2, wlan3, and wlan4.

New group: Includes wlan4, wlan5, and wlan6.

When the AP_1 moves from the default group to a new group

The APC asks the AP_1 to delete the wlan1, wlan2, and wlan3.

The APC asks the AP_1 to add the wlan5 and wlan6.

Configuration using CLI

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

- 1) Go to the configure mode of the CLI.

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

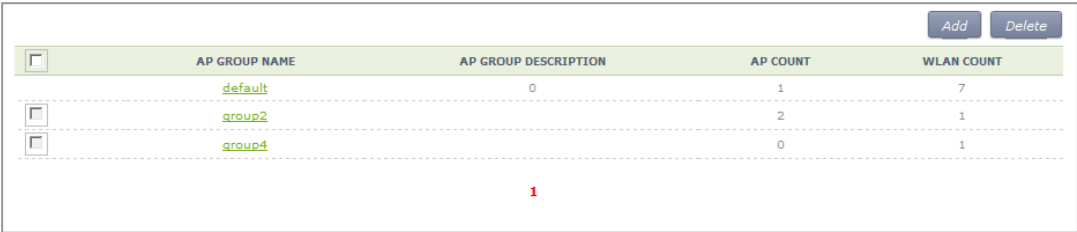
- 2) Create or delete an AP group. Use ‘no’ parameter in front of the command to delete an AP group.
 - ap-group [AP_GROUP_NAME]
 - no ap-group [AP_GROUP_NAME]

- 3) Add or delete an AP to or from the 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.



<input type="checkbox"/>	AP GROUP NAME	AP GROUP DESCRIPTION	AP COUNT	WLAN COUNT
<input type="checkbox"/>	default	0	1	7
<input type="checkbox"/>	group2		2	1
<input type="checkbox"/>	group4		0	1

1

Figure 75. AP groups configuration Window



AP Groups > Add

Back Apply

Figure 76. AP Group Addition Window

4.2.1.1 General AP Group Settings

To aid management of APs in groups, the APC allows configuration of settings which can be applied commonly to each group. The following functions are provided:

Parameter	Description
Description	This configures the description of the AP group.
AP Mode	This configures the operation mode of the AP. The operator can select General AP, Root AP, or Repeater AP.
Location	This configures the installation location information of the AP.
IP Mode	This configures the IP configuration mode of the AP. The operator can select DHCP or AP Priority.
AP Status	This configures the up/down status of the AP.
Redundancy	If the APCs are configured for redundancy, this configures the discovery type and Primary/Secondary/Tertiary Controller settings of the AP.

The APC provides the overwrite option for each AP group setting. If the Overwrite option is enabled for each setting, the respective setting is applied to all APs within the group. For example, if the Overwrite option is enabled for AP Mode and AP Mode is set to General, all the APs within the group will run as General APs.

Configuration using CLI

To configure redundancy settings for the AP group, perform the following commands:

- 1) Go to the configure mode of the CLI.

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

- 2) Enter the AP Group configuration mode.
 - ap-group [AP_GROUP_NAME]
- 3) Enter the profile configuration mode for the AP group.
 - Profile
- 4) Configure the following AP group profiles:
 - description
 - overwrite-ap-mode
 - no overwrite-ap-mode
 - ap-mode
 - overwrite-location
 - no overwrite-location
 - location

- overwrite-ip-mode
- no overwrite-ip-mode
- ip-mode
- overwrite-state
- no overwrite-state
- shutdown
- no shutdown
- no overwrite-redundancy
- discovery
- primary-apc
- no primary-apc
- secondary-apc
- no secondary-apc
- tertiary-apc
- no tertiary-apc

Parameter	Description
DESCRIPTION	This contains a brief description of the AP group.
OVERWRITE-AP-MODE	If overwrite-ap-mode is enabled, the AP mode information set for the group is applied to all APs within the group.
AP-MODE	This is the AP operation mode. The following modes are available: <ul style="list-style-type: none"> - generalAp: General operation mode. Default value. - rootAp: AP mode where a repeater AP can be connected. - repeaterAp: AP mode that is connected to a wireless area and the APC through the root AP.
OVERWRITE-LOCATION	If overwrite-location is enabled, the location information set for the group is applied to all APs within the group.
LOCATION	This is the location information of the AP.
OVERWRITE-IP-MODE	If overwrite-ip is enabled, the IP mode information set for the group is applied to all APs within the group.
IP-MODE	This is the mode of receiving an IP address by the AP. The following modes are available: <ul style="list-style-type: none"> - dhcp: The AP receives IP address allocation using DHCP. - ap: The AP uses a manually configured IP address.
OVERWRITE-STATE	If overwrite-state is enabled, the AP state information set for the group is applied to all APs within the group.
shutdown	This sets the AP state to UP or DOWN.
OVERWRITE-REDUNDANCY	If overwrite-redundancy is enabled, the redundancy setting (primary-apc, secondary-apc, tertiary-apc) of the AP group is applied to all APs within the group.
DISCOVERY	If the APCs are configured for redundancy, this configures the method used for APs to connect to the APC. The following modes are available: <ul style="list-style-type: none"> - ap-followed: The discovery type and discovery list configured for the

Parameter	Description
	<p>AP are used.</p> <ul style="list-style-type: none"> - apc-referral: The APC list configured for the APC is used as the discovery list. - DHCP: The APC list information relayed by DHCP option 138 (IPv4) or option 52 (IPv6) is used as the discovery list. - auto: Discovery type is automatically changed by the AP for automatic connection to the APC.
PRIMARY-APC	This is the name of the primary APC server. The AP attempts to connect to this APC first.
SECONDARY-APC	This is the name of the secondary APC server. If the AP is unable to connect to the primary APC, the AP attempts to connect to this APC on its second connection attempt.
TERTIARY-APC	This is the name of the tertiary APC server. If the AP is unable to connect to the secondary APC, the AP attempts to connect to this APC on its third connection attempt. The WEC8050 model does not support Tertiary-APC.

- 5) Use the 'show ap-group detail [AP_GROUP_NAME]' command to check the AP group information.

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, select <AP Groups> in the submenu, and then select an AP group to configure. In the 'General' tab of the AP group, configure the necessary settings. If the OVERWRITE AP CONFIG checkbox is selected, the respective setting is applied to all APs within the group.

The screenshot displays the 'General' tab of the 'AP Groups' configuration window. The breadcrumb path is 'AP Groups > General'. The configuration fields are as follows:

- AP GROUP NAME:** testgroup01
- AP GROUP DESCRIPTION:** 0
- AP COUNT:** 3
- WLAN COUNT:** 16
- OVERWRITE AP CONFIG:** ☐ (unchecked)
- AP MODE:** General AP (dropdown menu)
- OVERWRITE AP CONFIG:** ☐ (unchecked)
- LOCATION:** 0
- OVERWRITE AP CONFIG:** ☐ (unchecked)
- IP MODE:** ☐ DHCP, ☒ AP Priority (AP Followed)
- OVERWRITE AP CONFIG:** ☐ (unchecked)
- ADMIN STATUS:** ☒ Enable, ☐ Disable
- OVERWRITE AP CONFIG:** ☐ (unchecked)
- DISCOVERY TYPE:** AP Followed (dropdown menu)
- PRIMARY CONTROLLER NAME:** (empty dropdown menu)
- SECONDARY CONTROLLER NAME:** (empty dropdown menu)

Buttons for 'Back' and 'Apply' are located in the top right corner.

Figure 77. General Configuration Window for AP Group

4.2.1.2 Adding/Removing APs

To aid management of APs in groups, the APC allows addition/removal of APs to/from AP groups.

Configuration using CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Create an AP group or enter the AP group configuration mode.
 - ap-group [AP_GROUP_NAME]
- 3) Add/remove an AP to/from the AP group. Use 'no' parameter in front of the command to delete an AP from the AP group. However, you cannot delete an AP from a default AP group. If you delete an AP from groups other than the default group, the deleted AP is then included in 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>, select <AP Groups> in the submenu, and then select an AP group to configure. Under the 'APs' tab of the AP group, APs can be added or removed.

AP Groups > APs

Back

AP GROUP NAME: TestApGroup

Current Filter : None Change

Selected APs

<input type="checkbox"/>	AP PROFILE NAME	AP NAME	MAC ADDRESS	IP ADDRESS	AP GROUP NAME
No data					

▽ ▲

Current Filter : None Change

All APs

<input type="checkbox"/>	AP PROFILE NAME	AP NAME	MAC ADDRESS	IP ADDRESS	AP GROUP NAME
<input type="checkbox"/>	ap_1	PV-77-104	f4:d9:fb:24:2d:c1	0.0.0.0	test1
<input type="checkbox"/>	ap_2	PV-49-100	00:00:aa:19:19:19	0.0.0.0	test1
<input type="checkbox"/>	ap_3	PV-76-101	f4:d9:fb:24:cb:a0	0.0.0.0	default
<input type="checkbox"/>	ap_4	AP_0000aa262626	00:00:aa:26:26:26	0.0.0.0	default
<input type="checkbox"/>	ap_5	AP_f4d9fb2427c1	f4:d9:fb:24:27:c1	0.0.0.0	default

Figure 78. AP Add/Remove Window for AP Group

4.2.1.3 Adding/Removing WLANs

To allow the same WLAN services to be provided to the APs allocated to each group, the APC allows addition/removal of WLANs to/from each AP group.

Configuration using CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Create an AP group or enter the AP group configuration mode.
 - ap-group [AP_GROUP_NAME]
- 3) Add/remove an WLAN to/from the AP group. Use 'no' parameter in front of the command to delete an WLAN from the AP group.
 - add-wlan [WLAN_ID]
 - no add-wlan [WLAN_ID]

- 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>, select <AP Groups> in the submenu, and then select an AP group to configure. Under the ‘WLANs’ tab of the AP group, WLANs can be added or removed.

AP Groups > WLANs

Back

AP GROUP NAME default

Current Filter : None Change

Selected WLANs

<input type="checkbox"/>	PROFILE NAME	SSID	INTERFACE GROUP
<input type="checkbox"/>	wlan2	ztest_wlan2	aaaa
<input type="checkbox"/>	wlan3	ztest_wlan3	aaaa
<input type="checkbox"/>	wlan4	ztest_wlan4	aaaa
<input type="checkbox"/>	wlan5	ztest_wlan5	aaaa
<input type="checkbox"/>	wlan6	ztest_wlan6	aaaa

▽ ▲

Current Filter : None Change

All WLANs

<input type="checkbox"/>	PROFILE NAME	SSID	INTERFACE GROUP
<input type="checkbox"/>	wlan17	ztest_wlan17	aaaa
<input type="checkbox"/>	wlan18	ztest_wlan18	aaaa
<input type="checkbox"/>	wlan19	ztest_wlan19	aaaa
<input type="checkbox"/>	wlan20	ztest_wlan20	aaaa
<input type="checkbox"/>	wlan21	ztest_wlan21	aaaa

Figure 79. WLAN Add/Remove Window for AP Group

4.2.1.4 802.11a/n/ac Configuration

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, select <AP Groups> in the submenu, and then select an AP group to configure. Settings can be configured under the '802.11a/n/ac' tab of the AP group.

The screenshot shows the '802.11a/n/ac' configuration window for an AP group named 'test'. The window is divided into several sections, each with an 'Apply' button. The sections are:

- AP GROUP NAME:** test
- SERVICE:** ☒ Enable ☐ Disable
- OPERATIONAL TYPE:**
 - ☒ 802.11a
 - ☒ 802.11n
 - ☒ 802.11ac
- OPTIONS:**
 - Guard Interval: 20MHz ☒ Short ☐ Long, 40MHz ☒ Short ☐ Long, 80MHz ☒ Short ☐ Long
 - Beamforming: ☒ Enable ☐ Disable
- CURRENT CHANNEL:** 153
- CHANNEL FIX:** ☐ Enable ☒ Disable
- TX CURRENT POWER (DBM) ¹:** 3
- TX POWER FIX ²:** ☒ Enable ☐ Disable
- BANDWIDTH (MHZ):** 20
- MAX. ALLOWED STATIONS ON AN AP ³:** 127
- CONTROLLED VOICE OPTIMIZATION ⁴:** ☐ Enable ☒ Disable
- MULTI-ANTENNA MODE ⁵:** ☒ Dynamic ☐ Static

Figure 80. 802.11a/n/ac Window for AP Group

The configuration items are as follows:

[Service Configuration of AP Group]

- SERVICE: Enable or disable the radio service.

[OPERATIONAL TYPE]

- Enable or disable the 11n/ac.

[OPTIONS]

- Guard-interval(11ac): select short or long for Guard-interval 20/40/80 Mhz.
- Beamforming: Enable or disable the Beamforming.

[Channel Configuration]

- **CURRENT CHANNEL:** Channel configuration (range: 36-165)
- **CHANNEL FIX:** The configured channel is configured as fixed and it is not affected by automatic adjustment functions such as RRM. When the **<Monitor> → <Access Points> → <Radio> → <802.11a/n/ac>** menu is selected, the channel value is shown as * (optional).

[TX Power Setting]

- **TX CURRENT POWER:** TX power (range: 3-30)
- **TX POWER FIX:** The configured TX power is configured as fixed and it is not affected by automatic adjustment functions such as RRM. When the **<Monitor> → <Access Points> → <Radio> → <802.11a/n/ac>** menu is selected, the TxPower value is shown as * (optional).



NOTE

To check the configured channel and TX power information, go to **<Monitor> → <Access Points> → <Radio> → <802.11a/n/ac>**.

[General]

- **BANDWIDTH:** select bandwidth(range: 20, 40, 80). for 802.11a/n/ac.
- **Max. Allowed Stations on an AP:** define max allowed stations for Radio.
- **CONTROLLED VOICE OPTIMIZATION:** set voice optimization.
- **Multi-antenna Mode :** select Dynamic/Static.

4.2.1.5 802.11b/g/n Configuration

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, select <AP Groups> in the submenu, and then select an AP group to configure. Settings can be configured under the '802.11b/g/n' tab of the AP group.

AP GROUP NAME		test	Back	Apply
SERVICE		<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
CURRENT CHANNEL		5	Apply	
CHANNEL FIX		<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
TX CURRENT POWER (DBM)		15	Apply	
TX POWER FIX		<input type="radio"/> Enable <input checked="" type="radio"/> Disable		

Figure 81. 802.11b/g/n Window for AP Group

The configuration items are as follows:

[Service Configuration of AP Group]

- SERVICE: Enable or disable the radio service.

[OPERATIONAL TYPE]

- Enable or disable of 11n service.

[OPTIONS]

- Guard-interval(11n): select short/long for Guard-interval 20/40 Mhz.
- Beamforming : Enable or disable of Beamforming.

[Channel Configuration]

- CURRENT CHANNEL: Channel configuration (range: 1-14)
- CHANNEL FIX: The configured channel is configured as fixed and it is not affected by automatic adjustment functions such as RRM. When the <Monitor> → <Access Points> → <Radio> → <802.11b/g/n> menu is selected, the channel value is shown as * (optional).

[TX Power Setting]

- TX CURRENT POWER: TX power (range: 3-30)
- TX POWER FIX: The configured TX power is configured as fixed and it is not affected by automatic adjustment functions such as RRM. When the <Monitor> → <Access Points> → <Radio> → <802.11b/g/n> menu is selected, the TxPower value is shown as * (optional).



NOTE

To check the configured channel and TX power information, go to **<Monitor>** → **<Access Points>** → **<Radio>** → **<802.11b/g/n>**.

[General]

- Max. Allowed Stations on an AP: Define max allowed stations for each Radio.
- CONTROLLED VOICE OPTIMIZATION: set voice optimization.
- Multi-antenna Mode : set Dynamic/Static.

4.2.1.6 Advanced Configuration

In order to provide the same services to the APs allocated to each group, the APC allows configuration of advanced settings for each AP group.

Configuring AP Group Profile with CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Create an AP group or enter the AP group configuration mode.
 - ap-group [AP_GROUP_NAME]
- 3) Enter the profile configuration mode for the AP group.
 - profile
- 4) Configure the following AP group profiles:
 - overwrite-apc-ap-timer
 - no overwrite-apc-ap-timer
 - echo-interval
 - discovery-interval
 - report-interval
 - statistics-timer
 - retransmit-interval
 - echo-retransmit-interval
 - max-echo-retransmit
 - overwrite-telnet-ssh
 - no overwrite-telnet-ssh
 - telnet-enable
 - no telnet-enable
 - ssh-enable

- no ssh-enable
- overwrite-console
- no overwrite-console
- console-enable
- no console-enable
- overwrite-dtls
- no overwrite-dtls
- dtls-policy
- overwrite-led-control
- no overwrite-led-control
- led-config
- overwrite-vlan
- no overwrite-vlan
- vlan-support
- no vlan-support
- native-vlanId
- no native-vlanId
- overwrite-poe-type
- no overwrite-poe-type
- overwrite-uplink-bandwidth
- no overwrite-uplink-bandwidth
- uplink-bandwidth
- overwrite-temperature-alarm
- no overwrite-temperature-alarm
- temperature-alarm-on-level
- temperature-alarm-off-level
- temperature-alarm-control-type
- overwrite-link-aggregation
- no overwrite-link-aggregation
- link-aggregation
- no link-aggregation

Parameter	Description
DESCRIPTION	This contains a brief description of the AP group.
OVERWRITE-APC-AP-TIMER	If overwrite-apc-ap-timer is enabled, the APC-AP timer setting of the group is applied to all APs within the group.
ECHO-INTERVAL	Configures the time when an echo request message is transmitted to the APC where an AP joins (unit: seconds).
DISCOVERY-INTERVAL	Configures a waiting time until the CAPWAP discovery response message is received (unit: seconds).
REPORT-INTERVAL	Configures the time interval for transmitting the description error from AP to the APC (unit: seconds).
STATISTICS-TIMER	Configures the time interval for transmitting the statistical

Parameter	Description
	information provided by the CAPWAP (unit: seconds).
RETRANSMIT-INTERVAL	The APC waits for this length of time before retransmitting an echo request message when there is no response. The APC sets double the length of echo-interval as the echo timeout time. If no echo message is received from the AP for as long as double the length of the echo-interval, the APC judges that the AP is down (unit: seconds).
MAX-ECHO-RETRANSMIT	The APC waits for this length of time before retransmitting an echo request message when there is no response. The APC sets double the length of echo-interval as the echo timeout time. If no echo message is received from the AP for as long as double the length of the echo-interval, the APC judges that the AP is down (unit: seconds).
OVERWRITE-TELNET-SSH	If overwrite-telnet-ssh is enabled, the telnet and SSH settings for the AP group are applied to all APs within the group.
TELNET-ENABLE	This enables the telnet server and configures telnet port of the AP.
SSH-ENABLE	This enables the SSH server and configures SSH port of the AP.
OVERWRITE-CONSOLE	If overwrite-console is enabled, the telnet and SSH settings of the AP group are applied to all APs within the group.
CONSOLE-ENABLE	This configures whether to allow console access to the AP.
OVERWRITE-DTLS	If overwrite-dtls is enabled, the DTLS settings of the AP group are applied to all APs within the group.
DTLS-POLICY	Configures the DTLS Policy of an AP.
OVERWRITE-LED-CONTROL	If overwrite-led-control is enabled, the LED settings of the AP group are applied to all APs within the group.
LED-CONFIG	This configures whether to turn the LED on/off.
OVERWRITE-VLAN	If overwrite-vlan is enabled, the VLAN settings of the AP group are applied to all APs within the group.
VLAN-SUPPORT	This configures whether to enable the native VLAN of the AP.
NATIVE-VLANID	This configures the native VLAN value of the AP.
OVERWRITE-POE-TYPE	If the overwrite-poe-type is activated, the POE Type information set in the AP group is applied to all APs in the group.
POE-TYPE	Sets the POE Type information below. 802.3at/802.3af/auto
OVERWRITE-UPLINK-BANDWIDTH	If the overwrite-uplink-bandwidth is activated, the uplink bandwidth information set in the AP group is applied to all APs in the group.
UPLINK-BANDWIDTH	Sets the allowed value for AP uplink bandwidth. Possible to set between 1 and 1024 Mbps and if it is set to 0, the uplink bandwidth is not restricted.

Parameter	Description
OVERWRITE-TEMPERATURE-ALARM	If the overwrite-temperature-alarm is activated, the temperature alarm information set in the AP group is applied to all APs in the group.
TEMPERATURE-ALARM-ON-LEVEL	If the temperature of the AP exceeds the Temperature-Alarm-On-Level, the temperature alarm occurs. The default is 98 and possible to set between 50 and 130.
TEMPERATURE-ALARM-OFF-LEVEL	If the temperature of the AP is less than the Temperature-Alarm-Off-Level, the temperature alarm is cleared. The default is 90 and possible to set between 50 and 130.
TEMPERATURE-ALARM-CONTROL-TYPE	If the temperature alarm occurs, whether the radio of the AP is set to be off or on.
OVERWRITE-LINK-AGGREGATION	If the overwrite-link-aggregation is activated, the link aggregation information set in the AP group is applied to all APs in the group.
LINK-AGGREGATION	In case of an AP model for 802.11ac, provide two uplink Ethernet ports. Possible to set link aggregation for two Ethernet ports. If link aggregation is activated, possible to set the following mode: - Both (Destination + Source) - Destination - Source

- 5) Use the 'show ap-group detail [AP_GROUP_NAME]' command to check the AP group information.

Configuring AirMove Service of AP Group with CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Create an AP group or enter the AP group configuration mode.
 - ap-group [AP_GROUP_NAME]
- 3) Enter the profile configuration mode for the AP group.
 - profile
- 4) Configure the AirMove service of the AP group.
 - enable: Enables/disables the AirMove service.

- **target-ap:** This option is used for selecting APs which will be applied with the changes made to the group settings. If 'all' is selected, changes are applied to all APs and config priority of the APs also change to group. If 'keep-ap-config' is selected, only the APs whose config priority is set to group have the airmove value of the group applied to them.

```

WEC8500# configure terminal
WEC8500/configure# ap-group default
GroupName : default
WEC8500/configure/ap-group default# airmove
WEC8500/configure/ap-group default/airmove# ?
    decision-delta      Set delta value for handover decision
    enable              Airmove enable
    exit                Exit from airmove mode
    number-of-channel   Set the number of channel required during
one time scanning
    number-of-proreq    Set the number of probe request required
during one time scanning
    scan-time-channel   Set time required for one channel scanning
    scan-time-interleave Set interval time required for new scanning
start
    scan-time-service   Set time required for STA service during
STA's scanning
    scan-trigger-level  Set a trigger level for STA's scanning
start
    target-ap           Set config target ap
    <cr>
WEC8500/configure/ap-group default/airmove# enable ?
    <cr>
WEC8500/configure/ap-group default/airmove# decision-delta ?
    1 - 100             Enter the value [dBm]

WEC8500/configure/ap-group default/airmove# number-of-channel ?
    1 - 20              Enter the number
WEC8500/configure/ap-group default/airmove# number-of-proreq ?
    1 - 10              Enter the number

WEC8500/configure/ap-group default/airmove# scan-time-channel ?
    0 - 100             Enter the time [ms]

WEC8500/configure/ap-group default/airmove# scan-time-interleave ?
    1000 - 10000        Enter the time [ms]

WEC8500/configure/ap-group default/airmove# scan-time-service ?
    1 - 1000            Enter the time [ms]

WEC8500/configure/ap-group default/airmove# scan-trigger-level ?
    -128 - 0            Enter the trigger level [dBm]

WEC8500/configure/ap-group default/airmove# target-ap ?
    all                 All
    keep-ap-config      Keep ap config
WEC8500/configure/ap-group default/airmove# end

```

- 5) Use the 'show airmove group [ap_group_name]' command to check the AP group information.

```
WEC8500# show airmove group default

Airmove Group Configurations
-----
  Airmove State           Disable
  Target AP              Keep Ap Config
  Scan trigger level      -70 dBm
  Scanning time for one channel  5 ms
  Service time during scanning  100 ms
  Scanning interval time  1000 ms
  Number of probe requests    2
  Number of scanning channels  4
  Value of station roam delta  15
WEC8500#
```

Configuring SSL (Smart Service Link) of AP Group with CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Create an AP group or enter the AP group configuration mode.
ap-group[AP_GROUP_NAME]
- 3) Enter the profile configuration mode for the AP group.
profile
- 4) Configure the SSL function for the AP group.
 - enable: Enables/disables the SSL function.
 - target-ap: This option is used for selecting APs that will have the changes applied to the group settings. If 'all' is selected, changes are applied to all APs and the config priority of the APs also change to group. If 'keep-ap-config' is selected, only the APs whose config priority is set to group have the SSL value of the group applied to them.

```
WEC8500# configure terminal
WEC8500/configure# ap-group default
GroupName : default
WEC8500/configure/ap-group default# sta-ssl
WEC8500/configure/ap-group default/sta-ssl# ?

    decision-delta      Set delta value for handover decision
    enable              sta-ssl enable
```

```

number-of-channel      Set the number of channel required during one
time scanning
    number-of-proreq    Set the number of probe request required
during one time scanning
    scan-time-channel   Set time required for one channel
scanning
    scan-time-interleave Set interval time required for new
scanning start
    scan-time-service   Set time required for STA service during
STA's scanning
    scan-trigger-level  Set a trigger level for STA's scanning
start
    target-ap           Set config target ap
    <cr>
WEC8500/configure/ap-group default/sta-ssl# enable ?
    <cr>
WEC8500/configure/ap-group default/sta-ssl# decision-delta ?
    1 - 100            Enter the value [dBm]

WEC8500/configure/ap-group default/sta-ssl# number-of-channel ?
    1 - 20             Enter the number

WEC8500/configure/ap-group default/sta-ssl# number-of-proreq ?
    1 - 10            Enter the number

WEC8500/configure/ap-group default/sta-ssl# scan-time-channel ?
    0 - 100           Enter the time [ms]

WEC8500/configure/ap-group default/sta-ssl# scan-time-interleave ?
    1000 - 10000      Enter the time [ms]

WEC8500/configure/ap-group default/sta-ssl# scan-time-service ?
    1 - 1000          Enter the time [ms]

WEC8500/configure/ap-group default/sta-ssl# scan-trigger-level ?
    -128 - 0          Enter the trigger level [dBm]

WEC8500/configure/ap-group default/sta-ssl# target-ap ?
    all               All
    keep-ap-config    Keep ap config
WEC8500/configure/ap-group default/sta-ssl# end

```

- 5) To check the AP group information, use the 'show stats-report conf [ap_group_name]' command.

```

WEC8500# show sta-ssl group default

SSL Group Configurations
-----
Sta SSL State           Disable
Target AP               Keep Ap Config

```

```

Scan trigger level          -70 dBm
Scanning time for one channel  5 ms
Service time during scanning  100 ms
Scanning interval time      1000 ms
Number of probe requests     2
Number of scanning channels  4
Value of station roam delta  15
WEC8500#

```

Smart Service Link	
AP GROUP NAME	default
SERVICE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
TARGET AP	<input type="checkbox"/> Keeping individual setting
SCAN TRIGGER LEVEL (DBM)	-70
SCANNING TIME FOR ONE CHANNEL (MS)	5
SERVICE TIME DURING SCANNING (MS)	100
SCANNING INTERVAL TIME (MS)	3000
NUMBER OF PROBE REQUESTS	2
NUMBER OF SCANNING CHANNELS	2
VALUE OF STATION ROAM DELTA (DBM)	15

Figure 82. AP Group SSL Configuration

Configuring IPSec Service of AP Group with CLI

- 1) Go to the configure mode of the CLI.

```

WEC8500# configure terminal
WEC8500/configure#

```

- 2) Create an AP group or enter the AP group configuration mode.
ap-group[AP_GROUP_NAME]
- 3) Enter the IPSec configuration mode for the AP group.
 - ip-sec
- 4) Configure the IPSec function for the AP group.
 - overwrite-ip-sec
 - enable
 - primary-ip
 - right-subnet
 - right-subnet-mask
 - auth-mode
 - ike-version
 - ike-lifetime
 - ipsec-lifetime

Parameter	Description
OVERWRITE-IP-SEC	If overwrite-ip-sec is enabled, the ip-sec information set for the AP group is applied to all APs within the group.
ENABLE	Enables/disables the IPSec function.
PRIMARY-IP	Configures the address of the primary security gateway.
RIGHT-SUBNET	Configures the address of the traffic selector for IPSec.
RIGHT-SUBNET-MASK	Configures subnet mask of the traffic selector for IPSec.
AUTH-MODE	Configures the authentication mode used in IPSec. PSK/PKI
IKE-VERSION	Configures the IKE version. 1/2
IKE-LIFETIME	Configures the IKE SA validity. (Unit: hours)
IPSEC-LIFETIME	Configures the IPSec SA validity. (Unit: minutes)

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, select <AP Groups> in the submenu, and then select an AP group to configure. Advanced settings and AirMove settings of the AP group can be changed under the 'Advanced' tab of AP Group.

General	APs	WLANs	802.11a/n	802.11b/g/n	Advanced
AP Groups > Advanced					
					Back Apply
AP GROUP NAME		testgroup01			
<input type="checkbox"/> OVERWRITE AP CONFIG					
ECHO INTERVAL (SEC) ¹		30			
MAX DISCOVERY INTERVAL (SEC) ²		20			
REPORT INTERVAL (SEC) ³		120			
STATISTICS TIMER (SEC) ⁴		120			
RETRANSMIT INTERVAL (100MS) ⁵		5			
MAX RETRANSMIT ⁶		5			
ECHO RETRANSMIT INTERVAL (SEC) ⁷		3			
MAX ECHO RETRANSMIT ⁸		5			
<input type="checkbox"/> OVERWRITE AP CONFIG					
TELNET ⁹		<input type="radio"/> Enable <input checked="" type="radio"/> Disable 50023			
SSH ¹⁰		<input type="radio"/> Enable <input checked="" type="radio"/> Disable 50022			
<input type="checkbox"/> OVERWRITE AP CONFIG					
CONSOLE		<input type="radio"/> Enable <input checked="" type="radio"/> Disable			
<input type="checkbox"/> OVERWRITE AP CONFIG					
DTLS ¹¹		Disable			
<input type="checkbox"/> OVERWRITE AP CONFIG					
LED		On 00 00 ~ 00 00			
<input type="checkbox"/> OVERWRITE AP CONFIG					
VLAN SUPPORT ¹²		<input type="radio"/> Enable <input checked="" type="radio"/> Disable			
NATIVE VLAN ID ¹³		0			
					Apply
AirMove					
SERVICE		<input type="radio"/> Enable <input checked="" type="radio"/> Disable			
TARGET AP		<input checked="" type="checkbox"/> Keeping individual setting			
SCAN TRIGGER LEVEL (DBM)		-70			
SCANNING TIME FOR ONE CHANNEL (MS)		5			
SERVICE TIME DURING SCANNING (MS)		100			
SCANNING INTERVAL TIME (MS)		1000			
NUMBER OF PROBE REQUESTS		2			
NUMBER OF SCANNING CHANNELS		4			
VALUE OF STATION ROAM DELTA (DBM)		15			

Figure 83. Advanced Configuration Window for AP Group

4.2.2 Configuring Remote AP Group

If the APs are located in an area where the APC is not located, those APs must be classified into a separate group for service. The APC can manage the APs in another area by grouping them into a remote AP group.

In the Remote AP group, the operator can configure the below information and the APs in the Remote AP group are operating based on the same configuration.

- Addition/Deletion of Remote AP
 - Possible to add or delete APs to be included in the remote AP group.
- Local Authentication
 - Radius Server
Possible to set a Radius server which will authenticate a station connecting to the remote AP.
 - Remote AP User List
Possible to add or delete a user (station) to be managed in the remote AP.
- Role Based Access Control
 - Possible to apply the ACL profile.
- Tunnel Forwarding
 - Possible to add the split tunnel ACL settings of the WLAN set with the tunneling mode.
- Local Bridging Forwarding
 - Possible to add settings of VLAN ID, ACL, and Pre-Auth ACL of the WLAN set with the local bridging mode.

When an AP group is added and the remote AP group is checked, APs included in the AP group operates in the remote AP mode.

If an AP is added to or deleted from a remote AP group, the AP is rebooted and reconnected to the APC. If an AP moves between remote AP groups, the AP is not rebooted.

4.2.2.1 Addition/Removal Setting

Configuration using CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Create an AP group.
 - ap-group[REMOTE_AP_GROUP_NAME]

- 3) Designate remote AP group properties to the AP group.
 - group-type remote
- 4) When the remote AP group is deleted, use the 'no' parameter in front of the ap-group command to delete the remote AP group.
 - no ap-group[REMOTE_AP_GROUP_NAME]

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. Click the <Add> or <Delete> button to add or delete a group.

Remote AP Groups

AddDelete

Total Entry : 1

	REMOTE AP GROUP NAME	AAA			AP COUNT
		PRIMARY RADIUS	SECONDARY RADIUS	AP LOCAL AUTHEN.	
<input type="checkbox"/>	RemoteAPGroup_test	-	-	Enable	0

Figure 84. Remote AP Group Add/Remove Window

4.2.2.2 Local Authentication Configuration for Remote AP Group

Users (stations) accessing the remote AP and the Radius server which authenticates such users can be configured.

Configuration using CLI

To configure the local authentication of the remote AP group, perform the command as follows:

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

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

- WEC8500/configure/ap-group {remote-ap-group-name}
 - WEC8500/configure/ap-group/{remote-ap-group-name}#remote
- 2) Configure Primary Radius Server 1, Primary Radius Server 2, and Primary Radius Server 3. The RADIUS server information must be created in the radius of the security item in advance. To delete the configured RADIUS server information, enter 'no' parameter in front of the command.
 - remote primary-radius[RADIUS_SERVER_INDEX]
 - no remote primary-radius[RADIUS_SERVER_INDEX]
 - remote secondary-radius[RADIUS_SERVER_INDEX]

- no remote secondary-radius[RADIUS_SERVER_INDEX]
 - remote tertiary-radius[RADIUS_SERVER_INDEX]
 - no remote tertiary-radius[RADIUS_SERVER_INDEX]
- 3) Add or delete users (stations) connecting to the remote AP.
 - add-user [USER NAME]
 - no add-user [USER NAME]
 - 4) Execute the 'show remote-ap-group detail [REMOTE AP GROUP NAME]' 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. After selecting the name of a remote AP group, configure a Radius server or add or delete users in “User Authentication” item of the ‘Remote AP Group’ tab.

AP Groups > Remote AP Group > User Authentication

User Authentication | ACL Profile

Back Apply

AP GROUP NAME: remote_ap_group

BACKUP RADIUS SERVER 1: ---

BACKUP RADIUS SERVER 2: ---

BACKUP RADIUS SERVER 3: ---

Foot Notes :

1. At least one Radius server should be configured in 'Security > AAA > Radius'

Send To APs

Current Filter : None Change

Remote AP User List Total Entry : 0

ID	NAME	DEPARTMENT	E-MAIL
No data			

Current Filter : None Change

Local Net User List Total Entry : 2

ID	NAME	DEPARTMENT	E-MAIL
user100	user100	sw lab1	user100@samsung.com
user200	user200	sw lab2	user200@samsung.com

Figure 85. Local Authentication Configuration Window for Remote AP Group

4.2.2.3 Role-based Access Control Configuration of Remote AP Group

Explanation on the configuration of the role based access control of the remote AP group is separately made in the “Role Based Access Control” chapter.

4.2.2.4 Configuring Tunneling Forwarding of Remote AP Group

Possible to configure the split ACL to a WLAN set with tunneling among WLANs included in the remote AP group.

Configuration using CLI

To configure the split ACL of the remote AP group, perform the command as follows:

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

```
WEC8500# configure terminal
WEC8500/configure#
WEC8500/configure/ap-group [remote-ap-group-name]
WEC8500/configure/ap-group/[remote-ap-group-name]#remote
```

- 2) Designate the split ACL in the WLAN set with the tunneling mode.
 - tunneling-forwarding [WLAN-ID] [SPLIT-ACL-NAME]
- 3) Execute the ‘show ap-group remote-forwarding [REMOTE AP GROUP NAME]’ command to check the AP group information.
- 4) Use the ‘send-remote-acl-to-ap profile-only’ command to send the ACL Profile information of the remote AP group to APs.
- 5) Use the ‘send-remote-acl-to-ap all’ command to send the information on the ACL Profile, Tunneling Forwarding and Local Bridging Forwarding of the remote AP group to APs.

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. After selecting the name of the remote AP group, you can configure Tunneling Forwarding in the “ACL Profile” item of the 'Remote AP Group' tab. In addition, you can click the “Send To APs” button to send the information on ACL Profile, Tunnel Forwarding, and Local Bridging Forwarding to APs.

AP Groups > Remote AP Group > ACL Profile

User Authentication | **ACL Profile**

Back Send To APs

AP GROUP NAME remote_ap_group

SCOPE ☒ All ☐ ACL Profile Only

Apply

ACL PROFILE NAME ---

OVERWRITE AP CONFIG ☐ Tunnel Forwarding ☐ Local Bridging Forwarding

Tunnel Forwarding

WLAN --- Split Tunnel ACL --- Add Delete

<input type="checkbox"/>	NO.	WLAN	SPLIT TUNNEL ACL	EDIT
No data				

Local Bridging Forwarding

WLAN --- VLAN ID 0 ACL --- Pre-Auth. ACL --- Add Delete

<input type="checkbox"/>	NO.	WLAN	VLAN ID	ACL	PRE-AUTH. ACL	EDIT
No data						

Figure 86. Window for Configuring Tunneling Forwarding of Remote AP Group

4.2.2.5 Configuring Local Bridging Forwarding of Remote AP Group

You can configure the VLAN ID, ACL, and PreAuth ACL to a WLAN set with local bridging among WLANs included in the remote AP group.

Configuration using CLI

To configure the local bridging forwarding of the remote AP group, perform the command as follows:

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

```
WEC8500# configure terminal
WEC8500/configure#
WEC8500/configure/ap-group [remote-ap-group-name]
WEC8500/configure/ap-group/[remote-ap-group-name]#remote
```

- 2) Configure the information on Local Bridging to the WLAN set with the tunneling mode.
 - local-bridging [WLAN-ID] { vlan-id [VLAN-ID] | acl-name [ACL-NAME] | pre-auth-name [PRE-AUTH-NAME] }
- 3) Execute the 'show ap-group remote-forwarding [REMOTE AP GROUP NAME]' command to check the AP group information.

- 4) Use the 'send-remote-acl-to-ap profile-only' command to send the ACL Profile information of the remote AP group to APs.
- 5) Use the 'send-remote-acl-to-ap all' command to send the information on the ACL Profile, Tunneling Forwarding and Local Bridging Forwarding of the remote AP group to APs.

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. After selecting the name of the remote AP group, you can configure Local Bridging in the “ACL Profile” item of the 'Remote AP Group' tab. In addition, you can click the “Send To APs” button to send the information on ACL Profile, Tunnel Forwarding, and Local Bridging Forwarding to APs.

AP Groups > Remote AP Group > ACL Profile

User Authentication | ACL Profile

Back Send To APs

AP GROUP NAME remote_ap_group

SCOPE ☒ All ☐ ACL Profile Only

Apply

ACL PROFILE NAME ---

OVERWRITE AP CONFIG ☐ Tunnel Forwarding ☐ Local Bridging Forwarding

Tunnel Forwarding

WLAN --- Split Tunnel ACL --- Add Delete

NO.	WLAN	SPLIT TUNNEL ACL	EDIT
No data			

Local Bridging Forwarding

WLAN --- VLAN ID 0 ACL --- Pre-Auth. ACL --- Add Delete

NO.	WLAN	VLAN ID	ACL	PRE-AUTH. ACL	EDIT
No data					

Figure 87. Window for Configuring Local Bridging Forwarding of Remote AP Group

4.2.3 AP Time Synchronization per Group

The AP can configure its time information using either the time stamp method or the NTP method.

In the Time Stamp type, the APC periodically transmits the time of APC to an AP and the AP is operating based on the received time. Unless a user changes the configuration, the default is Time Stamp type and the interval is set to 7200 seconds (2 hours).

In the NTP type, the NTP server information is transmitted to an AP and the AP synchronizes the time with the NTP server. A NTP server list must be created to transmit the NTP server information to an AP and maximum 10 lists can be added. The ntp-interval (2^N) is the interval when an AP receives the time information from the NTP server. For example, if the ntp-interval is set to 6, an AP receives the time information from the NTP server at every 2^6 , i.e. 128 seconds.

The APC provides a function for configuring the time configuration method of the AP.

Configuring Time Stamp type using CLI

- 1) Go to configure → apc → ap-time-config configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# apc
WEC8500/configure/apc# ap-time-config
WEC8500/configure/apc/ap-time-config#
```

- 2) Configure how to transmit the time information to an AP using 'ac-stamp' and configure the interval.
 - mode ac-stamp
 - ac-stamp-interval [INTERVAL]
- 3) To check the information, execute the 'show apc ap-time-config' command.

Configuring NTP type using CLI

- 1) Go to configure → apc → ap-time-config configuration mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# apc
WEC8500/configure/apc# ap-time-config
WEC8500/configure/apc/ap-time-config#
```

- 2) Add the NTP server information to transmit to an AP. Maximum 10 NTP server information can be added. To delete the configured NTP server information, enter 'no' parameter in front of the command

- add-ntp [NTP_SERVER_ADDRESS]
 - no add-ntp [NTP_SERVER_ADDRESS]
 - ntp-interval [NUMBER]
- 3) Configure the method of transmitting the time information to an AP as 'ntp'.
- mode ntp
- 4) Use the 'show apc ap-time-config' command to check the configured information.

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, select <NTP> in the submenu, and then select a time setting mode of the AP (TimeStamp or NTP), timestamp interval, and NTP polling interval. Also, you can add/remove NTP server from which to fetch time access information for the AP.

NTP > AP

Apply

MODE ☒ TimeStamp ☐ NTP

STAMP INTERVAL 7200

NTP POLLING INTERVAL 6

IP address [] [] [] [] Add Delete

☐ NO AP NTP SERVER

No data

Figure 88. AP Time Synchronization Configuration Options

4.2.4 AP Configuration



NOTE

The management interface of APC must be configured for the connection between APC 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 profile name]
WEC8500/configure/ap ap_1#
```

If there exists the same AP when entering [ap profile name], you are guided to the mode where operator can configure the AP. If there is no same AP, the new AP information is created.

- 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 config’ 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.

AP PROFILE NAME	ap_1
MAC ADDRESS	00:16:32:ff:8e:2b

Figure 89. Adding Access Points

4.2.4.2 Configuring AP Profile

Configuration using CLI

To configure an AP profile 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 the name of an AP. If it is not entered, the 'AP_' + 'MAC address' is used as a name.
E.g. MAC address: f4:d9:fb:24:cb:a0
AP name: AP_f4d9fb24cba0
 - ap-mode [generalAp/rootAp/repeaterAp/snifferAp]: Configures the AP operation mode.
 - ap-stats-history-enable: Configures whether to enable the AP statistics history.
 - client-ip [IP_ADDRESS]: Configures the client IP address, if the AP operation mode is set to Sniffer AP.
 - console-enable: This configures whether to allow console access to the AP.
 - discovery [ap-followed/apc-referral/multicast/broadcast/DHCP]: Configures the discovery type of an AP to find APC.
 - ap-followed: Finds the APC using the discovery type and discovery list configured in an AP.
 - apc-referral: Uses the APC list information configured in an APC as the discovery list
 - DHCP: Uses the APC list information that is received through DHCP option 138 (IPv4) or option 52 (IPv6) as the discovery list.
 - auto: Discovery type is automatically changed by the AP for automatic connection to the APC.
 - discovery-interval [INTERVAL]: Configures the time waiting for a CAPWAP discovery response message (unit: seconds)
 - dtls-policy: Configures the DTLS Policy of an AP.
 - echo-interval [INTERVAL]: Configures the time when an AP transmits an echo request to the joined APC (Unit: seconds)
 - echo-retransmit-interval [INTERVAL]: Waiting time to retransmit an echo request message if there is no reply. The APC configures the echo timeout as much as two times of echo-interval. If the APC cannot receive an echo message from an AP until two times of echo-interval is elapsed, the APC assumes that the AP is down (Unit: seconds)

- edge-ap: Configures whether to enable the Edge AP function.
- edge-ap-opmode: Smart Handover is enabled as operation mode of the edge AP. In RSSI mode, handover is determined by looking up the RSSI value. In Force mode, handover is performed by force.
- edge-ap-threshold: Configures a threshold value for performing smart handover at the edge AP (range: -60 to -100 dBm, default: -80 dBm).
- edge-ap-window: Configures a window value for performing smart handover at the edge AP (range: 200-1000 ms, default: 200 ms).
- fragment-size [SIZE]: Configures a fragment size based on MTU to prevent the fragmentation of a CAPWAP packet that is transmitted by an AP to the APC.
- ip-mode [dhcp/static/ap]: Configures the IP address of an AP to DHCP, Static or AP Followed.
 - dhcp: Configures the AP IP operation type to DHCP
 - static: Configures the AP IP operation type to static
 - ap: Operates with an IP configured in an AP
- led-config: Configures LED on/off setting of the AP.
 - on: Sets LED of the AP on.
 - off: Sets LED of the AP off.
 - off-time: Sets LED of the AP off only for specific hours.
- local-bridging: Configures WLAN-VLAN Mapping of the Local Switching WLAN, ACL, and Pre-Authentication ACL of Captive Portal for each remote AP.
 - vlan-id: Configures a VLAN ID to allocate to the Local Switching WLAN.
 - acl-name: Configures an ACL name to allocate to the Local Switching WLAN for packet allowance/blocking.
 - pre-auth-name: Configures a Pre-Authentication ACL name for Captive Portal operation of the Local Switching WLAN.
- location [STRING]: Configures the information of location where an AP is installed.
- mac [MAC_ADDRESS]: Configures the MAC address of an AP
- max-echo-retransmit [COUNT]: Configures the maximum number of retransmission times of an echo request message.
- max-retransmit [COUNT]: Configures the maximum number of retransmission times of a CAPWAP control message.
- name [STRING]: Configures an AP name.
- native-vlanId [VLAN_ID]: Configures the native VLAN in an AP.
- primary-apc [APC_AME]: Configures the name of a primary APC.
- secondary-apc [APC_AME]: Configures the name of a secondary APC.
- tertiary-apc [APC_AME]: Configures the name of a tertiary APC. The WEC8050 model does not support the tertiary-apc function.
- repeater-whitelist [MAC ADDRESS]: Adds the Repeater AP Whitelist.
- report-interval [INTERVAL]: Configures the time interval for an AP to transmit the description error to the APC (Unit: seconds)
- retransmit-interval [INTERVAL]: Configures the waiting time until the AP retransmits a CAPWAP control message when there is no reply from the APC (unit: seconds)

- ssh-enable: Configures whether to enable the SSH server of an AP.
 - static-ip [IP_ADDRESS] [NETMASK] [GATEWAY]: Configures the static IP address of an AP.
 - statistics-timer [TIMER]: Configures the time interval of transmitting the statistics information provided by CAPWAP (unit: seconds)
 - telnet-enable: Configures whether to enable the telnet server of an AP.
 - time-config: Configure the timezone per AP.
 - vlan-support: Configures whether to enable the native VLAN of an AP.
 - poe-type: Set the POE Type of the AP. You can set 802.3at, 802.3af, and auto.
 - uplink-bandwidth: Set the allowed value for AP uplink bandwidth. Possible to set between 1 and 1024 Mbps and if it is set to 0, the uplink bandwidth is not restricted.
 - temperature-alarm-on-level: If the temperature of the AP exceeds the Temperature-Alarm-On-Level, the temperature alarm occurs. The default is 98 and possible to set between 50 and 130.
 - temperature-alarm-off-level: If the temperature of the AP is less than the Temperature-Alarm-Off-Level, the temperature alarm is cleared. The default is 98 and possible to set between 50 and 130.
 - temperature-alarm-control-type: If the temperature alarm occurs, set whether the radio of the AP is set to be off or on.
 - link-aggregation: In case of an AP model for 802.11ac, provide two uplink Ethernet ports. Possible to set link aggregation for two Ethernet ports. If the link aggregation is activated, Both (Destination + Source), Destination, and Source modes are configurable.
 - Link-aggregation: The 11ac AP model provides 2 uplink Ethernet ports. The 2 Ethernet ports can be configured for link aggregation. If link aggregation is enabled, the following modes can be configured.
 - Both (Destination + Source)
 - Destination
 - Source
- 3) To check the information of a configured AP profile, use the 'show ap detail [AP_NAME]' command.

Configuring IPSec with CLI

Execute the following command to configure IPSec for the AP.

- 1) In the CLI, go to configure → AP configuration → AP ip-sec mode.

```
WEC8500# configure terminal
WEC8500/configure# ap ap_1
WEC8500/configure/ap ap_1# ip-sec
WEC8500/configure/ap ap_1/ip-sec#
```

- 2) Configure ip-sec for the AP using the commands below.
- enable

- primary-ip
- right-subnet
- right-subnet-mask
- auth-mode
- ike-version
- ike-lifetime
- ipsec-lifetime

Parameter	Description
ENABLE	Enables/disables the IPSec function.
PRIMARY-IP	Configures the address of the primary security gateway.
RIGHT-SUBNET	Configures the address of the traffic selector for IPSec.
RIGHT-SUBNET-MASK	Configures subnet mask of the traffic selector for IPSec.
AUTH-MODE	Configures the authentication mode used in IPSec. PSK/PKI
IKE-VERSION	Configures the IKE version. 1/2
IKE-LIFETIME	Configures the IKE SA validity. (Unit: hours)
IPSEC-LIFETIME	Configures the IPSec SA validity. (Unit: minutes)

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.

Access Points > General	
AP PROFILE NAME	ap_1
AP NAME	PV-77-104
AP GROUP NAME	test1
REMOTE AP GROUP NAME	test
AP MODE ¹	General AP
MAC ADDRESS	f4:d9:fb:24:2d:c1
MAP LOCATION	
LOCATION	
IP ADDRESS	0.0.0.0
IP ADDRESS POLICY	<input type="radio"/> DHCP <input checked="" type="radio"/> AP Priority (AP Followed) <input type="radio"/> Static IP
IP ADDRESS	0 0 0 0
NETMASK	0 0 0 0
GATEWAY	0 0 0 0
DISCOVERY TYPE ²	AP Followed <small>Current Discovery Type : Static</small>
ADMIN STATUS	Up
OPER STATUS	Down
PRIMARY CONTROLLER NAME ³	APC101 (10.10.10.10)
SECONDARY CONTROLLER NAME ³	
TERTIARY CONTROLLER NAME ³	

Figure 90. AP Profile Setting (1)

- AP NAME: AP name
- AP GROUP NAME: Indicates name of the AP GROUP to which the AP belongs.
- REMOTE AP GROUP NAME: Indicates name of the REMOTE AP GROUP to which the AP belongs.
- AP MODE: AP operational mode (General AP/Root AP/Repeater AP/Sniffer AP)
- MAC ADDRESS: Cannot be changed to the MAC address of an AP.
- MAP LOCATION
- LOCATION: Information of location where an AP is installed
- IP ADDRESS: IP address of AP
- 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
For WEC8050, the TERTIARY CONTROLLER NAME is not supported.

- IP SEC: IPSec service specific features

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.

General	802.11a/n/ac	802.11b/g/n	Advanced
Access Points > Advanced			
<input type="button" value="Back"/> <input type="button" value="Apply"/>			
AP PROFILE NAME	ap_1		
AP NAME	AP_f4d9fb118973		
AP GROUP NAME	testgroup01		
ECHO INTERVAL (SEC) ¹	30		
MAX DISCOVERY INTERVAL (SEC) ²	60		
REPORT INTERVAL (SEC) ³	120		
STATISTICS TIMER (SEC) ⁴	120		
RETRANSMIT INTERVAL (100MS) ⁵	5		
MAX RETRANSMIT ⁶	5		
ECHO RETRANSMIT INTERVAL (SEC) ⁷	3		
MAX ECHO RETRANSMIT ⁸	5		
TELNET ⁹	<input checked="" type="radio"/> Enable <input type="radio"/> Disable 23		
SSH ¹⁰	<input type="radio"/> Enable <input checked="" type="radio"/> Disable 50022		
CONSOLE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
DTLS ¹¹	Disable		
LED	On 00 : 00 ~ 00 : 00		
POE TYPE ¹²	802.3at		
EDGE AP	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
EDGE AP OPERATION MODE	RSSI		
SMHO THRESHOLD (DBM)	-80		
SMHO WINDOW SIZE (MS)	300		
COUNTRY CODE	North America(US)		
ENVIRONMENT	Both		
TIME ZONE	Asia/Seoul		

VLAN	
VLAN SUPPORT ¹³	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
NATIVE VLAN ID ¹⁴	0
<input type="button" value="Apply"/>	
AirMove	
CONFIG PRIORITY	<input type="radio"/> AP <input checked="" type="radio"/> AP Group
SCAN TRIGGER LEVEL (DBM)	-70
SCANNING TIME FOR ONE CHANNEL (MS)	5
SERVICE TIME DURING SCANNING (MS)	100
SCANNING INTERVAL TIME (MS)	1000
NUMBER OF PROBE REQUESTS	2
NUMBER OF SCANNING CHANNELS	4
VALUE OF STATION ROAM DELTA (DBM)	15

Smart Service Link	
CONFIG PRIORITY	<input type="radio"/> AP <input checked="" type="radio"/> AP Group
SCAN TRIGGER LEVEL (DBM)	-70
SCANNING TIME FOR ONE CHANNEL (MS)	5
SERVICE TIME DURING SCANNING (MS)	100
SCANNING INTERVAL TIME (MS)	3000
NUMBER OF PROBE REQUESTS	2
NUMBER OF SCANNING CHANNELS	2
VALUE OF STATION ROAM DELTA (DBM)	15
Apply	

IPsec	
SERVICE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
PRIMARY G/W IP ADDRESS	0 . 0 . 0 . 0
RIGHT SUBNET	0 . 0 . 0 . 0
RIGHT SUBNET MASK	0 . 0 . 0 . 0
IKE VERSION	<input checked="" type="radio"/> v1 <input type="radio"/> v2
IKE LIFETIME (HOURS)	3
IPSEC LIFETIME (MIN.)	60
AUTH. MODE	<input checked="" type="radio"/> PSK <input type="radio"/> PKI

Figure 91. 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 (generalAp/rootAp/repeaterAp/snifferAp/relayAP) <ul style="list-style-type: none"> - generalAp: Typical operation mode. Default value. - rootAp: AP mode where a repeater AP can be connected. - repeaterAp: AP mode that is connected to a wireless area and the APC through the root AP. - snifferAp: AP mode where the packets operating in a wireless environment can be captured. - relayAp: An AP mode which connects a root AP and a repeater AP

Parameter	Description
	wirelessly

- 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 92. AP mode configuration

The screenshot shows the 'General' configuration page for an Access Point. The left sidebar contains a menu with 'Access Points' selected. The main content area has a 'General' tab active. The configuration fields are as follows:

- AP PROFILE NAME: ap_1
- AP NAME: AP_f4d9fb24cba0
- AP GROUP NAME: default
- AP MODE: General AP (selected from a dropdown)
- MAC ADDRESS: f4:d9:fb:24:cb:a0
- MAP LOCATION: (empty field)
- LOCATION: (empty field)
- IP ADDRESS: 100.100.100.50
- IP ADDRESS POLICY: ☒ DHCP ☒ AP Priority (AP Followed) ☐ Static IP
- IP ADDRESS: 0 . 0 . 0 . 0
- NETMASK: 0 . 0 . 0 . 0
- GATEWAY: 0 . 0 . 0 . 0
- DISCOVERY TYPE: AP Followed (selected from a dropdown) Current Discovery Type : Static
- ADMIN STATUS: Up
- OPER STATUS: Up
- PRIMARY CONTROLLER NAME: (empty field)
- SECONDARY CONTROLLER NAME: (empty field)
- TERTIARY CONTROLLER NAME: (empty field)

Buttons for 'Back' and 'Apply' are located at the top right of the configuration area. A 'Foot Notes' section is at the bottom.

4.2.4.4 AP CLI Access Account

The APC operator can add or remove account information relating to the AP CLI. When the APC is first installed, a default account is provided (id: root, password: samsung).

Up to three AP CLI accounts can be added, and at least one account must be configured.

Therefore, if there is only one remaining account, it cannot be deleted.

(* While each account may be in any of the three available levels (Administrator/Operator/Monitor), there are currently no functional differences for the APs.)

Configuration using CLI

Execute the following commands to configure the AP access account.

- 1) Go to configure → APC mode of CLI.

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

- 2) Add an AP CLI account.
 - ap-account [ID] [PASSWORD] [LEVEL]

Parameter	Description
ID	This is the ID of the AP CLI account. Only an alphanumeric value of up to eight characters can be entered.
Password	This is the password of the AP CLI account. Only an alphanumeric value of up to eight characters can be entered.
Level	This is the level of the AP CLI account. Available values are administrator/operator/monitor.

- 3) An account can be deleted by entering the 'no' parameter as shown below.
 - no ap-account [ID]
- 4) Use the 'show apc ap-account' command to retrieve the AP configuration information.

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Configuration>, and then select <Local Management Users> → AP in the submenu.

Click the 'Add' or 'Delete' button to add or delete the AP CLI account.



Figure 93. AP CLI Account Add/Remove Window

4.2.4.5 AP SNMP Agent Configuration

The APC operator can configure SNMP Agent settings for all APs.

Configuration using CLI

Execute the following commands to configure the SNMP Agent settings of the AP.

- 1) Go to configure → snmp → ap mode of CLI.

```
WEC8500# configure terminal
WEC8500/configure# snmp
WEC8500/configure/snmp# ap
WEC8500/configure/snmp/ap#
```

- 2) Configure the snap agent information of the AP.

Enable/disable SNMP of the AP.

- enable or no enable

Configure the SNMP port number of the AP.

- Port [PORT NUMBER]

Configure the Read Only Community Name of the AP.

- ro-community [COMMUNITY NAME]

Configure the Write Only Community Name of the AP.

- rw-community [COMMUNITY NAME]

Configure the user information of the AP.

- Use r[USER NAME] [AUTHENTICATION TYPE] [AUTHENTICATION KEY]
[PRIVATE PROTOCOL] [PRIVATE KEY]

Parameter	Description
PORT NUMBER	This is the SNMP port number.
COMMUNITY NAME	This is the SNMP Read Only or Write Only Community name.
USER NAME	This is the SNMP user name.
AUTHENTICATION TYPE	This is the SNMP authentication type. Either of the following two can be selected: - MD5 - SHA
AUTHENTICATION KEY	A number in the range of 8 to 20 can be entered.
PRIVATE PROTOCOL	Either of the following two can be selected: - DES - AES

Parameter	Description
PRIVATE KEY	A number in the range of 8 to 20 can be entered.

- 3) Use the 'show snmp ap' command to retrieve the agent information configured for the AP.

Configuration using Web UI

In the menu bar of <WEC Main Window>, select <Administration>, select <AP> in the submenu, and then select <v1/v2c Community> or <v3 User> to configure the SNMP agent information.

Figure 94. AP SNMP v1/v2c Community Configuration Window

Figure 95. AP v3 User Configuration Window

4.2.5 Information Management

The APC manages the history statistics information, real-time interface statistics information, and tech support information of the AP.

AP History Statistics

The AP transmits the interface (WAN and WLAN) and CPU load/memory usage statistics information collected for 5 min. to the APC. The APC forwards the information to the WEM via FTP. If the APC does not interoperate with the WEM, the APC stores the information for 3 days.

AP real-time statistics

If the APC requests the interface information to an AP, the AP transmits the interface information (WAN and WLAN) to the APC at every 5 second and the APC stores the information in its internal DB. An operator can retrieve the information by using CLI or WEC.

AP Tech Support

If there occurs a problem with a specific AP, an operator can download the Tech Support information from the AP. Execute the following command to use the function.

The Tech Support from an AP includes the following information.

- System log message file
- System crash information file
- System report files (status/configuration information)
- Core file used to check application malfunctioning

4.2.5.1 History Statistics Information

To check the history statistics information relay status 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.

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

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

```
WEC8500/configure/ap ap_1# 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, and then you can check detail information.

Statistics > AP Ports

Current Filter : None

Change

(e) : Edge AP, (r) : Remote AP

Total Entry : 1

AP PROFILE NAME	AP NAME	MAC ADDRESS	IP ADDRESS	UP TIME	CAPWAP UP TIME	ADMIN STATUS	OPER STATUS	MAP LOCATION	MODE	MODEL	VERSION
ap_1	AP_f4d9fb24cba0	f4:d9:fb:24:cb:a0	100.100.100.50	1 day, 4 hour, 15 min, 2 sec	1 day, 3 hour, 14 min, 22 sec	Up	Up		General AP	WEA303i	1.4.3.R

Figure 96. AP Ports window

Statistics > AP Ports		Back	
AP PROFILE NAME	ap_1		
AP NAME	AP_f4d9fb24cba0		
INTERFACE NAME	ap_1.wan		
INTERFACE TYPE	Wan IF		
RX UNICAST PACKETS	79,627		
RX MULTICAST PACKETS	0		
RX DISCARDED PACKETS	0		
RX ERROR PACKETS	0		
RX UNKNOWN PROTOCOL PACKETS	0		
TX UNICAST PACKETS	181,379		
TX MULTICAST PACKETS	0		
TX DISCARDED PACKETS	0		
TX ERROR PACKETS	0		

Figure 97. AP Ports detail information window

4.2.5.3 Tech Support Information

Execute the below command to download the Tech Support information from an AP.

Configuration using CLI

- 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 coredump file of the AP.

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

- 3) Request the crashfile of the AP.

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

- 4) Request the log file of the AP.

```
WEC8500/configure/ap ap_1/tech-support# get-log-file
```

- 5) Use 'show ap tech-support' command to check the Tech Support file information of APs. Operator can use FTP or SFTP to download Tech Support files.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <Tech Support> → <AP Crash> menu in the sub-menus.

By clicking the profile name of an AP, operator can download the Tech Support file.



Tech Support > AP Crash

AP Crash

Current Filter : None Change

(r) : Remote AP Total Entry : 1

AP PROFILE NAME	AP NAME	MODEL	VERSION	MAC ADDRESS	IP ADDRESS	MODE	ADMIN STATUS	OPERATIONAL STATUS	MAP LOCATION
ap_1	AP_f4d9fb24cba0	WEA303i	1.4.3.R	f4:d9:fb:24:cb:a0	100.100.100.50	General AP	Up	Up	

Figure 98. AP Tech Support Information Receiving Window

4.2.6 Outdoor AP Configuration

The APC system provides outdoor AP connection diagnostic functions for outdoor APs. The AP connection diagnostics function checks ping status of outdoor APs and displays the results on the operator's monitor.

Procedure of using the outdoor AP connection diagnostics function is as follows:

- 1) The operator creates/deletes outdoor APWEC using CLI.
- 2) The APC system periodically pings the outdoor AP to check the network connection of the AP and stores the results.
- 3) The operator uses the WEC, WEM or CLI to determine network connection status of the outdoor AP.

Concerning outdoor AP count:

- 1) Outdoor APs are not included in the AP count of the APC license.
- 2) Outdoor APs are not included in the ordinary AP count.
- 3) The maximum up-ported outdoor AP count is 300 for the WEC8500 model and 75 for the WEC8050 model.
- 4) The APC system can retrieve the total/up/down outdoor AP count using the WEC or CLI.

4.2.6.1 Outdoor AP Addition/Removal

The APC system allows creation/deletion of outdoor AP information using the WEC or CLI.

Configuration using CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Create or delete an AP. Use the 'no' parameter in front of the command to delete an outdoor AP.
 - outdoor-ap [PROFILE_NAME] [MAC_ADDRESS] [IP_ADDRESS]
 - no outdoor-ap [PROFILE_NAME]
- 3) Create or delete an outdoor AP. Use the 'no' parameter in front of the command to delete an outdoor AP.
- 4) Use the 'show ap summary' command to check the outdoor AP information.

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. To create an outdoor AP, click <Add>, select <3rd Party Outdoor AP>, enter AP PROFILE NAME, MAC ADDRESS, and IP ADDRESS, and then select <Apply>.

Access Points > Add	
AP PROFILE NAME	outdoorAp <input checked="" type="checkbox"/> 3rd Party Outdoor AP
MAC ADDRESS	f4 : d9 : fb : 24 : 30 : 01
IP ADDRESS	10 . 231 . 107 . 22

Figure 99. Outdoor AP Create Window

4.2.7 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]

This command configures 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]

This command 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]

This command configures the maximum number of simultaneous downloads when transmitting the package file of an AP from the APC 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]

This command 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]

This command 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]

This command 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

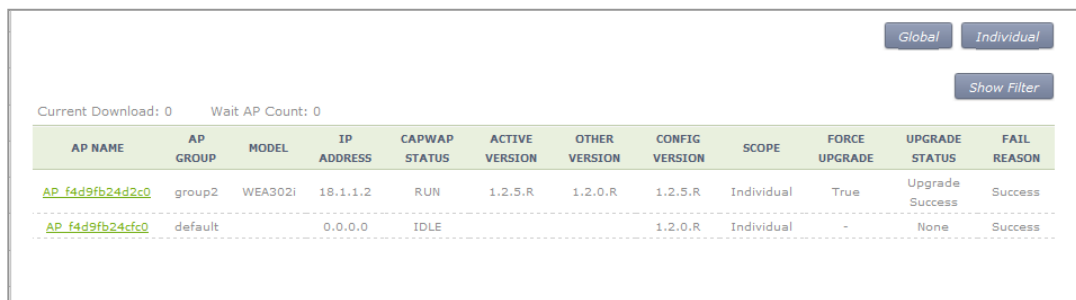
Configuration using Web UI

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]

AP Upgrade tab upgrades all the APs or a specific AP.

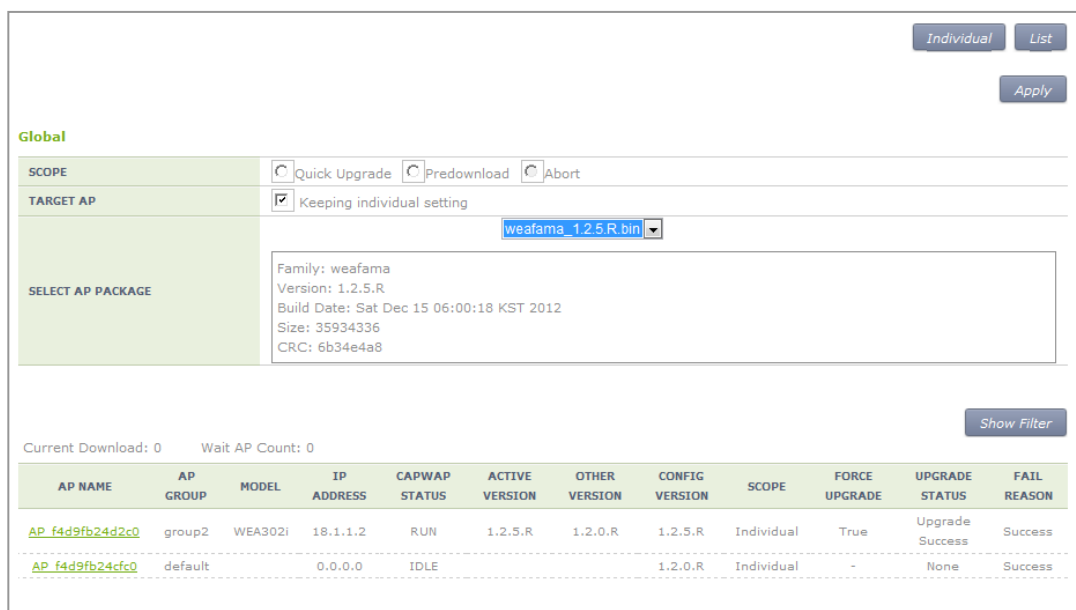


AP NAME	AP GROUP	MODEL	IP ADDRESS	CAPWAP STATUS	ACTIVE VERSION	OTHER VERSION	CONFIG VERSION	SCOPE	FORCE UPGRADE	UPGRADE STATUS	FAIL REASON
AP f4d9fb24d2c0	group2	WEA302i	18.1.1.2	RUN	1.2.5.R	1.2.0.R	1.2.5.R	Individual	True	Upgrade Success	Success
AP f4d9fb24cfc0	default		0.0.0.0	IDLE			1.2.0.R	Individual	-	None	Success

Figure 100. 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.



Global

SCOPE: ☐ Quick Upgrade ☐ Predownload ☒ Abort

TARGET AP: ☒ Keeping individual setting

SELECT AP PACKAGE: weafama_1.2.5.R.bin

Family: weafama
Version: 1.2.5.R
Build Date: Sat Dec 15 06:00:18 KST 2012
Size: 35934336
CRC: 6b34e4a8

AP NAME	AP GROUP	MODEL	IP ADDRESS	CAPWAP STATUS	ACTIVE VERSION	OTHER VERSION	CONFIG VERSION	SCOPE	FORCE UPGRADE	UPGRADE STATUS	FAIL REASON
AP f4d9fb24d2c0	group2	WEA302i	18.1.1.2	RUN	1.2.5.R	1.2.0.R	1.2.5.R	Individual	True	Upgrade Success	Success
AP f4d9fb24cfc0	default		0.0.0.0	IDLE			1.2.0.R	Individual	-	None	Success

Figure 101. 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.

Individual

SCOPE: ☐ to Global ☒ to Individual

FORCE UPGRADE: ☐ Enable ☒ Disable

SELECT AP PACKAGE: **weafama_1.2.5.R.bin**

Family: weafama
Version: 1.2.5.R
Build Date: Sat Dec 15 06:00:18 KST 2012
Size: 35934336
CRC: 6b34e4a8

Current Download: 0 Wait AP Count: 0

	AP NAME	AP GROUP	MODEL	IP ADDRESS	CAPWAP STATUS	ACTIVE VERSION	OTHER VERSION	CONFIG VERSION	SCOPE	FORCE UPGRADE	UPGRADE STATUS	FAIL REASON
<input type="checkbox"/>	AP_f4d9fb24d2c0	group2	WEA302I	18.1.1.2	RUN	1.2.5.R	1.2.0.R	1.2.5.R	Individual	True	Upgrade Success	Success
<input checked="" type="checkbox"/>	AP_f4d9fb24cfc0	default		0.0.0.0	IDLE			1.2.0.R	Individual	-	None	Success

Figure 102. 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.

TRANSFER MODE	<input checked="" type="radio"/> FTP <input type="radio"/> SFTP
MAX DOWNLOAD	10
MAX RETRY	3
DEFAULT AP PACKAGE	wea302_1.2.0.R.bin Current

Figure 103. 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.

4.2.8 Remote AP Package Upgrade

APs in a remote group can be upgraded by downloading an AP package from a specific AP. This is useful for efficient management of APC-AP bandwidth.

A master AP can be selected for each AP package model. After downloading an AP package from the APC, the master AP allows the AP package to be downloaded to other APs in the remote group.

The operator can manage AP upgrade of the APs in the remote group by checking the AP package download status in the remote group and performing reboot and upgrade.

4.2.8.1 Activating Upgrade

The operator can enable/disable the AP upgrade in the remote group. When the AP upgrade is enabled, version priority in AP upgrade status changes to Remote.

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configuration# ap-group rUpgrade
WEC8500/configuration/ap-group rUpgrade# remote
WEC8500/configuration/ap-group rUpgrade/remote# upgrade
WEC8500/configuration/ap-group rUpgrade/remote/upgrade# enable
WEC8500/configuration/ap-group rUpgrade/remote/upgrade# no enable
```

CLI for checking configuration:

```
WEC8500 # show remote-ap-group upgrade config rUpgrade

===== Remote Ap Group Upgrade Config =====

Group Name          : rUpgrade
Enable              : Enable
Type                : Default
Mode                : FTP
Path                : package/ap
PortNum             : 21
MAXretries          : 3
ForceOption         : Disable

weafama             : (APID:0, IP:0.0.0.0)
                   : ()
weafamb             : (APID:0, IP:0.0.0.0)
                   : ()

WEC8500# show remote-ap-group upgrade list rUpgrade

/* (RC/FR/RC) : RetryCount/FailReason/RebootCause
AP_ID  Model  Version(config/current)  Status(RC/FR/RC)  MasterAp
  1    WEA303i  Remote/1.7.0.U2          None( 0/ 0/128)   -
  2    WEA312i  Remote/1.7.0.U2          None( 0/ 0/128)   -
  3    WEA303i  Remote/1.7.0.U1          None( 0/ 0/128)   -
```

Configuration using Web UI

Administration > Package Upgrade > Remote AP Group

Example:

Package Upgrade > Remote AP Group

Multi Set Enable ¹ Disable Start Stop Upgrade & Reboot ²

Total Entry : 5

	REMOTE AP GROUP NAME	REMOTE AP UPGRADE	REMOTE AP UPGRADE STATUS	AP COUNT
<input type="checkbox"/>	remotetestargroup01	Disable	-	0
<input type="checkbox"/>	remotetestargroup02	Disable	-	0
<input type="checkbox"/>	wec1	Disable	-	0
<input type="checkbox"/>	wec2	Disable	-	0
<input type="checkbox"/>	rUpgrade	Enable	-	3

¹

Foot Notes :

1. When Enable for Remote AP Upgrade, AP package will be received from Master AP.
 2. All APs reboot in Remote Group, and will be working upgrade version.

Figure 104. Remote AP Group Upgrade Activation_1

Package Upgrade > Remote AP Group > AP Upgrade

Start Stop Back Apply

REMOTE AP GROUP NAME	rUpgrade	
REMOTE AP UPGRADE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	
REMOTE AP UPGRADE STATUS	-	
FORCE UPGRADE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable	
SELECT AP PACKAGE	300 series (weafama) <input type="text"/>	400 series (weafamb) <input type="text"/>
CURRENT AP PACKAGE	300 series (weafama) Package Version : 1.7.0.U Package File Name : weafama_1.7.0.U.bin	400 series (weafamb) Package Version : - Package File Name : -

Figure 105. Remote AP Group Upgrade Activation_2

4.2.8.2 Master AP Configuration (Optional)

The operator can configure the master AP for AP upgrade in the remote group. If none is configured, a master AP is automatically selected.

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# ap-group rUpgrade
WEC8500/configure/ap-group rUpgrade# remote
WEC8500/configure/ap-group rUpgrade/remote# upgrade
WEC8500/configure/ap-group rUpgrade/remote/upgrade# select-masterAP
ap_1

WEC8500/configure/ap-group rUpgrade/remote/upgrade# delete-masterAP
[weafama/weafamb]
```

CLI for checking configuration:

```
WEC8500# show remote-ap-group upgrade config rUpgrade

===== Remote Ap Group Upgrade Config =====

Group Name       : rUpgrade
Enable           : Enable
Type             : Default
Mode             : FTP
Path             : package/ap
PortNum          : 21
MAXretries       : 3
ForceOption      : Disable

weafama          : ap_1 (APID:1, IP:10.10.10.160)
                  : ()
weafamb          : (APID:0, IP:0.0.0.0)
                  : ()
```



```

WEC8500# show remote-ap-group upgrade list rUpgrade

/* (RC/FR/RC)      : RetryCount/FailReason/RebootCause
AP_ID  Model  Version(config/current)      Status(RC/FR/RC) MasterAp
  1    WEA303i    Global/1.7.0.U2      None( 0/ 0/128)  MasterApCfg
  2    WEA312i    Global/1.7.0.U2      None( 0/ 0/146)  -
  3    WEA303i    Global/1.7.0.U1      None( 0/ 0/146)  -

```

Configuration using Web UI

Administration > Package Upgrade > Remote AP Group

Example:

Package Upgrade > Remote AP Group > AP Upgrade

CURRENT AP PACKAGE

300 series (weafama)
Package Version : 1.7.0.U
Package File Name : weafama_1.7.0.U.bin

400 series (weafamb)
Package Version : -
Package File Name : -

Current Filter : None

Change

Total Entry : 3

AP NAME	MODEL	IP ADDRESS	CAPWAP STATUS	ACTIVE VERSION	OTHER VERSION	SCOPE	UPGRADE STATUS	FAIL REASON	MASTER STATUS
AP_0000aa171717	WEA303i	10.10.10.160	RUN	1.7.0.U	1.7.0.U2	RemoteAP	Upgrade Success	Success	Master
AP_f4d9fb24cba0	WEA312i	10.10.10.122	RUN	1.7.0.U	1.7.0.U2	RemoteAP	Upgrade Success	Success	
AP_0000aa161616	WEA303i	10.10.10.99	RUN	1.7.0.U	1.7.0.U1	RemoteAP	Upgrade Success	Success	

Figure 106. Checking Master AP Configuration

Package Upgrade > Remote AP Group > AP Upgrade

BackMaster Select

General

AP PROFILE NAME	ap_1
AP NAME	AP_0000aa171717
AP GROUP NAME	default
IP ADDRESS	10.10.10.160
MAC ADDRESS	00:00:aa:17:17:17
MAP LOCATION	
LOCATION	
AP MODE	Local AP
ADMIN STATUS	Up
OPERATION STATUS	Up
CAPWAP STATUS	RUN
MODEL NAME	WEA303i
SERIAL NUMBER	S123456789
UP TIME	18 min, 45 sec
CAPWAP UP TIME	18 min, 15 sec
LAST JOIN TIME	Wed Mar 5 20:20:48 2014
REBOOT CAUSE	reboot after package upgrade

Version Information

ACTIVE VERSION	1.7.0.U
OTHER VERSION	1.7.0.U2
UPGRADE MODE	RemoteAP
FORCED UPGRADE	True
UPGRADE STATUS	Upgrade Success
FAIL REASON	Success
CONFIGED VERSION	1.7.0.U2
BOOT VERSION	FF21

High Availability

PRIMARY CONTROLLER NAME	
SECONDARY CONTROLLER NAME	
TERTIARY CONTROLLER NAME	

Advanced

Figure 107. Checking Master AP Configuration

4.2.8.3 AP Package Configuration

The operator can configure an AP package to upgrade in the remote group.

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# ap-group rUpgrade
WEC8500/configure/ap-group rUpgrade# remote
WEC8500/configure/ap-group rUpgrade/remote# upgrade
WEC8500/configure/ap-group rUpgrade/remote/upgrade# select-package
weafama weafama_1.7.0.U.bin

WEC8500/configure/ap-group rUpgrade/remote/upgrade#delete-package
[weafama/weafamb]
```

CLI for checking configuration:

```
WEC8500# show remote-ap-group upgrade config rUpgrade

===== Remote Ap Group Upgrade Config =====

Group Name       : rUpgrade
Enable           : Enable
Type             : Default
Mode             : FTP
Path             : package/ap
PortNum          : 21
MAXretries       : 3
ForceOption      : Disable

weafama          : ap_1 (APID:1, IP:10.10.10.160)
                  : weafama_1.7.0.U.bin (1.7.0.U)
weafamb          : (APID:0, IP:0.0.0.0)
                  : ()
```

Configuration using Web UI

Administration > Package Upgrade > Remote AP Group

Example:

The screenshot shows the 'Package Upgrade > Remote AP Group > AP Upgrade' configuration page. It includes a breadcrumb trail at the top and four buttons (Start, Stop, Back, Apply) on the right. The configuration is organized into several sections:

- REMOTE AP GROUP NAME:** rUpgrade
- REMOTE AP UPGRADE:** ☒ Enable ☐ Disable
- REMOTE AP UPGRADE STATUS:** -
- FORCE UPGRADE:** ☐ Enable ☒ Disable
- SELECT AP PACKAGE:** This section contains two columns for selecting packages. The left column is for '300 series (weafama)' and the right for '400 series (weafamb)'. The left dropdown is set to 'weafama_1.7.0.U1.bin'. A tooltip is visible for this selection, showing details: Family: weafama, Version: 1.7.0.U1, Build Date: Mon Mar 3 19:32:46 KST 2014, Size: 37712000, CRC: f1698883.
- CURRENT AP PACKAGE:** This section shows the current state for both series. For the 300 series (weafama), the package version is 1.7.0.U and the file name is weafama_1.7.0.U.bin. For the 400 series (weafamb), the package version is - and the file name is -.

Figure 108. AP Package Configuration

4.2.8.4 Starting AP Upgrade

The operator can start or stop AP upgrade in the remote group.

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# ap-group rUpgrade
WEC8500/configure/ap-group rUpgrade# remote
WEC8500/configure/ap-group rUpgrade/remote# upgrade
WEC8500/configure/ap-group rUpgrade/remote/upgrade# start

WEC8500/configure/ap-group rUpgrade/remote/upgrade# stop
```

CLI for checking configuration:

```
WEC8500# show remote-ap-group upgrade config rUpgrade

===== Remote Ap Group Upgrade Config =====

Group Name      : rUpgrade
Enable          : Enable
Type            : Predownload
Mode            : FTP
```

```

Path                : package/ap
PortNum             : 21
MAXretries          : 3
ForceOption         : Disable

weafama              : ap_1 (APID:1, IP:10.10.10.160)
                    : weafama_1.7.0.U.bin (1.7.0.U)
weafamb              : (APID:0, IP:0.0.0.0)
                    : ()

WEC8500# show remote-ap-group upgrade list rUpgrade

/* (RC/FR/RC) : RetryCount/FailReason/RebootCause
AP_ID Model      Version(config/current)   Status(RC/FR/RC)   MasterAp
  1  WEA303i Remote/1.7.0.U2 DownloadSuccess( 0/ 0/128) MasterApCfg
  2  WEA312i Remote/1.7.0.U2 DownloadSuccess( 0/ 0/146) -
  3  WEA303i Remote/1.7.0.U2 DownloadSuccess( 0/ 0/146) -

```

Configuration using Web UI

Administration > Package Upgrade > Remote AP Group

Example:

Package Upgrade > Remote AP Group > **AP Upgrade**

Start Stop Back Apply

REMOTE AP GROUP NAME	rUpgrade		
REMOTE AP UPGRADE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable		
REMOTE AP UPGRADE STATUS	-		
FORCE UPGRADE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
SELECT AP PACKAGE	300 series (weafama)	400 series (weafamb)	
	weafama_1.7.0.U1.bin	-----	
CURRENT AP PACKAGE	300 series (weafama)		400 series (weafamb)
	Package Version : 1.7.0.U Package File Name : weafama_1.7.0.U.bin		Package Version : - Package File Name : -

Family: weafama
Version: 1.7.0.U1
Build Date: Mon Mar 3 19:32:46 KST 2014
Size: 37712000
CRC: f1698883

Figure 109. Starting AP Upgrade

4.2.8.5 Restarting and Upgrading AP

After downloading the AP package, APs in the remote group are restarted so that they can run on the upgraded version.

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# ap-group rUpgrade
WEC8500/configure/ap-group rUpgrade# remote
WEC8500/configure/ap-group rUpgrade/remote# reboot upgrade
```

CLI for checking configuration:

```
WEC8500# show remote-ap-group upgrade config rUpgrade

===== Remote Ap Group Upgrade Config =====

Group Name           : rUpgrade
Enable               : Enable
Type                 : Default
Mode                 : FTP
Path                 : package/ap
PortNum              : 21
MAXretries           : 3
ForceOption          : Disable

weafama              : ap_1 (APID:1, IP:10.10.10.160)
                    : weafama_1.7.0.U.bin (1.7.0.U)
weafamb              : (APID:0, IP:0.0.0.0)
                    : ()

WEC8500# show remote-ap-group upgrade list rUpgrade

/* (RC/FR/RC) : RetryCount/FailReason/RebootCause
AP_ID  Model  Version(config/current)  Status(RC/FR/RC)  MasterAp
  1   WEA303i   Remote/1.7.0.U          Success( 0/ 0/128) MasterApCfg
  2   WEA312i   Remote/1.7.0.U          Success( 0/ 0/146) -
  3   WEA303i   Remote/1.7.0.U          Success( 0/ 0/146) -
```

Configuration using Web UI

Administration > Package Upgrade > Remote AP Group

Example:

Package Upgrade > Remote AP Group

Multi Set Enable ¹ Disable Start Stop Upgrade & Reboot ²

Total Entry : 5

<input type="checkbox"/>	REMOTE AP GROUP NAME	REMOTE AP UPGRADE	REMOTE AP UPGRADE STATUS	AP COUNT
<input type="checkbox"/>	remotetestgroup01	Disable	-	0
<input type="checkbox"/>	remotetestgroup02	Disable	-	0
<input type="checkbox"/>	wec1	Disable	-	0
<input type="checkbox"/>	wec2	Disable	-	0
<input checked="" type="checkbox"/>	rUpgrade	Enable	-	3

¹

Foot Notes :

1. When Enable for Remote AP Upgrade, AP package will be received from Master AP.
2. All APs reboot in Remote Group, and will be working upgrade version.

Figure 110. Restarting and Upgrading AP

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 WLAN Configuration

5.1.1 Basic WLAN Configuration

The WLAN profile helps configure and manage the WLAN connection service of an AP in the APC. 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: 1-255)

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) Add WLAN to an AP group.

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.

**NOTE**

A newly created WLAN is added to the 'default' AP group if the WLAN ID is in the range of 1-16. If its WLAN ID is 17 or above, the WLAN is not included in the 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 the WLAN service will be provided.
Several VLAN interfaces can be added to an interface group, and the WLAN service is available only 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.
Make sure to configure a SSID to use the WLAN service.
 - ssid [SSID_NAME]
- 5) Configure radio by selecting 2.4G, 5G or All (2.4G/5G).
 - radio [Radio ID: 1: 5 GHz, 2: 2.4 GHz, 3: ALL]
- 6) 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.

EnableDisableAddDelete

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

Figure 111. WLAN basic configuration (1)

GeneralSecurity802.11a/n/ac802.11b/g/nAdvanced

WLANs > WLANs > General

BackApply

ID	1
PROFILE NAME	wlan1
SSID	ztestmakeWlan_1
AP GROUP LISTS	default
INTERFACE GROUP	ifg_test4
RADIO AREA 1	All
CAPWAP TUNNEL MODE 2	802.3 Tunnel
SUPPRESS SSID	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
AAA OVERRIDE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
MAX. ALLOWED STATIONS ON A BSS 3	127
ADMIN STATUS	<input checked="" type="radio"/> Enable <input type="radio"/> Disable

Figure 112. 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:
- 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:** If the WLAN is enabled with the device authentication function using a AAA server, the AAA-override function can be enabled so that the user-specific settings configured in the AAA server are applied with priority over the APC settings.
- **MAXIMUM ALLOWED STATIONS:** Limits the number of users per WLAN.
- **ADMIN STATUS:** Enables or disables the function.

5.1.2 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) If the WLAN is enabled with the device authentication function using a AAA server, the AAA-override function can be enabled so that the user-specific settings configured in the AAA server are applied with priority over the APC settings.

```
WEC8500/configure/wlan 1# aaa-override
```

- 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 APC.

- 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).

- 9) Broadcast packets can be forwarded to the WLAN. The default value is disable.

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

- 10) Multicast packets can be forwarded to the WLAN. The default value is disable.

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

- 11) Configure the 802.11k service for the WLAN. The default value is enable.
- voice-enterprise-80211k [enable/disable] [CAPABILITIES]

Parameter	Description
CAPABILITIES	- link-measurement - neighbor-report - beacon-passive-measurement - beacon-active-measurement - beacon-table-measurement - statistics-measurement - ap-channel-report

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'.

5.1.3 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
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.

PROFILE NAME	wlan1	Back	Apply
ACL RULE	acl1		
STATIC ADDRESS DISALLOWED	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
DHCP OVERRIDE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
DHCP SERVER	0 . 0 . 0 . 0		
WMM	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	Apply	
DTIM	1		
STATION IDLE TIMEOUT (SEC)	300		
AMPDU	<input checked="" type="radio"/> Enable <input type="radio"/> Disable		
VOIP FAILURE DETECT	<input type="radio"/> Enable <input checked="" type="radio"/> Disable	Apply	

Figure 113. WLAN-based ACL configuration

- ACL RULE: Configures the WLAN-based ACL function.
- STATIC ADDRESS DISALLOWED
- DHCP OVERRIDE
- DHCP SERVER: Enter a DHCP server IP address.
- WMM: Configures the WiFi Multimedia (WMM) mode.
- DTIM: Enter a Delivery Traffic Indication Message (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.

5.1.4 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 APC.

The root AP must be enabled with the repeater service to allow repeater AP connections.

Configuration using CLI

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

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

- 2) Enable or disable the repeater service. The repeater service must be enabled for the repeater AP to connect to the root AP.
 - repeater-service: Enabled
 - no repeater-service: Disabled
- 3) Use the 'show wlan detail repeater' command to check the root WLAN settings.

```
WEC8500/configure/apc# show wlan detail repeater
```

[Changing to Root AP]

The procedure of changing a Wireless Enterprise AP to a Root AP is as follows:

- 1) Go to the configure mode of the 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 the configure mode of the 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.

Controller > General	
<div style="text-align: right;"> <input type="button" value="Apply"/> <input type="button" value="Apply"/> </div>	
AP Management	
IP ADDRESS	10.10.10.10
INTERFACE	vlan1.110 <input type="button" value="Select Interface"/>
AUTO REGISTRATION	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
<input type="button" value="Apply"/>	
Repeater Service	
SERVICE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
SIP ALG¹	
SIP ALG (VOIP AWARE)	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
SIP ERROR RESPONSE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
SIP DETECT LONG DURATION CALL	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
SIP NO ANSWER TIMEOUT (SEC)	600
SIP CONNECT TIMEOUT (SEC)	7200
SIP MONITORING PORT 1	5060
SIP MONITORING PORT 2	0
SIP MONITORING PORT 3	0
SIP MONITORING PORT 4	0
SIP MONITORING PORT 5	0

Figure 114. 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.

Access Points > General

Back Apply

AP PROFILE NAME	ap_1
AP NAME	AP_f4d9fb24cba0
AP GROUP NAME	default
AP MODE ¹	Root AP
MAC ADDRESS	f4:d9:fb:24:cb:a0
MAP LOCATION	
LOCATION	
IP ADDRESS	100.100.100.50
IP ADDRESS POLICY	<input type="radio"/> DHCP <input checked="" type="radio"/> AP Priority (AP Followed) <input type="radio"/> Static IP
IP ADDRESS	0 0 0 0
NETMASK	0 0 0 0
GATEWAY	0 0 0 0
DISCOVERY TYPE ²	AP Followed <input type="button" value="v"/> Current Discovery Type : Static
ADMIN STATUS	Up
OPER STATUS	Up
PRIMARY CONTROLLER NAME ³	
SECONDARY CONTROLLER NAME ³	
TERTIARY CONTROLLER NAME ³	

Figure 115. Root service management (2)

5.1.5 MCS Configuration Management by WLAN

This is a function of configuring data rate and MCS by WLAN. You can configure MCS, etc. by each WLAN differently because it is necessary to configure MCS, etc. differently depending on the types of services such as FMC.

Configuration using CLI

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

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

- 2) Go to 80211a or 80211b depending on the bandwidth to configure.

```
WEC8500/configure/wlan 1# 80211a
WEC8500/configure/wlan 1/80211a#
```

- 3) Configure the data rate. The settings described as shown below can be made only when the corresponding WLAN is set to be disabled.

```
WEC8500/configure/wlan 1/80211a# rate [MODE] [RATE]
```

Parameter	Description
Mode	Mode (basic/supported) - Basic: Basic rate supported for a terminal to access 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 80211b: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, or 54 Mbps

- 4) Configure the 802.11n Modulation and Coding Scheme (MCS) rate.

```
WEC8500/configure/wlan 1/80211a# mcs-11n [RATE]
```

Parameter	Description
RATE	MSC rate (Range: 0~23)

- 5) Configure the 802.11ac Modulation and Coding Scheme (MCS) rate. Only 5G bandwidth for 802.11ac MCS is configurable.

```
WEC8500/configure/wlan 1/80211a# mcs-11ac num-ss 2/3
enter the maximum MCS(7~9) for 1 spatial stream(s): 7
the maximum MCS : 7
enter the maximum MCS(7~9) for 2 spatial stream(s): 7
the maximum MCS : 7
enter the maximum MCS(7~9) for 3 spatial stream(s): 7
the maximum MCS : 7

[Wlan:1] Radio : 5GHz, number of SS: 3, max mcs : 7, 7, 7 Enable
```

- 6) You can check the configuration with the 'show wlan detail #' command.

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

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANs> menu in the sub-menus. Select the WLAN ID to change in the WLANs screen and move to the <802.11a/n/ac> or <802.11b/g/n> tab depending on the bandwidth.

Data Rates ¹		MCS Setting		
6 MBPS	Basic ▼	HT(802.11N) MCS SETTING		
9 MBPS	Supported ▼			
12 MBPS	Basic ▼			
18 MBPS	Supported ▼			
24 MBPS	Basic ▼			
36 MBPS	Supported ▼			
48 MBPS	Basic ▼			
54 MBPS	Supported ▼			
				<input checked="" type="checkbox"/> 0 (7 Mbps) <input checked="" type="checkbox"/> 12 (87 Mbps)
				<input checked="" type="checkbox"/> 1 (14 Mbps) <input checked="" type="checkbox"/> 13 (116 Mbps)
		<input checked="" type="checkbox"/> 2 (21 Mbps) <input checked="" type="checkbox"/> 14 (130 Mbps)		
		<input type="checkbox"/> 3 (29 Mbps) <input type="checkbox"/> 15 (144 Mbps)		
		<input type="checkbox"/> 4 (43 Mbps) <input type="checkbox"/> 16 (22 Mbps)		
		<input type="checkbox"/> 5 (58 Mbps) <input type="checkbox"/> 17 (43 Mbps)		
		<input checked="" type="checkbox"/> 6 (65 Mbps) <input checked="" type="checkbox"/> 18 (65 Mbps)		
		<input checked="" type="checkbox"/> 7 (72 Mbps) <input checked="" type="checkbox"/> 19 (87 Mbps)		
		<input checked="" type="checkbox"/> 8 (14 Mbps) <input checked="" type="checkbox"/> 20 (130 Mbps)		
		<input type="checkbox"/> 9 (29 Mbps) <input type="checkbox"/> 21 (173 Mbps)		
		<input type="checkbox"/> 10 (43 Mbps) <input type="checkbox"/> 22 (195 Mbps)		
		<input type="checkbox"/> 11 (58 Mbps) <input type="checkbox"/> 23 (217 Mbps)		
		VHT(802.11AC) MCS SETTING		
		1 Spatial Stream	0~7 ▼	
		2 Spatial Streams	0~8 ▼	
		3 Spatial Streams	0~9 ▼	

Figure 116. MCS by WLAN: 802.11a/n/ac Configuration Management window

Data Rates¹

1 MBPS	Basic	▼
2 MBPS	Basic	▼
5.5 MBPS	Supported	▼
6 MBPS	Supported	▼
9 MBPS	Disable	▼
11 MBPS	Disable	▼
12 MBPS	Basic	▼
18 MBPS	Basic	▼
24 MBPS	Supported	▼
36 MBPS	Supported	▼
48 MBPS	Disable	▼
54 MBPS	Disable	▼

MCS Setting

HT(802.11N) MCS SETTING

<input checked="" type="checkbox"/> 0 (7 Mbps)	<input checked="" type="checkbox"/> 12 (87 Mbps)
<input type="checkbox"/> 1 (14 Mbps)	<input type="checkbox"/> 13 (116 Mbps)
<input checked="" type="checkbox"/> 2 (21 Mbps)	<input checked="" type="checkbox"/> 14 (130 Mbps)
<input type="checkbox"/> 3 (29 Mbps)	<input type="checkbox"/> 15 (144 Mbps)
<input checked="" type="checkbox"/> 4 (43 Mbps)	<input checked="" type="checkbox"/> 16 (22 Mbps)
<input type="checkbox"/> 5 (58 Mbps)	<input type="checkbox"/> 17 (43 Mbps)
<input checked="" type="checkbox"/> 6 (65 Mbps)	<input checked="" type="checkbox"/> 18 (65 Mbps)
<input type="checkbox"/> 7 (72 Mbps)	<input type="checkbox"/> 19 (87 Mbps)
<input checked="" type="checkbox"/> 8 (14 Mbps)	<input checked="" type="checkbox"/> 20 (130 Mbps)
<input type="checkbox"/> 9 (29 Mbps)	<input type="checkbox"/> 21 (173 Mbps)
<input checked="" type="checkbox"/> 10 (43 Mbps)	<input checked="" type="checkbox"/> 22 (195 Mbps)
<input type="checkbox"/> 11 (58 Mbps)	<input type="checkbox"/> 23 (217 Mbps)

Figure 117. MCS by WLAN: 802.11b/g/n Configuration Management window

5.2 Local Switching

The APC provides the local switching function to support a service to an individual network such as a branch office. The local switching function enables an AP to be connected to WAN for external connection in an individual network where the APC is not installed. The control packet of an AP and a wireless terminal is processed in the centralized APC and a general data packet is processed in an individual network. Therefore, if the tunnel mode of the WLAN is changed to local switching, part of the data packet forwarding process performed by the APC is performed by the AP.

The following AP functions must be configured in the WLAN which is configured for local switching:

- 1) WLAN-VLAN Mapping
 - The wireless device traffic connected to the configured local switching WLAN is forwarded by the AP with the configured VLAN tag.
- 2) ACL
 - Packet filtering ACL is performed for the wireless device traffic connected to the configured local switching WLAN.
- 3) Preauthentication ACL of Captive Portal
 - Web preauthentication packet forwarding ACL is processed for the wireless device traffic connected to the local switching WLAN configured for captive portal.

The functions above are activated only for the APs added to the remote AP group.

Configuration using CLI

The procedure of local switching configuration is as follows:

- 1) By referring to the 'Configuring Remote AP Group', add an AP to a remote AP group.
- 2) Enter into the configure → wlan configuration mode of CLI, and configure 'tunnel-mode' to 'local-bridging'.

```
WEC8500# configure terminal
WEC8500/configure# wlan 1
WEC8500/configure/wlan 1# tunnel-mode local-bridging
```

- tunnel-mode local-bridging
- 3) Enter into the configure → AP configuration mode of CLI, and configure a local Vlan ID per WLAN.

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

- local-bridging [WLAN_ID][VLAN_ID/ACL_NAME/PRE_AUTH_ACL_NAME]

Parameter	Description
WLAN_ID	WLAN ID (Range: 1-254) (available only for WLANs the tunnel-mode of which is local-bridging)
VLAN_ID	VLAN ID (Range: 1-4094)
ACL_NAME	ACL name to configure for the WLAN service (only for options set in IP ACL)
PRE_AUTH_ACL_NAME	ACL name to configure for pre-authentication of the WLAN (only for options set in IP ACL)

- 4) Operator can check the configuration information by executing the ‘show remote-ap-group summary’, ‘show wlan detail’, ‘show ap local-bridging [AP_PROFILE_NAME]’ command.

Configuration using Web UI

By referring to the ‘Configuring Remote AP Group’, add an AP to a remote AP group.

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. After changing the ‘CAPWAP TUNNEL MODE’ to ‘Local Bridging’, click the <Apply> button.

ID	1
PROFILE NAME	wlan1
SSID	apm_test
AP GROUP LISTS	default
INTERFACE GROUP	ifg_01
RADIO AREA ¹	All
CAPWAP TUNNEL MODE ²	Local Bridging
SUPPRESS SSID	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
AAA OVERRIDE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
MAX. ALLOWED STATIONS	127
GUEST SERVICE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
ADMIN STATUS	<input checked="" type="radio"/> Enable <input type="radio"/> Disable

Figure 118. Local Switching Configuration Window of WLAN

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Access Points> menu in the sub-menus. In the Access Points screen, select an AP to change and go to the <Remote AP> tab.

Select the WLAN set with tunneling and enter the split ACL before clicking the <Add> button.

NO.	WLAN	SPLIT TUNNEL ACL	EDIT
No data			

Figure 119. Split ACL Configuration Window of WLAN Allocated to AP

Select the WLAN set with local bridging and then enter VLAN ID/ACL/Pre-Auth. ACL before clicking the <Add> button.

NO.	WLAN	VLAN ID	ACL	PRE-AUTH. ACL	EDIT
No data					

Figure 120. VLAN/ACL/Pre-Auth.ACL Configuration Window of WLAN Allocated to AP

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:

- Wired Equivalent Privacy (WEP)
- Wi-Fi Protected Access Version 1 (WPA1), Wi-Fi Protected Access Version 2 (WPA2)
- Authentication type: Pre-Shared Key (PSK), 802.1X
- Encryption type: Temporal Key Integrity Protocol (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 121. 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.
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 - 802.1x (Dynamic WEP): Dynamic WEP security function - Static WEP + 802.1x (Dynamic WEP): Static/Dynamic 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	WPA2	The WPA Version 2 function is always enabled and cannot be changed.
	ENCRYPTION TYPE	The only supported encryption method is CCMP and this cannot be changed. - CCMP: AES-CCMP method
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
	PSK FORMAT	PSK key input type - ASCII: ASCII character string - HEX: Hexadecimal value
	PSK KEY	PSK key - 8-63 ASCII character string

Item		Description
		- 64-characters of hexadecimal value
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: 0)
PROTECTED MANAGEMENT FRAME		Protected management frames (802.11w) function - Disabled: Disables the function - Optional: Enables the function and allows connection even by devices not using the function - Required: Enables the function but allows connection only by devices using the function
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)
STATIC WEP	WEP KEY INDEX	Key index (1-4)
	WEP KEY	key value
802.1X(DYNAMIC WEP)	WEP KEY SIZE	Key length - 40: 40-bit (5-byte) - 104: 104-bit (13-byte)

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 Version 2 must be enabled at all times. - 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 Version 2 must be enabled at all times. - wpa: WPA Version 1 - wpa2: WPA Version 2
ENC_TYPE	Encryption type (tkip/ccmp) - tkip: TKIP type. TKIP cannot be configured for WPA Version 2. - 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.

		Back	Apply
ID	1		
PROFILE NAME	wlan1		
L2 SECURITY TYPE ¹	WPA + WPA2 ▼		
WPA POLICY	<input type="checkbox"/> WPA		
ENCRYPTION TYPE	CCMP ▼		
WPA2 POLICY	<input checked="" type="checkbox"/> WPA2		
ENCRYPTION TYPE	CCMP ▼		
AUTH KEY MGMT	<input checked="" type="radio"/> PSK <input type="radio"/> 802.1x		
PSK FORMAT	ASCII ▼		
PSK KEY <input type="checkbox"/> ³	●●●●●●		
PMK LIFETIME (SECONDS)	43200		
EAPOL REAUTHENTICATION PERIOD	0		
PROTECTED MANAGEMENT FRAME	Disabled ▼		

Figure 122. 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:



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 Version 2 must be enabled at all times. - 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

Parameter	Description
	configured before. WPA Version 2 must be enabled at all times. - wpa: WPA Version 1 - wpa2: WPA Version 2
ENC_TYPE	Encryption type (tkip/ ccmp) - tkip: TKIP type. TKIP cannot be configured for WPA Version 2. - 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) 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.

ID	1
PROFILE NAME	wlan1
AUTHENTICATION SERVER	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
RADIUS SERVER 1	90.90.1.242 : 1812 ▼
RADIUS SERVER 2	----- ▼
RADIUS SERVER 3	----- ▼
ACCOUNTING SERVER	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
RADIUS SERVER 1	90.90.1.242 : 1813 ▼
RADIUS SERVER 2	----- ▼
RADIUS SERVER 3	----- ▼
FALLBACK TEST INTERVAL (SECONDS)	0
ACCOUNTING INTERVAL (SECONDS)	600

Figure 123. WPA/WPA2 802.1x Configuration (1)

Item		Description
PROFILE NAME		A WLAN configuration name is displayed.
AUTHENTIC ATION SERVER	Enable/ Disable	Whether the authentication function is enabled. - Enable: The authentication function is enabled. - Disable: The authentication function is disabled.
	RADIUS SERVER 1	Authentication server that will be used as the first priority (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.)

Item		Description
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.

Internal RADIUS Server

Operator can use a RADIUS server in the APC. The internal RADIUS server only supports the authentication function and does not support the accounting or aaa-override, etc. To use an internal RADIUS server, select 'Internal' when selecting a RADIUS server during authentication server configuration.

- 2) Click the <L2> tab.

ID	1
PROFILE NAME	wlan1
L2 SECURITY TYPE ¹	WPA + WPA2
WPA POLICY	<input type="checkbox"/> WPA
ENCRYPTION TYPE	CCMP
WPA2 POLICY	<input checked="" type="checkbox"/> WPA2
ENCRYPTION TYPE	CCMP
AUTH KEY MGMT	<input type="radio"/> PSK <input checked="" type="radio"/> 802.1x
PSK FORMAT	ASCII
PSK KEY	<input type="checkbox"/> ³ <input type="text"/>
PMK LIFETIME (SECONDS)	43200
EAPOL REAUTHENTICATION PERIOD	0
PROTECTED MANAGEMENT FRAME	Disabled

Figure 124. 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.

Back Apply	
ID	1
PROFILE NAME	wlan1
L2 SECURITY TYPE ¹	Static WEP ▼
STATIC WEP	
WEP KEY FORMAT	ASCII ▼
WEP KEY SIZE	104 bits ▼
WEP KEY INDEX	1 ▼
WEP KEY	1234567890123
MAC AUTHENTICATION	<input type="radio"/> Enable <input checked="" type="radio"/> Disable

Figure 125. 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'.

5.3.5 Dynamic WEP Configuration

The Dynamic WEP is a security algorithm that improves the security vulnerabilities of a static WEP by using 802.1x authentication. Unlike the static WEP that is based on a configured fixed key, it creates a cryptographic key by executing 802.1x authentication when a terminal is connected.

Configuration using CLI

For dynamic WEP configuration, execute the command as follows:

- 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) Enable the 802.1x authentication.

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

- 4) To configure the length of a cryptographic key of dynamic WEP, execute the following command.

```
WEC8500/configure/wlan 1/security# ieee8021x encryption [KEY_LENGTH]
```

Parameter	Description
KEY_LENGTH	Key length (Bit unit) - 40 - 104

- 5) 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.)

- 6) 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.)

- 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 the configuration information, execute the following command.

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

- 9) To check configuration information, execute 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. For details about configuration, refer to the section 5.3.3.
- 2) Click the <L2> tab.

Back Apply	
ID	1
PROFILE NAME	wlan1
L2 SECURITY TYPE ¹	802.1x(Dynamic WEP) ▼
802.1X(DYNAMIC WEP)	
WEP KEY SIZE	104 bits ▼
EAPOL REAUTHENTICATION PERIOD	0

Figure 126. Dynamic WEP Configuration Window

Select the L2 Security Type as Dynamic 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 APC 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 APC dynamically allocates an IP address to a client.

Configuration using CLI

- 1) Go to the configure mode of the 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 127. 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 the configure mode of the 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]

This command 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]

This command configures or deletes a domain name.

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

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

[Configuring Fixed IP Address to MAC Address]

This command 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

[Capwap Access Controller Address Configuration]

Up to three IP addresses for a Capwap controller can be configured or deleted. Also, all Capwap controller addresses can be deleted using the 'no capwap-dhcp-option' command.

- capwap-dhcp-option [IP_ADDRESS]
- no capwap-dhcp-option

Parameter	Description
IP_ADDRESS	IP address of the Capwap Controller

[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 (32 bit 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] - 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]	Configures an option.
- 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.

Apply

DHCP SERVER SERVICE

☐ Enable ☒ Disable

AddDelete

	POOL NAME	NETWORK	MASK	LEASE TIME (SEC)
<input type="checkbox"/>				

Figure 128. DHCP Pool (1)

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

DHCP > Internal Server > Edit

POOL NAME

sample

NETWORK

1000

MASK

2550000

LEASE TIME (SEC)

86400

DOMAIN NAME

DEFAULT GATEWAY

0000

1ST DNS SERVER

0000

2ND DNS SERVER

0000

3RD DNS SERVER

0000

1ST NTP SERVER

0000

2ND NTP SERVER

0000

3RD NTP SERVER

0000

APC List (Option 138)

IP Address0000AddDelete

	NO.	IP ADDRESS	EDIT
<input type="checkbox"/>			

Range Pool

Start IP Address0000End IP Address0000AddDelete

	NO.	START IP ADDRESS	END IP ADDRESS	EDIT
<input type="checkbox"/>				

Fix Address Pool ¹

MAC Address00:00:00:00:00:00IP Address0000AddDelete

	NO.	MAC ADDRESS	IP ADDRESS	EDIT
<input type="checkbox"/>				

Figure 129. 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.
- **APC List (Option 138):** Configures APL list value corresponding to DHCP user option #138.
- **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 the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Switch to the DHCP relay.

The relay and proxy are operating in the switching mode. If a proxy is not used, it is operating in the relay mode.


```
WEC8500/configure # no ip dhcp-proxy enable
```

- 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.



Global Parameter	
DHCP PROXY MODE	<input type="radio"/> Proxy <input checked="" type="radio"/> Relay
TIMEOUT	5
PRIMARY SERVER	0 . 0 . 0 . 0
SECONDARY SERVER	0 . 0 . 0 . 0

Figure 130. 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 the configure mode of the 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.

Global Parameter	
DHCP PROXY MODE	<input type="radio"/> Proxy <input checked="" type="radio"/> Relay
TIMEOUT	5
PRIMARY SERVER	0 . 0 . 0 . 0
SECONDARY SERVER	0 . 0 . 0 . 0

Figure 131. DHCP Proxy

5.4.4 Option 82 Configuration

The APC 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 APC 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]

This command enables or disables the Option 82 function. It 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.

						Add	Delete
<input type="checkbox"/>	INTERFACE NAME	VLAN ID	IP ADDRESS	ADMIN STATUS	OPER STATUS		
	lo	-	1.1.1.1	up	up		
<input type="checkbox"/>	VLAN0010	10	10.10.10.3	up	down		
	lo	-	127.0.0.1	up	up		
	mgmt0	-	192.168.5.132	up	up		

1

Figure 132. Option 82 configuration (1)

Select an item in the list and perform detail configuration.

Controller > Interfaces > Edit

Back Apply

INTERFACE NAME	VLAN0010		
VLAN ID	10		
ADMIN STATUS	<input checked="" type="radio"/> Up <input type="radio"/> Down		

Physical

PORTS	MODE	HYBRID EGRESS_TAGGED
ge1	Not Used	Service Disable
ge2	Access	Service Disable
ge3	Not Used	Service Disable
ge4	Not Used	Service Disable
ge5	Not Used	Service Disable
ge6	Not Used	Service Disable
ge7	Not Used	Service Disable
ge8	Not Used	Service Disable
xe1	Not Used	Service Disable
xe2	Not Used	Service Disable

Address

IP ADDRESS	10	10	10	3
NETMASK	255	255	255	0

DHCP

GLOBAL USE	<input checked="" type="checkbox"/>
PRIMARY DHCP SERVER	0 0 0 0
SECONDARY DHCP SERVER	0 0 0 0
OPTION 82 STATE	Disable
OPTION 82 TYPE	AP-MAC

Figure 133. 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 maximum two DHCP servers. Here, the two servers are called a primary server and a secondary 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 the configure mode of the 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.

						Add	Delete
<input type="checkbox"/>	INTERFACE NAME	VLAN ID	IP ADDRESS	ADMIN STATUS	OPER STATUS		
<input type="checkbox"/>	lo	-	1.1.1.1	up	up		
<input type="checkbox"/>	VLAN0010	10	10.10.10.3	up	down		
<input type="checkbox"/>	lo	-	127.0.0.1	up	up		
<input type="checkbox"/>	mgmt0	-	192.168.5.132	up	up		

1

Figure 134. Primary/Secondary server configuration (1)

Select an item in the list and perform detail configuration.

Controller > Interfaces > Edit

Back Apply

INTERFACE NAME	VLAN0010
VLAN ID	10
ADMIN STATUS	<input checked="" type="radio"/> Up <input type="radio"/> Down

Physical

PORTS	MODE	HYBRID EGRESS_TAGGED
ge1	Not Used	Service Disable
ge2	Access	Service Disable
ge3	Not Used	Service Disable
ge4	Not Used	Service Disable
ge5	Not Used	Service Disable
ge6	Not Used	Service Disable
ge7	Not Used	Service Disable
ge8	Not Used	Service Disable
xe1	Not Used	Service Disable
xe2	Not Used	Service Disable

Address

IP ADDRESS	10	10	10	3
NETMASK	255	255	255	0

DHCP

GLOBAL USE	<input checked="" type="checkbox"/>
PRIMARY DHCP SERVER	0 . 0 . 0 . 0
SECONDARY DHCP SERVER	0 . 0 . 0 . 0
OPTION 82 STATE	Disable
OPTION 82 TYPE	AP-MAC

Figure 135. 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.

Apply

Global Parameter

DHCP PROXY MODE	<input type="radio"/> Proxy <input checked="" type="radio"/> Relay
TIMEOUT	5
PRIMARY SERVER	0 . 0 . 0 . 0
SECONDARY SERVER	0 . 0 . 0 . 0

Figure 136. Primary/Secondary server configuration (3)

5.5 Radio Service Configuration

The APC 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.

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

- 2) Configure whether to enable or disable WMM.

- wmm-mode [WLAN_ID] [MODE]

Parameter	Description
WLAN_ID	WLAN ID (range: 1-240)
MODE	WMM configuration mode (disable/enable)

- 3) Configure DTIM.

- dtim [WLAN_ID] [DTIM]

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

PROFILE NAME	wlan1	Back	Apply
ACL RULE		
STATIC ADDRESS DISALLOWED	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
DHCP OVERRIDE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
DHCP SERVER	0 . 0 . 0 . 0		
Apply			
WMM	<input checked="" type="radio"/> Enable <input type="radio"/> Disable		
DTIM	1		
STATION IDLE TIMEOUT (SEC)	300		
Apply			
VOIP FAILURE DETECT	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		

Figure 137. 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, 802.11b/g, 802.11n or 802.11ac 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/ac Radio Property

6.1.1 802.11a/b/g Configuration

The configuration of radio property for 802.11a/b/g/ac 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.

```
APC# configure terminal
APC/configure# 80211a
APC/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: 1-3000)

- 3) Configure channel of multiple APs belonging to the group.
- channel [CHANNEL] group [GROUP_ID] all-ap/active-ap: Channel is configured for multiple APs.
 - channel [CHANNEL] group [GROUP_ID] all-ap/active-ap fixed: Channel is fixed and is not affected by automatic adjustment functions such as RRM. (Channel values are indicated as * when retrieved by 'show 80211a summary' or 'show 80211bg summary'.)

Parameter	Description
CHANNEL	Channel Configuration - Range for 80211a: 36-165 - Range for 80211bg: 1-14
GROUP_ID	ID of the AP group
all-ap	Applies to all APs in the group
active-ap	Applies to all live APs in the group

- 4) Configure the TX power of an AP.
- txPower [POWER] ap [AP_ID]: Configures a TX power.
 - txPower [POWER] ap [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: 3-30)
AP_ID	AP ID (range: 1-3000)

- 5) Configure TX power of multiple APs belonging to the group.
- txPower [POWER] group [GROUP_ID] all-ap/active-ap: TX Power Setting
 - txPower [POWER] group [GROUP_ID] all-ap/active-ap fixed: TX power is fixed and is not affected by automatic adjustment functions such as RRM. (Channel values are indicated as * when retrieved by 'show 80211a summary' or 'show 80211bg summary'.)

Parameter	Description
POWER	TX power value (range: 3-30)
GROUP_ID	ID of the AP group
all-ap	Applies to all APs in the group
active-ap	Applies to all live APs in the group

- 6) To check the configured channel and TX power information, use the following command.

```
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

In this example, the AP_f4d9fb23bfb9 whose Tx Power is displayed as 10* has a fixed TX power.

- 7) Configure the beacon period of an AP.
- beacon period [PERIOD] global

Parameter	Description
PERIOD	Beacon period (range: 40-3500)

- 8) Configure the fragmentation threshold of an AP.
- threshold fragmentation [THRESHOLD] global

Parameter	Description
THRESHOLD	Fragmentation threshold (range: 256-8000)

- 9) 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

- 10) To check the configured beacon period, fragmentation threshold, and data rate information, uses the 'show 80211a radio-config global' command.

11) Configure the bandwidth of the AP. Bandwidth can be configured only for 80211a/n/ac.

- bandwidth [BANDWIDTH] ap [AP_ID]: Bandwidth is configured for a specific AP.
- bandwidth [BANDWIDTH] global: Bandwidth is configured for all APs.
- bandwidth[BANDWIDTH] group[GROUP_ID] all-ap/active-ap :Bandwidth is configured for multiple Aps in the group.

Parameter	Description
BANDWIDTH	- 20: 20 MHz - 40: 40 MHz - 80: 80 MHz - 160: 160 MHz (to be supported in the future) - 8080: 80 + 80 MHz (to be supported in the future)
AP_ID	ID of the AP (range: 1-3000)
GROUP_ID	ID of the AP group
all-ap	Applies to all APs in the group
active-ap	Applies to all live APs in the group

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> menu in the sub-menus.

An example of selecting 802.11a/n is shown below.

The screenshot displays the configuration page for 802.11a/b/g/n radio. It features three main configuration blocks, each with an 'Apply' button:

- AP Profile Name:** Set to 'ap_1'. **AP Name:** Set to 'PV45'. **SERVICE:** Radio button selected for 'Enable', 'Disable' is unselected.
- CURRENT CHANNEL:** Set to '161' (dropdown). **CHANNEL FIX:** Radio button selected for 'Disable', 'Enable' is unselected.
- TX CURRENT POWER(DBM):** Set to '3'. **TX POWER FIX:** Radio button selected for 'Disable', 'Enable' is unselected.

Figure 138. 802.11a/b/g/n radio (1)

The configuration items are as follows:

[AP Service Configuration]

- SERVICE: Enable or disable the radio service.

[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/ac>** or **<802.11b/g/n>** menu, the channel value is displayed as *. (Optional)

[TX power Configuration]

- **TX CURRENT POWER:** TX Power (range: 3-30)
- **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/ac>** 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/ac>** or **<802.11b/g/n>**.

In the menu bar of **<WEC Main window>**, select **<Configuration>** and then select the **<Radio> → <802.11a/n/ac>** or **<802.11b/g/n> → <802.11h>** menu in the sub-menus. An example of selecting 802.11a/n/ac is shown below.

General		Data Rates ²	
BANDWIDTH (MHZ)	80	6 MBPS	Disable
BEACON PERIOD (TUS)	110	9 MBPS	Disable
RTS THRESHOLD (BYTES)	2346	12 MBPS	Disable
SHORT RETRY	4	18 MBPS	Disable
LONG RETRY	30	24 MBPS	Basic
FRAGMENTATION THRESHOLD (BYTES) ¹	3000	36 MBPS	Supported
TX MSDU LIFE TIME (TUS)	512	48 MBPS	Supported
RX MSDU LIFE TIME (TUS)	512	54 MBPS	Supported
MAX. ALLOWED STATIONS	127		
CONTROLLED VOICE OPTIMIZATION	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		

Figure 139. 802.11a/b/g/n radio (2)

[General]

- **BANDWIDTH:** Configures bandwidth (range: 20, 40, 80). Available for 802.11a/n/ac only.
- **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

Select <Configuration> in the menu bar of <WEC Main Window> and select <WLANs> → <WLANs> → <802.11a/n/ac> or <802.11b/g/n> in submenus to configure Data Rates.

Select <Configuration> in the menu bar of <WEC Main Window> and select <Radio> → <802.11a/n/ac> or <802.11b/g/n> in submenus to configure Data Rates.

An example of selecting 802.11a/n/ac is shown below.

WLANs > WLANs > 802.11a/n/ac

Back

Apply

ID	1
PROFILE NAME	wlan1

Data Rates¹

6 MBPS	Disable
9 MBPS	Disable
12 MBPS	Disable
18 MBPS	Disable
24 MBPS	Basic
36 MBPS	Supported
48 MBPS	Supported
54 MBPS	Supported

MCS Setting

HT(802.11N) MCS SETTING

<input type="checkbox"/>	0 (7 Mbps)	<input checked="" type="checkbox"/>	12 (87 Mbps)
<input type="checkbox"/>	1 (14 Mbps)	<input checked="" type="checkbox"/>	13 (116 Mbps)
<input type="checkbox"/>	2 (21 Mbps)	<input checked="" type="checkbox"/>	14 (130 Mbps)
<input checked="" type="checkbox"/>	3 (29 Mbps)	<input checked="" type="checkbox"/>	15 (144 Mbps)
<input checked="" type="checkbox"/>	4 (43 Mbps)	<input checked="" type="checkbox"/>	16 (22 Mbps)
<input checked="" type="checkbox"/>	5 (58 Mbps)	<input checked="" type="checkbox"/>	17 (43 Mbps)
<input checked="" type="checkbox"/>	6 (65 Mbps)	<input checked="" type="checkbox"/>	18 (65 Mbps)
<input checked="" type="checkbox"/>	7 (72 Mbps)	<input checked="" type="checkbox"/>	19 (87 Mbps)
<input checked="" type="checkbox"/>	8 (14 Mbps)	<input checked="" type="checkbox"/>	20 (130 Mbps)
<input checked="" type="checkbox"/>	9 (29 Mbps)	<input checked="" type="checkbox"/>	21 (173 Mbps)
<input checked="" type="checkbox"/>	10 (43 Mbps)	<input checked="" type="checkbox"/>	22 (195 Mbps)
<input checked="" type="checkbox"/>	11 (58 Mbps)	<input checked="" type="checkbox"/>	23 (217 Mbps)

VHT(802.11AC) MCS SETTING

1 Spatial Stream	0~7
2 Spatial Streams	0~7
3 Spatial Streams	0~7

Figure 140. 802.11a/n/ac DataRates

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]
GROUP_ID {all-ap/active-ap}/global]
```

Parameter	Description
AP_ID	AP ID (range: 1-500)
GROUP_ID	ID of the AP group
all-ap	Applies to all APs in the group
active-ap	Applies to all live APs in the group

- 4) Configure the Modulation and Coding Scheme (MCS) rate.

```
WEC8500/configure/80211a/11n-support# mcs [RATE] global
```

Parameter	Description
RATE	MSC rate (range: 0-23)

- 5) To check the configured 11n-support information, use the ‘show 80211a radio-config ap [AP_ID]’ command.

[OPTIONS]

- Guard-interval(11n): select short/long for each Guard-interval 20/40 Mhz.
- Beamforming : select use or not use.

Configuration using Web UI

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

Select <Configuration> in the menu bar of <WEC Main Window> and select <WLANs> → <WLANs> → <802.11a/n/ac> or <802.11b/g/n> in submenus to configure MCS Setting.

Select <Configuration> in the menu bar of <WEC Main Window> and select <AP Groups> → <802.11a/n/ac> or <802.11b/g/n> in submenus to configure Operational Type & Options.

An example of selecting 802.11b/g/n is shown below.

AP Groups > 802.11b/g/n

Back

Apply

AP GROUP NAME	test
SERVICE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable

Apply

OPERATIONAL TYPE	<input checked="" type="checkbox"/> 802.11b/g <input checked="" type="checkbox"/> 802.11n
OPTIONS	Guard Interval 20MHz <input checked="" type="radio"/> Short <input type="radio"/> Long 40MHz <input checked="" type="radio"/> Short <input type="radio"/> Long Beamforming <input checked="" type="radio"/> Enable <input type="radio"/> Disable

Figure 141. 802.11b/g/n Operational Type & OptionsWindow

WLANs > WLANs > 802.11b/g/n

Back

Apply

ID	1
PROFILE NAME	wlan1

Data Rates¹

1 MBPS	Disable
2 MBPS	Disable
5.5 MBPS	Disable
6 MBPS	Disable
9 MBPS	Disable
11 MBPS	Disable
12 MBPS	Disable
18 MBPS	Disable
24 MBPS	Basic
36 MBPS	Supported
48 MBPS	Supported
54 MBPS	Supported

MCS Setting

HT(802.11N) MCS SETTING

<input type="checkbox"/> 0 (7 Mbps)	<input checked="" type="checkbox"/> 12 (87 Mbps)
<input type="checkbox"/> 1 (14 Mbps)	<input checked="" type="checkbox"/> 13 (116 Mbps)
<input type="checkbox"/> 2 (21 Mbps)	<input checked="" type="checkbox"/> 14 (130 Mbps)
<input checked="" type="checkbox"/> 3 (29 Mbps)	<input checked="" type="checkbox"/> 15 (144 Mbps)
<input checked="" type="checkbox"/> 4 (43 Mbps)	<input checked="" type="checkbox"/> 16 (22 Mbps)
<input checked="" type="checkbox"/> 5 (58 Mbps)	<input checked="" type="checkbox"/> 17 (43 Mbps)
<input checked="" type="checkbox"/> 6 (65 Mbps)	<input checked="" type="checkbox"/> 18 (65 Mbps)
<input checked="" type="checkbox"/> 7 (72 Mbps)	<input checked="" type="checkbox"/> 19 (87 Mbps)
<input checked="" type="checkbox"/> 8 (14 Mbps)	<input checked="" type="checkbox"/> 20 (130 Mbps)
<input checked="" type="checkbox"/> 9 (29 Mbps)	<input checked="" type="checkbox"/> 21 (173 Mbps)
<input checked="" type="checkbox"/> 10 (43 Mbps)	<input checked="" type="checkbox"/> 22 (195 Mbps)
<input checked="" type="checkbox"/> 11 (58 Mbps)	<input checked="" type="checkbox"/> 23 (217 Mbps)

Figure 142. 802.11b/g/n MCS SettingWindow

6.1.3 802.11ac Configuration

The 802.11ac configuration is as follows:

Configuration using CLI

- 1) Go to configure radio mode of 80211a to configure.

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

- 2) Enter 11ac-support mode.

```
WEC8500/configure/80211a#11ac-support
```

- 3) Configure the AP so that it can support the 802.11ac property.

```
WEC8500/configure/80211a/11ac-support# enable [AP_ID]
GROUP_ID {all-ap/active-ap}/global]
```

Parameter	Description
AP_ID	ID of the AP (range: 1-500)
GROUP_ID	ID of the AP group
all-ap	Applies to all APs in the group
active-ap	Applies to all live APs in the group

- 4) Configure the Modulation and Coding Scheme (MCS) rate.

```
WEC8500/configure/80211a/11ac-support# mcs num-ss [SPATIAL STREAM ]
global
```

Parameter	Description
SPATIAL STREAM	Number of spatial streams (range: 2~3)
AP_ID	ID of the AP (range: 1-500)

- 5) To check the configured 11ac-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 select <Access Points> → <802.11a/n/ac> or <802.11b/g/n> → <General> submenus.

Select <Configuration> in the menu bar of <WEC Main Window> and select <WLANs> → <WLANs> → <802.11a/n/ac> or <802.11b/g/n> in submenus to configure MCS Setting.

Select <Configuration> in the menu bar of <WEC Main Window> and select <AP Groups> → <802.11a/n/ac> or <802.11b/g/n> in submenus to configure Operational Type & Options.

An example of selecting 802.11a/n/ac is shown below.

AP Groups > 802.11a/n/ac

Apply

OPERATIONAL TYPE	<input checked="" type="checkbox"/> 802.11a
	<input checked="" type="checkbox"/> 802.11n
	<input checked="" type="checkbox"/> 802.11ac

OPTIONS	Guard Interval	20MHz	<input checked="" type="radio"/> Short	<input type="radio"/> Long
		40MHz	<input checked="" type="radio"/> Short	<input type="radio"/> Long
		80MHz	<input checked="" type="radio"/> Short	<input type="radio"/> Long
	Beamforming	<input checked="" type="radio"/> Enable <input type="radio"/> Disable		

Figure 143. 802.11a/n/ac Operational Type & OptionsWindow

WLANs > WLANs > 802.11a/n/ac

Back Apply

ID	1
PROFILE NAME	wlan1

Data Rates¹

6 MBPS	Disable
9 MBPS	Disable
12 MBPS	Disable
18 MBPS	Disable
24 MBPS	Basic
36 MBPS	Supported
48 MBPS	Supported
54 MBPS	Supported

MCS Setting

HT(802.11N) MCS SETTING

<input type="checkbox"/> 0 (7 Mbps)	<input checked="" type="checkbox"/> 12 (87 Mbps)
<input type="checkbox"/> 1 (14 Mbps)	<input checked="" type="checkbox"/> 13 (116 Mbps)
<input type="checkbox"/> 2 (21 Mbps)	<input checked="" type="checkbox"/> 14 (130 Mbps)
<input checked="" type="checkbox"/> 3 (29 Mbps)	<input checked="" type="checkbox"/> 15 (144 Mbps)
<input checked="" type="checkbox"/> 4 (43 Mbps)	<input checked="" type="checkbox"/> 16 (22 Mbps)
<input checked="" type="checkbox"/> 5 (58 Mbps)	<input checked="" type="checkbox"/> 17 (43 Mbps)
<input checked="" type="checkbox"/> 6 (65 Mbps)	<input checked="" type="checkbox"/> 18 (65 Mbps)
<input checked="" type="checkbox"/> 7 (72 Mbps)	<input checked="" type="checkbox"/> 19 (87 Mbps)
<input checked="" type="checkbox"/> 8 (14 Mbps)	<input checked="" type="checkbox"/> 20 (130 Mbps)
<input checked="" type="checkbox"/> 9 (29 Mbps)	<input checked="" type="checkbox"/> 21 (173 Mbps)
<input checked="" type="checkbox"/> 10 (43 Mbps)	<input checked="" type="checkbox"/> 22 (195 Mbps)
<input checked="" type="checkbox"/> 11 (58 Mbps)	<input checked="" type="checkbox"/> 23 (217 Mbps)

VHT(802.11AC) MCS SETTING

1 Spatial Stream	0~7
2 Spatial Streams	0~7
3 Spatial Streams	0~7

Figure 144. 802.11a/n/ac MCS SettingWindow

[OPERATIONAL TYPE]

Enable/disable 11ac operation.

[VHT (802.11AC) MCS SETTING]

- Determine the spatial stream count for each AP model and enter maximum MCS value for each spatial stream count.
- Example: maximum of seven MCS for one spatial stream, maximum of eight MCS for two spatial streams, and maximum of nine MCS for three spatial streams
 - 1 spatial stream: 7
 - 2 spatial streams: 8
 - 3 spatial streams: 9

[OPTIONS]

- Guard-interval (11n): Select short/long for Guard-interval 20/40 Mhz respectively.
- Guard-interval (11ac): Select short/long for Guard-interval 20/40/80 Mhz respectively.
- Beamforming: Select use or not use beamforming.

6.2 Wi-Fi QoS Configuration

The APC 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 Enhanced Distributed Channel Access (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.

```
APC# configure terminal
APC/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 <Radio>→ <802.11a/n> or <802.11b/g/n> → <QoS> menu in the sub-menus.

In the Qos menu, there are Wired and Wireless tab. To change the Station EDCA parameter, select the Wired tab. If you want to change the AP EDCA parameter to configure the QoS of an AP wireless section, select the Wireless tab.

[Wired tab]

Apply

EDCA PROFILE	WMM Default ▼
---------------------	---------------

Tagging Policy

802.1P POLICY	None ▼
DSCP POLICY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
OUTER DSCP	Inner Packet ▼
INNER DSCP	Default Value ▼
PROTOCOL	DSCP ▼

QoS Default Values

ACCESS CATEGORY	PROTOCOL	VALUE
VOICE	802.1p	6
	DSCP	46
VIDEO	802.1p	4
	DSCP	26
BEST EFFORT	802.1p	0
	DSCP	0
BACKGROUND	802.1p	1
	DSCP	8

Figure 145. QoS configuration of a wireless terminal (1)**[Wireless tab]**

Apply

EDCA PROFILE	WMM Default ▼
---------------------	---------------

QoS Default Values

ACCESS CATEGORY	PROTOCOL	VALUE
VOICE	802.1p	6
	DSCP	46
VIDEO	802.1p	4
	DSCP	26
BEST EFFORT	802.1p	0
	DSCP	0
BACKGROUND	802.1p	1
	DSCP	8

Figure 146. QoS configuration of a wireless terminal (2)

6.2.2 QoS Configuration of AP

6.2.2.1 Wire Section

The APC provides QoS in a wire section using 802.1p and Differentiated Services Code Point (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 APC and AP, execute the command as follows:

- 1) Go to configure → QoS mode of a wireless section of CLI.

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

- 2) Configure 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 <Radio> → <802.11a/n> or <802.11b/g/n> → <QoS> 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.

```
APC# configure terminal
APC/configure# [80211a/80211bg] qos
APC/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 <Radio> → <802.11a/n> or <802.11b/g/n> → <QoS> menu in the sub-menus.

ACCESS CATEGORY	PROTOCOL	VALUE
VOICE	802.1p	6
	DSCP	46
VIDEO	802.1p	4
	DSCP	26
BEST EFFORT	802.1p	0
	DSCP	0
BACKGROUND	802.1p	1
	DSCP	8

Figure 147. 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.

```
APC# configure terminal
APC/configure# qos <profile name>
APC/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 <User QoS> menu in the sub-menus. To create a QoS profile to apply to a terminal, click the <Add> button in the initial window.

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

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

Figure 148. Configuring QoS profile of a specific terminal

- ID: ID (range: 1-16)
- PROFILE NAME: Profile name
- DESCRIPTION: Profile description
- MAX. DSCP 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 APC 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.

```
APC# configure terminal
APC/configure# [80211a|80211bg] cvo
APC/configure/80211a/cvo#
```

- 2) Enable or disable the function.
 - [no] enable [ap <AP ID> | global | group <group ID>]

Parameter	Description
AP ID	ID of AP(range: 1~3000)
group ID	ID of AP group(range: 1~3000)

- 3) To check the configured information, use the 'show [80211a | 80211bg] cvo config [ap <AP ID> | group <group ID> | global]' command.

Configuration using Web UI

1) Configure for each Radio

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

The screenshot displays the WEC Main window configuration interface. It features two main tabs: 'General' and 'Data Rates'. The 'General' tab is active, showing various configuration parameters with input fields and checkboxes. The 'Data Rates' tab is also visible, showing a list of supported data rates with corresponding dropdown menus. Both tabs have an 'Apply' button at the top right.

General		Data Rates	
BEACON PERIOD (TUS)	100	6 MBPS	Basic
RTS THRESHOLD (BYTES)	2346	9 MBPS	Supported
SHORT RETRY	4	12 MBPS	Basic
LONG RETRY	10	18 MBPS	Supported
FRAGMENTATION THRESHOLD (BYTES)	2346	24 MBPS	Basic
TX MSDU LIFE TIME (TUS)	512	36 MBPS	Supported
RX MSDU LIFE TIME (TUS)	512	48 MBPS	Supported
MAX. CLIENT COUNTS	127	54 MBPS	Supported
CONTROLLED VOICE OPTIMIZATION	<input type="checkbox"/> Enable <input checked="" type="checkbox"/> Disable		

Figure 149. Configuring voice optimization by radio

2) Configure for each AP Group

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

		Apply
BANDWIDTH (MHZ)	20	
MAX. ALLOWED STATIONS ON AN AP ³	127	
CONTROLLED VOICE OPTIMIZATION ⁴	<input type="radio"/> Enable <input checked="" type="radio"/> Disable	
MULTI-ANTENNA MODE ⁵	<input checked="" type="radio"/> Dynamic <input type="radio"/> Static	

Figure 150. Configuring voice optimization by each AP Group

3) **Configure for each AP**

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.

		Apply
MAX. ALLOWED STATIONS ON AN AP ³	127	
CONTROLLED VOICE OPTIMIZATION ⁴	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	
LOCAL CALL OPTIMIZATION ⁴	<input type="radio"/> Enable <input checked="" type="radio"/> Disable	
MULTI-ANTENNA MODE ⁵	<input checked="" type="radio"/> Dynamic <input type="radio"/> Static	

Figure 151. Configuring voice optimization by each AP

To enable Controlled Voice Optimization (CVO), select Enable in the CONTROLLED VOICE OPTIMIZATION. To disable it, select Disable.

6.3 802.11h Configuration

The APC supports the configuration and transmission power limitation for the Dynamic Frequency Selection (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.

```
APC# configure terminal
APC/configure# 80211h
APC/configure/80211h#
```

- 2) Configure the 802.11h information.

- channel-switch [MODE] [RESTRICTION] [SWITCH COUNT]

Parameter	Description
MODE	Whether the switching announcement function is enabled/disabled
RESTRICTION	Whether the channel packet transmission restriction mode is enabled (disable/enable)
SWITCH COUNT	Waiting time until channel switching announcement

- 3) Configure the transmission power of a wireless terminal.

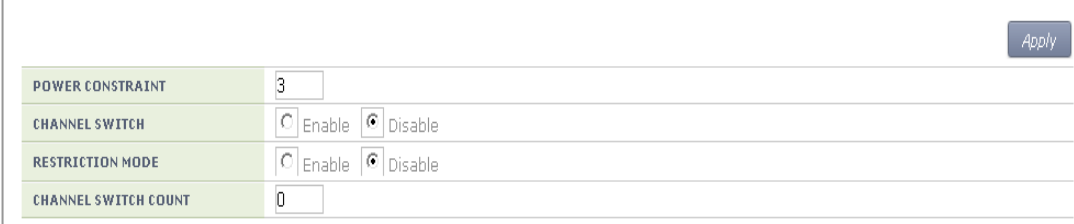
- power-constraint [VALUE]

Parameter	Description
VALUE	Transmission power(0-31 dB)

- 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> → <802.11h> menu in the sub-menus.



The image shows a web interface for configuring 802.11h settings. It features a table with four rows, each representing a configuration parameter. The first row is 'POWER CONSTRAINT' with a text input field containing the value '3'. The second row is 'CHANNEL SWITCH' with two radio buttons: 'Enable' (unselected) and 'Disable' (selected). The third row is 'RESTRICTION MODE' with two radio buttons: 'Enable' (unselected) and 'Disable' (selected). The fourth row is 'CHANNEL SWITCH COUNT' with a text input field containing the value '0'. An 'Apply' button is located in the top right corner of the form.

POWER CONSTRAINT	<input type="text" value="3"/>
CHANNEL SWITCH	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
RESTRICTION MODE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
CHANNEL SWITCH COUNT	<input type="text" value="0"/>

Figure 152. Configuring 802.11h

- POWER CONSTRAINT: Power constraint value (0-100)
- CHANNEL SWITCH: Enables channel switch announcement.
- RESTRICTION MODE: Configures transmission restriction.
- CHANNEL SWITCH 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.

```
APC# configure terminal
APC/configure# country
APC/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.

[AP Group Country Code Configuration]

To configure a country code, execute the command as follows:

- set-group [AP group ID] [COUNTRY_CODE] [VALUE]

Parameter	Description
AP group ID	AP group ID (range: 1-3000)
COUNTRY_CODE	Country code to configure
VALUE	Environment configuration (both/outdoor/indoor/none)

To check the configuration information, use the ‘show country group-config[AP group 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.

Configured Country Code

DEFAULT COUNTRY	Republic of Korea(KR)
DEFAULT ENVIRONMENT	Both
CONFIGURED COUNTRY #1	None
CONFIGURED ENVIRONMENT #1	Both
CONFIGURED COUNTRY #2	None
CONFIGURED ENVIRONMENT #2	Both
CONFIGURED COUNTRY #3	None
CONFIGURED ENVIRONMENT #3	Both

Edit Country Code

COUNTRY	Republic of Korea(KR)											
MAX TX POWER LEVEL(5GHZ)	<input checked="" type="checkbox"/> 36	21	<input checked="" type="checkbox"/> 40	21	<input checked="" type="checkbox"/> 44	21	<input checked="" type="checkbox"/> 48	21	<input type="checkbox"/> 52	0	<input type="checkbox"/> 56	0
	<input type="checkbox"/> 56	0	<input type="checkbox"/> 60	0	<input type="checkbox"/> 64	0	<input type="checkbox"/> 100	0	<input type="checkbox"/> 104	0	<input type="checkbox"/> 108	0
	<input type="checkbox"/> 108	0	<input type="checkbox"/> 112	0	<input type="checkbox"/> 116	0	<input type="checkbox"/> 120	0	<input type="checkbox"/> 124	0	<input type="checkbox"/> 128	0
	<input type="checkbox"/> 128	0	<input checked="" type="checkbox"/> 149	23	<input checked="" type="checkbox"/> 153	23	<input checked="" type="checkbox"/> 157	23	<input checked="" type="checkbox"/> 161	23		
MAX TX POWER LEVEL(2.4GHZ)	<input checked="" type="checkbox"/> 1	20	<input type="checkbox"/> 2	0	<input type="checkbox"/> 3	0	<input type="checkbox"/> 4	0	<input checked="" type="checkbox"/> 5	20	<input type="checkbox"/> 6	0
	<input type="checkbox"/> 6	0	<input type="checkbox"/> 7	0	<input type="checkbox"/> 8	0	<input checked="" type="checkbox"/> 9	20	<input type="checkbox"/> 10	0	<input type="checkbox"/> 11	0
	<input type="checkbox"/> 11	0	<input type="checkbox"/> 12	0	<input checked="" type="checkbox"/> 13	20						

Figure 153. 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.

[AP Country Code Configuration]

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

Back

Apply

AP PROFILE NAME	AP-7F01		
AP NAME	AP-7F01		
AP GROUP NAME	R3-7Floor-Lab		
ECHO INTERVAL (SEC) ¹	30		
MAX DISCOVERY INTERVAL (SEC) ²	20		
REPORT INTERVAL (SEC) ³	120		
STATISTICS TIMER (SEC) ⁴	120		
RETRANSMIT INTERVAL (100MS) ⁵	5		
MAX RETRANSMIT ⁶	5		
ECHO RETRANSMIT INTERVAL (SEC) ⁷	3		
MAX ECHO RETRANSMIT ⁸	5		
TELNET ⁹	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	50023	
SSH ¹⁰	<input type="radio"/> Enable <input checked="" type="radio"/> Disable	50022	
CONSOLE	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
DTLS ¹¹	Enable		
LED	On	00	00 ~ 00 : 00
POE TYPE ¹²	802.3at		
EDGE AP	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		
EDGE AP OPERATION MODE	RSSI		
SMHO THRESHOLD (DBM)	-80		
SMHO WINDOW SIZE (MS)	300		
COUNTRY CODE	Republic of Korea(KR)		
ENVIRONMENT	Both		
TIME ZONE	Asia/Seoul		

Figure 154. AP Country Code Configuration

After selecting COUNTRY and ENVIRONMENT, click the <Apply> button.

[AP Group Country Code Configuration]

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

Apply

Country

COUNTRY CODE	Republic of Korea(KR)
ENVIRONMENT	Both

Figure 155. AP Group Contry Code Configuration

CHAPTER 7. WLAN Additional Services

This chapter covers how to configure WLAN additional services such as wireless terminal management, spectrum analysis, Call Admission Control (CAC) and Radio Resource Management (RRM), etc.

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 APC.

- **show station summary:** When you enter this command, the summary information of all the wireless terminals connected to the APC 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.

										Show Filter List Export
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 156. 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 APC.

- 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 APC 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 APC.

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 APC. 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 APC. - 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.

Network Controlled Handover	
OPERATION MODE	STA
BUFFERED FORWARDING	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
SCAN TRIGGER LEVEL (DBM)	-70
SCAN REPORT LEVEL (DBM)	-120
SCANNING TIME FOR ONE CHANNEL (MS)	5
SERVICE TIME DURING SCANNING (MS)	100
SCANNING INTERVAL TIME (MS)	1000
NUMBER OF PROBE REQUESTS	2
NUMBER OF SCANNING CHANNELS	4
VALUE OF HANDOVER DECISION DELTA	5
VALUE OF STATION ROAM DELTA	15

Figure 157. 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 APC 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 APC 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 Call Admission Control (CAC) Configuration

The CAC function is provided to protect existing calls from the calls incoming to a wireless LAN. The APC does not allow an additional call when maximum allowed number of calls per radio is reached.

7.3.1 SIP ALG Configuration

To make Call Admission Control (CAC) working, the Session Initiation Protocol (SIP) Application Layer Gateway (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 monitor-port : Configures SIP packet port to monitoring. It can be set max. 5 port. (default : 5060)
- 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 the configure mode of the CLI.

```
APC# configure terminal
```

- 2) Enable the SIP ALG.

```
APC/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.

Controller > General

AP Management

IP ADDRESS: 10.64.2.23 Select

AUTO REGISTRATION: ☐ Enable ☒ Disable

Repeater Service

SERVICE: ☐ Enable ☒ Disable

Smart Service Link

SERVICE: ☐ Enable ☒ Disable

ROAM PARAMETER CONTROL: ☐ Enable ☒ Disable

Broadcast/Multicast Filtering

BROADCAST FORWARDING: ☐ Enable ☒ Disable

BROADCAST ACL RULE: -----

MULTICAST FORWARDING: ☐ Enable ☒ Disable

MULTICAST ACL RULE: -----

SIP ALG¹

SIP ALG (VOIP AWARE): ☒ Enable ☐ Disable

SIP ERROR RESPONSE: ☒ Enable ☐ Disable

SIP DETECT LONG DURATION CALL: ☒ Enable ☐ Disable

SIP NO ANSWER TIMEOUT (SEC): 600

SIP CONNECT TIMEOUT (SEC): 7200

SIP MONITORING PORT 1: 5060

SIP MONITORING PORT 2: 5080

SIP MONITORING PORT 3: 0

SIP MONITORING PORT 4: 0

SIP MONITORING PORT 5: 0

Public Port for Servers

FTP PUBLIC PORT: 0

SFTP PUBLIC PORT: 0

HTTP PUBLIC PORT: 0

HTTPS PUBLIC PORT: 0

Foot Notes :

1. The Voice License is needed to carry out this operation.

Figure 158. 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 Voice CAC Configuration

To protect existing calls, the voice 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 voice calls for handover.

Configuration using CLI

For voice CAC configuration, execute the command as follows:

- 1) Go to configure → voice CAC mode of a wireless section of CLI.

```
APC# configure terminal
APC/configure# [80211a/80211bg] cac voice
APC/configure/80211a/cac/voice#
```

- 2) Enable or disable the voice CAC function.

- acm [MODE]

Parameter	Description
MODE	Enables or disables the voice CAC function - enable: Enable - disable: Disable

- 3) Configure maximum allowed number of voice calls.

- max-calls [VALUE]

Parameter	Description
VALUE	Maximum allowed number of voice calls.

- 4) Configure the number of marginal voice calls considering the handover.

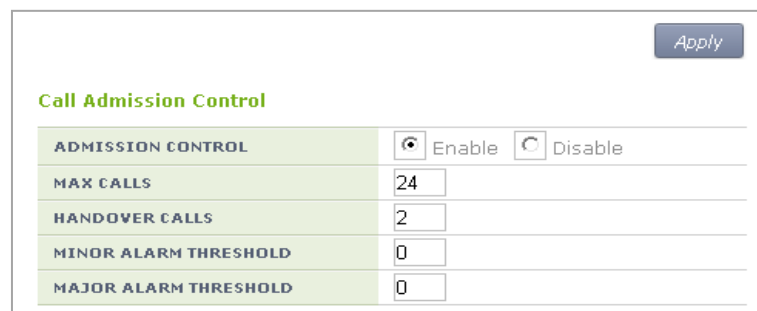
- reserved-ho-calls [VALUE]

Parameter	Description
VALUE	Number of marginal voice calls considering the handover

- 5) To check the configured voice CAC information, use the 'show [80211a | 80211bg] cac voice 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> → <Admission Control> menu in the sub-menus.



Call Admission Control	
ADMISSION CONTROL	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
MAX CALLS	24
HANDOVER CALLS	2
MINOR ALARM THRESHOLD	0
MAJOR ALARM THRESHOLD	0

Figure 159. Admission control 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.

7.3.3 Video CAC Configuration

To protect existing video calls, the video CAC function configures the maximum allowed number of video 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 video CAC configuration, execute the command as follows:

- 1) Go to configure → video CAC mode of a wireless section of CLI.

```
APC# configure terminal
APC/configure# [80211a/80211bg] cac video
APC/configure/80211a/cac/video#
```

- 2) Enable or disable the video CAC function.

- acm [MODE]

Parameter	Description
Mode	Enables or disables the CAC function - enable: Enable - disable: Disable

- 3) Select a video CAC method.

- method [method]

Parameter	Description
method	Select a video CAC method (static/chan_util) - static: Based on video calls - chan_util: Based on channel usage

- 4) Configure the maximum allowed number of calls.

- max-calls [VALUE]

Parameter	Description
VALUE	Maximum allowed number of video calls

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

- reserved-ho-calls [VALUE]

Parameter	Description
VALUE	Number of marginal calls with consideration for handover

6) Configure the maximum allowed usage of channels.

- max-chan-util [VALUE]

Parameter	Description
VALUE	Maximum allowed usage of channels

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

- reserved-ho-chan-util [VALUE]

Parameter	Description
VALUE	Usage of marginal channels with consideration for handover

8) You can view the video CAC information you configured by executing the 'show [80211a | 80211bg] cac video configuration' command.

Configuration using Web UI

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

Video Call Admission Control	
ADMISSION CONTROL	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
METHOD	<input checked="" type="radio"/> Static <input type="radio"/> Channel Utilization
MAX CALLS	<input type="text" value="6"/>
HANDOVER CALLS	<input type="text" value="0"/>
MAX CHANNEL UTILIZATION (%)	<input type="text" value="10"/>
HANDOVER CHANNEL UTILIZATION (%)	<input type="text" value="0"/>

Figure 160. 802.11a/n Admission Control Configuration Window

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

- ADMISSION CONTROL: Configure the video CAC function
- METHOD: Select a video CAC method (static/chan_util)
- MAX CALLS: Maximum allowed number of calls (range: 2-30)
- HANDOVER CALLS: Number of marginal calls with consideration for handover (range: 0-8)
The maximum allowed number of calls becomes MAX CALLS-HANDOVER CALLS.
- MAX CHANNEL UTILIZATION (%): Maximum allowed usage of channels (range: 5-85)
- HANDOVER CHANNEL UTILIZATION (%): Usage of marginal channels with

consideration for handover (range: 0-25)

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

This section 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) Enable RRM. The 'no' parameter is used to disable RRM. DCS, DPC and CHDC, which are functions of RRM, can run only if 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) Configure priorities between the neighbor list of each Wlan. Go to the wireless section the configuration of which you want to change and then enter neighbor-list setup mode. You can select between rssi and handover, and the default value is rssi.

```
WEC8500/configure/rrm# 80211a
WEC8500/configure/rrm/80211a# neighbor-list
WEC8500/configure/rrm/80211a/neighbor-list# wlan-neighbor-priority
rssi/handover
```

- 5) 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/ac> 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/ac screen or 802.11b/g/n screens. Configure priorities between the neighbor list of each Wlan at the bottom of the menu.

Figure 161. RRM configuration window

7.4.2 DPC Configuration

This section 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 Received Signal Strength Indication (RSSI) threshold for neighbor AP. The default value is -70 (dBm).

```
WEC8500/configure/rrm/80211a/dpc# rssi-threshold [value]
```

- 5) If you need to change the RSSI threshold for the station, execute the following command. The default value is -70 (dBm). This parameter is used only in the DCS-DPC joint algorithm.

```
WEC8500/configure/rrm/80211a/dpc# rssi-threshold-for-stn [value]
```

- 6) Execute the following command to change the execution interval. The default value is 600 (seconds).

```
WEC8500/configure/rrm/80211a/dpc# periodic-interval [value]
```

- 7) Execute the following command to change the Tx Power range which is automatically set by DPC. The default minimum is 3 and the default maximum is 30 for both 80211a and 80211b.

```
WEC8500/configure/rrm/80211a/dpc# txPower min [value] max [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/ac> 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.

Dynamic TX Power Control	
SERVICE ²	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
RSSI THRESHOLD(DBM)	<input type="text" value="-70"/>
INTERVAL(SEC.)	<input type="text" value="600"/>
TX POWER MINIMUM	<input type="text" value="5"/>
TX POWER MAXIMUM	<input type="text" value="20"/>

Figure 162. DPC settings

7.4.3 DCS Configuration

This section 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) Configure whether to apply the DCS-DPC joint algorithm. If the 'no' parameter is selected, the configuration is cleared.

```
WEC8500/configure/rrm/80211a/dcs# joint-algo-enable
```

- 5) Execute the following command to change the execution interval. The default value is 120 (seconds).

```
WEC8500/configure/rrm/80211a/dcs# periodic-interval [value]
```

- 6) Execute the following command to change the Channel Utilization threshold. The default value is 80 (%).

```
WEC8500/configure/rrm/80211a/dcs# channel-utilization-threshold [value]
```

- 7) Execute the following command to change the My Utilization threshold. The default is 10 (%) for 802.11a and 40 (%) for 802.11b.

```
WEC8500/configure/rrm/80211a/dcs# my-utilization-threshold [value]
```

- 8) Execute the following command to set the anchor time. The default value is start time 4, end time 5. 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]
```

- 9) 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]
```

- 10) Execute the following command to use the Delayed Channel Change function. To disable the configuration, enter the 'no' parameter. The default is Disable. The Delayed Channel Change function delays channel change instead of changing it immediately when a channel becomes busy due to channel utilization. If the anchor time is not configured, the default value is used at 4 o'clock.

```
WEC8500/configure/rrm/80211a/dcs# delayed-channel-change
```

- 11) To use the Aware Option function, execute the following command. To disable the configuration, enter the 'no' parameter. The Aware Option does not change a channel if there is a specific condition. Therefore, three functions are provided based on whether there is a voice, the association of a station, or traffic in a station. The default is that only the Voice Aware function is enabled. The Station Aware function specifies the number of stations at the same time.

```
WEC8500/configure/rrm/80211a/dcs# aware-option voice
WEC8500/configure/rrm/80211a/dcs# aware-option station [station count]
WEC8500/configure/rrm/80211a/dcs# aware-option traffic
```

- 12) 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/ac> or <802.11b/g/n> → <RRM> menu in the sub-menus. Enable or disable the DCS in the SERVICE field in Dynamic Channel Selection.

Dynamic Channel Selection	
SERVICE ³	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
INTERVAL(SEC.)	<input type="text" value="120"/>
CHANNEL UTILIZATION THRESHOLD(%)	<input type="text" value="80"/> My Utilization Threshold(%) <input type="text" value="10"/>
INTERFERENCE LEVEL THRESHOLD(%)	<input type="text" value="80"/>
DELAYED CHANNEL CHANGE ⁴	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
AWARE OPTION	<input checked="" type="checkbox"/> Voice <input type="checkbox"/> Traffic <input type="checkbox"/> Station Association Count <input type="text" value="1"/>
ANCHOR TIME START	<input type="text" value="4"/> O'clock
ANCHOR TIME END	<input type="text" value="5"/> O'clock
CHANNELS	<input checked="" type="checkbox"/> 36 <input checked="" type="checkbox"/> 40 <input checked="" type="checkbox"/> 44 <input checked="" type="checkbox"/> 48 <input checked="" type="checkbox"/> 149 <input checked="" type="checkbox"/> 153 <input checked="" type="checkbox"/> 157 <input checked="" type="checkbox"/> 161

Figure 163. DCS settings

7.4.4 CHDC Configuration

This section 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 enable it Use the 'no' parameter to disable the mode. The function operates only when the RRM is enabled.

```
WEC8500/configure/rrm/80211a# chdc
WEC8500/configure/rrm/80211a/chdc# enable
```

- 4) To use the pre-alarm function, operator can collect the statistics from an AP. After entering into the chdc configuration mode, complete configuration (statsCollectEnable). To disable the configuration, enter the 'no' parameter. All the functions for pre-alarm are available only when both RRM and CHDC are enabled.

```
WEC8500/configure/rrm/80211a/chdc# statsCollectEnable
Success: DBI set for DPC 11A Stats collect Enable : 1
```

- 5) If a coverage hole is estimated from the statistics for the pre-alarm function, a warning can be transmitted. After entering into the chdc configuration mode, complete configuration (statsWarningEnable). To disable the configuration, enter the 'no' parameter.

```
WEC8500/configure/rrm/80211a/chdc# statsWarningEnable
Success: DBI set for DPC 11A Stats Warning Enable : 1
```

- 6) If a coverage hole is estimated from the statistics for the pre-alarm function, CHDC can be executed. After entering into the chdc configuration mode, complete configuration (statsActionEnable). To disable the configuration, enter the 'no' parameter.

```
WEC8500/configure/rrm/80211a/chdc# statsActionEnable
Success: DBI set for DPC 11A Stats Action Enable : 1
```

- 7) Configure the minimum value of statistics Failed Client Count for the pre-alarm function. It can be 1~75.

```
WEC8500/configure/rrm/80211a/chdc# min-failed-client-count 70
CHDC 802.11a : Set Minimum Failed Client Count Success
```

- 8) Configure the percentage of statistics Failed Client Count for the pre-alarm function. It can be 10~35.

```
WEC8500/configure/rrm/80211a/chdc# percent-failed-client-count 20
Success: CHDC 802.11a : Set Percentage of Failed Client Count Success
```

- 9) Configure the threshold of RSSI that will be added to the statistics Failed Client Count for the pre-alarm function. Configure it for Voice Frame and Data Frame. It can be -90~-20 (dB).

```
WEC8500/configure/rrm/80211a/chdc# rssi-threshold data -75
Success: CHDC 802.11a : Set RSSI THRESHOLD(-75) Successful

WEC8500/configure/rrm/80211a/chdc# rssi-threshold voice -75
Success: CHDC 802.11a : Set RSSI THRESHOLD(-75) Successful
```

- 10) Configure a value that requests an interval to an AP to collect statistics for the pre-alarm function. The default is 120 seconds and it can be 30~3600 seconds.

```
WEC8500/configure/rrm/80211a/chdc# statsCollectInterval 60
This Value: 60 is already set
```

- 11) Configure the minimum value of the idle time-out count of statistics for the pre-alarm function. This parameter can have a value ranging from 0 to 1,000.

```
WEC8500/configure/rrm/80211a/chdc# min-idle-timeout-count 10
CHDC : Set Minimum IdleTimeOutCnt Success
```

- 12) To check the configured information, execute the 'show rrm config-summary' command. In the 'Coverage Hole Detection and Control', operator can check the current status of all the configured values.

```
WEC8500/configure/rrm/80211a/chdc# show rrm config-summary

RRM Status ..... Enabled
Rf Group Name ... Group

                        80211a/n      80211b/g/n
Dynamic Power Control -----
DPC Enable              .. Enabled    Enabled
Periodic Interval       .. follow DCS follow DCS
RSSI Threshold for Neighbor AP .. -70    -70
RSSI Threshold for Station .. -70    -70
TX Power Min. - Max.    .. 17 - 20    14 - 20
Minimum Number of AP    .. 2         2
Elapsed Time After Last Run .. 36     7
Dynamic Channel Selection -----
DCS Enable              .. Enabled    Enabled
DCS-DPC Joint Algorithm Enable .. Enabled Enabled
Periodic Interval       .. 60         60
Anchor Time Start       .. 0          0
Anchor Time Stop        .. 23         23
Interference Level Threshold .. 80     80
Channel Utilization Threshold .. 99     99
My Utilization Threshold .. 10        40
Delayed Channel Change   .. Enabled    Enabled
Aware-Option: Voice Call .. Enabled    Enabled
Aware-Option: Traffic    .. Enabled    Enabled
Aware-Option: Station Assoc. .. Enabled Enabled
Station Count for Station Aware .. 1      1
Elapsed Time After Last Run .. 36     7
Coverage Hole Detection and Control -----
CHDC Enable            .. Enabled    Enabled
Statistics Collect Enable .. Enabled    Enabled
Statistics Warning Enable .. Enabled    Enabled
```

Statistics Action Enable	..	Enabled	Enabled
RSSI Voice Threshold	..	-75	-75
RSSI Data Threshold	..	80	-30
Minimum Failed Client Count	..	1	1
Percentage Min. Failed Count	..	25	25
Minimum Idle time-out Count	..	10	10
Statistics Collect Interval	..	120	60
Neighbor List Management	-----	-----	-----
WLAN Neighbor Priority	..	Handover	Handover

Configuration using Web UI

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

In the Coverage Hole Detection Control window, operator can enable or disable the CHDC and configure the values using the same functions as the CLI.

Coverage Hole Detection Control	
SERVICE ⁵	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
STATISTICS COLLECTION	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
NOTIFY TRAP WARNING MESSAGE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
STATISTICS ACTIVATE POWER CONTROL	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
PERCENTAGE OF FAILED CLIENT COUNT	<input type="text" value="25"/>
MINIMUM RSSI THRESHOLD FOR VOICE TRAFFIC(DBM)	<input type="text" value="-75"/>
MINIMUM RSSI THRESHOLD FOR DATA TRAFFIC(DBM)	<input type="text" value="-80"/>
MINIMUM FAILED CLIENT COUNT	<input type="text" value="1"/>
TIME INTERVAL	<input type="text" value="120"/>
MINIMUM IDLE TIME-OUT COUNT	<input type="text" value="10"/>

Figure 164. CHDC settings

7.4.5 Sleeping Cell Detection

This is a function that allows the APC to detect the statuses of APs that are not performing basic functions and transmit an alarm/warning.

Configuration using CLI

- 1) Enable/Disable: Configure whether the silent alarm detection function will be performed.

(Enable: function performing, Disable: function not performing)

```
WEC8500/configure/rrm# sleep-cell-detect
WEC8500/configure/rrm/sleep-cell-detect# enable
```

- 2) APC Threshold: Minimum number of connected users throughout the whole APC for sleeping cell detection.

If the total number of STA associations is equal to or smaller than the APC threshold, the day is judged as a holiday and consequently the sleeping cell detection is not performed.

```
WEC8500/configure/rrm/sleep-cell-detect# apc-threshold
```

- 3) AP Threshold: Minimum number of users connected to an AP for sleeping cell detection. If the number of STA associations of an AP is equal to or smaller than the AP threshold, a silent alarm occurs.

```
WEC8500/configure/rrm/sleep-cell-detect# ap-threshold
```

- 4) PERIOD_1ST: Start and end times of sleeping cell detection for Specific Period 1. (For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/sleep-cell-detect# period_1st
```

- 5) PERIOD_2ND: Start and end times of sleeping cell detection start for Specific Period 2. (For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/sleep-cell-detect# period_2nd
```

- 6) PERIOD_ALL: Start and end times of sleeping cell detection for periods other than Specific Periods 1 and 2.

```
WEC8500/configure/rrm/sleep-cell-detect# period_all
```

Configuration using Web UI

From the menu bar of <WEC Main Window>, select <Configuration> and then select <Radio> → <Advanced> → <Sleeping Cell Detection> in the submenus.

Radio > Advanced > Sleeping Cell Detection	
SERVICE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
APC THRESHOLD ¹	<input type="text" value="1"/>
AP THRESHOLD ²	<input type="text" value="10"/>
Period (1st)	
RANGE (UNIT:15MIN) ³	<input type="text" value="1"/>
START HOUR	<input type="text" value="8"/> O'clock
END HOUR	<input type="text" value="21"/> O'clock
Period (2nd)	
RANGE (UNIT:15MIN) ³	<input type="text" value="2"/>
START HOUR	<input type="text" value="0"/> O'clock
END HOUR	<input type="text" value="4"/> O'clock
Period (ALL)	
RANGE (UNIT:15MIN)	<input type="text" value="2"/>

7.4.6 Energy Saving Groups

- The purpose is to reduce the power consumption of the APC by turning off the RF radios of APs without any connected STA at a specific time when the number of STAs connected to the APC drops drastically.
- The APs of the APC are divided into the active group in which APs are always in operation and the standby group in which the RF radios of APs are turned off. When the standby group (energy saving group) is defined, the APC recognizes the remaining APs as the active group. You can define up to 10 groups.

Configuration using CLI

- 1) **Enable/Disable:** Configure whether the energy saving function will be performed.
(Enable: function performing, Disable: function not performing)

```
WEC8500/configure/rrm# energy-saving-group 1
WEC8500/configure/rrm/energy-saving-group 1# enable
```

- 2) **APC Threshold:** Maximum number of connected users throughout the whole APC for energy saving detection.

If the total number of STA associations is equal to or smaller than the APC threshold, the day is judged as a holiday and the energy saving function is performed according to the times set for weekends.

```
WEC8500/configure/rrm/energy-saving-group 1# apc-threshold
```

- 3) **WEEKDAY:** Start and end times of energy saving for weekdays.
(For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/energy-saving-group 1# weekday
```

- 4) **WEEKDEND:** Start and end times of energy saving for weekends.
(For a full day, set the start and end times as the same time.)

```
WEC8500/configure/rrm/energy-saving-group 1# weekend
```

- 5) **ADD-AP:** Add AP members to the energy saving group.

```
WEC8500/configure/rrm/energy-saving-group 1# add-ap
```


- 6) DEL-AP: Delete AP members from the energy saving group.

```
WEC8500/configure/rrm/energy-saving-group 1# del-ap
```

Configuration using Web UI

From the menu bar of <WEC Main Window>, select <Configuration> and then select <Radio> → <Advanced> → <Energy Saving Groups> → <GROUP NAME> in the submenus.

Samsung Wireless Enterprise Monitor Configuration Administration Help User [samsung] Logout

Radio > Advanced > Energy Saving Groups > Edit

GROUP NAME: save1

SERVICE: ☒ Enable ☐ Disable

APC THRESHOLD ¹: 0

WEEKDAY

START HOUR: 21 O'clock

END HOUR: 8 O'clock

WEEKEND

START HOUR: 0 O'clock

END HOUR: 0 O'clock

AP COUNT: 5

Current Filter: None

Selected APs

	AP PROFILE NAME	AP NAME	MAC ADDRESS	IP ADDRESS
<input type="checkbox"/>	ap_71	AP_707172737c60	70:71:72:73:7c:60	201.1.1.168
<input type="checkbox"/>	ap_72	AP_707172737c80	70:71:72:73:7c:80	201.1.1.169
<input type="checkbox"/>	ap_73	AP_707172737ca0	70:71:72:73:7c:a0	201.1.1.170
<input type="checkbox"/>	ap_74	AP_707172737cc0	70:71:72:73:7c:c0	201.1.1.171
<input type="checkbox"/>	ap_75	AP_707172737ce0	70:71:72:73:7c:e0	201.1.1.172

7.4.7 Energy Saving Auto Classification

The purpose of the AP without the connected STA at a specific time when the STA connected to the APC is drastically reduced is to reduce power consumption of the APC by turning off the RF radio of the AP.

The APs of the APC are classified into an active group to keep them at the operational status all the time and a standby group to make their RF radio off at the designated time. When the APC designates a standby group (energy saving group), the others are recognized as an active group.

Up to 20 groups can be designated (Same as WEC8500/WEC8050).

Energy Saving Auto Classification is not a method under which the operator configures a standby group but a method under which the system automatically classifies an energy saving group by using the analysis of each AP.

For the convenience of the operator, the existing Energy Saving Groups and Energy Saving Auto Classification functions can be used by mixture. In short, as shown in the existing method, only Energy Saving Groups or only Energy Saving Auto Classification or both can be used.

Configuration using CLI

- 1) Enable/Disable: Check the configuration of whether the Energy Saving Auto Classification function operates.
(Enable: Function operation, Disable: No function operation)

```
WEC8500/configure/rrm# energy-saving-auto-class
WEC8500/configure/rrm/energy-saving-auto-class# enable
```

- 2) APC Threshold: The maximum number of all users connecting to the APC for Energy Saving Auto Classification
If the number of all STA associations is less than APC threshold, the day is considered as a holiday and the Energy Saving Auto Classification function operates depending on the weekend setting time.

```
WEC8500/configure/rrm/energy-saving-auto-class# apc-threshold
```

- 3) WEEKDAY: Energy saving start/end time on a weekday
(For all day, the start time and the end time are set to the same time.)

```
WEC8500/configure/rrm/energy-saving-auto-class# weekday
```

- 4) WEEKDEND: Energy saving start/end time on a weekend
(For all day, the start time and the end time are set to the same time.)

```
WEC8500/configure/rrm/energy-saving-auto-class# weekend
```

- 5) UNCONDITIONAL RADIO OFF: Configure whether the AP radio is turned off unconditionally, regardless of the connection of the STA.
(radio_off_unconditionally: Unconditionally off, no radio_off_unconditionally: If the STA is connected, keep the state ON.)

```
../configure/rrm/energy-saving-auto-class# radio_off_unconditionally
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select <Radio> → <Advanced> → <Energy Saving> → <Automatic Classification> menus in the sub-menus.

Radio > Advanced > Energy Saving > Automatic Classification	
SERVICE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
APC THRESHOLD	<input type="text" value="2"/>
UNCONDITIONAL RADIO OFF	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
WEEKDAY	
START HOUR	<input type="text" value="21"/>
END HOUR	<input type="text" value="8"/>
WEEKEND	
START HOUR	<input type="text" value="0"/>
END HOUR	<input type="text" value="0"/>

7.5 Location Tracking

The APC 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:

7.5.1 Configure Location Tracking

- 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
```

7.5.2 Configure Location Tracking Scan

- 1) When applying the location tracking scan information to the APC, the method varies according to type. A method of applying the scan information can be selected using the following command.
 - scan-result-type[TYPE]

Parameter	Description
TYPE	- 0: Applies scan information to all channels - 1: Applies AP information using the same SSID - 2: Transmits the previously scanned information first and then applies the scan information to all channels - 3: Transmits the previously scanned information first and then applies the AP information using the same SSID - 4: Transmits the previously scanned information only

- 2) The maximum number of APs belonging to the APC, which is to be applied with the location tracking scan information, can be specified using the following command.
 - num-req-ap-list[NUM]

Parameter	Description
NUM	NUM (range: 1-500)

- 3) The scanning interval for location tracking can be configured using the following command.
- scan-report-intv[NUM]

Parameter	Description
NUM	NUM (range: 5-3600) default: 10

- 4) To check the configuration information, execute the following command.
- show locationtrack config

```
WEC8500/configure/locationtrack # show locationtrack config
Location tracking enable.....: Enabled
Algorithm type.....: 4
Expiry date of history files.....: 0
Scan Result Type.....: 0
Number of ap list for report.....: 0
scan report interval.....: 10
count number of scan or report.....: 0
```

7.5.3 Configures Location Tracking Scan

- 1) Configure the MAC address of a wireless terminal for which the tracking function will be executed.
 - station [MAC_ADDRESS]
- 2) To check the location information of a wireless terminal to track, execute the 'show locationtrack station' command.

```
WEC8500/configure/locationtrack # show locationtrack station
No.  stationId station_MAC_Addr  ap_MAC_Addr      (staX,staY)
lastTime(+)
-----
1          1 f4:d9:fb:34:20:60 f4:d9:fb:34:20:60 (2432,1947)
0(1374022070)
```

7.6 Spectrum Analysis

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

7.6.1 Retrieving Spectrum Analysis Data

The spectrum analysis function of APC provides the following data.

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

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

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

Configuration using CLI

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

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

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

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

- FFT report

```
APC# show spectrum-analysis report sample ap 1

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

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

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

• Duty cycle report

```
APC# show spectrum-analysis report duty_cycle ap 1

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

```

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

```

- Interference report

```

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

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

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

```



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

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

Configuration using Web UI

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

Show Filter

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

Figure 165. Spectrum Analysis Data

7.6.2 Spectrum Analysis Configuration

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

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

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

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

[Enable/Disable Spectrum]

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

- service [MODE]

Parameter	Description
MODE	Enables or disables spectrum analysis - 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 the configure mode of the CLI.

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

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

7.7 Controlling Usage per User

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

Configuration using CLI

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

- 1) Go to the configure mode of the CLI.

```
APC# configure terminal
```

- 2) Create a QoS profile.

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

Parameter	Description
PROFILE_NAME	Name of a QoS profile to create

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

Parameter	Description
VALUE	Downward usage

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

Parameter	Description
VALUE	Upward usage

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

Configuration using Web UI

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

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

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

Figure 166. Controlling Usage per User

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

7.8 Remote Packet Capture

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

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

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

Configuring the MAC address of a wireless terminal

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

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

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

Configuring AP MAC address

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

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

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

Configuring Filtering Mode

Capture target can be specified by configuring the filtering mode

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

Parameter	Description
FILTERING MODE	Filtering mode <ul style="list-style-type: none"> - station-only: Use only the configured station MAC information. - ap-only: Use only the configured AP MAC information.

Starting Service

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

The related commands are given below.

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

Retrieving Configuration Information

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

```
APC# show pcap current-config detail

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

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

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

WEC8500#
```

7.9 Clustering

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

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

Configuration using CLI

[Cluster Setting]

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

- 1) Go to the configure mode of the 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 the configure mode of the CLI.

```

WEC8500# configure terminal
WEC8500/configure#

```

- 2) Add the APC to a cluster.
 - cluster add-apc [INDEX] [APC_NAME] [IPV4_ADDRESS] [DB_REFRESH_INTERVAL]

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

[Deleting APC from cluster]

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

- 1) Go to the configure mode of the CLI.

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

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

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

[Retrieving APC information added in cluster]

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

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

Configuration using Web UI

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

The Clustering window is shown below.

Apply

Information

CLUSTER NAME

IAHO

KEEP ALIVE INTERVAL (SEC)

60

KEEP ALIVE RETRY COUNT

3

OWN APC ID

1

Add

Delete

Clustering Members

	APC ID	APC NAME	APC IP ADDRESS	MULTICAST ADDRESS	DB REFRESH INTERVAL (SEC)	CONNECT STATUS
<input type="checkbox"/>	1	APC-1	90.90.11.153	0.0.0.0	60	connected
<input type="checkbox"/>	2	APC-2	90.90.11.154	0.0.0.0	60	connected

Figure 167. 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.

Back

Apply

INDEX

1

APC NAME

APC-1

IP ADDRESS

90

90

11

153

DB REFRESH INTERVAL (SEC)

120

Figure 168. Clustering addition window

7.10 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.

7.10.1 Limiting Connections per Radio

Configuration using CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Configure connection limitation.

- [RADIO] max-associated-stations [MAX_STATION] global: Configures connection limitation per wireless bandwidth. When you enter the 'global' parameter at the end, connection limitation is applied to all the APs.
- [RADIO] max-associated-stations [MAX_STATION] [TARGET] [AP_ID]: Configures connection limitation to a specific AP.
- [RADIO] max-associated-stations [MAX_STATION] [group] [AP group ID]: Configures connection limitation to a specific AP group.

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: 1-3000)
AP group ID	AP group ID (range: 1-3000)

- 3) To check the configuration information, use the 'show [80211a | 80211bg] radio-config [ap <ID> | group <ID> | global]' command.

Configuration using Web UI

[Configures per Radio]

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.

Apply

General

BEACON PERIOD (TUS)	100
RTS THRESHOLD (BYTES)	2346
SHORT RETRY	4
LONG RETRY	10
FRAGMENTATION THRESHOLD (BYTES)	2346
TX MSDU LIFE TIME (TUS)	512
RX MSDU LIFE TIME (TUS)	512
MAX. CLIENT COUNTS	127
CONTROLLED VOICE OPTIMIZATION	<input type="checkbox"/> Enable <input checked="" type="checkbox"/> Disable

Apply

Data Rates

6 MBPS	Basic
9 MBPS	Supported
12 MBPS	Basic
18 MBPS	Supported
24 MBPS	Basic
36 MBPS	Supported
48 MBPS	Supported
54 MBPS	Supported

Figure 169. Configuring connection limitation per radio

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

[Configures per AP Group]

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

Apply

BANDWIDTH (MHZ)	20
MAX. ALLOWED STATIONS ON AN AP ³	127
CONTROLLED VOICE OPTIMIZATION ⁴	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
MULTI-ANTENNA MODE ⁵	<input checked="" type="radio"/> Dynamic <input type="radio"/> Static

Figure 170. Configuring connection limitation per AP Group

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

[Configures per AP]

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

Apply

MAX. ALLOWED STATIONS ON AN AP ³	127
CONTROLLED VOICE OPTIMIZATION ⁴	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
LOCAL CALL OPTIMIZATION ⁴	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
MULTI-ANTENNA MODE ⁵	<input type="radio"/> Dynamic <input checked="" type="radio"/> Static

Figure 171. Configuring connection limitation per AP

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

7.10.2 Connection Limitation per WLAN

Configuration using CLI

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

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

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

- 2) Disable the WLAN.

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

- 3) Configure connection limitation.

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

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

- 4) Enable the WLAN.

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

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

Configuration using Web UI

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

The screenshot shows the WEC Web UI configuration page for WLAN. It has two main sections: 'General' and 'Data Rates'. The 'General' section includes fields for BEACON PERIOD (TUS), RTS THRESHOLD (BYTES), SHORT RETRY, LONG RETRY, FRAGMENTATION THRESHOLD (BYTES), TX MSDU LIFE TIME (TUS), RX MSDU LIFE TIME (TUS), MAX. CLIENT COUNTS, and CONTROLLED VOICE OPTIMIZATION. The 'Data Rates' section shows a list of data rates with their corresponding status (Basic or Supported). Both sections have an 'Apply' button at the top right.

General		Data Rates	
BEACON PERIOD (TUS)	100	6 MBPS	Basic
RTS THRESHOLD (BYTES)	2346	9 MBPS	Supported
SHORT RETRY	4	12 MBPS	Basic
LONG RETRY	10	18 MBPS	Supported
FRAGMENTATION THRESHOLD (BYTES)	2346	24 MBPS	Basic
TX MSDU LIFE TIME (TUS)	512	36 MBPS	Supported
RX MSDU LIFE TIME (TUS)	512	48 MBPS	Supported
MAX. CLIENT COUNTS	127	54 MBPS	Supported
CONTROLLED VOICE OPTIMIZATION	<input type="radio"/> Enable <input checked="" type="radio"/> Disable		

Figure 172. Configuring connection limitation per WLAN

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

Apply

Call Admission Control

ADMISSION CONTROL	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
MAX CALLS	24
HANDOVER CALLS	2
MINOR ALARM THRESHOLD	0
MAJOR ALARM THRESHOLD	0

7.11 Voice Statistics and Communication Failure Detection

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

7.11.1 Voice Statistics Function

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

Configuration using CLI

Use the following command to check voice statistics.

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


Configuration using Web UI

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

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

Figure 173. Voice statistics

7.11.2 Detecting WLAN-based Communication Failure

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

Configuration using CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Enable or disable communication failure detection.

- [no] call-fail-detect [WLAN_ID]

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

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

Configuration using Web UI

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

The screenshot shows the 'Advanced' configuration tab for a WLAN profile named 'wlan1'. The settings are as follows:

- PROFILE NAME:** wlan1
- ACL RULE:** (Dropdown menu)
- STATIC ADDRESS DISALLOWED:** ☐ Enable ☒ Disable
- DHCP OVERRIDE:** ☐ Enable ☒ Disable
- DHCP SERVER:** 0 . 0 . 0 . 0
- WMM:** ☒ Enable ☐ Disable
- DTIM:** 1
- STATION IDLE TIMEOUT (SEC):** 300
- VOIP FAILURE DETECT:** ☐ Enable ☒ Disable

Buttons for 'Back', 'Apply', and 'Apply' are visible at the top right, middle right, and bottom right of the configuration area respectively.

Figure 174. Detecting WLAN-based communication failure

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

7.12 Voice Signal and Media Monitoring

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

7.12.1 Checking Voice Related Wireless Information

Configuration using CLI

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

[Checking Voice Related Wireless Information]

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

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

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

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

3) Check the information of a completed call.

```

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

```

4) Check the voice signal related log.

```

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

```

5) Check a WLAN event related to a voice.

```

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

```

6) Check the voice related statistics.

```

WEC8500# show voice statistics radio

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

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

```

```

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

WEC8500# show voice statistics device

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

```

[Configures Device Type]

Statistics by device requires that a device type be specified for devices to monitor.

- 1) Go to the configure mode of the CLI.

```

WEC8500# configure terminal
WEC8500/configure#

```

- 2) Configure the model name and OS version of the devices to monitor.

- station device_type [MODEL NAME] [OS VERSION]

Parameter	Description
MODEL NAME	Enter the model name of the devices. E.g.: 'SHVE250S'
OS VERSION	Enter the OS version of the devices.

When the devices monitored are registered for SIP, the following information can be checked, along with statistics by devices.

Id	Model Name	OS Version	Build Version
1	SHV-E160S	4.0.4	VH29
2	SHV-E210S	4.3	E210SKSUGND1
3	SHV-E300L	4.2.2	E300LKSANMH3
4	SHV-E330S	4.3	E330SKSUBMK4
5	SHV-E250S	4.3	E250SKSUENC3
6	SHV-E300S	4.2.2	E300SKSANMH3
7	SHV-E160S	4.1.2	E160SKSJMJ1
8	SHW-M250S	4.1.2	M250SKSJMJ1
9	SHW-M440S	4.3	M440SKSUGNK2
10	SHV-E120S	4.1.2	E120SKSJMH3
11	SHV-E210L	4.3	E210LKLUGNA1
12	SHW-M250K	4.1.2	M250KKKJML1
13	SHW-M440S	4.1.2	M440SKSJMC4
14	SHV-E330K	4.3	E330KKKUBMK4
15	SHV-E300K	4.2.2	E300KKSANMH3
16	SHV-E210K	4.1.2	E210KKKJMK1
17	SHW-M440S	4.3	M440SKSUGND1
18	SHV-E300S	4.2.2	E300SKSANMH2
19	SHW-M250S	4.0.4	UH07
20	SHV-E160K	4.1.2	E160KKKJMB1
21	SHW-M250K	4.1.2	M250KKKJMG1

Configuration using Web UI

[Checking a voice wireless terminal]

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

In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <VoIP Stations> <Active Calls> <Complete Calls> menu in the sub-menus.

VoIP Calls > VoIP Stations											
Current Filter : None										Change	
											Export
Total Entry : 2											
MAC ADDRESS	USER NAME	IP ADDRESS	TEL NUMBER	CALL PROTOCOL	CALL STATUS	REG. STATUS	CALL SERVER	SSID	RADIO	AP NAME	BSSID
c8:19:f7:70:89:04		10.10.2.12		UDP	Idle	Not registered	0.0.0.0	voice2	5G	AP_f4d9fb24c8e0	f4:d9:fb:24:c8:e3
50:01:bb:fd:96:e1		10.10.10.11		UDP	Idle	Not registered	0.0.0.0	voice2	5G	AP_f4d9fb24c8e0	f4:d9:fb:24:c8:e3
Foot Notes :											
1. Only station that register the VoIP server is displayed											

Figure 175. VoIP Stations Retrieval Screen

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

In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <Active Calls> menu in the sub-menus.

VoIP Calls > Active Calls

Current Filter : None Change

Export

Total Entry : 1

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

1

Figure 176. Active Call Retrieval Screen

- 3) Check the information of a completed call.

In the menu bar of <WEC Main window>, select <Monitor> and then select the <VoIP Call> → <Complete Calls> menu in the sub-menus.

VoIP Calls > Completed Calls

Search Condition

MAC ADDRESS: 00:00:00:00:00:00 USER NAME: TEL NUMBER: START TIME: 00:00:00 END TIME: 00:00:00 Apply Cancel

Export

Total Entry : 4

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

1

Figure 177. Complete Calls Retrieval Screen

[Configures Device Type]

- 1) In the menu bar of <WEC Main window>, select <Statistics> and then select the <Network Quality> <Device Types> menu in the sub-menus.

Statistics > Network Quality > Device Types							
Current Filter : None				Change			
Registration ¹				Export			
ID	MODEL	OS VER.	BUILD VER.	5MIN, ASSOCIATION LATENCY(MSEC)			
				MIN	MAX	AVG	COUNT
1	SHV-E160S	4.0.4	VH29	0	0	0	0
2	SHV-E210S	4.3	E210SKSUGND1	0	0	0	0
3	SHV-E300L	4.2.2	E300LKSANMH3	0	0	0	0
4	SHV-E330S	4.3	E330SKSUBMK4	0	0	0	0
5	SHV-E250S	4.3	E250SKSUENC3	0	0	0	0
6	SHV-E300S	4.2.2	E300SKSANMH3	0	0	0	0
7	SHV-E160S	4.1.2	E160SKSJMD1	0	0	0	0
8	SHW-M250S	4.1.2	M250SKSJMD1	0	0	0	0
9	SHW-M440S	4.3	M440SKSUGNK2	0	0	0	0
10	SHV-E120S	4.1.2	E120SKSJM3	0	0	0	0
11	SHV-E210L	4.3	E210LKLUGNA1	0	0	0	0
12	SHW-M250K	4.1.2	M250KKKJML1	0	0	0	0
13	SHW-M440S	4.1.2	M440SKSJM4	0	0	0	0
14	SHV-E330K	4.3	E330KKKUBMK4	0	0	0	0
15	SHV-E300K	4.2.2	E300KKKSANMH3	0	0	0	0
16	SHV-E210K	4.1.2	E210KKKJMK1	0	0	0	0
17	SHW-M440S	4.3	M440SKSUGND1	0	0	0	0
18	SHV-E300S	4.2.2	E300SKSANMH2	0	0	0	0
19	SHW-M250S	4.0.4	UH07	0	0	0	0
20	SHV-E160K	4.1.2	E160KKKJMB1	0	0	0	0

1

Foot Notes :

1. The statistics value is only updated for devices that are configured in "Registration" menu.
2. It does not affect this list immediately, even if a device type is configured in "Registration" menu. The Device will be listed only when it runs and sends SIP register message as FMC client.

- 2) Configure the Registration screen in the top left corner, and enter a model name and an OS version for the devices to monitor.

Statistics > Network Quality > Device Types

Model OS Ver.

Total Entry : 39

<input type="checkbox"/>	ID	MODEL	OS VERSION
<input type="checkbox"/>	0	SHV-E210L	4.3
<input type="checkbox"/>	1	SHV-E210S	4.3
<input type="checkbox"/>	2	SHV-E250K	4.3
<input type="checkbox"/>	3	SHV-E250L	4.3
<input type="checkbox"/>	4	SHV-E250S	4.3
<input type="checkbox"/>	5	SHV-E300K	4.3
<input type="checkbox"/>	6	SHV-E300L	4.3
<input type="checkbox"/>	7	SHV-E300S	4.3
<input type="checkbox"/>	8	SHV-E330K	4.3
<input type="checkbox"/>	9	SHV-E330S	4.3
<input type="checkbox"/>	10	SHW-M250K	4.3
<input type="checkbox"/>	11	SHW-M250S	4.3
<input type="checkbox"/>	12	SHW-M440S	4.3
<input type="checkbox"/>	13	SM-N900L	4.3
<input type="checkbox"/>	14	SM-N900S	4.3
<input type="checkbox"/>	15	SHW-M250S	4.0.3
<input type="checkbox"/>	16	SHV-E120K	4.0.4
<input type="checkbox"/>	17	SHV-E120S	4.0.4
<input type="checkbox"/>	18	SHV-E160L	4.0.4
<input type="checkbox"/>	19	SHV-E160S	4.0.4

1 2

7.12.2 Checking Voice Related Quality Information

Configuration using CLI

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

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

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

WEC8500#
```

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

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

=====
[CONN-2 Start Time=2013/7/19.14:52:36, Duration=30 sec(s)
  Station Mac [fc:a1:3e:47:59:e7: <-> 78:47:1d:c5:4c:85:] startBssid
  [f4:d9:fb:23:66:10 <-> f4:d9:fb:23:66:10] endBssid
  [f4:d9:fb:23:66:10 <-> f4:d9:fb:23:66:10]
```

```

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

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

WEC8500#

```

3) Operator can check the call statistics information.

```

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

```

```

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

```

WEC8500#

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

```

WEC8500# show voice vqm alarms brief
=====
VQM ActiveRfactor/ActivePktLoss/ActivePktDly/ActiveMos = 1/1/1/1
VQM QualityThresh/LossThresh/DelayThresh/MOSThresh = 50/50/195/35
ALARMS REPORTED :
  Src Call Id = f03c77b50564418855587192e12b889d Dst Call Id =
ca371fce-6e10-401a-9a4e-dd53678804c6@ug1.scm.com Session = 0
  Direction :Forward Type : [Low-Quality]      [Excessive Burst]
[Excessive delay]
  Direction :Reverse Type : [Excessive Burst]  [Excessive delay]
ALARMS REPORTED :
  Src Call Id = 035be38a40032eb8edb0b94e944d58d4 Dst Call Id =
917a913e-83ae-497f-ad84-bf0ee80edf36@ug1.scm.com Session = 1
  Direction :Forward Type : [Excessive Burst]
  Direction :Reverse Type : [Excessive Burst]  [Excessive delay]
ALARMS REPORTED :
  Src Call Id = a47241e5f5d3d6b7f942d0aaeddbd8ef Dst Call Id =
65031276-a4dd-4b1c-a718-4ed3188e44a5@ug1.scm.com Session = 2
  Direction :Forward Type : [Excessive Burst]
  Direction :Reverse Type : [Excessive Burst]

```

WEC8500#

7.13 Multicast Stream Admission Control

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

7.13.1 Configuring Admission Control

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

Configuration using CLI

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

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

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

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

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

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

Parameter	Description
VALUE	Maximum allowed number of streams

- 4) Set the maximum allowed usage of channels.

- max-chan-util [VALUE]

Parameter	Description
VALUE	Maximum allowed usage of channels

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

- reserved-ho-streams [VALUE]

Parameter	Description
VALUE	Number of marginal streams with consideration for handover

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

- reserved-ho-chan-util [VALUE]

Parameter	Description
VALUE	Usage of marginal channels with consideration for handover

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

Configuration using Web UI

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

Multicast Stream Admission Control

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

Figure 178. 802.11a/n Admission Control Configuration Window

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

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

7.14 Wi-Fi Band Steering

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

7.14.1 Activating Band Steering Function

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

Configuration using CLI

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

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

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

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

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

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

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

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

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

4) Add an entry to the dual band station database.

- band-steering add-station [MAC]

Parameter	Description
MAC	Station MAC Address

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

5) Delete an entry from the dual band station database.

- band-steering delete-station [MAC]

Parameter	Description
MAC	Station MAC Address

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

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

- band-steering delete-all

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

Configuration using Web UI

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

Samsung
Wireless Enterprise

Monitor | Configuration | Administration | Help

User [samsung] | Logout | Save Configuration | Ping | Refresh

General | Security | **Advanced**

Controller > WLANs > WLANs > **Advanced**

Controller >

Access Points

AP Groups

Security >

WLANs >

WLANs

Radio >

QoS

Mobility Management >

DNS

NTP

DHCP >

Back

Apply

PROFILE NAMEwlan1

ACL RULE-----

STATIC ADDRESS DISALLOWED☐ Enable ☒ Disable

DHCP OVERRIDE☐ Enable ☒ Disable

DHCP SERVER0 0 0 0

Apply

WMM☒ Enable ☐ Disable

DTIM1

STATION IDLE TIMEOUT (SEC)300

Apply

VOIP FAILURE DETECT☐ Enable ☒ Disable

Apply

BAND STEERING5GHz preferred
Disabled
2.4GHz preferred
5GHz preferred

Apply

Figure 179. Band Steering Function On/Off and Band Setting

7.15 Wi-Fi Load Balancing

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

7.15.1 Activating Load Balancing Function

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

Configuration using CLI

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

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

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

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

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

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

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

Parameter	Description
VALUE	1-127 (127 by default)

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

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

Parameter	Description
VALUE	1-10 (2 by default)

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

Configuration using Web UI

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

WLAN > Advanced > THRESHOLD[Value]

WLAN > Advanced > MAXIMUM DENIAL COUNT[Value].

The screenshot shows the Samsung Wireless Enterprise Web UI. The top navigation bar includes 'Monitor', 'Configuration', 'Administration', and 'Help'. The user is logged in as 'samsung'. The left sidebar lists various configuration categories. The main area is for 'WLANs > WLANs > Advanced' configuration. It includes sections for 'STATION IDLE TIMEOUT (SEC)' (300), 'AMPOU' (Enable), 'VOIP FAILURE DETECT' (Disable), 'BAND STEERING' (Disabled), 'LOAD BALANCING' (Disable), 'THRESHOLD' (127), 'MAXIMUM DENIAL COUNT' (2), 'MULTICAST TO UNICAST' (Disable), and 'MULTICAST PACKET DISCARD' (Disable). Each section has an 'Apply' button.

Figure 180. Configuring Load Balancing Function

7.16 Station-based Adaptive Load Balancing

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

7.16.1 Basic Setting of Station-based Adaptive Load Balancing

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

Configuration using CLI

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

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

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

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

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

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

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

Parameter	Description
NUMBER	RSSI calibration value (-dbm) - Default value: 0 dbm

- 7) To exclude stations where the traffic occurs from load balancing, the following option must be set (Default: no idle-station):
- idle-station
- 8) The following option must be configured to use the HandOver function of Smart Service Link. (default: no ssl-ho)
- ssl-ho

7.16.2 Setting AP Group Parameter

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

Configuration using CLI

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

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

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

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

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

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

Parameter	Description
NUMBER	Interval for performing load balancing (sec)

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

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

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

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

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

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

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

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

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

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

7.16.3 Setting AP Parameters

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

Configuration using CLI

To set AP parameters, execute the command as follows:

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

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

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

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

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

Parameter	Description
NUMBER	Interval for performing load balancing (sec)

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

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

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

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

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

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

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

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

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

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

CHAPTER 8. Security

The Wireless Enterprise wireless LAN system supports security functions, 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. The WEC8050 also provides the internal RADIUS server function.

8.1.1 External RADIUS Server

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.

8.1.1.1 Basic Settings

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

Configuration using CLI

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

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

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

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

Parameter	Description
IP_ADDRESS	The IP address of a RADIUS server

- 3) Configure the key of a RADIUS server.

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

Parameter	Description
KEY_TYPE	RADIUS server key input format - 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) Configure the items related to retransmissions in RADIUS communications. You can use default values without changing configuration.

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

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

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

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

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

Configuration using Web UI

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

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

The server addition window is shown below.

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

Figure 181. RADIUS server configuration

Item	Description
INDEX	ID that distinguishes RADIUS server configurations
TYPE	Selects the type of the RADIUS server

Item	Description
	<ul style="list-style-type: none"> - Auth: Performs authentication - Acct: Performs accounting - Auth/Acct: Performs authentication and accounting
IP ADDRESS	IP address of the RADIUS server
SHARED SECRET FORMAT	Key input format for communications with the RADIUS server <ul style="list-style-type: none"> - ASCII: ASCII strings - HEX: Hexadecimal values
SHARED SECRET	Key for RADIUS server communications
CONFIRM SHARED SECRET	Re-enters the key for RADIUS server communications for confirmation
AUTH PORT NUMBER	Number of the communication port for RADIUS server authentication (range: 1-65,535, default value: 1,812)
ACCT PORT NUMBER	Number of the communication port for RADIUS server accounting (range: 1-65,535, default value: 1,813)
RETRANSMIT INTERVAL	Retransmission interval for a RADIUS message (range: 1-60, default value: 2, unit: seconds)
TOTAL RETRANSMIT COUNT	Maximum retransmission count of a RADIUS message (range: 1-20, default value: 10)
RETRANSMIT COUNT FAILOVER	Maximum retransmission count of a RADIUS message before a RADIUS server failover is attempted (range: 1-10, default value: 3, must be smaller than the TOTAL RETRANSMIT value)

8.1.1.2 Configuring MAC Authentication

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

Configuration using CLI

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Configuration using Web UI

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

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

MAC Authentication	
PASSWORD TYPE	MAC Address ▼
MAC DELIMITER	No Delimiter (xxxxxxxxxxx) ▼
MAC CASE	Lower ▼

Figure 182. RADIUS Server MAC Authentication Configuration Window

Item	Description
PASSWORD TYPE	Password type - MAC Address: MAC address of the UE. The string in a type same to the MAC string used as a user ID upon the authentication of the MAC of the UE - APC Shared Secret: The shared key between the APC and the RADIUS server
MAC DELIMITER	MAC string delimiter type - No Delimiter: No delimiter (xxxxxxxxxxx) - Colon: ':' used as delimiter (xx:xx:xx:xx:xx:xx) - Hyphen: '-' used as delimiter (xx-xx-xx-xx-xx-xx) - Single Hyphen: Only one '-' used in the middle (xxxxxx-xxxxxx)
MAC CASE	English upper case and lower case types of the MAC string - Lower: Lower case used - Upper: Upper case used

8.1.2 Internal RADIUS Server

The Wireless Enterprise wireless LAN system provides the security and authentication function by interoperating with an internal RADIUS server.

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

Configuration using CLI

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

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

Operator can execute various commands for Local Net Users.

[Adding User]

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

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

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

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

[Modifying User]

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

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

[Deleting User]

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

- `delete-local-userdb {username}`

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

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

- Remove-all-local-userdb

[Importing User]

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

- Import-local-userdb {filename}

Parameter	Description
Filename	File to import - CSV file format - Filename (1-512)

[Exporting User]

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

- Export-local-userdb {filename}

Parameter	Description
Filename	File to export - CSV file format - Filename (1-512)

[Checking User]

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

- Show radiuscm username {username}

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

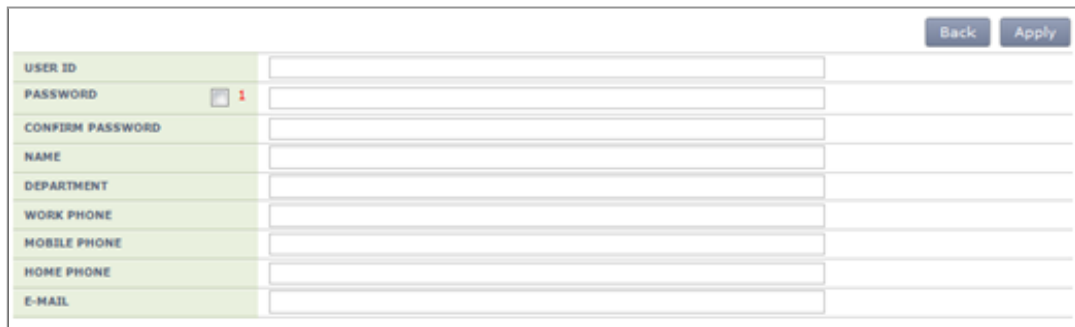
- Show radiuscm all-user

Configuration using Web UI

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

<div> <div>Add</div> <div>Delete</div> <div>Import RADIUS User List</div> <div>Export RADIUS User List</div> </div>					
Total Entry : 1					
<input type="checkbox"/>	NO.	ID	NAME	DEPARTMENT	E-MAIL
<input type="checkbox"/>	1	test111			a@mail.com
1					

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

A web form for adding a user. It contains several input fields with labels on the left: USER ID, PASSWORD, CONFIRM PASSWORD, NAME, DEPARTMENT, WORK PHONE, MOBILE PHONE, HOME PHONE, and E-MAIL. The PASSWORD field has a small icon and a red exclamation mark. At the top right of the form are two buttons: 'Back' and 'Apply'.

- 1) Enter an item according to each parameter description, and click the **<Apply>** button.
 - ID: ID of a user to add
 - PASSWORD: User's initial password
 - CONFIRM PASSWORD: Repeat Password
 - NAME: User's name (option)
 - DEPARTMENT: User's department information (option)
 - WORK PHONE: Office phone number (option)
 - MOBILE PHONE: Mobile phone number (option)
 - HOME PHONE: Home phone number (option)
 - E-MAIL: email (option)
- 2) Importing a local net user list
Operator can import or export the list of local users. The user list is in the CSV format. An existing data is deleted if there is new importing.
- 3) Exporting a local net user list
Operator can export the list of local users in the CSV format file.

8.2 Unauthorized AP/Terminal Detection and Blocking

As the security function, the Wireless Enterprise wireless LAN device provides the detection service for an unauthorized AP using the Wireless Intrusion Detection System (WIDS)/WIPS function.

This function detects any AP that is illegally installed without an administrator's approval and also any wireless terminals connected to the AP. If an authorized wireless terminal is connected to an unauthorized AP, some information may be exposed or the wireless LAN may be attacked in some ways. Therefore, it is important to manage the risk.

8.2.1 Enabling Detection Function

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

Configuration using CLI

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Enable the detection function.

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

- 3) To check the configured information, use the following command.
 - show wi current-config

Configuration using Web UI

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

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

Wireless Intrusions > General	
Apply	
General	
SERVICE STATE ¹	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
EXPIRATION TIMEOUT ²	1200

Figure 183. Wireless Intrusion General Configuration Window

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
Managed AP	AP that is allowed to be used by an administrator among the detected unauthorized APs - Configures the managed AP classification policy. - An administrator can classify a specific AP as a managed AP among the manually detected unauthorized APs.
Unmanage 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 unmanaged AP classification policy. - An administrator can classify a specific AP as a unmanaged AP among the manually detected unauthorized APs.

8.2.2.1 Configuring the managed AP classification policy

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

Configuration using CLI

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

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

- 2) Configure the managed type authorized AP policy.
 - add-classification-rule- managed [RULE_NAME] enable [PRIORITY] [SSID_TYPE] [SSID]

Parameter	Description
RULE_NAME	Classification policy name
PRIORITY	Priority number
SSID_TYPE	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

Parameter	Description
	SSID_NAME is classified as a friendly type unauthorized AP.)
SSID_NAME	SSID that is used when the SSID_TYPE is entered as user-configured-ssid

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

Configuration using Web UI

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

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

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

Figure 184. Managed Rule Configuration Window

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

Figure 185. Managed Addition Window

8.2.2.2 Configuring the unmanaged AP classification policy

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

Configuration using CLI

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

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

- 2) Configure the unmanaged type unauthorized AP policy.
 - add-classification-rule-unmanaged [RULE_NAME] enable [PRIORITY] [MATCH_TYPE] [MIN_RSSI] [MIN_DURATION] [NO_OF_MIN_ASSOC CLIENTS] [ENCRYPTION] [SSID_TYPE] [SSID]

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

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

Configuration using Web UI

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

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



Figure 186. Unmanaged Rule Configuration Window

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

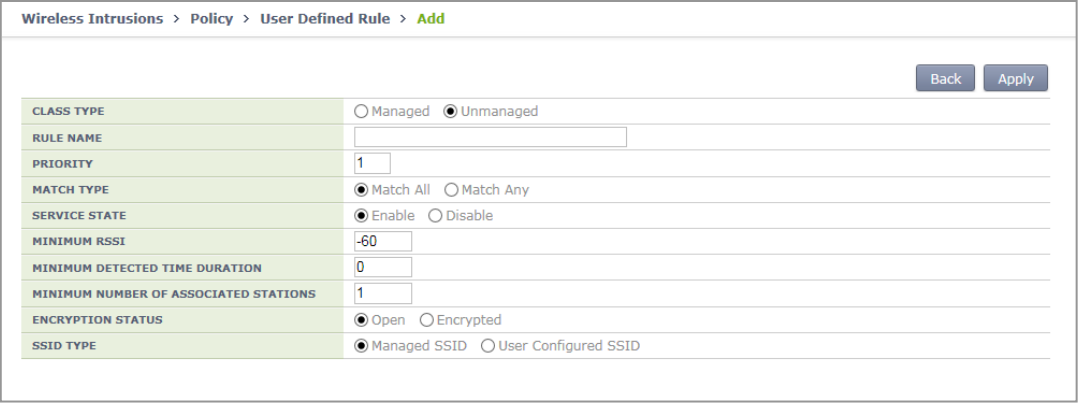


Figure 187. Unmanaged Rule Addition Window

8.2.2.3 Manual configuration (Move)

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

Configuration using CLI

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

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

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

- move [MAC] [FROM] [TO]

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

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

Configuration using Web UI

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

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

Wireless Intrusions > AP

Current Filter : None Change

Containment Remove Export

Total Entry : 1432

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

Figure 188. List Window to Manually Change Classification

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

Wireless Intrusions > AP > Detail

Back Apply

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

Figure 189. Classification Change Window in AP Detail Screen

8.2.2.4 Manual configuration (Remove)

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

Configuration using CLI

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

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

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

Parameter	Description
MAC	MAC address of an unauthorized AP

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

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitor> and then select the <Wireless Intrusion> → <AP> menu in the sub-menus. And when the AP list is displayed, check a desired MAC in the list and click the <Remove> button to manually remove an AP.

In addition, after going into the detail view screen by selecting one out of the AP list, operator can also remove an AP by changing the REMOVE MANUALLY option to On.

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

Wireless Intrusions > AP

Current Filter : None Change

Containment Remove Export

Total Entry : 1432

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

Figure 190. List Window to Manually Remove

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

Wireless Intrusions > AP > Detail

Back Apply

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

Figure 191. Manual Remove Change Window in AP Detail Screen

8.2.2.5 Unauthorized AP detection option

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

Configuration using CLI

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

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

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

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

The description of OPTION parameter is as follows:

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

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

Configuration using Web UI

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

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

Option	Detect & Notify	Detect	None
AP BLACKLIST	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
HONEYPOT ASSOCIATED WITH UNMANAGED STATION	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
HONEYPOT	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
HIDDEN SSID	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
FAKE AP WORKS ON INVALID CHANNEL	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
INVALID SECURITY	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
MAC SPOOFING	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
INVALID CHANNEL	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
ADHOC	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
MANAGED AP WORKS ON VALID CHANNEL	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
UNCLASSIFIED	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
FAKE AP WITH INVALID UIC	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
USER DEFINED MANAGED AP	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Figure 192. Configuration Window for Unauthorized AP Detection Option

8.2.2.6 Unauthorized client detection option

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

Configuration using CLI

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

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

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

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

The description of OPTION parameter is as follows:

Parameter	Description
assoc-fail-det	Classifies a client that exceeds the association fail threshold as an unauthorized client.
auth-fail-det	Classifies a client that exceeds the authentication fail

Parameter	Description
	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.
staBlack-list	Classifies a station whose MAC is found in the station blacklist as an unauthorized station.
oneXauth-fail-det	Classifies a client that exceeds the 802.1X authentication fail threshold 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.
Unclassified	Unclassified station

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

Configuration using Web UI

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

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

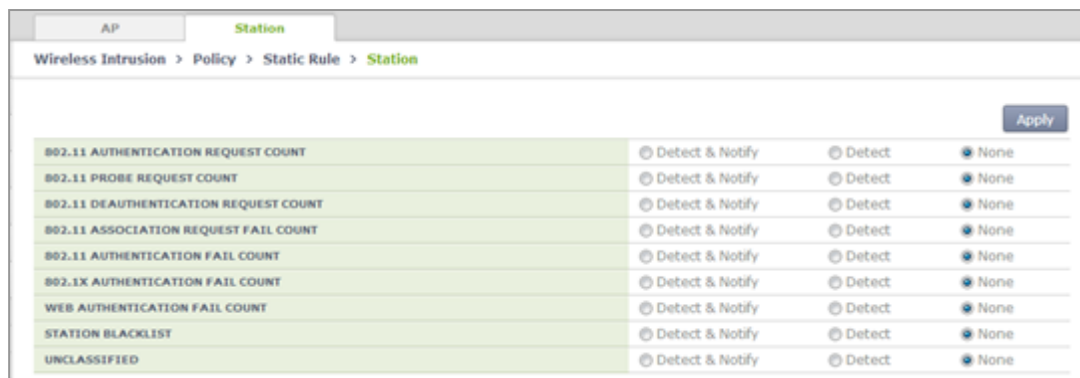


Figure 193. Configuration Window for Unauthorized Station Detection Option

8.2.2.7 Unauthorized Channel Validation Configuration

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

Configuration using CLI

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

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

- 2) Enable the unauthorized channel validation function.

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

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

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

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

Configuration using Web UI

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

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

Wireless Intrusions > Channel Validation

Apply

General

SERVICE STATE ¹ ☒ Enable ☐ Disable

Apply

Valid Channel List ²

2.4GHZ	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input checked="" type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8	<input type="checkbox"/> 9	<input checked="" type="checkbox"/> 10
	<input type="checkbox"/> 11	<input type="checkbox"/> 12	<input type="checkbox"/> 13							
5GHZ	<input type="checkbox"/> 36	<input type="checkbox"/> 40	<input type="checkbox"/> 44	<input type="checkbox"/> 48	<input type="checkbox"/> 52	<input type="checkbox"/> 56	<input type="checkbox"/> 60	<input type="checkbox"/> 64	<input type="checkbox"/> 100	<input type="checkbox"/> 104
	<input type="checkbox"/> 108	<input type="checkbox"/> 112	<input type="checkbox"/> 116	<input type="checkbox"/> 120	<input type="checkbox"/> 124	<input type="checkbox"/> 128	<input type="checkbox"/> 132	<input type="checkbox"/> 136	<input type="checkbox"/> 140	<input type="checkbox"/> 149
	<input type="checkbox"/> 153	<input type="checkbox"/> 157	<input type="checkbox"/> 161	<input type="checkbox"/> 165						

Figure 194. Configuration Window for Channel Validation

8.2.2.8 Configuring and Searching Black/White List

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

Configuration using CLI

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

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

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

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

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

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

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

Parameter	Description
OUI	First 3 bytes of station MAC address

5) Configure the Managed/Neighbor AP.

- Managed [MAC] [TYPE]

Parameter	Description
MAC	AP MAC address of Managed/Neighbor AP
TYPE	<ul style="list-style-type: none"> - Managed: Indicates that the address is located internally during configuration - Neighbor: Indicates that the address is located externally during configuration

6) To check the changed configuration, execute the following command.

- show wi lists managed-ap
- show wi lists ap-blacklist
- show wi lists managed-stat
- show wi lists client-blacklist
- show wi lists managed ssid
- show wi lists oui-list
- show wi lists neighbor-ap

Configuration using Web UI

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

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

Figure 195. AP blacklist Configuration Window

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

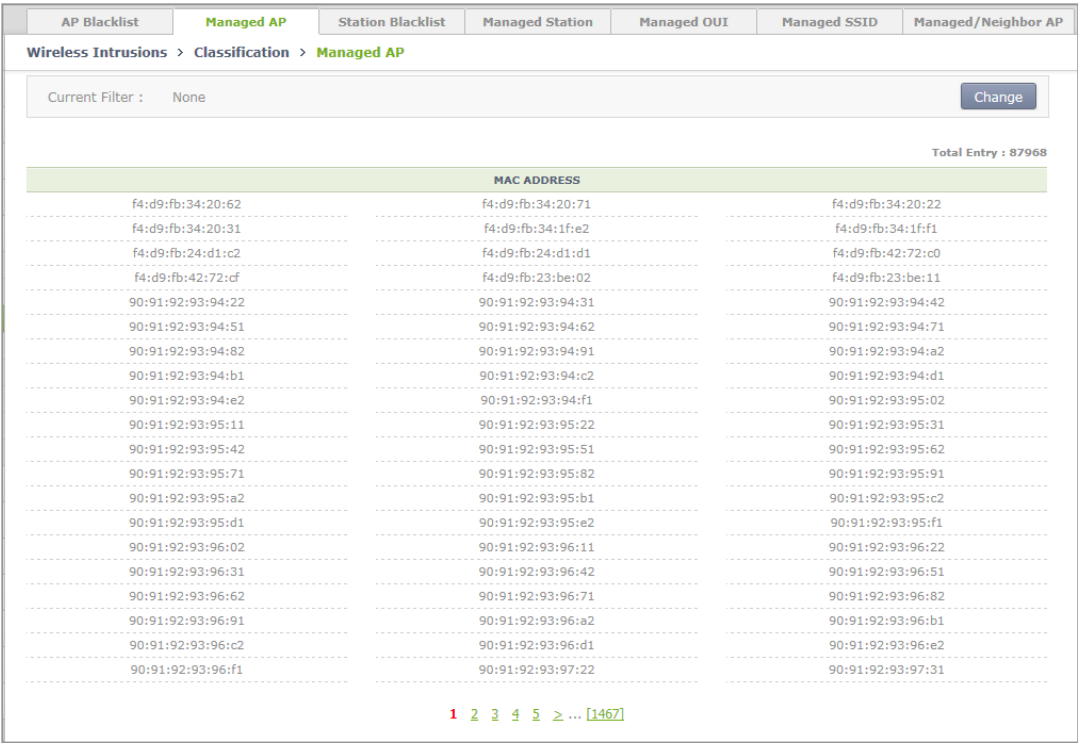


Figure 196. Managed AP Window

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

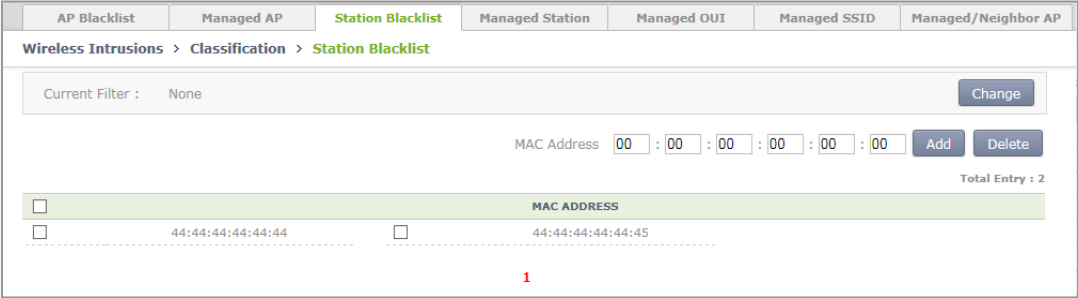


Figure 197. Station blacklist Search/Configuration Window

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

AP Blacklist	Managed AP	Station Blacklist	Managed Station	Managed OUI	Managed SSID	Managed/Neighbor AP
Wireless Intrusions > Classification > Managed Station						
Current Filter : None				Change		
						Total Entry : 114
MAC ADDRESS						
a2:a3:a4:a5:a7:1d			a2:a3:a4:a5:a6:1c			a2:a3:a4:a5:a6:82
a2:a3:a4:a5:a8:37			a2:a3:a4:a5:a8:7b			a2:a3:a4:a5:a9:d3
a2:a3:a4:a5:a9:4e			a2:a3:a4:a5:a7:5b			a2:a3:a4:a5:a9:d8
a2:a3:a4:a5:a7:e1			a2:a3:a4:a5:a9:c6			a2:a3:a4:a5:a9:86
a2:a3:a4:a5:a8:50			a2:a3:a4:a5:a7:e0			a2:a3:a4:a5:a9:5c
a2:a3:a4:a5:a9:ab			a2:a3:a4:a5:a6:a9			a2:a3:a4:a5:a9:40
a2:a3:a4:a5:a9:45			a2:a3:a4:a5:a7:20			a2:a3:a4:a5:a6:06
a2:a3:a4:a5:a9:30			a2:a3:a4:a5:a8:0c			a2:a3:a4:a5:a8:85
a2:a3:a4:a5:a7:03			a2:a3:a4:a5:a8:92			a2:a3:a4:a5:a8:a5
a2:a3:a4:a5:a9:b8			a2:a3:a4:a5:a6:a3			a2:a3:a4:a5:a6:36
a2:a3:a4:a5:a8:1c			a2:a3:a4:a5:a8:64			a2:a3:a4:a5:a8:fb
a2:a3:a4:a5:a9:bc			a2:a3:a4:a5:a8:d6			a2:a3:a4:a5:a8:01
a2:a3:a4:a5:a8:69			a2:a3:a4:a5:a7:e8			a2:a3:a4:a5:a9:2f
a2:a3:a4:a5:a6:75			a2:a3:a4:a5:a7:0e			a2:a3:a4:a5:a6:03
a2:a3:a4:a5:a6:0c			a2:a3:a4:a5:a6:d8			a2:a3:a4:a5:a6:d5
a2:a3:a4:a5:a6:2c			a2:a3:a4:a5:a9:94			a2:a3:a4:a5:a8:8b
a2:a3:a4:a5:a7:0a			a2:a3:a4:a5:a6:d9			a2:a3:a4:a5:a7:07
a2:a3:a4:a5:a8:6a			a2:a3:a4:a5:a9:81			a2:a3:a4:a5:a6:70
a2:a3:a4:a5:a7:4d			a2:a3:a4:a5:a8:20			a2:a3:a4:a5:a8:0e
a2:a3:a4:a5:a8:f1			a2:a3:a4:a5:a6:f2			a2:a3:a4:a5:a9:a9
1 2						

Figure 198. Managed Station Search Window

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

AP Blacklist

Managed AP

Station Blacklist

Managed Station

Managed OUI

Managed SSID

Managed/Neighbor AP

Wireless Intrusions > Classification > Managed OUI

Current Filter : None

Change

OUI

00 : 00 : 00

Add

Delete

Total Entry : 6052

OUI					
<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
<input type="checkbox"/>	33:33:01	<input type="checkbox"/>	33:33:02	<input type="checkbox"/>	33:33:03
<input type="checkbox"/>	33:33:04	<input type="checkbox"/>	a0:11:01	<input type="checkbox"/>	a0:11:02
<input type="checkbox"/>	a0:11:03	<input type="checkbox"/>	a0:11:04	<input type="checkbox"/>	a0:11:05
<input type="checkbox"/>	a0:11:06	<input type="checkbox"/>	a0:11:07	<input type="checkbox"/>	a0:11:08
<input type="checkbox"/>	a0:11:09	<input type="checkbox"/>	a0:11:10	<input type="checkbox"/>	a0:11:11
<input type="checkbox"/>	a0:11:12	<input type="checkbox"/>	a0:11:13	<input type="checkbox"/>	a0:11:14
<input type="checkbox"/>	a0:11:15	<input type="checkbox"/>	a0:11:16	<input type="checkbox"/>	a0:11:17
<input type="checkbox"/>	a0:11:18	<input type="checkbox"/>	a0:11:19	<input type="checkbox"/>	a0:11:20
<input type="checkbox"/>	a0:11:21	<input type="checkbox"/>	a0:11:22	<input type="checkbox"/>	a0:11:23
<input type="checkbox"/>	a0:11:24	<input type="checkbox"/>	a0:11:25	<input type="checkbox"/>	a0:11:26
<input type="checkbox"/>	a0:11:27	<input type="checkbox"/>	a0:11:28	<input type="checkbox"/>	a0:11:29
<input type="checkbox"/>	a0:11:30	<input type="checkbox"/>	a0:11:31	<input type="checkbox"/>	a0:11:32
<input type="checkbox"/>	a0:11:33	<input type="checkbox"/>	a0:11:34	<input type="checkbox"/>	a0:11:35
<input type="checkbox"/>	a0:11:36	<input type="checkbox"/>	a0:11:37	<input type="checkbox"/>	a0:11:38
<input type="checkbox"/>	a0:11:39	<input type="checkbox"/>	a0:11:40	<input type="checkbox"/>	a0:11:41
<input type="checkbox"/>	a0:11:42	<input type="checkbox"/>	a0:11:43	<input type="checkbox"/>	a0:11:44
<input type="checkbox"/>	a0:11:45	<input type="checkbox"/>	a0:11:46	<input type="checkbox"/>	a0:11:47
<input type="checkbox"/>	a0:11:48	<input type="checkbox"/>	a0:11:49	<input type="checkbox"/>	a0:11:50
<input type="checkbox"/>	a0:11:51	<input type="checkbox"/>	a0:11:52	<input type="checkbox"/>	a0:11:53
<input type="checkbox"/>	a0:11:54	<input type="checkbox"/>	a0:11:55	<input type="checkbox"/>	a0:11:56

1 2 3 4 5 > ... [101]

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

AP Blacklist	Managed AP	Station Blacklist	Managed Station	Managed OUI	Managed SSID	Managed/Neighbor AP
Wireless Intrusions > Classification > Managed SSID						
Current Filter : None						Change
						Total Entry : 255
SSID						
ZCLUSTERED_RRM_5G	ZCLUSTERED_RRM_2G	ZRRM_TEST1				
ZCLUSTERED_RRM_3	ZCLUSTER_TEST_5	ZCLUSTER_1234567890				
ZCLUSTER_7777	ZCLUSTER_8888	ZCLUSTER_9999				
ZCLUSTER_10	ZCLUSTER_11	ZCLUSTER_12				
ZCLUSTER_13	ZCLUSTER_14	ZCLUSTER_15				
ZCLUSTER_TEST_16	ZRRM_17	ZRRM_18				
ZRRM_19	ZRRM_20	ZRRM_21				
ZRRM_22	ZRRM_23	ZRRM_24				
ZRRM_25	ZRRM_26	ZRRM_27				
ZRRM_28	ZRRM_29	ZRRM_30				
ZRRM_31	ZRRM_32	ZRRM_33				
ZRRM_34	ZRRM_35	ZRRM_36				
ZRRM_37	ZRRM_38	ZRRM_39				
ZRRM_40	ZRRM_41	ZRRM_42				
ZRRM_43	ZRRM_44	ZRRM_45				
ZRRM_46	ZRRM_47	ZRRM_48				
ZRRM_49	ZRRM_50	ZRRM_51				
ZRRM_52	ZRRM_53	ZRRM_54				
ZRRM_55	ZRRM_56	ZRRM_57				
ZRRM_58	ZRRM_59	ZRRM_60				
1 2 3 4 5						

Figure 199. Managed SSID Window

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

AP Blacklist

Managed AP

Station Blacklist

Managed Station

Managed OUI

Managed SSID

Managed/Neighbor AP

Wireless Intrusions > Classification > Managed/Neighbor AP

Current Filter : None

Change

Add

Delete

Total Entry : 8

	MAC ADDRESS	STATE
<input type="checkbox"/>	f4:d9:fb:24:d2:02	Managed
<input type="checkbox"/>	f4:d9:fb:37:a9:02	Neighbor
<input type="checkbox"/>	f4:d9:fb:37:a1:02	Managed
<input type="checkbox"/>	f4:d9:fb:35:e6:03	Neighbor
<input type="checkbox"/>	f4:d9:fb:36:c5:04	Neighbor
<input type="checkbox"/>	f4:d9:fb:23:be:04	Managed
<input type="checkbox"/>	22:22:22:22:22:22	Managed
<input type="checkbox"/>	22:22:22:22:22:23	Managed

1

Figure 200. Managed/Neighbor AP Search/Configuration Window

- Managed/Neighbor AP list addition screen

Figure 201. Managed/Neighbor AP List Addition Window

8.2.2.9 Station Allow Limit

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

Configuration using CLI

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

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

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

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

Configuration using Web UI

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

Wireless Intrusions > Station Allow Limit

Apply

EXCESSIVE 802.11 AUTH REQUESTS THRESHOLD	3
EXCESSIVE 802.11 DEAUTH REQUESTS THRESHOLD	5
EXCESSIVE 802.11 PROBE REQUESTS THRESHOLD	5
EXCESSIVE 802.11 ASSOCIATION FAILURES THRESHOLD	5
EXCESSIVE 802.11 AUTH FAILURES THRESHOLD	5
EXCESSIVE 802.1X AUTH FAILURES THRESHOLD	3
EXCESSIVE WEB AUTH FAILURES THRESHOLD	5

Foot Notes :

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

Figure 202. Station Allowed Limit Configuration Window

8.2.3 Enabling Blocking Function

The setting of enabling the blocking function is as follows:

Configuration using CLI

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Enable the blocking function.

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

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

Configuration using Web UI

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

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



Figure 203. Wireless Intrusion Containment General Configuration Window

8.2.4 Blocking

The Wireless Enterprise WLAN system performs blocking to the detected AP and the wireless device.

The method for blocking is classified as follows:

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

8.2.4.1 Configuring Manual Blocking

To configure manual blocking, execute the command as follows:

Configuration using CLI

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

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

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

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

Configuration using Web UI

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

Select the target and perform containment to perform manual blocking.

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

Wireless Intrusion > AP

Current Filter : None Change

Containment Remove Export

Total Entry : 1846

	MAC ADDRESS	SSID	CHANNEL NUMBER	NUMBER OF CLIENTS	CLASS TYPE	STATUS	DETECTING AP
<input type="checkbox"/>	3c:a1:0d:11:00:29		6	2	Unmanaged	Removed	00:00:f0:07:08:29
<input type="checkbox"/>	00:00:f0:d2:00:40	PMF_TEST_1X	40	0	Unmanaged	Alert	f4:d9:fb:42:77:ae
<input type="checkbox"/>	00:00:f0:d2:00:41	PMF_TEST_PSK	40	1	Unmanaged	Alert	f4:d9:fb:42:77:ae
<input type="checkbox"/>	00:00:aa:01:01:23	hoon	157	0	Unmanaged	Alert	00:00:f0:07:08:29
<input type="checkbox"/>	00:00:f0:07:04:80	stability	157	0	Unmanaged	Alert	00:00:f0:07:08:29
<input type="checkbox"/>	00:00:f0:07:04:81	stability3	157	0	Unmanaged	Alert	00:00:f0:07:08:29
<input type="checkbox"/>	00:00:f0:07:04:82	stability4	157	0	Unmanaged	Removed	00:00:f0:07:08:29
<input type="checkbox"/>	00:00:f0:07:04:83	SMBtest01	157	0	Unmanaged	Alert	00:00:f0:07:08:29
<input type="checkbox"/>	00:00:f0:07:04:84	External	157	0	Unmanaged	Alert	00:00:f0:07:08:29
<input type="checkbox"/>	f4:d9:fb:24:04:e2	testgroup16	1	0	Unmanaged	Alert	f4:d9:fb:35:9f:ad
<input type="checkbox"/>	f4:d9:fb:24:04:e2	testgroup1	149	0	Unmanaged	Alert	f4:d9:fb:42:77:ae
<input type="checkbox"/>	f4:d9:fb:24:04:e3	testgroup15	1	0	Unmanaged	Alert	00:00:f0:07:08:29
<input type="checkbox"/>	f4:d9:fb:24:04:e3	testgroup2	149	0	Unmanaged	Alert	f4:d9:fb:42:77:ae
<input type="checkbox"/>	f4:d9:fb:24:04:e4	testgroup14	1	0	Unmanaged	Alert	f4:d9:fb:42:77:ae

Figure 204. List Window for Blocking AP

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

Wireless Intrusion > Station

Current Filter : None Change

Containment Export

Total Entry : 498

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

Figure 205. List Window for Blocking Station

8.2.4.2 Configuring Automatic Blocking

To configure automatic blocking, execute the command as follows:

Configuration using CLI

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

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

- 2) Configure automatic blocking.

- auto[OPTION]

The description of OPTION parameter is as follows:

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

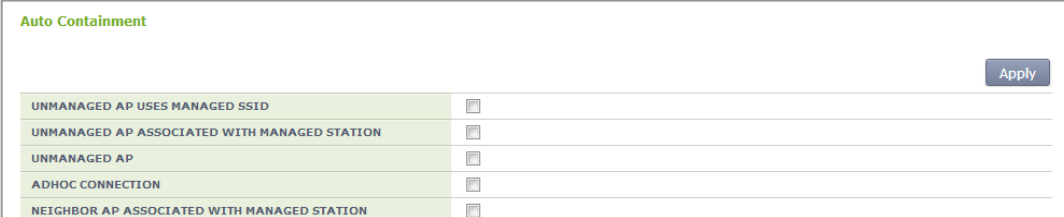
Parameter	Description
unmanaged-ap-uses-managed-ssid	If the honeypot is detected, it is automatically blocked.
unmanaged-ap	If the unmanaged AP is detected, it is automatically blocked.

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

Configuration using Web UI

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

Select the target and press Apply to configure automatic blocking.



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

Figure 206. Automatic Blocking Configuration Window

8.3 Captive Portal

The Wireless Enterprise WLAN system provides the Captive Portal function. A Web Certified user can receive a normal service after connected to a specific WLAN (SSID) and going through user authentication.

8.3.1 Configuring Web Authentication User

Configuration using CLI

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

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

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

- 2) The command to add a web authentication user is as follows:
 - Web-auth-users add [ID][PASSWD][START_TIME][END_TIME]

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

- 3) The command to add a web authentication user is as follows:
 - Web-auth-users delete [ID]

Parameter	Description
ID	User ID

Configuration using Web UI

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

Web Authentication Users

USER ID

Generator

PASSWORD

Generator

CONFIRM PASSWORD

START TIME

2015-01-08

00

:

00

:

00

☐ Immediate

END TIME

2015-01-08

23

:

59

:

59

☐ Unlimited

FULL NAME

COMPANY

EMAIL

PHONE

MAX ALLOWED STATIONS

STATUS

☒ Enable ☐ Disable

COMMENTS

Sponsor

NAME

DEPARTMENT

EMAIL

PHONE

COMMENTS

Figure 207. Web Certification User Configuration Window

The operator can check and delete a Web Certification User created in the <Web Certification Users> menu.

AddDelete

Total Entry : 1

<input type="checkbox"/>	USER ID	START TIME	END TIME
<input type="checkbox"/>	u2	2013-08-13 07:00:00	9999-99-99 99:99:99

Figure 208. Web Ceertification User List Window

8.3.2 Configuring Pre-Auth ACL

To operate the captive portal services, redirection must be basically performed and if a drop occurs by the Pre-Auth ACL of the WLAN, the redirection is performed.

Accordingly, the proper configuration of the ACL for Pre-Auth is necessary depending on types of captive portal services.

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

Configuration using CLI

To configure the Pre-Auth ACL, execute the following command:

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

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

- 2) Configure an access list.

```
WEC8500/configure/fqm-mode#
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 1 udp
any eq * any eq 53 os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 2 tcp
192.168.20.10 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 3 tcp
any eq * 192.168.20.10 255.255.255.255 eq 80 os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 4 tcp
90.90.100.120 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 5 tcp
any eq * 90.90.100.120 255.255.255.255 eq 80 os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 6 udp
any eq * any eq * os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 7 tcp
192.168.10.10 255.255.255.255 eq 80 any eq * os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 8 tcp
any eq * 192.168.10.10 255.255.255.255 eq 80 os-aware *
WEC8500/configure/fqm-mode# access-list ip guest_acl permit seq 10 tcp
192.168.0.0 255.255.0.0 eq * any eq 443 os-aware *
```

Configuration using Web UI

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

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

☐

NAME

Add

Delete

Figure 209. Access List Addition Window

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

Figure 210. Access List Entry Addition Window

8.3.3 Configuring Web Authentication

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

Configuration using CLI

[WLAN Configuration]

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

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

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

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

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

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

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

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

Parameter	Description
ACL	ACL applied before authenticated

- 5) Configures Web Page Type
 - web-page-type [Page Type]

Parameter	Description
Page Type	Web authentication method - internal: Uses the internal authentication page. - external: Uses the authentication page of an external web server. - downloaded: Uses the authentication page downloaded from the system. - customized: Uses the authentication page created through configuration.

6) Configure the Web Authentication Server.

- server-type [Server Type]

Parameter	Description
Server Type	Type of the authentication server (local-only, radius-only, local-radius, radius-local)

7) Configure the Primary/Secondary Radius Server.

- radius-servers [Radius ID] [Radius ID]

Parameter	Description
Radius ID	Radius ID used for authentication (1~48, 255 (internal server))

8) Configure the Cache Duration.

- cache-duration [Days]

Parameter	Description
Days	Cache validity since authentication

9) Configure the After Authentication Type.

- after-auth [Auth Type]

Parameter	Description
Auth Type	Operation after authentication - redirect: Redirect to a specified URL. - request: Redirect to a requested URL.

- after-auth-redirect-url [URL]

Parameter	Description
URL	Redirect URL if after auth type is redirect

10) The configuration can be checked using the 'show wlan security detail' command.

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

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANs> menu in the sub-menus. Select a WLAN ID in the WLANs screen and go to <L3> on the <Security> tab.

Enable <WEB POLICY>, select the Web Authentication option, and specify the Pre-Auth ACL configured in the ACL for <PRE-AUTHENTICATION ACL>. Specify a web page type to authenticate.

Select <Server Type>, and select a Radius server to perform authentication from <Primary/Secondary Radius Server>.

Enable the operation after authentication and configure <URL>.

For details on <Derivation Profile Name> configuration, see the section on 8.7.2 Derivation Profile Configuration in this document.

ID	1
PROFILE NAME	wlan1
WEB POLICY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
	<input checked="" type="radio"/> Web Authentication
	<input type="radio"/> Web Authentication on MAC Authentication failure ¹
	<input type="radio"/> Web Pass Through
	<input type="radio"/> Conditional Web Redirection
	<input type="radio"/> One Time Redirection
PRE-AUTHENTICATION ACL	pre_acl ▼
WEB PAGE TYPE	Customized ▼
Web Authentication ²	
SERVER TYPE	Local ▼
PRIMARY RADIUS SERVER ▼
SECONDARY RADIUS SERVER ▼
CACHE DURATION (DAYS)	1 days
AFTER AUTHENTICATION	<input type="radio"/> Redirect to the requested URL <input checked="" type="radio"/> Redirect URL
	http://2.2.2.2/index.php
DERIVATION PROFILE NAME ▼

Figure 211. WLAN Web Policy Configuration Window

8.3.4 Configuring Web Authentication on MAC Authentication Failure

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

Configuration using CLI

[WLAN Configuration]

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

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

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

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

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

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

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

Next step, refer to CLI of 8.3.2 Web Authentication.

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANS> menu in the sub-menus. In the WLANS screen, select WLAN ID and go to the <L2> of the <Security> tab. Enable <MAC AUTHENTICATION>.

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

Figure 212. WLAN Layer 2 Security Configuration Window

Go to the <L3> of the <Security> tab.

Enable <WEB POLICY> and select the Web Authentication on MAC Authentication Failure

Next step, refer to Configures Web UI at 8.3.2 Web Authentication.

ID	1
PROFILE NAME	wlan1
WEB POLICY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
	<input type="radio"/> Web Authentication
	<input checked="" type="radio"/> Web Authentication on MAC Authentication failure ¹
	<input type="radio"/> Web Pass Through
	<input type="radio"/> Conditional Web Redirection
	<input type="radio"/> One Time Redirection
PRE-AUTHENTICATION ACL	pre_acl ▼
WEB PAGE TYPE	Internal ▼

Figure 213. WLAN Web Policy Configuration Window

8.3.5 Configuring Web Pass-through

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

Configuration using CLI

[WLAN Configuration]

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

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

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

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

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

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

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

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

Parameter	Description
ACL	ACL for occurrence of redirection

- 5) Configure the Web Page Type.
 - web-page-type [Page Type]

Parameter	Description
Page Type	Web authentication method - external: Uses the authentication page of an external web server. - downloaded: Uses the authentication page downloaded from the system.

- 6) The configuration can be checked using the 'show wlan security detail' command.

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

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANS> menu in the sub-menus. In the WLANS screen, select WLAN ID, move to <Security> -> <L3> , enable the <WEB POLICY> option, select Web PassThrough, enable <OVERRIDING REDIRECT URL>, set <URL>

ID	1
PROFILE NAME	wlan1
WEB POLICY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
	<input type="radio"/> Web Authentication
	<input type="radio"/> Web Authentication on MAC Authentication failure ¹
	<input checked="" type="radio"/> Web Pass Through
	<input type="radio"/> Conditional Web Redirection
	<input type="radio"/> One Time Redirection
PRE-AUTHENTICATION ACL	pre_acl ▼
WEB PAGE TYPE	Downloaded ▼

Figure 214. Web Pass-through Configuration Window

8.3.6 Configuring One Time Redirection

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

Configuration using CLI

[WLAN Configuration]

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

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

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

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

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

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

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

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

Parameter	Description
ACL	ACL to perform redirection

- 5) Configures Pre-Authentication ACL
 - Web-policy oneTimeRedirection

Parameter	Description
Page Type	Web authentication method - external: Uses the authentication page of an external web server. - downloaded: Uses the authentication page downloaded from the system.

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

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

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select the <WLANs> menu in the sub-menus. In the WLANs screen, select WLAN ID and go to the <L3> of the <Security> tab.

Enable <WEB POLICY> and select One Time Redirection.

Enable <OVERRIDING REDIRECT URL> and configure <URL>.

ID	1
PROFILE NAME	wlan1
WEB POLICY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
<input type="radio"/> Web Authentication	
<input type="radio"/> Web Authentication on MAC Authentication failure ¹	
<input type="radio"/> Web Pass Through	
<input type="radio"/> Conditional Web Redirection	
<input checked="" type="radio"/> One Time Redirection	
PRE-AUTHENTICATION ACL	pre_acl ▼
WEB PAGE TYPE	Downloaded ▼

Figure 215. One Time Redirection Configuration Window

8.3.7 Redirection Address Format

The Captive Portal attempts at first redirection for the request of the web service of the station.

The redirection address transmitted by the station in the APC to perform redirection is formed as follows:

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

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

8.3.8 Captive Portal Web Page Configuration

The Captive Portal allows the user to access the Internet using an ID and a password assigned on the web page. Instead of using web pages on external web servers, default internal web pages, edited versions of internal web pages or downloaded web pages can be used. Alternatively, guests could be allowed to access the Internet simply by entering their email, etc.

Internal web page configuration can be done in Configuration > Security > Captive Portal > Web Page. The configured web page can be selected when configuring L3 for the WLAN.

WEB PAGE TYPE	Description
Internal	Default internal web pages
Downloaded	Downloading web pages to the system

WEB PAGE TYPE	Description
Customized	Editing internal web pages Logo, Header, Body, Footer, etc. can be edited on internal web pages. After enabling the GUEST SELF REGISTRATION option in Customized, the user only needs to enter the name, email, etc. to access the Internet service.



Web authentication user accounts

Up to 2048 web authentication user accounts can be registered, and Guest Self Registration is also created as a web authentication account.

8.3.9 Captive Portal Web Service Configuration

Web Service Address and Web Service Port can be configured in Configuration > Security > Captive Portal > Web Service.

If the Captive Portal is using an internal web server, the IP address and name of the system can be configured in Web Service Address.

The domain name entered is displayed on the Captive Portal web browser so that the IP address is not shown in tunnel mode.

A domain name and a matching IP address can be configured.

If no IP address is entered, the AP Management IP address is used by default.

When in Local Bridge mode, since domain names cannot be used, the address entered in IP ADDRESS is shown as the internal web server address of the system.

Ports allowed in Pre Auth can be configured in Web Service Port.

8.3.10 Captive Portal Authentication Cache List

The web authenticated list can be viewed in Configuration > Security > Captive Portal > Web Auth. Cache List. Once authenticated, web authenticated users can continue using the Internet without re-authentication over multiple sessions for a set period of time.

The length of time allowed for Internet access without requiring re-authentication can be configured using Cache Duration (Days) in the L3 option when creating the WLAN.

8.4 NAT and Firewall Configuration

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

8.4.1 Firewall Configuration

Configuration using CLI

[Firewall Configuration]

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Configure the accelerator function of a firewall.

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

[Firewall Configuration using Access List]

- 1) Go to the configure mode of the 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.

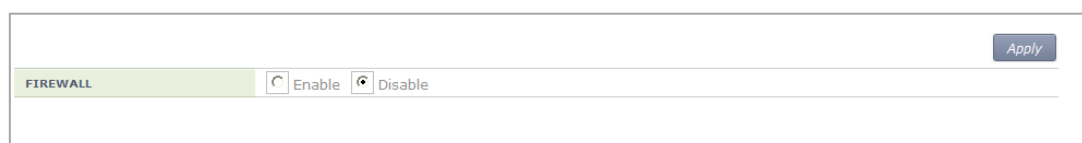


Figure 216. Firewall configuration (1)

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 217. Firewall configuration (2)

8.4.2 Access List Configuration

Configuration using CLI

- 1) Go to the configure mode of the 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.

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

Figure 218. Access-list configuration

8.4.3 NAT Configuration

Configuration using CLI

[SNAT Configuration using Access List]

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

- 1) Go to the configure mode of the 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 the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Configure a NAT to the interface.

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

- 3) Configure a NAT rule using a static IP.

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

[DNAT Configuration using Access List]

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

- 1) Go to the configure mode of the 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 the configure mode of the 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.

					Back	Apply
NAME	pool1					
START IP ADDR	192	168	20	10		
END IP ADDR	192	168	20	200		
SUBNET MASK	255	255	255	0		

Figure 219. 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.

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

Figure 220. NAT configuration (2)



NOTE

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

8.5 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: 1-20)

- 3) Configure the filtering policy.

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

Parameter	Description
POLICY	Table policy of MAC filtering list

- 4) Configure a MAC entry.

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

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

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

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

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

6) You can check the configured information below.

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

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

Configuration using Web UI

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

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

Security > MAC Filter

Add

Delete

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

Figure 221. MAC configuration

The procedure for MAC entry configuration is given below.

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

Security > MAC Filter > Add

Back

Apply

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

Figure 222. MAC entry configuration window(1)

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

Security > MAC Filter > Edit	
INDEX	1
NAME	MAC_Filter_1
POLICY ¹	Deny
RADIUS AUTH ²	disable
INTERVAL ³	1
COUNT	0

Figure 223. MAC entry configuration(2)

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

WLANs > WLANs > Security > L2	
L2 L3 Radius	
PROFILE NAME	wlan2
L2 SECURITY TYPE ¹	None
MAC FILTER	MAC_Filter_1

Figure 224. MAC entry configuration(3)

8.6 Operator Authentication through Interoperation with TACACS+ Server

A Wireless Enterprise wireless LAN system provides an operator authentication function by interoperating with an external TACACS+ server.

8.6.1 Configuring External TACACS+ Server

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

8.6.1.1 Basic Settings

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

Configuration using CLI

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

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

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

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

Parameter	Description
IP_ADDRESS	IP address of the TACACS+ server

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

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

Parameter	Description
KEY_STRING	Public key of the TACACS+ server

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

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

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

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

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

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

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

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

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

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

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

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

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

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


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

Configuration using Web UI

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

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

The server addition window is shown below.

Figure 225. TTACACS+ Server Configuration Window

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

8.6.2 Configuring Authentication Type of Operator Account

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

Configuration using CLI

- 1) Go to the configure mode of the CLI.

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

- 2) Configure the type of operator account authentication.

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

Parameter	Description
AUTH_TYPE	<p>Authentication type of the operator account (default value: local)</p> <ul style="list-style-type: none"> - local: Authentication is performed using the database stored inside. - tacacs: Authentication is performed using the TACACS+ server. - local-tacacs: Authentication is performed using the database stored inside first, and, failing that, an authentication request is transmitted to the TACACS+ server. - tacacs-local: An authentication request is transmitted to the TACACS+ server first, and, failing that, authentication is performed using the DB stored inside.

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

Configuration using Web UI

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

Security > AAA > Management User

ORDER USED FOR AUTHENTICATION: TACACS+/Local

Apply

Figure 226. Operator Account Authentication Type Configuration Window

8.7 Role Based Access Control

The Wireless Enterprise WLAN system can manage the user's access authority depending on a designated role.

It can designate ACL, limit the bandwidth, designate the interface, or manage redirecting URL, etc. by user.

8.7.1 Configuring Role Profile

The Wireless Enterprise WLAN system can designate the configuration of ACL, QoS, VLAN, and URL and manage as a profile.

To provide a service of a role desired to a specific user or a user group, it can use a role profile.

8.7.1.1 Configuring Profile

The basic settings of the role profile are as follows:

Configuration using CLI

Example:

```
WEC8500# configure terminal
WEC8500/configure# rbac
WEC8500/configure/rbac# role-profile role_01
WEC8500/configure/rbac/role-profile role_01# acl acl1
WEC8500/configure/rbac/role-profile role_01# qos 1
WEC8500/configure/rbac/role-profile role_01# vlan 10
WEC8500/configure/rbac/role-profile role_01# url http://www.role1
WEC8500/configure/rbac/role-profile role_01# dpi rbac_dpi_01
WEC8500/configure/rbac/role-profile role_01# end

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

CLI for confirming configuration:

```
WEC8500# show rbac role-profile summary

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

Id ProfileName Acl      Qos Vlan Url                      DpiProfileName
== =====
1  role_01      acl1      1   10  http://www.role1  rbac_dpi_01
```

Configuration using Web UI

Configuration > Security > Role Based Access Control > Role Profile

Example:

Security > Role Based Access Control > Role Profile						
						<input type="button" value="Add"/> <input type="button" value="Delete"/>
Total Entry : 1						
<input type="checkbox"/>	PROFILE NAME	ACL RULE	USER QOS	APPLICATION QOS	VLAN ID	URL
<input type="checkbox"/>	rbac_role_1	acl1	1 (qos1)	rbac_dpi_01	10	http://www.role1

Figure 227. Role Profile Configuration

Security > Role Based Access Control > Role Profile > Edit	
<input type="button" value="Back"/> <input type="button" value="Apply"/>	
PROFILE NAME	rbac_role_1
ACL RULE	acl1
USER QOS	1 (qos1)
APPLICATION QOS	rbac_dpi_01
VLAN ID	10
URL	http://www.role1

Figure 228. Role Profile Add Configuration

8.7.2 Configuring Derivation Profile

The Wireless Enterprise WLAN system can edit conditions to allocate roles and manage by profile.

It can manage a role by user depending on the edited conditions.

8.7.2.1 Configuring Profile

The basic settings of the derivation profile are as follows:

Configuration using CLI

Example:

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

```

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

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

```

CLI for confirming configuration:

```

WEC8500# show rbac derivation-profile summary

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

```

Configuration using Web UI

Configuration > Security > Role Based Access Control > Derivation Profile

Example:

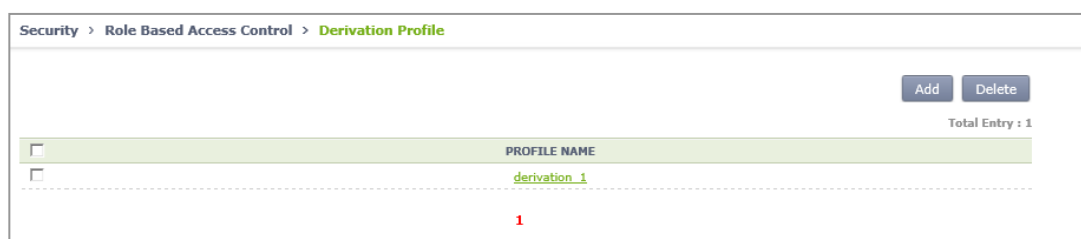


Figure 229. Derivation Profile Configuration

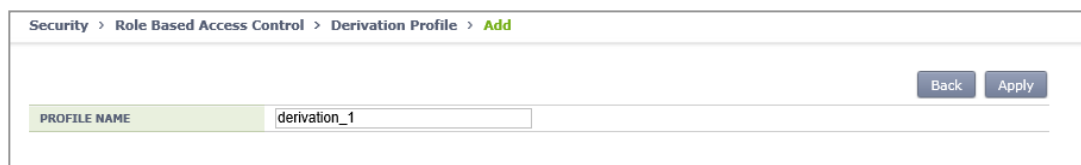


Figure 230. Derivation Profile Add Configuration

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

Back Apply

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

Figure 231. Derivation Profile Configuration

Security > Role Based Access Control > Derivation Profile > **Edit**

Back

PROFILE NAME			
derivation_1			

Add Delete

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

Figure 232. Derivation Profile Add Configuration

8.7.2.2 WLAN Configuration

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

Configuration using CLI

Example:

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

WEC8500/configure/wlan 1# exit
WEC8500/configure# wlan 2
WEC8500/configure/wlan 2# derivation-profile web-auth derivation_2
WEC8500/configure/wlan 2# end
```

CLI for confirming configuration:

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

===== RbacDerivationConfigForWlan =====

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

1	CaptivePortal	0
2	Global	0
2	Open	0
2	Radius	0
2	CaptivePortal	2

Configuration using Web UI

Configuration > WLANs > Security > Radius

Example:

WLANs > WLANs > Security > Radius

L2 | L3 Radius

Back Apply

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

Foot Notes :

1. If L2 Security Type in 'Security > AAA > L2' is one of the following conditions,
- 802.1x
- Static WEP + 802.1x
- WPA+WPA2 and 802.1x is enabled
At least one Radius server should be configured in 'Security > AAA > Radius'. Also, Radius must be enabled in 'WLANs > Security > Radius'

Figure 233. Wlan Derivation Profile Configuration

Configuration > WLANs > Security > L3

Example:

WLANs > WLANs > Security > L3

ID	1
PROFILE NAME	wlan1
WEB POLICY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
<input checked="" type="radio"/> Web Authentication <input type="radio"/> Web Authentication on MAC Authentication failure ¹ <input type="radio"/> Web Pass Through <input type="radio"/> Conditional Web Redirection <input type="radio"/> One Time Redirection	
PRE-AUTHENTICATION ACL	acl2
WEB PAGE TYPE	Internal
Web Authentication ²	
SERVER TYPE	RADIUS
PRIMARY RADIUS SERVER	90.90.1.242 : 1812 / 0
SECONDARY RADIUS SERVER	
CACHE DURATION (DAYS)	1 days
AFTER AUTHENTICATION	<input checked="" type="radio"/> Redirect to the requested URL <input type="radio"/> Redirect URL
DERIVATION PROFILE NAME	rbac_dev_1

Figure 234. Wlan Derivation Profile Configuration

8.7.3 Configuring ACL Profile

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

Security > Role Based Access Control > ACL Profile

Add Delete Send To APs

Total Entry : 1

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

Foot Notes :

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

8.7.3.1 Configuring Profile

The basic settings of the ACL profile are as follows:

Configuration using CLI

Example:

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

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

CLI for confirming configuration:

```
WEC8500# show rbac acl-profile summary

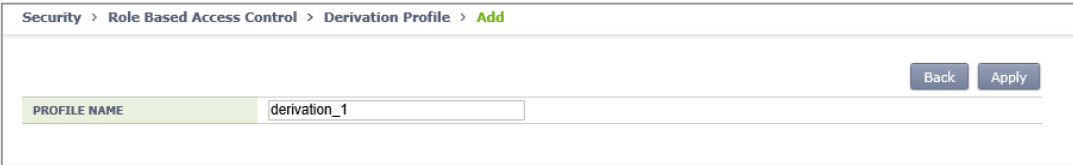
===== LocalSwAclProfile =====

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

Configuration using Web UI

Configuration > Security > Role Based Access Control > Derivation Profile

Example:



Security > Role Based Access Control > Derivation Profile > Add

Back Apply

PROFILE NAME derivation_1

Figure 235. Acl Profile Configuration

Figure 236. Acl Profile Add Configuration

Figure 237. Acl Profile Edit Configuration

8.7.3.2 Remote Ap Group Configuration

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

Configuration using CLI

Example:

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

CLI for confirming configuration:

```
WEC8500# show rbac remote-group summary

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

Configuration using Web UI

Configuration > AP Groups > Remote AP Group > ACL Profile

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

Example:

AP Groups > Remote AP Group > ACL Profile

User Authentication | ACL Profile

Back Send To APs

AP GROUP NAMEtestgroup01

SCOPEAll ACL Profile Only

Apply

ACL PROFILE NAMEtest

OVERWRITE AP CONFIG Tunnel Forwarding Local Bridging Forwarding

Tunnel Forwarding

WLAN Split Tunnel ACL Add Delete

NO.	WLAN	SPLIT TUNNEL ACL	EDIT
1	wlan220	acl01	Edit

Local Bridging Forwarding

WLAN VLAN ID 0 ACL Pre-Auth. ACL Add Delete

NO.	WLAN	VLAN ID	ACL	PRE-AUTH. ACL	EDIT
No data					

Figure 238. Remote Ap Group-Alc Profile Configuration

8.7.4 Configuration Synchronization (Remote AP Group)

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

8.7.4.1 Requesting Synchronization

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

Configuration using CLI

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

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

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

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

Synchronization can be confirmed as follows:

```
WEC8500# show rbac remote-group summary

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

Configuration using Web UI

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

Security > Role Based Access Control > ACL Profile

AddDeleteSend To APs

Total Entry : 0

PROFILE NAME	ACL COUNT	TOTAL RULE COUNT
No data		

Foot Notes :
1. Can't be deleted if the access list is used in an Access Group.

Figure 239. ACL Configuration Synchronization - All

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

AP Groups > Remote AP Group > ACL Profile

User Authentication | ACL Profile

BackSend To APs

AP GROUP NAMEtestgroup01

SCOPEAllACL Profile Only

Apply

ACL PROFILE NAMEtest

OVERWRITE AP CONFIGTunnel ForwardingLocal Bridging Forwarding

Tunnel Forwarding

WLANSplit Tunnel ACLAddDelete

NO.	WLAN	SPLIT TUNNEL ACL	EDIT
1	wlan220	acl01	Edit

Local Bridging Forwarding

WLANVLAN ID 0ACLPRE-Auth. ACLAddDelete

NO.	WLAN	VLAN ID	ACL	PRE-AUTH. ACL	EDIT
No data					

Figure 240. ACL Configuration Synchronization - Remote Group

Configuration > Access Points > Remote AP
→ ‘Send To APs’

Access Points > Remote AP

Back Send To APs

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

Tunnel Forwarding

WLAN Split Tunnel ACL Add Delete

NO.	WLAN	SPLIT TUNNEL ACL	EDIT
1	wlan220	acl01	Edit

Local Bridging Forwarding

WLAN VLAN ID ACL Pre-Auth. ACL Add Delete

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

Figure 241. ACL Configuration Synchronization - Remote AP

8.8 External BYOD Server

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

8.8.1 Configuring External BYOD Server

Configuration using CLI

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

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

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

- 2) Enter the IP address of the BYOD server.

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

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

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

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

- 4) Configure a HTTPS request URL.

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

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

- 5) To check the configured environment, use the 'show security byod configuration' command.

Configuration using Web UI

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

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

Figure 242. External BYOD Server Configuration Window

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

8.8.2 Captive Portal Configuration

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

Configuration using CLI

1) Configuring PreAuthentication ACL

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

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

2) Configuring WLAN

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

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

3) Configuring Web Authentication Type

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

Configuration using Web UI

1) Configuring PreAuthentication ACL

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

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

2) Configuring WLAN

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

Select External for WEB PAGE TYPE, configure the address of the web page redirect on the external BYOD server, and then click Apply.

		Back	Apply
ID	1		
PROFILE NAME	wlan1		
WEB POLICY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable		
	<input checked="" type="radio"/> Web Authentication		
	<input type="radio"/> Web Authentication on MAC Authentication failure ¹		
	<input type="radio"/> Web Pass Through		
	<input type="radio"/> Conditional Web Redirection		
	<input type="radio"/> One Time Redirection		
PRE-AUTHENTICATION ACL	preauth		
WEB PAGE TYPE	External		
URL	https://90.90.100.120/pc/zero_page.jsp		

CHAPTER 9. IP Application

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

9.1 DNS

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

If a DNS server is connected to the APC and a DNS proxy is configured, a station connected to the APC can receive the DNS service by configuring the APC as a DNS server.

9.1.1 DNS Client Configuration

Configuration using CLI

- 1) Go to the configure mode of the 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 243. DNS client

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

9.1.2 DNS Proxy Configuration

You can configure the DNS relay function or a cache for relay. The cache is a temporary space where the APC saves the DNS information obtained from a DNS server.

You can configure maximum number of entries as 10000-100000. The DNS relay is related to the DNS client configuration. If you disable the DNS client function or delete all the name servers, the DNS relay function is not working.

Configuration using CLI

- 1) Go to the configure mode of the 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.
- 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.

Apply

DNS Server

QUERY	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
1ST DNS SERVER	3 . 1 . 1 . 1
2ND DNS SERVER	2 . 2 . 2 . 2
3RD DNS SERVER	8 . 8 . 8 . 8

DNS Relay

SERVICE	<input checked="" type="radio"/> Enable <input type="radio"/> Disable
CACHING SIZE	10000

Figure 244. DNS proxy

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

9.2 NTP

The Network Time Protocol (NTP) is a protocol used to receive time from a configured server and synchronize the local time.

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

Configuration using CLI

[Configuring NTP Client]

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

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable a NTP client.
 - ntp client enable: Enable
 - no ntp client enable: Disable
- 3) Configure the interval of a NTP client.
 - ntp client interval [INTERVAL]: Configures an interval.
 - no ntp client interval: Disables an interval.

Parameter	Description
INTERVAL	Interval (range: 3-14)

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

[Configuring based on a domain name]

Enables or disables.

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

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

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

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

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

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

[Configuring based on IP address]

Enable or disable.

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

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

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

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

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

You can proceed with configurations simultaneously as shown below.

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

[NTP Server Configuration]

The NTP server configuration is as follows:

- 1) Go to the configure mode of the 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.

NTP Client

POLLING: ☐ Enable ☒ Disable

POLLING INTERVAL:

NO	SERVER IP ADDRESS	SERVER DOMIAN NAME	TYPE

NTP Server

SERVICE: ☐ Enable ☒ Disable

Figure 245. NTP client configuration

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

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

9.3 FTP/sFTP

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

Configuration using CLI

[SFTP Server Configuration]

The secure FTP server configuration is as follows:

- 1) Go to the configure mode of the 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 the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable the sFTP server.
 - ftp-server enable: Enable
 - no ftp-server enable: Disable
- 3) Enter as follows to change a user's ID and password.
 - ftp-server chguser [ID] [PASSWORD]

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

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

[Using as Client]

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

- file download
- file upload

A usage example is provided below.

- File download using a sFTP client

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

- File upload using a sFTP client

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

- File download using a FTP client

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

- File upload using a FTP client

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

Configuration using Web UI

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

Apply

FTP

FTP

☒ Enable ☐ Disable

PORT

21

USER

samsung

PASSWORD

☐ 3

.....

CONFIRM PASSWORD

.....

IDLE TIMEOUT (MINUTE) 4

17

SFTP

SFTP

☒ Enable ☐ Disable

PORT 2

22

USER

samsung

PASSWORD

☐ 3

.....

CONFIRM PASSWORD

.....

Figure 246. FTP/SFTP server configuration

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

Also for SFTP, you can change the user name and password of a SFTP server by entering ‘USER’, ‘PASSWORD’, or ‘CONFIRM PASSWORD’.

9.4 Telnet/SSH

The telnet or Secure Shell (SSH) is an Internet protocol that helps login to another computer in a network or connects to a virtual remote system. Using telnet or SSH, you can connect to another computer while staying at a current computer.

Because the SSH can access a remote system and transmit an encrypted message by using public key-based encryption method, it provides better security.

Configuration using CLI

[Telnet Server Configuration]

The Telnet server configuration is as follows:

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable the telnet service. If you configure the telnet service, you can use the APC as a telnet server.
 - telnet-server enable: Enable
 - no telnet-server enable: Disable
- 3) If you configure the telnet service, specify the port number of telnet server.
 - telnet-server port [PORT_NUMBER]

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

[SSH Server Configuration]

The SSH server configuration is as follows:

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
```

- 2) Enable or disable the SSH server.
 - ssh-server enable: Enable
 - no ssh-server enable: Disable
- 3) Specify the port number of SSH server.
 - ssh-server port [PORT_NUMBER]

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

[Checking Server Configuration Status]

To check the status of telnet or ssh server, enter the following command. You can retrieve the configured port number as well as server status.

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

[Using as Client]

By using the APC as a telnet or SSH client, you can connect to a server.

Enter as follows in CLI.

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

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

Configuration using Web UI

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



Telnet-SSH

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

Apply

Figure 247. Telnet/SSH server configuration

You can configure the service by using the Enable/Disable radio box of 'TELNET SERVICE' or 'SSH SERVICE'.

You can configure the port number of service by using 'TELNET PORT' or 'SSH PORT'. By using 'SESSION TIMEOUT', you can configure the session timeout of TELNET or SSH in min. and can also configure maximum number of sessions by using 'MAXIMUM NUMBER OF SESSIONS'.

9.5 Utilities

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

[ping]

Used to check network connection status.

- ping [IP_ADDRESS]

[traceroute]

Used to check a route path.

- traceroute [IP_ADDRESS]

[tcpdump]

Used to check the packet of a specific interface.

- tcpdump [INTERFACE_NAME]

CHAPTER 10. System Management

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

10.1 SNMP Configuration

10.1.1 SNMP Community

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

Configuration using CLI

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

- 1) Go to the configure mode of the 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.

The form contains the following fields:

- NAME:** A text input field.
- IP VERSION:** Radio buttons for v4 (selected) and v6.
- IPV4 ADDRESS:** Four input boxes for the octets of the IPv4 address.
- IPV6 ADDRESS:** Eight input boxes for the octets of the IPv6 address.
- NETMASK:** A single input box for the netmask.
- ACCESS TYPE:** A dropdown menu with 'RO' selected.

Buttons for 'Back' and 'Apply' are located at the top right of the form.

Figure 248. Adding SNMP community

10.1.2 SNMP Trap

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

Configuration using CLI

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

- 1) Go to the configure mode of the 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.

BackApply

IPv4 ADDRESS	<div>0000</div>
PORT NUMBER	<div>162</div>
TRAP VERSION	<div>v1</div>
COMMUNITY NAME	<div></div>

Figure 249. SNMP trap configuration

10.2 System Management

10.2.1 Retrieving System Information

Retrieving with CLI

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

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

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

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

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

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

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

```

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

Temperature Sensor Status :
CPU sensor1                      OK
CPU sensor2                      OK

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

```

The descriptions of the output parameters are as follows:

[System Info]

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

[Temperature Sensor Status]

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

[Fan Status]

For WEC8500:

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

For WEC8050:

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

[Power Supply Status]

The WEC8500 has dual detachable power module as shown below.

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

The WEC8050 has only one power module as shown below.

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

Retrieving with Web UI

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

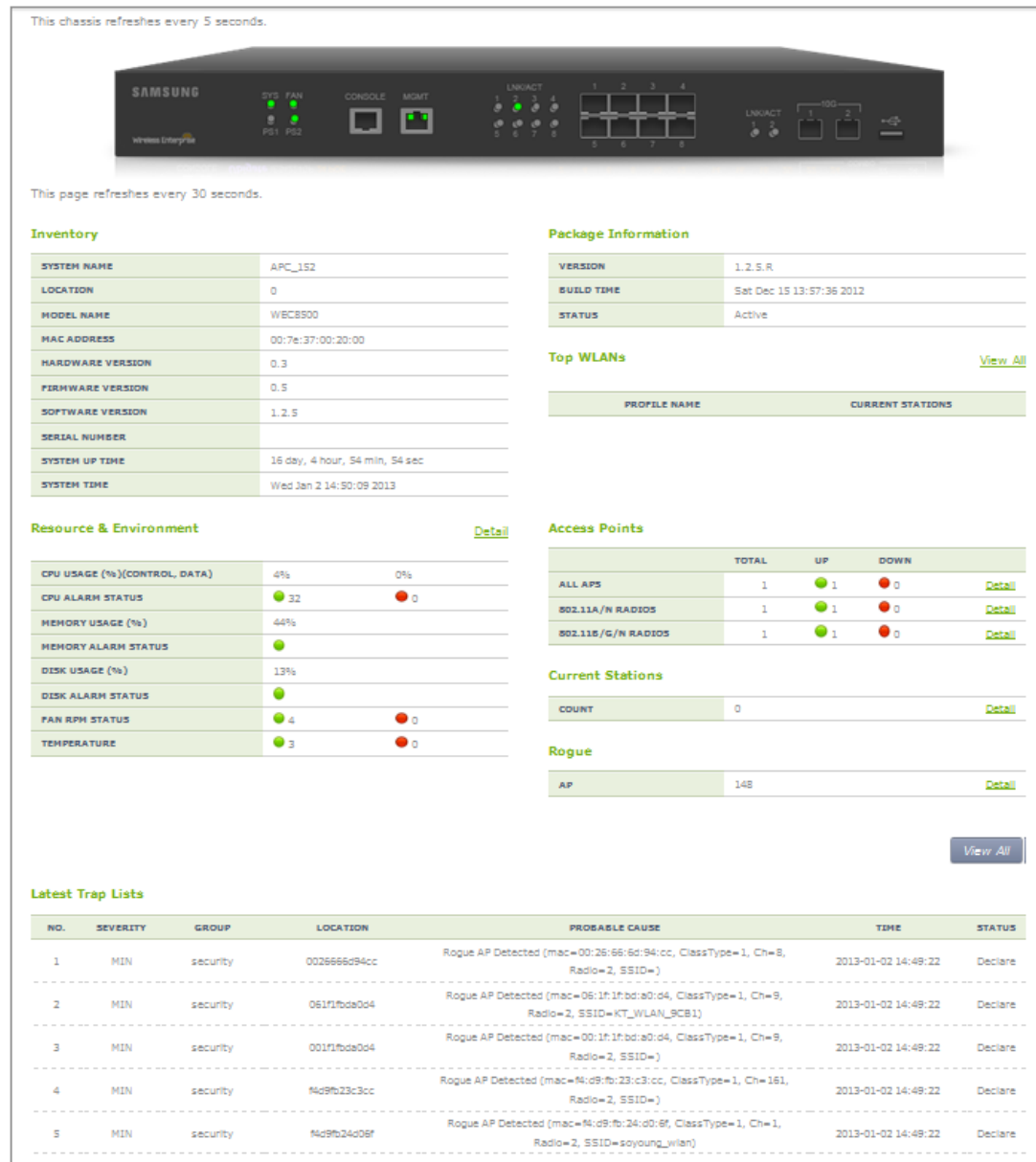



Figure 250. System information

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

Summary

This chassis refreshes every 5 seconds.



This page refreshes every 30 seconds.

Inventory

SYSTEM NAME	SMB_96
LOCATION	where
MODEL NAME	WEC8050
MAC ADDRESS	00:7e:37:00:21:d4
HARDWARE VERSION	0.0
FIRMWARE VERSION	0.1
SOFTWARE VERSION	0.4.4
SERIAL NUMBER	
SYSTEM UP TIME	16 min, 1 sec
SYSTEM TIME	Fri Sep 06 10:27:41 2013

Package Information

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

Top WLANs [View All](#)

PROFILE NAME	CURRENT STATIONS

Resource & Environment [Detail](#)

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

Access Points

	TOTAL	UP	DOWN	
ALL APs	150	● 0	● 150	Detail
802.11A/N RADIOS	150	● 0	● 150	Detail
802.11B/G/N RADIOS	150	● 0	● 150	Detail

Current Stations

COUNT	0	Detail
-------	---	------------------------

Rogue

AP	0	Detail
STATION	0	Detail
ADHOC	0	Detail

[View All](#)

Latest Trap Lists

NO.	SEVERITY	GROUP	LOCATION	PROBABLE CAUSE	TIME	STATUS
1	NOT	pm	APC	Reporting Statistics Failed (Reason=ftp connection failure)	2013-09-06 10:27:20	Notice
2	NOT	wifi	APC	RRM DPC RUN (Dynamic power control done [2.4GHz])	2013-09-06 10:22:53	Notice
3	NOT	wifi	APC	RRM DPC RUN (Dynamic power control done [5GHz])	2013-09-06 10:22:50	Notice
4	NOT	pm	APC	Reporting Statistics Failed (Reason=ftp connection failure)	2013-09-06 10:22:20	Notice
5	NOT	system	APC	Management User Login (ID=samsung, IP=10.254.175.139 (WEC))	2013-09-06 10:22:08	Notice

10.2.2 System Reboot

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

Configuration using CLI

Use the 'reboot' command to reboot the system.

```
WEC8500# reboot
```

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

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

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

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

To cancel the reservation, enter the 'no reboot' command.

```
WEC8500# no reboot
```

Configuration using Web UI

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

The Reboot window is shown below.

[APC]

Figure 251. Reboot (APC)

[AP]

Reboot All with Upgrade

Reboot

<input type="checkbox"/>	AP PROFILE NAME	AP NAME	REBOOT CAUSE
<input type="checkbox"/>	ap_1	AP_f4d9fb24d2c0	reboot after package upgrade
<input type="checkbox"/>	ap_2	AP_f4d9fb24cfc0	-

1

Figure 252. Reboot (AP)

10.3 System Resource Management

10.3.1 Retrieving System Status

Retrieving with CLI

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

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

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

[CPU Load]

The retrieving CLI execution result of WEC8500 is as follows:

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

The retrieving CLI execution result of WEC8050 is as follows:

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

```

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

```

[Memory usage]

```

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

```

[Disk usage]

```

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

```

[Fan RPM Level]

The retrieving CLI execution result of WEC8500 is as follows:

```

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

```

The retrieving CLI execution result of WEC8050 is as follows:

```

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

```

[System Temperature (°C)]

The retrieving CLI execution result of WEC8500 is as follows:

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

The retrieving CLI execution result of WEC8050 is as follows:

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

Retrieving with Web UI

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

10.3.2 Retrieving and Configuring Threshold

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

Configuration using CLI

To check each threshold, use the below command.

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

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

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

Parameter	Description
THRESHOLD	Threshold to configure (%)

Configuration using Web UI

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

You can retrieve and configure a threshold at which CPU load, disk usage, temperature alarm, memory usage, or fan alarm occurs. Enter a value for each item, and click the <Apply> button to make the configuration applied.

CPU Load

MONITOR ☒ Enable ☐ Disable

THRESHOLD(%) 90

Memory Usage

MONITOR ☒ Enable ☐ Disable

THRESHOLD(%) 90

Disk Usage

MONITOR ☒ Enable ☐ Disable

THRESHOLD(%) 90

Fan Alarm

MONITOR ☒ Enable ☐ Disable

THRESHOLD(LEVEL) 5

Temperature Alarm

MONITOR ☒ Enable ☐ Disable

THRESHOLD(°C) 88

Figure 253. 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.

						Clear	List Export
NO.	SEVERITY	GROUP	LOCATION	PROBABLE CAUSE	ALARM TIME		
0	MIN	security	002666d94cc	Rogue AP Detected (mac=00:26:66:d9:4c:cc)	2013-01-02 14:49:22		
1	MIN	security	061f1fbd0d4	Rogue AP Detected (mac=06:1f:1f:bd:a0:d4)	2013-01-02 14:49:22		
2	MIN	security	001f1fbd0d4	Rogue AP Detected (mac=00:1f:1f:bd:a0:d4)	2013-01-02 14:49:22		
3	MIN	security	f4d9fb23c3cc	Rogue AP Detected (mac=f4:d9:fb:23:c3:cc)	2013-01-02 14:49:22		
4	MIN	security	f4d9fb24d06f	Rogue AP Detected (mac=f4:d9:fb:24:d0:6f)	2013-01-02 14:49:22		
5	MIN	security	f4d9fb23f3e2	Rogue AP Detected (mac=f4:d9:fb:23:f3:e2)	2013-01-02 14:49:22		
6	MIN	security	e80462777443	Rogue AP Detected (mac=e8:04:62:77:74:43)	2013-01-02 14:44:09		
7	MIN	security	f4d9fb23bc02	Rogue AP Detected (mac=f4:d9:fb:23:bc:02)	2013-01-02 14:38:56		
8	MIN	security	000000000000	Rogue AP Detected (mac=00:00:00:00:00:00)	2013-01-02 14:38:56		
9	MIN	security	f4d9fb23f6a2	Rogue AP Detected (mac=f4:d9:fb:23:f6:a2)	2013-01-02 14:38:56		
10	MIN	security	f4d9fb23f4a2	Rogue AP Detected (mac=f4:d9:fb:23:f4:a2)	2013-01-02 14:38:56		
11	MIN	security	f4d9fb2401a2	Rogue AP Detected (mac=f4:d9:fb:24:01:a2)	2013-01-02 14:38:56		
12	MIN	security	e8046277a5d2	Rogue AP Detected (mac=e8:04:62:77:a5:d2)	2013-01-02 14:33:43		
13	MIN	security	e80462768553	Rogue AP Detected (mac=e8:04:62:76:85:53)	2013-01-02 14:28:30		
14	MIN	security	e80462777440	Rogue AP Detected (mac=e8:04:62:77:74:40)	2013-01-02 14:28:30		
15	MIN	security	e80462777442	Rogue AP Detected (mac=e8:04:62:77:74:42)	2013-01-02 14:28:30		
16	MIN	security	e80462777441	Rogue AP Detected (mac=e8:04:62:77:74:41)	2013-01-02 14:28:30		
17	MIN	security	f4d9fb24d010	Rogue AP Detected (mac=f4:d9:fb:24:d0:10)	2013-01-02 14:12:51		
18	MIN	security	dc7144eede7a	Rogue AP Detected (mac=dc:71:44:ee:de:7a)	2013-01-02 14:07:38		
19	MIN	security	a00bba0f0f84	Rogue AP Detected (mac=a0:0b:ba:0f:0f:84)	2013-01-02 14:02:25		

Figure 254. Current alarm

10.4.2 Retrieving History

Retrieving with CLI

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

[Alarm History]

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

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

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

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

[Event History]

You can retrieve event information using the following command.

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

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

```
WEC8500# show event group interface
1 interface 2012-08-31 13:48:32 NOT APC Index[1] Name[gel] 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.

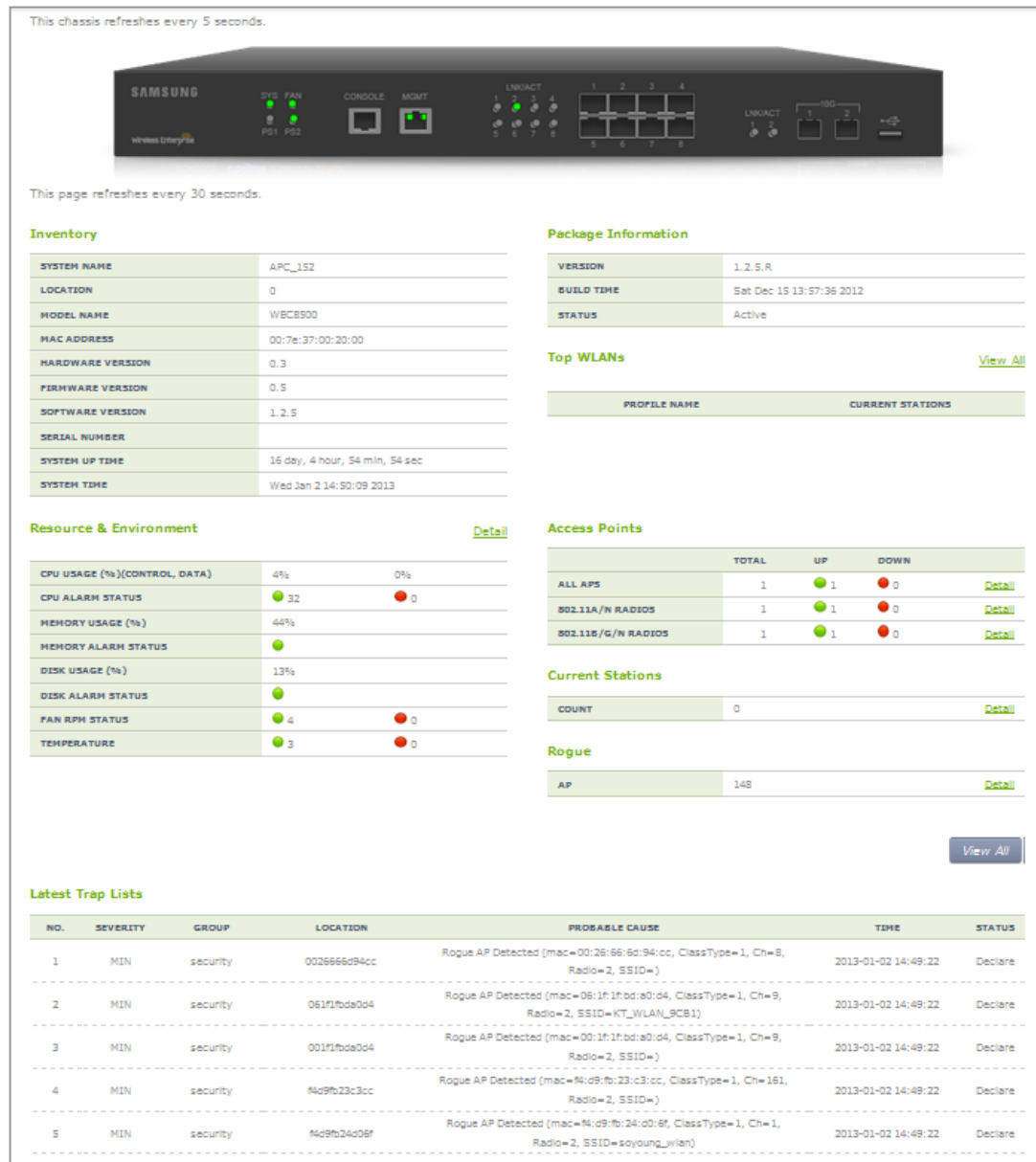


Figure 255. History

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 the configure mode of the 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.

Apply

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

☒ System
 ☒ Pm
 ☒ Ap
 ☒ Wlan
 ☒ wifi
 ☒ Security
 ☒ Network
 ☒ Interface
 ☒ Se
 ☒ All

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

☐ Critical
 ☐ Major
 ☒ Minor

Alarm Information
Assign severity level to each alarm.

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

Figure 256. Configuring alarm filter and level

10.5 Managing Traffic Performance

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

10.5.1 Managing History Information

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

Collecting information

- 1) Go to the configure mode of the 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 the configure mode of the 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 the configure mode of the CLI.

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

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

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

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

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

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

10.6 Managing License Key

The Samsung Electronics Common License Method (SLM) is applied to Version 1.5 or newer of the APC system.

Therefore, SLM licensing is applied to new websites that are installed using Version 1.5 or later.

However, if Version 1.4 is upgraded to Version 1.5, the existing license key is used without any modification. The existing license which is not SLM must be installed and used also in the case of expanding or reissuing the APC system.

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

These details are summarized in the table below.

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

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

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

10.6.1 Managing SLM License (Activation) Key

An SLM activation key can have differences in regard to the number of manageable APs, whether to support the VQM function, whether to support the firewall function, and the period of use of a function.

Every system has a unique activation key and activation keys are provided in the form of encrypted files.

To clear an SLM activation key installed in a system, the deactivation command needs to be executed and after the execution of the command, a deactivation key is issued to notify that clearing has been completed successfully.



NOTE

Installation

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

(Example)

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



NOTE

Period of Use

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



NOTE

Application

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

Configuration using CLI

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

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

[Installing Activation Key]

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

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

[Clearing Activation Key]

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

Configuration using Web UI

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

In the figure below, the 'SLM License Key Status' shows the installation and application statuses of SLM activation keys.

In the 'License Control' section, the operator can select an activation key stored in their PC and install it in the system.

In addition, the operator can also deactivate an installed activation key. The operator can clear an installed activation key by selecting Deactivation in 'License Control' and then entering the license key shown in 'SLM License Key Status'.

License

License Key Status ¹

OFFICIAL KEY	Valid
TEMPORARY KEY	Not valid

Current System Status

NUMBER OF AP	500
VQM	Enable
FIREWALL	Enable

SLM License Key Status

SLM LICENSE KEY 1	Activation(apply)	NWMIS1-3DC52V-WTEBZL-6ESN
SLM LICENSE KEY 2	Deactivation(apply)	NWMIS1-3DC52V-WTEBZL-6ESNBQ-ZCEHYP-NXDWMN-DEHFTG-EMRTGZ-RTAM07

Apply

License Control

CONTROL TYPE ²	<input checked="" type="radio"/> Activation <input type="radio"/> Deactivation
UPLOAD ACTIVATION KEY FILE	<input type="text"/> <div>찾아보기...</div>
REBOOT CONTROL ⁴	<input type="radio"/> With Reboot <input checked="" type="radio"/> Without Reboot

Figure 257. SLM License Search and Configuration Window

10.6.2 Managing Old License Key

An old license key can differ in regard to the number of manageable APs, whether to support the VQM function, whether to support the firewall function, and the period of use of a function.

A license key is unique for each system and it consists of encrypted 53 characters.

A license key is distributed in a file or text format.



Installation

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



Use period

An official license key has no restriction on use period.

A temporary license key has a restriction on use period and the period can be 1, 30, or 60-day.



Apply

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

Configuration using CLI

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

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

[Installing License Key]

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

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

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

[Deleting License Key]

You can delete a license key directly.

- no install-key [LICENSE_KEY]

Parameter	Description
LICENSE_KEY	License key to delete

[Retrieving License Key Information]

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

```

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

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

```

[Analyzing License Key]

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

- analyze-key [LICENSE-KEY]

Parameter	Description
LICENSE_KEY	License key

Configuration using Web UI

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

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

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

License

License Key Status¹

OFFICIAL KEY	Valid
TEMPORARY KEY	Not valid

Current System Status

NUMBER OF AP	500
VQM	Enable
FIREWALL	Enable

SLM License Key Status

SLM LICENSE KEY 1	None
SLM LICENSE KEY 2	None

License Control

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

Apply

Figure 258. Old License Installation Check Window

10.7 Syslog Configuration

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

Configuration using CLI

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

- 1) Go to the configure mode of the 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.

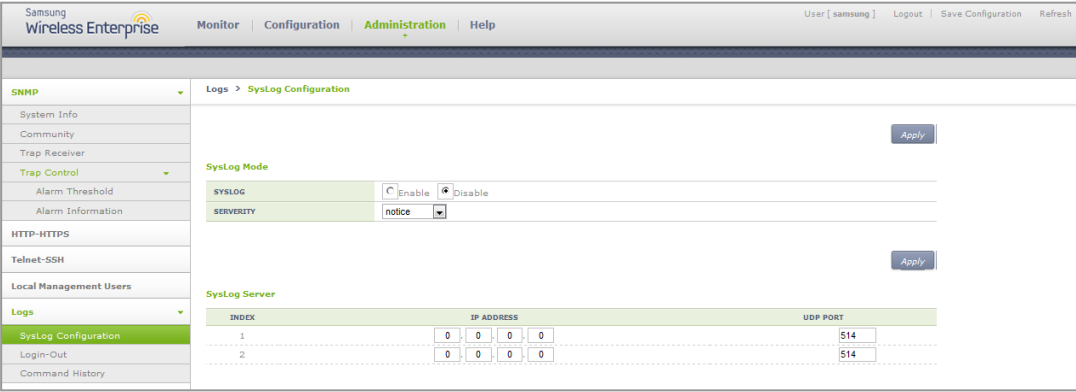


Figure 259. Syslog window

10.8 Upgrade

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

10.8.1 Checking Package Version

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

- show version

The following shows the execution results of the command:

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

Boot rom version information
  ver           : GC15
```

10.8.2 System Upgrade

The APC does system upgrade using CLI and Web UI.

Configuration using CLI

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

- 1) Go to the configure mode of the CLI.

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

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

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

A usage example is provided below. When the upgrade is completed, the system is rebooted to apply the package.

When executing the package upgrade command, the message recommending to save the configuration file is displayed.

If you save the current configuration, operator can use it for any future version downgrade.

If there is a configuration file saved during previous upgrade, the message asking whether you are going to use the file is displayed.

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

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

    Previous configuration file is existed. Do you want to use it?
(y/n): y
Package Validation check ... success
Package Upgrade ..... done
Success
```

3) If package upgrade fails, upgrade is cancelled.

Possible causes and the troubleshooting methods are described below.

Possible Cause	Error Message	Troubleshooting
File does not exist	Error: no exist 'wec8500_1.3.11.R.bin' file	Download the package to be upgraded again as the package error has occurred during the package downloading.
Checksum error on the file	Error: Package validation check	
Upgrade terminated due to an internal error	Error: Internal error	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.
Upgrade terminated due to timeout	saving the configuration-failed (time-out)	1) Execute the 'show process status' command to check the process status. 2) Execute the 'show system cpu detail' command to check the CPU status. 3) Transmit the logs above to the Samsung Technical Support.

- 4) After system rebooting, check if the new package is applied to the system.

```
WEC8500# show reboot cause
Reboot Cause: Block: Upgrade/ Code: Package Upgrade

WEC8500# show version
Samsung package version information
Primary (currently running)
  ver           : 0.7.1.R
  buildTime     : Mon Aug 20 11:35:43 2012
  builder       : gampul
  buildDir      : /data/nome/ymkim/apc_0817
Backup
  ver           : 0.7.1.R
  buildTime     : Mon Aug 20 11:35:43 2012
  builder       : gampul
  buildDir      : /data/nome/ymkim/apc_0817

Boot rom version information
  ver           : unknown
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <Package Upgrade> → <APC> menu in the sub-menus.

Package Upgrade > APC Apply

Select Package File

CURRENT VERSION	2.0.0.T
PACKAGE NAME	wec8500_1.5.4.R.bin
Model:	WEC8500
Version:	1.5.4
AddInfo:	R
BuildTime:	Wed Jan 8 13:19:57 2014
Builder:	apcbuild
Directory:	/home2/apcbuild/release/wec8500_1.5.5
PLD Version:	R1.01.040
MD5Sum:	0c88d0206d51036b7c499d7a3d319ccd

COMPATIBILITY: Compatible

BACKUP CONFIGURATION !

☒ Restore Backup Configuration ☐ Keep Current Configuration

Saving Control ²

☒ Save and Package Upgrade ☐ Package Upgrade Without Save

Package Upgrade Status

STATUS	None
--------	------

Foot Notes :

1. If the backup configuration exists, apply the configuration.
If you select "Restore Backup Configuration", the backup configuration of previous upgrade operations will be restored.

2. It is recommended that you save the configuration before upgrade.
If you select "Save and Package Upgrade", configuration is saved and also backup under the name of the package version.
You can apply the configuration in "Backup Configuration".

3. The system will be reboot after upgrade operations.

Figure 260. Package upgrade (APC)

10.9 Configuration Management

The APC supports the following functions for configuration management.

- Saves the current configuration information.
- Exports/imports the current configuration information (import/export).
- Initializes system

Configuration using CLI

To save the current configuration information in the system, execute the command as follows:

```
WEC8500# save local
```

To transmit the current configuration information in the system to outside, execute the command as follows: When you execute the command, the configuration information is compressed into the entered 'FILENAME' as a file.

```
WEC8500# export [FILENAME]
```

In addition, to apply a file ('FILENAME') from outside to the current system, execute the command as follows:

```
WEC8500# import [FILENAME]
```

To initialize the current configuration information to the factory default, execute the command as follows: If the 'full-erase' parameter is not entered, only the configuration information is initialized.

```
WEC8500# factory-reset (full-erase)
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Administrator> and then select the <DB backup/restore> menu in the sub-menus.

The screenshot displays a web interface for database backup and restore operations. It is divided into two main sections: 'DB Backup' and 'DB Restore'. Each section has a table with columns for 'FILE NAME' and 'STATUS'. In the 'DB Backup' section, the 'FILE NAME' column contains a text input field. In the 'DB Restore' section, the 'FILE NAME' column contains a dropdown menu with the text 'Select File Name'. Both sections have an 'Apply' button to the right of the table. The 'STATUS' column in both tables is currently empty.

DB Backup	
FILE NAME	<input type="text"/>
STATUS	

DB Restore	
FILE NAME	Select File Name ▼
STATUS	

Figure 261. 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.

10.10Configuration Synchronization

For all APCs in an environment configured with multiple APCs to provide the same WLAN service, all their service-related settings, other than the individual network settings, must be identical. For this, the system provides a function for automatically synchronizing service-related configurations across multiple APCs.

When service settings are changed on the master APC, the settings are automatically applied to the connected slave devices. Service configuration synchronization currently supports two APCs only.

Configuration using CLI

[Adding APC to APC List]

Add APCs to synchronize to the APC list by referring to 'APC List Management'.

[Adding APC to Sync List]

After adding APCs to the APC list, APCs to synchronize must be added to the Sync List.

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
WEC8500/configure# configuration-sync
WEC8500/configure/configuration-sync#
```

- 2) Add APCs to the Sync List.
 - add-apc[INDEX][APC_NAME][IPv4_ADDRESS]

Parameter	Description
INDEX	INDEX on the Sync List (range: 1-2)
APC_NAME	APC name (maximum 18 characters)
IPv4_ADDRESS	IPv4 address

[Deleting APC from Sync List]

Registered APCs can be deleted from the Sync List.

- 1) Go to the configure mode of the CLI.

```
WEC8500# configure terminal
WEC8500/configure# configuration-sync
WEC8500/configure/configuration-sync#
```

- 2) Delete APCs from the Sync List. To delete all APCs from the Sync List, enter the 'del-apc-all' command.

- del-apc[INDEX]
- del-apc-all

Parameter	Description
INDEX	Index on the Sync List (range: 1-2)

[Retrieving APC information registered on Sync List]

You can check the APC information registered on the Sync List using the 'show configuration-sync list-apc' command.

```
WEC8500# show configuration-sync list-apc
=====
INDEX  APC-NAME          IPv4-ADDRESS      CONNECT-STATUS
=====
1      APC-1             192.168.87.146    CONNECTED[1]
2      APC-2             192.168.87.217    CONNECTED[1]
=====
```

[Sync Role Configuration]

Available synchronization roles include Master, Slave, and Standalone. Only one Master is allowed within a synchronization domain. When there is an existing Master and a new APC's role is changed to Master, the new APC's synchronization role changes to Master, and the existing master APC's role automatically changes to Slave.

```
APC_hoon/configure# configuration-sync activeactive-role ?
master                Master
slave                 Slave
standalone             Standalone
```

[Sync Role Retrieval]

Synchronization roles can be checked using 'show configuration-sync conf' on the CLI. The MyAPC information is shown first, followed by the PeerAPC information.

```
APC_hoon/configure# show configuration-sync conf
MyAPC id   : 1
Role      : slave

PeerAPC id : 2
Mode      : none
Role      : master
LinkStatus : 0

MasterAPCid : 2 TimeStamp : 1419602839 syncStatus : 0
```

Configuration using Web UI

[Adding APC to APC List]

Add APCs to synchronize to the APC list by referring to 'APC List Management'.

[Synchronization Configuration]

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Configuration Synchronization> → <General> menu in the sub-menus.

Shown at the very top of Sync. Members is the current APC. Click the APC NAME of the current APC to open the role configuration screen.

BackApply

INDEX	2
APC NAME	kang
IP ADDRESS	10.251.193.194
ROLE	<input checked="" type="radio"/> Master <input type="radio"/> Slave <input type="radio"/> Standalone

Figure 262. Configuration Synchronization Role Configuration

[Adding/deleting members to/from Sync. Members]

Click the <Add>/<Delete> buttons to add/delete members to/from Sync. Members. The Add Sync. Member window is shown below.

BackApply

INDEX	2
APC NAME	WEC8500
IP ADDRESS	10.251.195.86

Figure 263. Add Sync. Members Window

[Retrieving Mismatching Configuration Information]

Configurations can be compared between synchronization members and mismatching configuration information can be viewed. To check mismatching configuration information, the APCs must be configured as synchronization members.

In the menu bar of <WEC Main window>, select <Configuration> and then select the <Configuration Synchronization> → <Audit> menu in the sub-menus.

- 1) Immediate retrieval of mismatching configuration information

Controller > Config-Sync > Audit

INDEX	APC NAME	CYCLE	AUDIT STATUS	AUDIT RESULT	LAST AUDIT TIME	SYNC. STATUS	LAST SYNC. TIME
1	apc_below	None	Success	Mismatched(24)	2014/12/12 19:54:54	Idle	
2	apc_upper	None	Idle	None		Idle	

AuditSync

Click the Sync button to retrieve the mismatching configuration information. The Mismatched count indicates the number of mismatching configurations. Click the count to view details.

2) Periodic retrieval of mismatching configuration information

Monthly/weekly/daily audits can be performed for mismatching configuration information.

a) Monthly configuration information retrieval: Enter date and time information.

Controller > Config-Sync > Audit > Edit	
<input type="button" value="Back"/> <input type="button" value="Apply"/>	
INDEX	1
APC NAME	apc_below
CYCLE	<input checked="" type="radio"/> Monthly <input type="radio"/> Weekly <input type="radio"/> Daily <input type="radio"/> None
	Day <input type="text" value="01"/> Time <input type="text" value="00"/> : <input type="text" value="00"/>

b) Weekly configuration information retrieval: Enter day of week and time information.

Controller > Config-Sync > Audit > Edit	
<input type="button" value="Back"/> <input type="button" value="Apply"/>	
INDEX	1
APC NAME	apc_below
CYCLE	<input type="radio"/> Monthly <input checked="" type="radio"/> Weekly <input type="radio"/> Daily <input type="radio"/> None
	Week <input type="text" value="SUN"/> Time <input type="text" value="00"/> : <input type="text" value="00"/>

c) Daily configuration information retrieval: Enter time information.

Controller > Config-Sync > Audit > Edit	
<input type="button" value="Back"/> <input type="button" value="Apply"/>	
INDEX	1
APC NAME	apc_below
CYCLE	<input type="radio"/> Monthly <input type="radio"/> Weekly <input checked="" type="radio"/> Daily <input type="radio"/> None
	Time <input type="text" value="00"/> : <input type="text" value="00"/>

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.

Apply

DB Backup

FILE NAME	
STATUS	

Apply

DB Restore

FILE NAME	
LOCAL MANAGEMENT USERS	<input type="radio"/> Include <input checked="" type="radio"/> Not include
STATUS	

Apply

Periodic Upload

UPLOAD	<input type="radio"/> Enable <input checked="" type="radio"/> Disable
CYCLE	<input checked="" type="radio"/> Monthly <input type="radio"/> Weekly <input type="radio"/> Daily
	Day <input type="text" value="01"/> Time <input type="text" value="00"/> : <input type="text" value="00"/>
IP VERSION	<input checked="" type="radio"/> v4 <input type="radio"/> v6
IPV4 ADDRESS	<input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/> . <input type="text" value="0"/>
IPV6 ADDRESS	<input type="text" value="0000"/> : <input type="text" value="0000"/> : <input type="text" value="0000"/> : <input type="text" value="0000"/> : <input type="text" value="0000"/> : <input type="text" value="0000"/> : <input type="text" value="0000"/> : <input type="text" value="0000"/>
PORT	<input type="text" value="21"/>
USER ACCOUNT	<input type="text" value="0"/>
USER PASSOWORD	<input type="password" value="•"/>
REMOTE PATH	<input type="text" value="0"/>
TRANSFER MODE	<input checked="" type="radio"/> FTP <input type="radio"/> SFTP

Figure 264. DB Backup/Restore/Periodic-Upload Window

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. STATUS shows the execution results of the backup/restore.

10.11 Debug and Diagnosis

10.11.1 Process

The APC can retrieve the status of an active process in the system and an error associated with each process.

Retrieving the Process Status

```
WEC8500# show processes
Processes Info.
Status: D - usually IO, R - Running, S - Sleep
        T - Stop, X - Dead, Z - Zombie
        up - Active, down - Inactive
        dis - Disable
```

id	name	pid	activationTime	status	reStart
--	-----	----	-----	-----	-----
0	swmmon	6222	2012-08-31 14:38:21	up (S)	0
1	evm	1759	2012-08-31 13:47:08	up (S)	0
2	evmlogd	1760	2012-08-31 13:47:08	up (S)	0
3	db	1807	2012-08-31 13:47:14	up (S)	0
4	license	1838	2012-08-31 13:47:34	up (S)	0
5	pcap	1839	2012-08-31 13:47:34	up (S)	0
6	filemgr	1840	2012-08-31 13:47:34	up (S)	0
7	filemib	1841	2012-08-31 13:47:34	up (S)	0
8	cm	1846	2012-08-31 13:47:34	up (S)	0
9	iim	1847	2012-08-31 13:47:34	up (S)	0
10	iimp	1850	2012-08-31 13:47:34	up (S)	0
11	nsm	1902	2012-08-31 13:47:35	up (S)	0
12	mstpd	1903	2012-08-31 13:47:35	up (S)	0
13	pimd	1904	2012-08-31 13:47:35	up (S)	0
14	ripd	1905	2012-08-31 13:47:35	up (S)	0
15	ospfd	1906	2012-08-31 13:47:35	up (S)	0
16	lacpd	1907	2012-08-31 13:47:35	up (S)	0
17	fqm	1909	2012-08-31 13:47:35	up (S)	0
18	imi	1942	2012-08-31 13:47:35	up (S)	0
19	zebosm	2188	2012-08-31 13:47:55	up (S)	0
20	awmb	2226	2012-08-31 13:48:00	up (S)	0
21	apm	2385	2012-08-31 13:48:30	up (S)	0
22	capwap	2386	2012-08-31 13:48:30	up (S)	0
23	hostapd	2387	2012-08-31 13:48:30	up (S)	0
24	eqm	2388	2012-08-31 13:48:30	up (S)	0

Checking process error log

You can check the log of errors that occurred in a current process

```
WEC8500# show processes log
```

id	date	name	pid	signal	backtrace	reason
-----	-----	-----	-----	-----	-----	-----
2509.	2012-12-21 15:59:50	iimp	1800	SIGTERM(15)	traced	signal
2510.	2012-12-21 15:59:50	sipalg	2377	SIGTERM(15)	traced	signal
2511.	2012-12-21 15:59:50	apclt	2375	SIGTERM(15)	traced	signal
2511.	2012-12-21 15:59:50	apcluster	2217	SIGTERM(15)	traced	signal
2512.	2012-12-21 15:59:50	evmlogd	1766	SIGTERM(15)	traced	signal
2513.	2012-12-21 15:59:50	imi	1893	SIGTERM(15)	traced	signal
2514.	2012-12-21 15:59:50	wids	2293	SIGTERM(15)	traced	signal
2515.	2012-12-21 15:59:50	ipwlogd	2416	SIGTERM(15)	traced	signal
2516.	2012-12-21 15:59:50	nfm	2417	SIGTERM(15)	traced	signal
2517.	2012-12-21 15:59:50	httprd	2379	SIGTERM(15)	traced	signal
2518.	2012-12-21 15:59:50	fqm	1882	SIGTERM(15)	traced	signal
2519.	2012-12-21 15:59:50	irfm	2297	SIGTERM(15)	traced	signal
2520.	2012-12-21 15:59:50	filemib	1770	SIGTERM(15)	traced	signal
2520.	2012-12-21 15:59:50	pm	2376	SIGTERM(15)	traced	signal
2521.	2012-12-21 15:59:50	salh	2415	SIGTERM(15)	traced	signal
2522.	2012-12-21 15:59:50	guestService	2294	SIGTERM(15)		

In addition, you can check the detail information corresponding to the 'id' of each error log by using the following command.

```
WEC8500# show processes log id 15
```

id	date	name	pid	signal	backtrace	reason
-----	-----	-----	-----	-----	-----	-----
15.	2012-08-02 18:39:08	eqm	2311	NONE(0)	-	coredump

detail (additional info.)

- core_dump (comm:eqm, signr:11, pid:2311)
- detected unixtime: 1343900344 -> Thu Aug 2 18:39:04 2012

id	date	name	pid	signal	backtrace	reason
-----	-----	-----	-----	-----	-----	-----
15.	2012-08-09 12:37:09	eqm	30103	NONE(0)	-	coredump

detail (additional info.)

- core_dump (comm:eqm, signr:11, pid:30103)

10.11.2 Retrieving Crash Information

When a critical problem occurs in the system platform during operation, the APC saves important system information at that time to provide the crash information that can be used for post mortem analysis. The crash information includes the Crash Detect and Report (CDR) information that has the context about the crash status and the core dump information that has the memory dump about the crash status of a user process.

10.11.2.1 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	<p>If there is no reboot information selection (id/all) option, the most recent system reboot information is deleted.</p> <ul style="list-style-type: none"> - id: A specific CDR ID value to delete - all: Delete all the CDR histories

10.11.2.2 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
```

10.12 File Management

The APC provides the file management functions of copying, moving, or retrieving a file and also file download and upload. In addition, it checks the integrity of a package file and provides version retrieving method.

To use a file related command, go to the file mode first. The command is basically used as follows:

- 1) Go to the file mode of CLI.

```
WEC8500# file
WEC8500/file#
```

- 2) Use each command. The following commands are used in the file mode.

Command	Description
cd	Changes the current directory.
copy	Copies a file.
df	Retrieves the brief information of a storage media connected to the system.
download	Downloads a file using FTP protocol.
dump	Shows the content of a file.
ls	Retrieves the list of files or directories in a specified path.
move	Changes the name of a file.
pwd	Shows the current directory.
remove	Deletes a file.
upload	Uploads a file using FTP protocol.
verify	Checks the integrity of a package file and shows the result.
version	Shows the information of a package file.

10.12.1 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

10.12.2 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#
```

10.12.3 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
```

10.12.4 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 0000 0188 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 |.... .[@.....|
```

10.12.5 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
```

Following is example of file downloading 'test' file from '3ffe:500::862b:2bff:fe6d:2199' to 'disk:/test'.

```
WEC8500/file# download guest guest 3ffe:500::862b:2bff:fe6d:2199 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
```

Following is example of file uploading to '3ffe:500::862b:2bff:fe6d:2199'

```
WEC8500/file# upload guest guest 3ffe:500::862b:2bff:fe6d:2199
disk:/uploadtest uploadtest
```

10.12.6 Package File

You can use a package file by downloading it from a network or copying it from a USB memory. The APC checks the integrity of a package file and provides the information retrieving function.

Checking the integrity of a package file

Checking if a package file is damaged is called integrity checking. An example of checking integrity using the 'verify' command is shown below.

[Checking APC package file]

```
WEC8500/file# verify package/wec8500_0.3.0.R.bin
Verify: success!!
```


[Checking AP package file]

```
WEC8500/file# verify package/ap/wea302.img
Verify: success!!
```

Retrieving the information of a package file

A package file includes the information such as version information, model information, package build information, etc. To check the content of a package file, use the ‘version’ command.

[Retrieving the information of APC package file]

```
WEC8500/file# version package/wec8500_0.3.0.R.bin
=====
Model       : WEC8500
Version     : 0.3.0.R
Build Date  : Sat Jun 30 15:57:09 2012
Builder     : apcbuild
Build Path  : /home2/apcbuild/release/apc
MD5SUM      : b715450abf1be81616fd7e6391e12cee
```

[Retrieving the information of AP package file]

```
WEC8500/file# version package/ap/wea302.img
=====
Model       : wea302
Version     : 0.1.0.R
Build Date  : Fri Apr 13 18:41:26 KST 2012
Sisze      : 31998080
CRC         : d5aa76ad
```

10.12.7 Retrieving Storage Media

The WEC8500 supports a disk and USB memory as a storage media. And the WEC8050 supports only a disk as a storage media. Both current directory-based relative path and absolute path are all supported during command execution and the path of each device is shown in the below table.

Device	Path	Description
Disk	disk:/	Uses the system disk as a storage media. (basic path)
USB memory	usb [N]:/	Uses a USB memory as a storage media. (‘N’ represents a partition number in a USB memory.)

To check the information of a storage media connected to the APC, use the ‘df’ command.

```
WEC8500/file# df
Device      : disk
Filesystem  : ext4
Total size  : 12.9G Free space: 11.3G

Device      : usb1
Filesystem  : vfat
Total size  : 7.4G Free space: 7.0G
```

Using the results of entering the above command, an operator can check the below information.

- The disk and USB memory are connected.
- Disk free space: 11.3 GB
- USB memory free space: 7 GB

10.12.8 Managing File in Web UI

10.12.8.1 File Uploading and Downloading

In the menu bar of <WEC Main window>, select <Administration> and then select the <File Management> → <APC-Local PC> menu in the sub-menus.

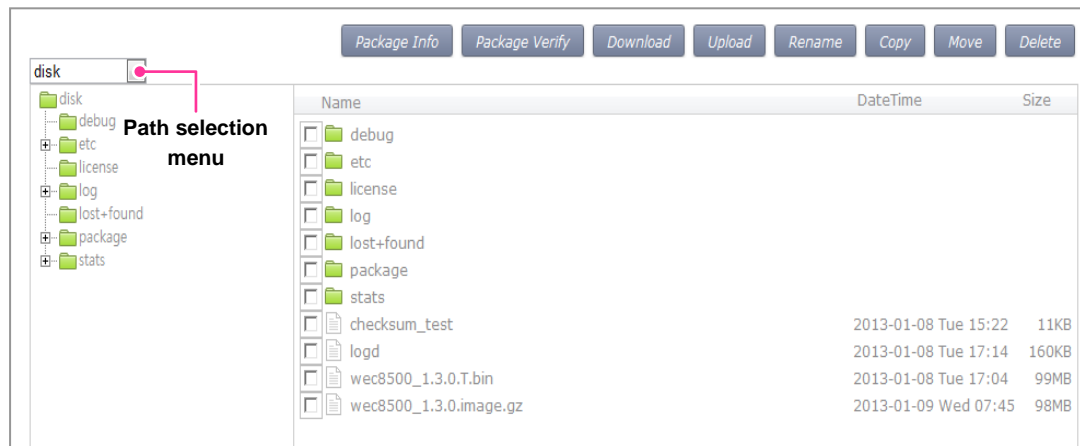


Figure 265. File management window

The File Management window provides the following functions:

Retrieving a file list

Select a desired path in the path selection menu, which is categorized based on the following criteria:

- disk: Select this to retrieve the entire files in the SSD disk of APC.
- APC Package: Select this to retrieve an APC package file.
- AP Package: Select this to retrieve an AP package file.
- Log: Select this to retrieve a log file.
- Stats: Select this to retrieve a statistics file.
- USBN: Select this to retrieve a file in a USB memory connected to the APC.
(The N represents a partition number in a USB memory.)

Copying a file

After selecting the checkbox of a file to copy, click the <Copy> button. Then a popup window is displayed. In the popup window, specify a location where the file will be copied.

Moving a file

After selecting the checkbox of a file to move, click the <Move> button. Then a popup window is displayed. In the popup window, specify a location where the file will be moved.

Deleting a file

After selecting the checkbox of a file to delete, click the **<Delete>** button.

Changing a filename

After selecting the checkbox of a file to change its name, click the **<Rename>** button. Then a popup window is displayed. In the popup window, enter a file name to change.

Downloading a file

After selecting the checkbox of a file to download, click the **<Download>** button.

Uploading a file

When you click the **<Upload>** button, the popup window where you can select a file to upload is displayed. After selecting a file in the upload window, click the **<Upload>** button.

Retrieving a package file

In the path selection menu, select **<APC Package>**. After selecting the checkbox of a package file to retrieve, click the **<Package Info>** button. The package file information is displayed in the popup window.

Checking the integrity of a package file

In the path selection menu, select **<APC Package>**. After selecting the checkbox of a package file to retrieve, click the **<Package Verify>** button. The result of checking the integrity of a package file is displayed in the popup window.

10.12.8.2 Configuring Language for Imported and Exported Files

The APC system provides a function of exporting information set in the APC to a PC or importing from a PC to the system by using the WEC. The operator can export and import the following information in an Excel file.

- Local Net User List
- Captive Portal User List
- Mac Filter List

If the language encoding method of the PC is different from that of the APC system, some characters, however, cannot be read.

For example, if the encoding method of the PC is Korean (EUC-KR), and the information on the configuration of the APC system is exported to the WEC, Korean cannot be seen as unidentifiable characters. Because the APC system use the UTF-8 method and the encoded file in the UTF-8 method cannot be displayed in the PC which uses EUC-KR.

To correct such problem, it provides a function of configuring a method for encoding in the PC.

When the operator configures an encoding method, the APC system automatically converts the encoding method of the file and allows the exported file to the WEC to be properly displayed in the PC. In addition, if the file stored in the PC is imported to the system through the WEC, it is properly processed in the system.

To configure an encoding method, it is possible to select <Administration> in the menu bar of <WEC Main window> and then configure in <File Management> → <Character Encoding> in the sub-menus.

File Management > Character Encoding

Apply

Character Encoding Type of Exporting File

CHARACTER ENCODING TYPE KOREAN(UHC) ▼

Foot Notes :

1. This setting only affects the exporting csv file

10.12.9 Statistics Function

It provides the statistics calculation function for statistics for group optimization.

It collects statistics for each statistical item by AP/radio, radio, WLAN (SSID), device type, and RF and again by time interval. The time intervals include 5 minutes, one hour, and 24 hours and the statistical value calculated by time is displayed when the statistics items are retrieved in WEC and CLI.

VoIP Statistics

It shows relevant statistics if VoIP is used with the SIP FMC terminal.

Configuration using CLI

- 1) Enable VoIP Statistics.

```
WEC8500/configure/network-stats/statistics/voip# enable
```

- 2) If the call setup, call drop, and MoS values of specific APs are monitored for a specific time and such values fail to reach the reference values, an event can be generated.
ex.) call-setup: If the call setup success rate is less than 50%, an event is generated.

```
../network-stats/alert/voip/call-setup# enable  
../network-stats/alert/voip/call-setup# threshold 50
```

- 3) Retrieve the status of configuration of the VoIP statistics.

```
WEC8500# show network-stats statistics voip configuration
```

- 4) Retrieve the status of configuration of the VoIP alert.

```
WEC8500# show network-stats alert voip configuration
```

- 5) Retrieve call statistics by radio.

```
WEC8500# show network-stats statistics voip radio
```

- 6) Retrieve call statistics by AP.

```
WEC8500# show network-stats statistics voip ap
```

7) Retrieve call statistics by WLAN.

```
WEC8500# show network-stats statistics voip wlan
```

8) Retrieve call statistics by device type.

```
WEC8500# show network-stats statistics voip device
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Monitoring> and then select <Statistics> → <Network Quality> → <by Radio> → <802.11a/n/ac> → <VoIP> in the sub-menus.

Statistics > Network Quality > Radios > 802.11a/n/ac > VoIP				
Last updated : Mon Dec 08 15:55:10 2014				
Call count statistics ¹				
Current calls : 0				
	5 MIN	1 HOUR	1 DAY	TOTAL
TOTAL ²	0	5	35	49
SETUP SUCCESS ³	0	5	35	49
SUCCESS ⁴	0	4	22	34
FAILURE ⁵	0	2	13	15
CANCEL	0	1	11	12
CALLED NUMBER BUSY	0	0	0	0
REQUEST TIMEOUT	0	0	0	0
NOT FOUND	0	0	0	0
FORBIDDEN	0	0	0	0
SIGNAL TIMEOUT	0	1	2	2
ETC	0	0	0	1
DROP, RATE	0(-%)	0(0%)	3(13.64%)	3(8.82%)
DISASSOCIATION	0	0	0	0
NO MEDIA	0	0	3	3
UNREGISTRATION	0	0	0	0
TIMEOUT	0	0	0	0
INTER-APC HANDOVER-OUT	0	0	0	0
INTER-APC HANDOVER-IN ⁶	0	0	0	0
Call setup time				
	5 MIN	1 HOUR	1 DAY	TOTAL
SETUP TIME MIN (MSEC)	0	902	237	5
SETUP TIME MAX (MSEC)	0	1,961	2,117	12,583
SETUP TIME AVG (MSEC)	0	1,354	1,307	1,224

In the menu bar of <WEC Main window>, select <Monitoring> and then select <Statistics> → <Network Quality> → <by AP> → <802.11a/n/ac> → <VoIP> in the sub-menus.

Assoc/Ho	Data Rates	Data Traffic	RF	VoIP
Statistics > Network Quality > APs > 802.11a/n/ac > VoIP				
<div>Radio Switch Back</div> <div>Last updated : Mon Dec 08 16:17:26 2014</div> <div> <div>PROFILE NAME</div> <div>AP-7F02</div> </div> <div> <div>AP NAME</div> <div>AP-7F02</div> </div>				
Call count statistics ¹				
Current calls : 0				
	5 MIN	1 HOUR	1 DAY	TOTAL
TOTAL ²	0	0	1	1
SETUP SUCCESS ³	0	0	1	1
SUCCESS ⁴	0	0	0	0
FAILURE ⁵	0	0	0	0
CANCEL	0	0	0	0
CALLED NUMBER BUSY	0	0	0	0
REQUEST TIMEOUT	0	0	0	0
NOT FOUND	0	0	0	0
FORBIDDEN	0	0	0	0
SIGNAL TIMEOUT	0	0	0	0
ETC	0	0	0	0
DROP	0	0	0	0
DISASSOCIATION	0	0	0	0
NO MEDIA	0	0	0	0
UNREGISTRATION	0	0	0	0
TIMEOUT	0	0	0	0
HANDOVER-OUT	0	0	1	1
HANDOVER-IN ⁶	0	0	0	0
INTER-APC HANDOVER-OUT	0	0	0	0
INTER-APC HANDOVER-IN ⁷	0	0	0	0

Radio Frequency (RF) Statistics

The statistics of RF show the statistics by channel for Channel-Utilization and Air-Quality and by radio for Rx(Tx)-Utilization and Noise-Level.

They show the minimum, maximum, and average values and error count exceeding the threshold by 5 min., one hour, 24 hours, and total period.

If the error count exceeds the threshold by each period, an alert occurs.

Configuration using CLI

- 1) Enable/Disable: Configure whether to operate RF Statistics.
(Enable: Function operation, Disable: No function operation)

```
WEC8500/configure/network-stats/statistics/rf-value# enable
```


- 2) enable-alert: Configure whether an alert occurs regarding Channel-Utilization, Air-Quality, and Noise-Level.
ex.) air-quality alert

```
../network-stats/alert/rf-value/enable-alert# air-quality enable
../network-stats/alert/rf-value/enable-alert# no air-quality enable
```

- 3) threshold: Configure the alert threshold of each RF value by radio.
ex.) air-quality 5G threshold → 90

```
../network-stats/alert/rf-value/threshold/80211a# air-quality 90
```

- 4) count-alert: An error count threshold to generate an alert in RF Statistics
If the error count is greater than the threshold by statistical period due to the RF values exceeding the threshold,
an alert occurs. If the value is 0, the alert of the corresponding period does not occur.
ex.) error count threshold per day → 720

```
../network-stats/alert/rf-value/count-alert# day1-threshold 720
```

- 5) Retrieve the status of configuration of the RF statistics.

```
WEC8500# show network-stats statistics rf-value summary
```

- 6) Retrieve the RF statistics of the RF values by AP.
ex.) Statistics of air-quality of AP 43

```
WEC8500# show network-stats statistics rf-value air-quality 43
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select <Statistics> → <Network Quality> → <APs> → <802.11a/n/ac> → <RF> in the sub-menus.

Tx/Rx Utilization and Noise Level

	5 MIN				1 HOUR				1 DAY				TOTAL			
	MIN	MAX	AVG	CNT ¹	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT
TX UTILIZATION (%)	6	6	6	0	6	7	6	0	0	0	0	0	6	7	6	0
RX UTILIZATION (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOISE LEVEL	-92	-91	-91	0	-92	-84	-90	0	0	0	0	0	-92	-84	-90	0

Channel Utilization

	5 MIN				1 HOUR				1 DAY				TOTAL			
	MIN	MAX	AVG	CNT ¹	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT
CHANNEL 36	19	25	20	0	12	56	26	0	0	0	0	0	10	65	21	0
CHANNEL 40	19	21	20	0	9	64	19	0	0	0	0	0	8	65	20	0
CHANNEL 44	12	34	17	0	10	40	16	0	0	0	0	0	6	41	16	0
CHANNEL 48	21	27	24	0	16	43	25	0	0	0	0	0	14	74	25	0
CHANNEL 52	1	2	1	0	1	4	1	0	0	0	0	0	1	18	1	0
CHANNEL 56	1	2	1	0	1	2	1	0	0	0	0	0	0	33	1	0
CHANNEL 60	1	1	1	0	1	2	1	0	0	0	0	0	1	2	1	0
CHANNEL 64	4	6	5	0	2	6	3	0	0	0	0	0	2	7	3	0
CHANNEL 100	3	3	3	0	2	4	2	0	0	0	0	0	1	5	2	0
CHANNEL 104	2	4	3	0	2	5	2	0	0	0	0	0	1	5	2	0
CHANNEL 108	2	3	2	0	2	6	2	0	0	0	0	0	1	6	2	0
CHANNEL 112	2	4	2	0	1	4	2	0	0	0	0	0	1	4	2	0
CHANNEL 116	4	4	4	0	2	6	3	0	0	0	0	0	1	6	3	0
CHANNEL 120	2	3	2	0	2	5	2	0	0	0	0	0	1	6	2	0
CHANNEL 124	2	3	2	0	2	6	2	0	0	0	0	0	1	6	2	0
CHANNEL 149	63	76	69	0	57	80	71	0	0	0	0	0	52	80	73	0
CHANNEL 153	32	49	41	0	16	53	45	0	0	0	0	0	14	58	45	0
CHANNEL 157	21	32	27	0	22	40	32	0	0	0	0	0	14	42	30	0
CHANNEL 161	29	29	29	0	26	31	28	0	0	0	0	0	26	32	28	0

Air Quality

	5 MIN				1 HOUR				1 DAY				TOTAL			
	MIN	MAX	AVG	CNT ²	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT	MIN	MAX	AVG	CNT
CHANNEL 36	75	81	79	0	44	88	72	0	0	0	0	0	35	90	78	0
CHANNEL 40	79	81	80	0	36	91	79	0	0	0	0	0	35	92	79	0

Data Traffic Statistics

Data traffic statistics on the air section. Possible to retrieve in a unit of AP. The statistics provide information on Control, User Data, Tx/Rx, Unicast/Multicast/Broadcast, Background/Best Effort/Video/Voice, and Peak-rate (Kbps) as detailed items. They also provide statistical information on Real-time Transport Protocol (RTP) as voice traffic as well.

Configuration using CLI

- 1) Check the configuration of the data traffic statistics and if the status is set to be disabled, set to be enabled.

```
WEC8500# show network-stats statistics data current-config
WEC8500/configure/network-stats/statistics/data# enable
```

- 2) To retrieve the statistical information of a specific AP, enter as follows:

```
WEC8500# show network-stats statistics data ap-stat 1
```

- 3) To retrieve the statistical information of RTP of a specific AP, give a RTP option as follows:

```
WEC8500# show network-stats statistics data ap-stat 1 rtp
```

- 4) To retrieve the statistical information of all APs, enter as follows:

```
WEC8500# show network-stats statistics data apc-stat
```

- 5) To retrieve the statistical information of RTP of all APs, give a RTP option as follows:

```
WEC8500# show network-stats statistics data apc-stat rtp
```

- 6) To generate a packet loss alert from the AP, enter as follows:

```
WEC8500/configure/network-stats/alert/data# packet-loss-alert enable
```

- 7) To generate a packet retry alert from the AP, enter as follows:

```
WEC8500/configure/network-stats/alert/data# packet-retry-alert enable
```

Configuration using Web UI

In the menu bar of <WEC Main window>, select <Configuration> and then select <Statistics> → <Network Quality> → <APs> → <802.11a/n/ac> → <Data Traffic> in the sub-menus.

Station Statistics

They provide the statistics of the network optimization to check service, tracking, debugging, status transition, etc. of a station. Main statistics items provided include station latency upon connection and handover, attempt count, statistics by failure reason, RSSI, success rate, data rate by AP, Disassoc/Deauth statistics, statistics by reason, handover path statistics, kickout statistics by AP, number of users, scanning statistics by AP, etc. and provide such statistics by 5 min., one hour, 24 hours, and total period by WLAN, AP, Radio, and Device Type.

Configuration using CLI

- 1) Enable or disable station network statistics.
 - network-stats statistics station [MODE]

Parameter	Description
Mode	Whether to configure network statistics - enable: Setting - disable: Release (by default)

```
APC# configure terminal
APC/configure# network-stats statistics station enable

Enabled Station Net-Stats
APC/configure# no network-stats statistics station enable

Disabled Station Net-Stat
```

- 2) Enable or disable station statistics alert.
 - network-stats alert station [MODE]

Parameter	Description
Mode	Whether to configure network statistics alert - enable: Set (by default) - disable: Cleared

```
APC/configure# network-stats alert station enable

Enabled Station Net-Stats Alert
APC/configure# no network-stats alert station enable

Disabled Station Net-Stats Alert
```

- 3) Configure the alert period (Duration).
- network-stats alert station alert-duration [VALUE]

Parameter	Description
VALUE	30~60 Min. (default: 30 min)

```
APC/configure# network-stats alert station alert-duration 40
Alert Duration: 40
```

- 4) Configure the alert boundary value of the assoc. success rate.
- network-stats alert station alert-assoc-rate [VALUE]

Parameter	Description
VALUE	10-90 % (default: 30 %)

```
APC/configure# network-stats alert station alert-assoc-rate 50
Assoc. Success Rate Alert Threshold: 50 %
```

- 5) Configure the alert boundary value of the assoc. RSSI.
- network-stats alert station alert-assoc-rssi [VALUE]

Parameter	Description
VALUE	-100~-50 dBm (default: -85 dBm)

```
APC/configure# network-stats alert station alert-assoc-rssi -90
Assoc & Reassoc RSSI Alert Threshold: -90 %
```

- 6) Configure the alert boundary value of the disassoc. attempt count.
- network-stats alert station alert-assoc-try [VALUE]

Parameter	Description
VALUE	10~1000 (default: 30)

```
APC/configure# network-stats alert station alert-assoc-try 40
Assoc Try Alert Threshold: 40
```

- 7) Configure the alert boundary value of the disassoc. attempt count.
- network-stats alert station alert-disassoc-try [VALUE]

Parameter	Description
VALUE	2~1000 (default: 30)

```
APC/configure# network-stats alert station alert-disassoc-try 40
Disassoc Try Alert Threshold: 40
```

- 8) Configure the alert boundary value of the handover success rate.
- network-stats alert station alert-handover-rate [VALUE]

Parameter	Description
VALUE	10-90 % (default: 50 %)

```
APC/configure# network-stats alert station alert-handover-rate 50
Handover Rate Alert Threshold: 50 %
```

- 9) Configure the alert boundary value of the handover attempt count.
- network-stats alert station alert-handover-try [VALUE]

Parameter	Description
VALUE	10~1000 (default: 30)

```
APC/configure# network-stats alert station alert-handover-try 40
Handover Try Alert Threshold: 40
```

- 10) Configure the max entry value of the target in the station network statistics.
- network-stats alert station alert-max-db [MODE]

Parameter	Description
VALUE	1000~50000 (default: 10000)

```
APC/configure# network-stats alert station alert-max-db 5000
Max Alert DB Number : 5000
```

Checking Statistical Information Using CLI

- 1) Check the station association latency (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association latency wlan 1

Station Association Latency [WLAN ID (1)]:

[Total]
  Station Association Latency Minimum..... 0 ms
  Station Association Latency Maximum..... 0 ms
  Station Association Latency Average..... 0 ms
  Station Association Latency Total Count..... 0
[5 Min]
  Station Association Latency Minimum..... 0 ms
  Station Association Latency Maximum..... 0 ms
  Station Association Latency Average..... 0 ms
  Station Association Latency Total Count..... 0
[1 Hour]
  Station Association Latency Minimum..... 0 ms
  Station Association Latency Maximum..... 0 ms
  Station Association Latency Average..... 0 ms
  Station Association Latency Total Count..... 0
[1 Day]
  Station Association Latency Minimum..... 0 ms
  Station Association Latency Maximum..... 0 ms
  Station Association Latency Average..... 0 ms
  Station Association Latency Total Count..... 0
```

- 2) Check the station association attempt count (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association num-of-attempt-
assoc wlan 1

[WLAN ID (1)]
Reason Total 5Min 1Hour 1Day
=====
=====
AssocAttempt 0 0 0 0
```

3) Check the statistics by station association failure reason (by AP/Device/Radio/WLAN).

ex.) by WLAN

```
APC# show network-stats statistics station association num-of-fail-by-
reason wlan 1
```

```
[WLAN ID (1)]
```

Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNSPECIFIED	0	0	0	0
PREV_AUTH_NOT_VALID	0	0	0	0
DEAUTH_LEAVING	0	0	0	0
DISASSOC_DUE_TO_INACTIVITY	0	0	0	0
DISASSOC_AP_BUSY	0	0	0	0
CLASS2_FRAME_FROM_NONAUTH_STA	0	0	0	0
CLASS3_FRAME_FROM_NONASSOC_STA	0	0	0	0
DISASSOC_STA_HAS_LEFT	0	0	0	0
STA_REQ_ASSOC_WITHOUT_AUTH	0	0	0	0
PWR_CAPABILITY_NOT_VALID	0	0	0	0
SUPPORTED_CHANNEL_NOT_VALID	0	0	0	0
INVALID_IE	0	0	0	0
MICHAEL_MIC_FAILURE	0	0	0	0
4WAY_HANDSHAKE_TIMEOUT	0	0	0	0
GROUP_KEY_UPDATE_TIMEOUT	0	0	0	0
IE_IN_4WAY_DIFFERS	0	0	0	0
GROUP_CIPHER_NOT_VALID	0	0	0	0
PAIRWISE_CIPHER_NOT_VALID	0	0	0	0
AKMP_NOT_VALID	0	0	0	0
UNSUPPORTED_RSN_IE_VERSION	0	0	0	0
INVALID_RSN_IE_CAPAB	0	0	0	0
IEEE_802_1X_AUTH_FAILED	0	0	0	0
CIPHER_SUITE_REJECTED	0	0	0	0
TDLS_TEARDOWN_UNREACHABLE	0	0	0	0
TDLS_TEARDOWN_UNSPECIFIED	0	0	0	0
TOO_MANY	0	0	0	0
STAION_RETRY_THRESHOLD	0	0	0	0
ACL_KICKOUT	0	0	0	0
AUTH_IDLE_TIMEOUT	0	0	0	0
AUTH_IN_ASSOC_STATE	0	0	0	0
WRONG_STA	0	0	0	0
EXPIRED_SERVICE_TIME	0	0	0	0
MAC_AUTH_TIMEOUT	0	0	0	0
MAC_AUTH_REJECT	0	0	0	0
MANUAL_KICKOUT	0	0	0	0
MALICIOUS_STA_STATISTICS	0	0	0	0
KICKOUT_MAC_FILTER	0	0	0	0
KICKOUT_INVALID_IP	0	0	0	0
KICKOUT_ACL	0	0	0	0
INTER_APC_HO	0	0	0	0
CLUSTER_DOWN	0	0	0	0
VAP_DOWN	0	0	0	0

- 4) Check the station association RSSI MIN/MAX/AVG statistics (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association rssi wlan 1
```

[WLAN ID (1)]				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
Minimum	0	0	0	0
Maximum	0	0	0	0
Average	0	0	0	0

- 5) Check the station association success rate statistics (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station association success-rate wlan 1
```

Station Association Success Rate [WLAN ID (1)]:

[Total]	
Station Association Succ Try.....	0
Station Association Succ Success.....	0
Station Association Succ Failure.....	0
Station Association Succ Rate(%).....	0.000000 %
[5 Min]	
Station Association Succ Try.....	0
Station Association Succ Success.....	0
Station Association Succ Failure.....	0
Station Association Succ Rate(%).....	0.000000 %
[1 Hour]	
Station Association Succ Try.....	0
Station Association Succ Success.....	0
Station Association Succ Failure.....	0
Station Association Succ Rate(%).....	0.000000 %
[1 Day]	
Station Association Succ Try.....	0
Station Association Succ Success.....	0
Station Association Succ Failure.....	0
Station Association Succ Rate(%).....	0.000000 %

- 6) Check the statistics of station data rate (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station data-rate 1
```

[AP ID (1), Radio 5-GHz]
802.11b/g_TxCount

Reason	Total	5Min	1Hour	1Day
=====				
802.11b/g_1M	0	0	0	0
802.11b/g_2M	0	0	0	0
802.11b/g_5.5M	0	0	0	0
802.11b/g_11M	0	0	0	0
802.11b/g_TxFailedCount				
Reason	Total	5Min	1Hour	1Day
=====				
802.11b/g_1M	0	0	0	0
802.11b/g_2M	0	0	0	0
802.11b/g_5.5M	0	0	0	0
802.11b/g_11M	0	0	0	0
802.11b/g_RxCount				
Reason	Total	5Min	1Hour	1Day
=====				
802.11b/g_1M	0	0	0	0
802.11b/g_2M	0	0	0	0
802.11b/g_5.5M	0	0	0	0
802.11b/g_11M	0	0	0	0
802.11g_TxCount				
Reason	Total	5Min	1Hour	1Day
=====				
802.11g_6M	0	0	0	0
802.11g_9M	0	0	0	0
802.11g_12M	0	0	0	0
802.11g_18M	0	0	0	0
802.11g_24M	0	0	0	0
802.11g_36M	0	0	0	0
802.11g_48M	0	0	0	0
802.11g_54M	0	0	0	0
802.11g_TxFailedCount				
Reason	Total	5Min	1Hour	1Day
=====				
802.11g_6M	0	0	0	0
802.11g_9M	0	0	0	0
802.11g_12M	0	0	0	0
802.11g_18M	0	0	0	0
802.11g_24M	0	0	0	0
802.11g_36M	0	0	0	0
802.11g_48M	0	0	0	0
802.11g_54M	0	0	0	0

802.11g_RxCount				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
802.11g_6M	0	0	0	0
802.11g_9M	0	0	0	0
802.11g_12M	0	0	0	0
802.11g_18M	0	0	0	0
802.11g_24M	0	0	0	0
802.11g_36M	0	0	0	0
802.11g_48M	0	0	0	0
802.11g_54M	0	0	0	0
TxHtMcs				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
MCS_0	0	0	0	0
MCS_1	0	0	0	0
MCS_2	0	0	0	0
MCS_3	0	0	0	0
MCS_4	0	0	0	0
MCS_5	0	0	0	0
MCS_6	0	0	0	0
MCS_7	0	0	0	0
MCS_8	0	0	0	0
MCS_9	0	0	0	0
MCS_10	0	0	0	0
MCS_11	0	0	0	0
MCS_12	0	0	0	0
MCS_13	0	0	0	0
MCS_14	0	0	0	0
MCS_15	0	0	0	0
MCS_16	0	0	0	0
MCS_17	0	0	0	0
MCS_18	0	0	0	0
MCS_19	0	0	0	0
MCS_20	0	0	0	0
MCS_21	0	0	0	0
MCS_22	0	0	0	0
MCS_23	0	0	0	0
TxHtMcsFailed				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
MCS_0	0	0	0	0
MCS_1	0	0	0	0
MCS_2	0	0	0	0
MCS_3	0	0	0	0
MCS_4	0	0	0	0
MCS_5	0	0	0	0

MCS_6	0	0	0	0
MCS_7	0	0	0	0
MCS_8	0	0	0	0
MCS_9	0	0	0	0
MCS_10	0	0	0	0
MCS_11	0	0	0	0
MCS_12	0	0	0	0
MCS_13	0	0	0	0
MCS_14	0	0	0	0
MCS_15	0	0	0	0
MCS_16	0	0	0	0
MCS_17	0	0	0	0
MCS_18	0	0	0	0
MCS_19	0	0	0	0
MCS_20	0	0	0	0
MCS_21	0	0	0	0
MCS_22	0	0	0	0
MCS_23	0	0	0	0
RxHtMcs				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
MCS_0	0	0	0	0
MCS_1	0	0	0	0
MCS_2	0	0	0	0
MCS_3	0	0	0	0
MCS_4	0	0	0	0
MCS_5	0	0	0	0
MCS_6	0	0	0	0
MCS_7	0	0	0	0
MCS_8	0	0	0	0
MCS_9	0	0	0	0
MCS_10	0	0	0	0
MCS_11	0	0	0	0
MCS_12	0	0	0	0
MCS_13	0	0	0	0
MCS_14	0	0	0	0
MCS_15	0	0	0	0
MCS_16	0	0	0	0
MCS_17	0	0	0	0
MCS_18	0	0	0	0
MCS_19	0	0	0	0
MCS_20	0	0	0	0
MCS_21	0	0	0	0
MCS_22	0	0	0	0
MCS_23	0	0	0	0
TxVhtMcs				
Reason	Total	5Min	1Hour	1Day
=====				
=====				

11AC_MCS[0][0]	0	0	0	0
11AC_MCS[0][1]	0	0	0	0
11AC_MCS[0][2]	0	0	0	0
11AC_MCS[0][3]	0	0	0	0
11AC_MCS[0][4]	0	0	0	0
11AC_MCS[0][5]	0	0	0	0
11AC_MCS[0][6]	0	0	0	0
11AC_MCS[0][7]	0	0	0	0
11AC_MCS[0][8]	0	0	0	0
11AC_MCS[0][9]	0	0	0	0
11AC_MCS[1][0]	0	0	0	0
11AC_MCS[1][1]	0	0	0	0
11AC_MCS[1][2]	0	0	0	0
11AC_MCS[1][3]	0	0	0	0
11AC_MCS[1][4]	0	0	0	0
11AC_MCS[1][5]	0	0	0	0
11AC_MCS[1][6]	0	0	0	0
11AC_MCS[1][7]	0	0	0	0
11AC_MCS[1][8]	0	0	0	0
11AC_MCS[1][9]	0	0	0	0
11AC_MCS[2][0]	0	0	0	0
11AC_MCS[2][1]	0	0	0	0
11AC_MCS[2][2]	0	0	0	0
11AC_MCS[2][3]	0	0	0	0
11AC_MCS[2][4]	0	0	0	0
11AC_MCS[2][5]	0	0	0	0
11AC_MCS[2][6]	0	0	0	0
11AC_MCS[2][7]	0	0	0	0
11AC_MCS[2][8]	0	0	0	0
11AC_MCS[2][9]	0	0	0	0
TxVhtMcsFailed				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
11AC_MCS[0][0]	0	0	0	0
11AC_MCS[0][1]	0	0	0	0
11AC_MCS[0][2]	0	0	0	0
11AC_MCS[0][3]	0	0	0	0
11AC_MCS[0][4]	0	0	0	0
11AC_MCS[0][5]	0	0	0	0
11AC_MCS[0][6]	0	0	0	0
11AC_MCS[0][7]	0	0	0	0
11AC_MCS[0][8]	0	0	0	0
11AC_MCS[0][9]	0	0	0	0
11AC_MCS[1][0]	0	0	0	0
11AC_MCS[1][1]	0	0	0	0
11AC_MCS[1][2]	0	0	0	0
11AC_MCS[1][3]	0	0	0	0
11AC_MCS[1][4]	0	0	0	0
11AC_MCS[1][5]	0	0	0	0
11AC_MCS[1][6]	0	0	0	0

11AC_MCS[1][7]	0	0	0	0
11AC_MCS[1][8]	0	0	0	0
11AC_MCS[1][9]	0	0	0	0
11AC_MCS[2][0]	0	0	0	0
11AC_MCS[2][1]	0	0	0	0
11AC_MCS[2][2]	0	0	0	0
11AC_MCS[2][3]	0	0	0	0
11AC_MCS[2][4]	0	0	0	0
11AC_MCS[2][5]	0	0	0	0
11AC_MCS[2][6]	0	0	0	0
11AC_MCS[2][7]	0	0	0	0
11AC_MCS[2][8]	0	0	0	0
11AC_MCS[2][9]	0	0	0	0
RxVhtMcs				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
11AC_MCS[0][0]	0	0	0	0
11AC_MCS[0][1]	0	0	0	0
11AC_MCS[0][2]	0	0	0	0
11AC_MCS[0][3]	0	0	0	0
11AC_MCS[0][4]	0	0	0	0
11AC_MCS[0][5]	0	0	0	0
11AC_MCS[0][6]	0	0	0	0
11AC_MCS[0][7]	0	0	0	0
11AC_MCS[0][8]	0	0	0	0
11AC_MCS[0][9]	0	0	0	0
11AC_MCS[1][0]	0	0	0	0
11AC_MCS[1][1]	0	0	0	0
11AC_MCS[1][2]	0	0	0	0
11AC_MCS[1][3]	0	0	0	0
11AC_MCS[1][4]	0	0	0	0
11AC_MCS[1][5]	0	0	0	0
11AC_MCS[1][6]	0	0	0	0
11AC_MCS[1][7]	0	0	0	0
11AC_MCS[1][8]	0	0	0	0
11AC_MCS[1][9]	0	0	0	0
11AC_MCS[2][0]	0	0	0	0
11AC_MCS[2][1]	0	0	0	0
11AC_MCS[2][2]	0	0	0	0
11AC_MCS[2][3]	0	0	0	0
11AC_MCS[2][4]	0	0	0	0
11AC_MCS[2][5]	0	0	0	0
11AC_MCS[2][6]	0	0	0	0
11AC_MCS[2][7]	0	0	0	0
11AC_MCS[2][8]	0	0	0	0
11AC_MCS[2][9]	0	0	0	0
[AP ID (1), Radio 2.4-GHz]				
802.11b/g_TxCount				
Reason	Total	5Min	1Hour	1Day

=====				
=====				
802.11b/g_1M	0	0	0	0
802.11b/g_2M	0	0	0	0
802.11b/g_5.5M	0	0	0	0
802.11b/g_11M	0	0	0	0
802.11b/g_TxFailedCount				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
802.11b/g_1M	0	0	0	0
802.11b/g_2M	0	0	0	0
802.11b/g_5.5M	0	0	0	0
802.11b/g_11M	0	0	0	0
802.11b/g_RxCount				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
802.11b/g_1M	0	0	0	0
802.11b/g_2M	0	0	0	0
802.11b/g_5.5M	0	0	0	0
802.11b/g_11M	0	0	0	0
802.11g_TxCount				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
802.11g_6M	0	0	0	0
802.11g_9M	0	0	0	0
802.11g_12M	0	0	0	0
802.11g_18M	0	0	0	0
802.11g_24M	0	0	0	0
802.11g_36M	0	0	0	0
802.11g_48M	0	0	0	0
802.11g_54M	0	0	0	0
802.11g_TxFailedCount				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
802.11g_6M	0	0	0	0
802.11g_9M	0	0	0	0
802.11g_12M	0	0	0	0
802.11g_18M	0	0	0	0
802.11g_24M	0	0	0	0
802.11g_36M	0	0	0	0
802.11g_48M	0	0	0	0
802.11g_54M	0	0	0	0

802.11g_RxCount				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
802.11g_6M	0	0	0	0
802.11g_9M	0	0	0	0
802.11g_12M	0	0	0	0
802.11g_18M	0	0	0	0
802.11g_24M	0	0	0	0
802.11g_36M	0	0	0	0
802.11g_48M	0	0	0	0
802.11g_54M	0	0	0	0
TxHtMcs				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
MCS_0	0	0	0	0
MCS_1	0	0	0	0
MCS_2	0	0	0	0
MCS_3	0	0	0	0
MCS_4	0	0	0	0
MCS_5	0	0	0	0
MCS_6	0	0	0	0
MCS_7	0	0	0	0
MCS_8	0	0	0	0
MCS_9	0	0	0	0
MCS_10	0	0	0	0
MCS_11	0	0	0	0
MCS_12	0	0	0	0
MCS_13	0	0	0	0
MCS_14	0	0	0	0
MCS_15	0	0	0	0
MCS_16	0	0	0	0
MCS_17	0	0	0	0
MCS_18	0	0	0	0
MCS_19	0	0	0	0
MCS_20	0	0	0	0
MCS_21	0	0	0	0
MCS_22	0	0	0	0
MCS_23	0	0	0	0
TxHtMcsFailed				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
MCS_0	0	0	0	0
MCS_1	0	0	0	0
MCS_2	0	0	0	0
MCS_3	0	0	0	0
MCS_4	0	0	0	0

MCS_5	0	0	0	0
MCS_6	0	0	0	0
MCS_7	0	0	0	0
MCS_8	0	0	0	0
MCS_9	0	0	0	0
MCS_10	0	0	0	0
MCS_11	0	0	0	0
MCS_12	0	0	0	0
MCS_13	0	0	0	0
MCS_14	0	0	0	0
MCS_15	0	0	0	0
MCS_16	0	0	0	0
MCS_17	0	0	0	0
MCS_18	0	0	0	0
MCS_19	0	0	0	0
MCS_20	0	0	0	0
MCS_21	0	0	0	0
MCS_22	0	0	0	0
MCS_23	0	0	0	0
RxHtMcs				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
MCS_0	0	0	0	0
MCS_1	0	0	0	0
MCS_2	0	0	0	0
MCS_3	0	0	0	0
MCS_4	0	0	0	0
MCS_5	0	0	0	0
MCS_6	0	0	0	0
MCS_7	0	0	0	0
MCS_8	0	0	0	0
MCS_9	0	0	0	0
MCS_10	0	0	0	0
MCS_11	0	0	0	0
MCS_12	0	0	0	0
MCS_13	0	0	0	0
MCS_14	0	0	0	0
MCS_15	0	0	0	0
MCS_16	0	0	0	0
MCS_17	0	0	0	0
MCS_18	0	0	0	0
MCS_19	0	0	0	0
MCS_20	0	0	0	0
MCS_21	0	0	0	0
MCS_22	0	0	0	0
MCS_23	0	0	0	0
TxVhtMcs				
Reason	Total	5Min	1Hour	1Day

=====				
=====				
11AC_MCS[0][0]	0	0	0	0
11AC_MCS[0][1]	0	0	0	0
11AC_MCS[0][2]	0	0	0	0
11AC_MCS[0][3]	0	0	0	0
11AC_MCS[0][4]	0	0	0	0
11AC_MCS[0][5]	0	0	0	0
11AC_MCS[0][6]	0	0	0	0
11AC_MCS[0][7]	0	0	0	0
11AC_MCS[0][8]	0	0	0	0
11AC_MCS[0][9]	0	0	0	0
11AC_MCS[1][0]	0	0	0	0
11AC_MCS[1][1]	0	0	0	0
11AC_MCS[1][2]	0	0	0	0
11AC_MCS[1][3]	0	0	0	0
11AC_MCS[1][4]	0	0	0	0
11AC_MCS[1][5]	0	0	0	0
11AC_MCS[1][6]	0	0	0	0
11AC_MCS[1][7]	0	0	0	0
11AC_MCS[1][8]	0	0	0	0
11AC_MCS[1][9]	0	0	0	0
11AC_MCS[2][0]	0	0	0	0
11AC_MCS[2][1]	0	0	0	0
11AC_MCS[2][2]	0	0	0	0
11AC_MCS[2][3]	0	0	0	0
11AC_MCS[2][4]	0	0	0	0
11AC_MCS[2][5]	0	0	0	0
11AC_MCS[2][6]	0	0	0	0
11AC_MCS[2][7]	0	0	0	0
11AC_MCS[2][8]	0	0	0	0
11AC_MCS[2][9]	0	0	0	0
TxVhtMcsFailed				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
11AC_MCS[0][0]	0	0	0	0
11AC_MCS[0][1]	0	0	0	0
11AC_MCS[0][2]	0	0	0	0
11AC_MCS[0][3]	0	0	0	0
11AC_MCS[0][4]	0	0	0	0
11AC_MCS[0][5]	0	0	0	0
11AC_MCS[0][6]	0	0	0	0
11AC_MCS[0][7]	0	0	0	0
11AC_MCS[0][8]	0	0	0	0
11AC_MCS[0][9]	0	0	0	0
11AC_MCS[1][0]	0	0	0	0
11AC_MCS[1][1]	0	0	0	0
11AC_MCS[1][2]	0	0	0	0
11AC_MCS[1][3]	0	0	0	0
11AC_MCS[1][4]	0	0	0	0

11AC_MCS[1][5]	0	0	0	0
11AC_MCS[1][6]	0	0	0	0
11AC_MCS[1][7]	0	0	0	0
11AC_MCS[1][8]	0	0	0	0
11AC_MCS[1][9]	0	0	0	0
11AC_MCS[2][0]	0	0	0	0
11AC_MCS[2][1]	0	0	0	0
11AC_MCS[2][2]	0	0	0	0
11AC_MCS[2][3]	0	0	0	0
11AC_MCS[2][4]	0	0	0	0
11AC_MCS[2][5]	0	0	0	0
11AC_MCS[2][6]	0	0	0	0
11AC_MCS[2][7]	0	0	0	0
11AC_MCS[2][8]	0	0	0	0
11AC_MCS[2][9]	0	0	0	0
RxVhtMcs				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
11AC_MCS[0][0]	0	0	0	0
11AC_MCS[0][1]	0	0	0	0
11AC_MCS[0][2]	0	0	0	0
11AC_MCS[0][3]	0	0	0	0
11AC_MCS[0][4]	0	0	0	0
11AC_MCS[0][5]	0	0	0	0
11AC_MCS[0][6]	0	0	0	0
11AC_MCS[0][7]	0	0	0	0
11AC_MCS[0][8]	0	0	0	0
11AC_MCS[0][9]	0	0	0	0
11AC_MCS[1][0]	0	0	0	0
11AC_MCS[1][1]	0	0	0	0
11AC_MCS[1][2]	0	0	0	0
11AC_MCS[1][3]	0	0	0	0
11AC_MCS[1][4]	0	0	0	0
11AC_MCS[1][5]	0	0	0	0
11AC_MCS[1][6]	0	0	0	0
11AC_MCS[1][7]	0	0	0	0
11AC_MCS[1][8]	0	0	0	0
11AC_MCS[1][9]	0	0	0	0
11AC_MCS[2][0]	0	0	0	0
11AC_MCS[2][1]	0	0	0	0
11AC_MCS[2][2]	0	0	0	0
11AC_MCS[2][3]	0	0	0	0
11AC_MCS[2][4]	0	0	0	0
11AC_MCS[2][5]	0	0	0	0
11AC_MCS[2][6]	0	0	0	0
11AC_MCS[2][7]	0	0	0	0
11AC_MCS[2][8]	0	0	0	0
11AC_MCS[2][9]	0	0	0	0

- 7) Check the statistics by station disassoc./Deauth reason (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station disassoc-deauth wlan 1
```

```
[WLAN ID (1)]
```

```
number of In/Out
```

Reason	Total	5Min	1Hour	1Day
DisassocIn	0	0	0	0
DeauthIn	0	0	0	0
DisassocOut	0	0	0	0
DeauthOut	0	0	0	0

```
DisassocInReason
```

Reason	Total	5Min	1Hour	1Day
UNSPECIFIED	0	0	0	0
PREV_AUTH_NOT_VALID	0	0	0	0
DEAUTH_LEAVING	0	0	0	0
DISASSOC_DUE_TO_INACTIVITY	0	0	0	0
DISASSOC_AP_BUSY	0	0	0	0
CLASS2_FRAME_FROM_NONAUTH_STA	0	0	0	0
CLASS3_FRAME_FROM_NONASSOC_STA	0	0	0	0
DISASSOC_STA_HAS_LEFT	0	0	0	0
STA_REQ_ASSOC_WITHOUT_AUTH	0	0	0	0
PWR_CAPABILITY_NOT_VALID	0	0	0	0
SUPPORTED_CHANNEL_NOT_VALID	0	0	0	0
INVALID_IE	0	0	0	0
MICHAEL_MIC_FAILURE	0	0	0	0
4WAY_HANDSHAKE_TIMEOUT	0	0	0	0
GROUP_KEY_UPDATE_TIMEOUT	0	0	0	0
IE_IN_4WAY_DIFFERS	0	0	0	0
GROUP_CIPHER_NOT_VALID	0	0	0	0
PAIRWISE_CIPHER_NOT_VALID	0	0	0	0
AKMP_NOT_VALID	0	0	0	0
UNSUPPORTED_RSN_IE_VERSION	0	0	0	0
INVALID_RSN_IE_CAPAB	0	0	0	0
IEEE_802_1X_AUTH_FAILED	0	0	0	0
CIPHER_SUITE_REJECTED	0	0	0	0
TDLS_TEARDOWN_UNREACHABLE	0	0	0	0
TDLS_TEARDOWN_UNSPECIFIED	0	0	0	0
TOO_MANY	0	0	0	0
STAION_RETRY_THRESHOLD	0	0	0	0
ACL_KICKOUT	0	0	0	0
AUTH_IDLE_TIMEOUT	0	0	0	0
AUTH_IN_ASSOC_STATE	0	0	0	0
WRONG_STA	0	0	0	0
EXPIRED_SERVICE_TIME	0	0	0	0
MAC_AUTH_TIMEOUT	0	0	0	0

MAC_AUTH_REJECT	0	0	0	0
MANUAL_KICKOUT	0	0	0	0
MALICIOUS_STA_STATISTICS	0	0	0	0
KICKOUT_MAC_FILTER	0	0	0	0
KICKOUT_INVALID_IP	0	0	0	0
KICKOUT_ACL	0	0	0	0
INTER_APC_HO	0	0	0	0
CLUSTER_DOWN	0	0	0	0
VAP_DOWN	0	0	0	0
DeauthInReason				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNSPECIFIED	0	0	0	0
PREV_AUTH_NOT_VALID	0	0	0	0
DEAUTH_LEAVING	0	0	0	0
DISASSOC_DUE_TO_INACTIVITY	0	0	0	0
DISASSOC_AP_BUSY	0	0	0	0
CLASS2_FRAME_FROM_NONAUTH_STA	0	0	0	0
CLASS3_FRAME_FROM_NONASSOC_STA	0	0	0	0
DISASSOC_STA_HAS_LEFT	0	0	0	0
STA_REQ_ASSOC_WITHOUT_AUTH	0	0	0	0
PWR_CAPABILITY_NOT_VALID	0	0	0	0
SUPPORTED_CHANNEL_NOT_VALID	0	0	0	0
INVALID_IE	0	0	0	0
MICHAEL_MIC_FAILURE	0	0	0	0
4WAY_HANDSHAKE_TIMEOUT	0	0	0	0
GROUP_KEY_UPDATE_TIMEOUT	0	0	0	0
IE_IN_4WAY_DIFFERS	0	0	0	0
GROUP_CIPHER_NOT_VALID	0	0	0	0
PAIRWISE_CIPHER_NOT_VALID	0	0	0	0
AKMP_NOT_VALID	0	0	0	0
UNSUPPORTED_RSN_IE_VERSION	0	0	0	0
INVALID_RSN_IE_CAPAB	0	0	0	0
IEEE_802_1X_AUTH_FAILED	0	0	0	0
CIPHER_SUITE_REJECTED	0	0	0	0
TDLS_TEARDOWN_UNREACHABLE	0	0	0	0
TDLS_TEARDOWN_UNSPECIFIED	0	0	0	0
TOO_MANY	0	0	0	0
STAION_RETRY_THRESHOLD	0	0	0	0
ACL_KICKOUT	0	0	0	0
AUTH_IDLE_TIMEOUT	0	0	0	0
AUTH_IN_ASSOC_STATE	0	0	0	0
WRONG_STA	0	0	0	0
EXPIRED_SERVICE_TIME	0	0	0	0
MAC_AUTH_TIMEOUT	0	0	0	0
MAC_AUTH_REJECT	0	0	0	0
MANUAL_KICKOUT	0	0	0	0
MALICIOUS_STA_STATISTICS	0	0	0	0
KICKOUT_MAC_FILTER	0	0	0	0
KICKOUT_INVALID_IP	0	0	0	0
KICKOUT_ACL	0	0	0	0

INTER_APC_HO	0	0	0	0
CLUSTER_DOWN	0	0	0	0
VAP_DOWN	0	0	0	0
DisassocOutReason				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNSPECIFIED	0	0	0	0
PREV_AUTH_NOT_VALID	0	0	0	0
DEAUTH_LEAVING	0	0	0	0
DISASSOC_DUE_TO_INACTIVITY	0	0	0	0
DISASSOC_AP_BUSY	0	0	0	0
CLASS2_FRAME_FROM_NONAUTH_STA	0	0	0	0
CLASS3_FRAME_FROM_NONASSOC_STA	0	0	0	0
DISASSOC_STA_HAS_LEFT	0	0	0	0
STA_REQ_ASSOC_WITHOUT_AUTH	0	0	0	0
PWR_CAPABILITY_NOT_VALID	0	0	0	0
SUPPORTED_CHANNEL_NOT_VALID	0	0	0	0
INVALID_IE	0	0	0	0
MICHAEL_MIC_FAILURE	0	0	0	0
4WAY_HANDSHAKE_TIMEOUT	0	0	0	0
GROUP_KEY_UPDATE_TIMEOUT	0	0	0	0
IE_IN_4WAY_DIFFERS	0	0	0	0
GROUP_CIPHER_NOT_VALID	0	0	0	0
PAIRWISE_CIPHER_NOT_VALID	0	0	0	0
AKMP_NOT_VALID	0	0	0	0
UNSUPPORTED_RSN_IE_VERSION	0	0	0	0
INVALID_RSN_IE_CAPAB	0	0	0	0
IEEE_802_1X_AUTH_FAILED	0	0	0	0
CIPHER_SUITE_REJECTED	0	0	0	0
TDLS_TEARDOWN_UNREACHABLE	0	0	0	0
TDLS_TEARDOWN_UNSPECIFIED	0	0	0	0
TOO_MANY	0	0	0	0
STAION_RETRY_THRESHOLD	0	0	0	0
ACL_KICKOUT	0	0	0	0
AUTH_IDLE_TIMEOUT	0	0	0	0
AUTH_IN_ASSOC_STATE	0	0	0	0
WRONG_STA	0	0	0	0
EXPIRED_SERVICE_TIME	0	0	0	0
MAC_AUTH_TIMEOUT	0	0	0	0
MAC_AUTH_REJECT	0	0	0	0
MANUAL_KICKOUT	0	0	0	0
MALICIOUS_STA_STATISTICS	0	0	0	0
KICKOUT_MAC_FILTER	0	0	0	0
KICKOUT_INVALID_IP	0	0	0	0
KICKOUT_ACL	0	0	0	0
INTER_APC_HO	0	0	0	0
CLUSTER_DOWN	0	0	0	0
VAP_DOWN	0	0	0	0

DeauthOutReason				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNSPECIFIED	0	0	0	0
PREV_AUTH_NOT_VALID	0	0	0	0
DEAUTH_LEAVING	0	0	0	0
DISASSOC_DUE_TO_INACTIVITY	0	0	0	0
DISASSOC_AP_BUSY	0	0	0	0
CLASS2_FRAME_FROM_NONAUTH_STA	0	0	0	0
CLASS3_FRAME_FROM_NONASSOC_STA	0	0	0	0
DISASSOC_STA_HAS_LEFT	0	0	0	0
STA_REQ_ASSOC_WITHOUT_AUTH	0	0	0	0
PWR_CAPABILITY_NOT_VALID	0	0	0	0
SUPPORTED_CHANNEL_NOT_VALID	0	0	0	0
INVALID_IE	0	0	0	0
MICHAEL_MIC_FAILURE	0	0	0	0
4WAY_HANDSHAKE_TIMEOUT	0	0	0	0
GROUP_KEY_UPDATE_TIMEOUT	0	0	0	0
IE_IN_4WAY_DIFFERS	0	0	0	0
GROUP_CIPHER_NOT_VALID	0	0	0	0
PAIRWISE_CIPHER_NOT_VALID	0	0	0	0
AKMP_NOT_VALID	0	0	0	0
UNSUPPORTED_RSN_IE_VERSION	0	0	0	0
INVALID_RSN_IE_CAPAB	0	0	0	0
IEEE_802_1X_AUTH_FAILED	0	0	0	0
CIPHER_SUITE_REJECTED	0	0	0	0
TDLS_TEARDOWN_UNREACHABLE	0	0	0	0
TDLS_TEARDOWN_UNSPECIFIED	0	0	0	0
TOO_MANY	0	0	0	0
STAION_RETRY_THRESHOLD	0	0	0	0
ACL_KICKOUT	0	0	0	0
AUTH_IDLE_TIMEOUT	0	0	0	0
AUTH_IN_ASSOC_STATE	0	0	0	0
WRONG_STA	0	0	0	0
EXPIRED_SERVICE_TIME	0	0	0	0
MAC_AUTH_TIMEOUT	0	0	0	0
MAC_AUTH_REJECT	0	0	0	0
MANUAL_KICKOUT	0	0	0	0
MALICIOUS_STA_STATISTICS	0	0	0	0
KICKOUT_MAC_FILTER	0	0	0	0
KICKOUT_INVALID_IP	0	0	0	0
KICKOUT_ACL	0	0	0	0
INTER_APC_HO	0	0	0	0
CLUSTER_DOWN	0	0	0	0
VAP_DOWN	0	0	0	0
DisassocStateInReason				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNKNOWN	0	0	0	0

AUTH	0	0	0	0
AUTH_SUCCESS	0	0	0	0
AUTH_FAILURE	0	0	0	0
IPFAIL	0	0	0	0
NORMAL	0	0	0	0
DeauthStateInReason				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNKNOWN	0	0	0	0
AUTH	0	0	0	0
AUTH_SUCCESS	0	0	0	0
AUTH_FAILURE	0	0	0	0
IPFAIL	0	0	0	0
NORMAL	0	0	0	0
DsassocStateOutReason				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNKNOWN	0	0	0	0
AUTH	0	0	0	0
AUTH_SUCCESS	0	0	0	0
AUTH_FAILURE	0	0	0	0
IPFAIL	0	0	0	0
NORMAL	0	0	0	0
DeauthStateOutReason				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
UNKNOWN	0	0	0	0
AUTH	0	0	0	0
AUTH_SUCCESS	0	0	0	0
AUTH_FAILURE	0	0	0	0
IPFAIL	0	0	0	0
NORMAL	0	0	0	0

- 8) Check the station handover latency (by AP/Device/Radio/WLAN).
ex.) by WLAN

```

APC# show network-stats statistics station hand-over latency wlan 1

Station H/O Latency [WLAN ID (1)]:

[Total]
  Station H/O Latency Minimum..... 0 ms
  Station H/O Latency Maximum..... 0 ms
  Station H/O Latency Average..... 0 ms
  Station H/O Latency Total Count..... 0

```



```

[5 Min]
  Station H/O Latency Minimum..... 0 ms
  Station H/O Latency Maximum..... 0 ms
  Station H/O Latency Average..... 0 ms
  Station H/O Latency Total Count..... 0
[1 Hour]
  Station H/O Latency Minimum..... 0 ms
  Station H/O Latency Maximum..... 0 ms
  Station H/O Latency Average..... 0 ms
  Station H/O Latency Total Count..... 0
[1 Day]
  Station H/O Latency Minimum..... 0 ms
  Station H/O Latency Maximum..... 0 ms
  Station H/O Latency Average..... 0 ms
  Station H/O Latency Total Count..... 0

```

- 9) Check the station handover attempt count (by AP/Device/Radio/WLAN).
ex.) by WLAN

```

APC# show network-stats statistics station hand-over num-of-attempt-ho
wlan 1

[WLAN ID (1)]
Reason                      Total      5Min      1Hour      1Day
=====
HandoverAttempt              0          0          0          0

```

- 10) Check the statistics by station handover failure reason (by AP/Device/Radio/WLAN).
ex.) by WLAN

```

APC# show network-stats statistics station hand-over num-of-fail-by-
reason wlan 1

[WLAN ID (1)]
Reason                      Total      5Min      1Hour      1Day
=====
UNSPECIFIED                  0          0          0          0
PREV_AUTH_NOT_VALID          0          0          0          0
DEAUTH_LEAVING               0          0          0          0
DISASSOC_DUE_TO_INACTIVITY    0          0          0          0
DISASSOC_AP_BUSY              0          0          0          0
CLASS2_FRAME_FROM_NONAUTH_STA 0          0          0          0
CLASS3_FRAME_FROM_NONASSOC_STA 0          0          0          0
DISASSOC_STA_HAS_LEFT         0          0          0          0
STA_REQ_ASSOC_WITHOUT_AUTH    0          0          0          0

```

PWR_CAPABILITY_NOT_VALID	0	0	0	0
SUPPORTED_CHANNEL_NOT_VALID	0	0	0	0
INVALID_IE	0	0	0	0
MICHAEL_MIC_FAILURE	0	0	0	0
4WAY_HANDSHAKE_TIMEOUT	0	0	0	0
GROUP_KEY_UPDATE_TIMEOUT	0	0	0	0
IE_IN_4WAY_DIFFERS	0	0	0	0
GROUP_CIPHER_NOT_VALID	0	0	0	0
PAIRWISE_CIPHER_NOT_VALID	0	0	0	0
AKMP_NOT_VALID	0	0	0	0
UNSUPPORTED_RSN_IE_VERSION	0	0	0	0
INVALID_RSN_IE_CAPAB	0	0	0	0
IEEE_802_1X_AUTH_FAILED	0	0	0	0
CIPHER_SUITE_REJECTED	0	0	0	0
TDLS_TEARDOWN_UNREACHABLE	0	0	0	0
TDLS_TEARDOWN_UNSPECIFIED	0	0	0	0
TOO_MANY	0	0	0	0
STAION_RETRY_THRESHOLD	0	0	0	0
ACL_KICKOUT	0	0	0	0
AUTH_IDLE_TIMEOUT	0	0	0	0
AUTH_IN_ASSOC_STATE	0	0	0	0
WRONG_STA	0	0	0	0
EXPIRED_SERVICE_TIME	0	0	0	0
MAC_AUTH_TIMEOUT	0	0	0	0
MAC_AUTH_REJECT	0	0	0	0
MANUAL_KICKOUT	0	0	0	0
MALICIOUS_STA_STATISTICS	0	0	0	0
KICKOUT_MAC_FILTER	0	0	0	0
KICKOUT_INVALID_IP	0	0	0	0
KICKOUT_ACL	0	0	0	0
INTER_APC_HO	0	0	0	0
CLUSTER_DOWN	0	0	0	0
VAP_DOWN	0	0	0	0

- 11) Check the station handover RSSI MIN/MAX/AVG statistics (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station hand-over rssi wlan 1
```

```
[WLAN ID (1)]
```

Reason	Total	5Min	1Hour	1Day
=====				
=====				
Minimum	0	0	0	0
Maximum	0	0	0	0
Average	0	0	0	0

- 12) Check the statistics of the station handover success rate (by AP/Device/Radio/WLAN).
ex.) by WLAN

```
APC# show network-stats statistics station hand-over success-rate wlan
1

Station H/O Success Rate [WLAN ID (1)]:

[Total]
  Station H/O Succ Try..... 0
  Station H/O Succ Success..... 0
  Station H/O Succ Failure..... 0
  Station H/O Succ Rate(%)..... 0.000000 %
[5 Min]
  Station H/O Succ Try..... 0
  Station H/O Succ Success..... 0
  Station H/O Succ Failure..... 0
  Station H/O Succ Rate(%)..... 0.000000 %
[1 Hour]
  Station H/O Succ Try..... 0
  Station H/O Succ Success..... 0
  Station H/O Succ Failure..... 0
  Station H/O Succ Rate(%)..... 0.000000 %
[1 Day]
  Station H/O Succ Try..... 0
  Station H/O Succ Success..... 0
  Station H/O Succ Failure..... 0
  Station H/O Succ Rate(%)..... 0.000000 %
```

- 13) Check the statistics of station handover path tracking (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station hand-over trace 1

[AP ID (1), Radio 5-GHz]
Reason                Total      5Min      1Hour      1Day
=====
=====
destAp(1) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(2) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(3) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(4) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(5) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(6) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(7) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(8) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(9) [destAp/statsCnt]  0/ 0    0/ 0    0/ 0    0/ 0
destAp(10) [destAp/statsCnt] 0/ 0    0/ 0    0/ 0    0/ 0
destAp(11) [destAp/statsCnt] 0/ 0    0/ 0    0/ 0    0/ 0
destAp(12) [destAp/statsCnt] 0/ 0    0/ 0    0/ 0    0/ 0
destAp(13) [destAp/statsCnt] 0/ 0    0/ 0    0/ 0    0/ 0
destAp(14) [destAp/statsCnt] 0/ 0    0/ 0    0/ 0    0/ 0
```

destAp(15) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(16) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(17) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(18) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(19) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(20) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(21) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(22) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(23) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(24) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(25) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(26) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(27) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(28) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(29) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(30) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(31) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(32) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
[AP ID (1), Radio 2.4-GHz]								
Reason	Total		5Min		1Hour		1Day	
=====								
=====								
destAp(1) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(2) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(3) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(4) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(5) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(6) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(7) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(8) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(9) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(10) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(11) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(12) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(13) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(14) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(15) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(16) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(17) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(18) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(19) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(20) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(21) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(22) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(23) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(24) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(25) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(26) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(27) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(28) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(29) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0

destAp(30) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(31) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0
destAp(32) [destAp/statsCnt]	0/	0	0/	0	0/	0	0/	0

14) Check the station kickout statistics (by AP/Radio).

ex.) by AP/Radio

```
APC# show network-stats statistics station kick-out 1

[AP ID (1), Radio 5-GHz]
Reason                      Total      5Min      1Hour      1Day
=====
retryCount                  0          0          0          0
exceedConsecutiveRetryCount 0          0          0          0
stationKickOutCount         0          0          0          0

[AP ID (1), Radio 2.4-GHz]
Reason                      Total      5Min      1Hour      1Day
=====
retryCount                  0          0          0          0
exceedConsecutiveRetryCount 0          0          0          0
stationKickOutCount         0          0          0          0
```

15) Check the number of users connecting with the station (MIN/MAX/AVG) (by AP/Radio/WLAN).

ex.) by WLAN

```
APC# show network-stats statistics station num-of-station wlan 1

[WLAN ID (1)]
Reason                      Total      5Min      1Hour      1Day
=====
Minimum                    0          0          0          0
Maximum                    0          0          0          0
Average                    0          0          0          0
```

- 16) Check the station scanning count statistics (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station scan 1
```

[AP ID (1), Radio 5-GHz]				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
ScanStat	0	0	0	0

[AP ID (1), Radio 2.4-GHz]				
Reason	Total	5Min	1Hour	1Day
=====				
=====				
ScanStat	0	0	0	0

- 17) Check the AP packet loss statistics (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station ap-packet-loss ap 1
```

Station Statistics for AP Packet Loss Data [AP ID (1)]:

[RADIO 5-GHz]	
AP Packet Loss Tx Failure Count.....	0
AP Packet Loss Tx Retry Success Count.....	0
AP Packet Loss Tx Success Count.....	0
AP Packet Loss Tx Fail Rate.....	0.000000%
AP Packet Loss Tx Retry Rate.....	0.000000%

[RADIO 2.4-GHz]	
AP Packet Loss Tx Failure Count.....	0
AP Packet Loss Tx Retry Success Count.....	0
AP Packet Loss Tx Success Count.....	0
AP Packet Loss Tx Fail Rate.....	0.000000%
AP Packet Loss Tx Retry Rate.....	0.000000%

- 18) Check the AP packet loss raw data statistics (by AP/Radio).
ex.) by AP/Radio

```
APC# show network-stats statistics station ap-packet-loss-raw ap 1
```

Station Statistics for AP Packet Loss Raw Data [AP ID (1)]:

[RADIO 5-GHz]	
AP Total Transmitted Success Data Frame Count	0
AP Total Transmission Failure Data Frame Count ...	0
AP Total Retry Success Data Frame Count	0
AP Total Transmitted Success Mgmt Frame Count	0

```

AP Total Transmission Failure Mgmt Frame Count ... 0
AP Total Retry Success Mgmt Frame Count ..... 0
[RADIO 2.4-GHz]
AP Total Transmitted Success Data Frame Count .... 0
AP Total Transmission Failure Data Frame Count ... 0
AP Total Retry Success Data Frame Count ..... 0
AP Total Transmitted Success Mgmt Frame Count .... 0
AP Total Transmission Failure Mgmt Frame Count ... 0
AP Total Retry Success Mgmt Frame Count ..... 0

```

Checking and Configuring Using Web UI

- Configure and check an alert.
 - Alert configuration: [Configuration Management] > [Statistics] > [Network Quality] > **Association/Handover**

The screenshot displays the Samsung Wireless Enterprise Web UI. The top navigation bar includes 'Monitor', 'Configuration', 'Administration', and 'Help'. The user is logged in as 'weSWlab3'. The left sidebar shows a tree view with 'Statistics' expanded and 'Network Quality' selected. The main content area is titled 'Controller > Statistics > Network Quality > Assoc/Ho'.

Data Monitoring

DATA MONITORING ☒ Enable ☐ Disable [Apply]

Alert Control

ASSOCIATION/HANDOVER ☒ Enable ☐ Disable

SCAN OF STATION ☐ Enable ☒ Disable Timer(Min) 30

STATION KICKOUT ☒ Enable ☐ Disable Timer(Min) 30 [Apply]

The Time Window Size for Deciding Alert

ASSOCIATION/HANDOVER (MINUTE) 30

The Threshold for Alert

ASSOCIATION SUCCESS RATE (%)	30
HANDOVER SUCCESS RATE (%)	50
ASSOCIATION TRY COUNT	30
DISASSOCIATION TRY COUNT	30
HANDOVER TRY COUNT	100
ASSOCIATION/HANDOVER RSSI (DBM)	-85
SCAN TRY COUNT	20
STATION KICKOUT RETRY COUNT	100

Black List Control

ASSOCIATION ☐ Enable ☒ Disable

HANDOVER ☐ Enable ☒ Disable

– Alert checking: [Monitoring] > [Network Quality] > **Alert List**

Samsung Wireless Enterprise **Monitor** Configuration Administration Help User [vesWeb3] Logout Save Configuration Ping Refresh

Summary Statistics > Network Quality > **Alert List**

Active Alarm

WLANs

Access Points

Stations

Wireless Intrusion

Interference Devices

Statistics

APC Ports

AP Ports

AP Join

RADIUS Servers

Mobility

Load Balancing

Network Quality

General

Alert List

System

Radios

WLANs

APs

Device Types

VoIP Calls

Resource

Latest Alert List

☒ All

ASSOC ☒ Blacklist ☒ Low Assoc Success ☒ Assoc Try ☒ Disassoc Try ☒ Deauth Try ☒ Low Handover Success

HANDOVER ☒ Handover Try ☒ Low RSSI Assoc ☒ Low RSSI Handover ☒ Scan Try ☒ SKO

DATA TRAFFIC ☒ Packet Loss ☒ Packet Retry ☒ RF

RF ☒ Call Setup Fail ☒ Call Drop ☒ Call Low MOS

VOIP

Total Entry : 3198

TIME	LOCATION	ALERT NAME	DESCRIPTION
2014-12-08 15:29:49.817	STA_00:21:6a:17:1a:86	Station Assoc Threshold Reached	Threshold(30) Value
2014-12-08 15:29:49.651	STA_00:21:6a:17:1a:86	Station Disassoc Threshold Reached	Threshold(30) Value
2014-12-08 15:29:49.649	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:27:16.121	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:25:44.904	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:24:13.687	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:22:42.437	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:22:32.495	AP_f4:d9:fb:35:45:6d	RF error threshold exceeded	Air-Quality 2.4GHz Ch(2) Error Count(60) for 1 Hour
2014-12-08 15:22:32.494	AP_f4:d9:fb:35:45:6d	RF error threshold exceeded	Channel-Utilization 2.4GHz Ch(2) Error Count(60) for 1 Hour
2014-12-08 15:21:25.862	APC	Call Drop Error	[AP:f4:d9:fb:35:45:6d] AP(1) Radio(1) Drop Call Rate: 100
2014-12-08 15:20:25.620	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:18:54.416	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:17:23.389	STA_00:21:6a:17:1a:86	Station Assoc Threshold Reached	Threshold(30) Value
2014-12-08 15:17:23.199	STA_00:21:6a:17:1a:86	Station Disassoc Threshold Reached	Threshold(30) Value
2014-12-08 15:17:23.196	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:13:38.217	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:11:18.084	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:09:46.955	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:08:15.822	STA_00:21:6a:17:1a:86	Station Low Assoc Success Rate	Success Rate(0.000000)
2014-12-08 15:07:32.519	AP_f4:d9:fb:35:45:6d	RF error threshold exceeded	Air-Quality 2.4GHz Ch(2) Error Count(60) for 1 Hour

1 2 3 4 5 > ... [160]

- Checking Statistical Value of Network
Network Statistics Root Path: [Monitoring] > [Statistics] > [Network Quality]

- 1) Check the station association latency and success rate (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] > [Association/Handover] > **General**

Association with authentication statistics

	5 MIN	1 HOUR	1 DAY	TOTAL
LATENCY MIN (MSEC)	157	111	100	100
LATENCY MAX (MSEC)	792	6,049	118,478	118,478
LATENCY AVG (MSEC)	377	861	1,131	1,059
LATENCY SAMPLE COUNT	6	61	561	719
SUCCESS COUNT, RATE	6(100%)	61(83.56%)	561(80.84%)	719(78.32%)
FAILURE COUNT, RATE	0(0%)	12(16.44%)	133(19.16%)	199(21.68%)
TRY COUNT	6	73	694	918

- 2) Check the Management Frame statistics (Station connection, Handover, AP/System Disassoc, Deauth) (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] >
[Association/Handover] > **Management Frame**

Association and Handover Try Count				
	5 MIN	1 HOUR	1 DAY	TOTAL
ASSOCIATION TRY	3	11	223	250
HANDOVER TRY	12	156	1,022	1,360

- 3) Check the station handover latency and success rate (by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] >
[Association/Handover] > **General**

Handover with authentication statistics				
	5 MIN	1 HOUR	1 DAY	TOTAL
LATENCY MIN (MSEC)	18	15	12	12
LATENCY MAX (MSEC)	401	2,467	2,467	2,467
LATENCY AVG (MSEC)	184	379	298	297
LATENCY SAMPLE COUNT	6	76	413	517
SUCCESS COUNT, RATE	6(100%)	76(91.57%)	413(93.02%)	517(94%)
FAILURE COUNT, RATE	0(0%)	7(8.43%)	31(6.98%)	33(6%)
TRY COUNT	6	83	444	550

- 4) Check the number of users connecting to the station (by AP/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] >
[Association/Handover] > **General**

Station Count statistics				
	5 MIN	1 HOUR	1 DAY	TOTAL
MIN	36	30	1	1
MAX	39	45	45	45
AVG	37	35	7	1

- 5) Check the minimum, maximum, and average statistics of station association and handover RSSI
(by AP/Device/Radio/WLAN).
ex.) by WLAN
[Monitoring] > [Statistics] > [Network Quality] > [by WLAN] >
[Association/Handover] > **RSSI/SKO**

Association RSSI Statistics				
	5 MIN	1 HOUR	1 DAY	TOTAL
MIN (DBM)	0	-78	-88	-88
MAX (DBM)	0	-47	-35	-35
AVG (DBM)	0	-63	-54	-50
Handover RSSI Statistics				
	5 MIN	1 HOUR	1 DAY	TOTAL
MIN (DBM)	-58	-87	-87	-87
MAX (DBM)	-39	-37	-29	-29
AVG (DBM)	-50	-54	-50	-43

- 6) Check the statistics by cause of station association and handover failure (by AP/Device/Radio/WLAN).
 ex.) by WLAN
 [Monitoring] > [Statistics] > [Network Quality] > [by WLAN] >
 [Association/Handover] > **Cause of Failure**
 ※ Check the association/handover statistics by using the tab on the top of the right.

Association ▼

Association Failure count by reason

	5 MIN	1 HOUR	1 DAY	TOTAL
UNSPECIFIED	0	0	2	2
PREV AUTH NOT VALID	0	10	92	156
DEAUTH LEAVING	0	0	0	0
DISASSOC DUE TO INACTIVITY	0	0	0	0
DISASSOC AP BUSY	0	0	0	0
CLASS2 FRAME FROM NONAUTH STA	0	0	0	0
CLASS3 FRAME FROM NONASSOC STA	0	0	0	0
DISASSOC STA HAS LEFT	0	0	6	6
STA REQ ASSOC WITHOUT AUTH	0	0	0	0
PWR CAPABILITY NOT VALID	0	0	0	0
SUPPORTED CHANNEL NOT VALID	0	0	0	0
INVALID IE	0	0	0	0
MICHAEL MIC FAILURE	0	0	0	0
4WAY HANDSHAKE TIMEOUT	0	0	3	4
GROUP KEY UPDATE TIMEOUT	0	0	0	0
IE IN 4WAY DIFFERS	0	0	0	0
GROUP CIPHER NOT VALID	0	0	0	0
PAIRWISE CIPHER NOT VALID	0	0	0	0
AKMP NOT VALID	0	0	0	0
UNSUPPORTED RSN IE VERSION	0	0	0	0
INVALID RSN IE CAPAB	0	0	0	0
IEEE 802.1X AUTH FAILED	0	2	41	42
CIPHER SUITE REJECTED	0	0	0	0
TDLS TEARDOWN UNREACHABLE	0	0	0	0
TDLS TEARDOWN UNSPECIFIED	0	0	0	0
TOO MANY	0	0	0	0
STAION RETRY THRESHOLD	0	0	0	0
ACL KICKOUT	0	0	0	0
AUTH IDLE TIMEOUT	0	0	0	0
AUTH IN ASSOC STATE	0	0	0	0
WRONG STA	0	0	0	0
EXPIRED SERVICE TIME	0	0	0	0
MAC AUTH TIMEOUT	0	0	0	0
MAC AUTH REJECT	0	0	0	0
MANUAL KICKOUT	0	0	0	0
MALICIOUS STA STATISTICS	0	0	0	0
KICKOUT MAC FILTER	0	0	0	0
KICKOUT INVALID IP	0	0	0	0
KICKOUT ACL	0	0	0	0
INTER-APC HO	0	0	0	0
CLUSTER DOWN	0	0	0	0
VAP DOWN	0	0	0	0

- 7) Check the statistics of disassoc. (by AP/Device/Radio/WLAN).
 ex.) by WLAN
 [Monitoring] > [Statistics] > [Network Quality] > [by WLAN] >
 [Association/Handover] > **Disassoc/Deauth**
 ※ Check the disassoc/deauth statistics by station/system by using the tab on the top
 of the right.
- 8) Check the statistics of disassoc. count of the UE by status (by AP/Device/Radio/
 WLAN).
 ex.) by WLAN
 [Monitoring] > [Statistics] > [Network Quality] > [by WLAN] >
 [Association/Handover] > **Disassoc/Deauth**

※ Check the disassoc/deauth statistics by station/system by using the tab on the top of the right.

Station Disassoc count by state				
	5 MIN	1 HOUR	1 DAY	TOTAL
UNKNOWN	0	0	0	0
AUTH	0	2	32	37
AUTH SUCCESS	0	0	0	0
AUTH FAILURE	0	0	0	0
IPFAIL	0	0	11	11
NORMAL	0	5	38	47

9) Check the statistics of disassoc. count of the UE by status (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] >

Transmission Speed

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Rx/Tx count by 802.11a data rates												
	5 MIN			1 HOUR			1 DAY			TOTAL		
	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL
6 MBPS	7,880	2	0	82,448	118	116	1,761,207	270	268	5,837,905	272	269
9 MBPS	0	0	0	0	0	0	0	0	0	0	0	0
12 MBPS	73,100	0	0	705,541	0	0	17,237,941	0	0	64,216,796	5,547	4,858
18 MBPS	4	0	0	52	0	0	1,223	0	0	3,841	0	0
24 MBPS	68,084	17,261	15,029	696,968	177,041	156,691	16,437,570	2,845,321	2,536,600	58,793,203	8,066,099	7,137,185
36 MBPS	0	0	0	3	0	0	27	0	0	90	0	0
48 MBPS	2	0	0	97	0	0	626	0	0	734	0	0
54 MBPS	183	0	0	1,483	0	0	25,539	0	0	84,596	0	0

Rx/Tx count by HT(802.11n) MCS												
	5 MIN			1 HOUR			1 DAY			TOTAL		
	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL
MCS 0 (7 MBPS)	0	371	271	1	5,203	4,955	57	14,183	13,436	57	15,236	14,157
MCS 1 (14 MBPS)	0	237	77	109	424	184	486	1,150	671	517	2,443	1,152
MCS 2 (21 MBPS)	0	100	55	129	344	188	542	1,614	903	562	2,514	1,350
MCS 3 (29 MBPS)	0	147	49	527	692	300	1,455	5,318	3,203	2,038	5,826	3,409
MCS 4 (43 MBPS)	389	355	120	1,259	2,433	705	4,773	54,911	7,296	6,276	55,824	7,759
MCS 5 (58 MBPS)	0	2,012	1,035	751	2,565	1,272	1,967	4,933	2,114	2,308	5,531	2,410
MCS 6 (65 MBPS)	4	4,124	865	1,355	5,190	1,087	2,610	7,599	1,722	2,821	7,932	1,870
MCS 7 (72 MBPS)	12,987	26,059	3,407	21,462	37,468	5,240	47,232	57,252	8,288	51,661	57,694	8,504
MCS 8 (14 MBPS)	0	0	0	0	0	0	1	0	0	3	0	0
MCS 9 (29 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 10 (43 MBPS)	0	0	0	0	0	0	0	0	0	2	0	0
MCS 11 (58 MBPS)	1	233	43	53	11,601	1,791	22,581	120,775	26,138	22,978	120,775	26,138
MCS 12 (87 MBPS)	14	344	200	4,887	22,375	5,745	31,716	72,678	29,846	35,474	72,678	29,846
MCS 13 (116 MBPS)	29	52	47	12,383	3,684	2,236	54,718	8,082	5,404	60,672	8,082	5,404
MCS 14 (130 MBPS)	114	0	0	8,127	86	64	41,049	239	178	44,484	239	178
MCS 15 (144 MBPS)	100	0	0	3,677	0	0	27,023	237	19	28,368	237	19
MCS 16 (22 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 17 (43 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 18 (65 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 19 (87 MBPS)	0	0	0	1	0	0	15	0	0	52	0	0
MCS 20 (130 MBPS)	0	0	0	1	0	0	168	0	0	327	0	0
MCS 21 (173 MBPS)	0	0	0	0	0	0	10	0	0	37	0	0
MCS 22 (195 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0
MCS 23 (217 MBPS)	0	0	0	0	0	0	0	0	0	0	0	0

Rx/Tx count by VHT MCS(802.11ac)												
	5 MIN			1 HOUR			1 DAY			TOTAL		
	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL	RX	TX	TX FAIL
SPATIAL STREAM1 0	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 1	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 2	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 3	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 4	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 5	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 6	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 7	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 8	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM1 9	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 0	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 1	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 2	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 3	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 4	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 5	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 6	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 7	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 8	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM2 9	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 0	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 1	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 2	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 3	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 4	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 5	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 6	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 7	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 8	0	0	0	0	0	0	0	0	0	0	0	0
SPATIAL STREAM3 9	0	0	0	0	0	0	0	0	0	0	0	0

10) Check the statistics of disassoc. count of the UE by status (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] >

Handover Trace

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Handover count by destination AP							
5 MIN		1 HOUR		1 DAY		TOTAL	
AP-7F22	0	AP-7F22	0	AP-7F22	0	AP-7F22	1
AP-7F32	0	AP-7F32	0	AP-7F32	2	AP-7F32	3
AP-7F02	0	AP-7F02	4	AP-7F02	6	AP-7F02	6
AP-7F28	0	AP-7F28	0	AP-7F28	9	AP-7F28	9
AP-7F30	0	AP-7F30	0	AP-7F30	1	AP-7F30	1
AP-7F29	0	AP-7F29	2	AP-7F29	5	AP-7F29	5
AP-7F26	0	AP-7F26	0	AP-7F26	1	AP-7F26	1
AP-7F31	0	AP-7F31	1	AP-7F31	2	AP-7F31	2

11) Check the statistics of scan count of the UE (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] >

[Association/Handover] > **RSSI/SKO**

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Scan Count Of Stations				
	5 MIN	1 HOUR	1 DAY	TOTAL
COUNT	0	30	131	145

12) Check the statistics of extracted UEs (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] >

[Association/Handover] > **RSSI/SKO**

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Station Kickout Statistics				
	5 MIN	1 HOUR	1 DAY	TOTAL
RETRY COUNT	0	24	41	53
EXCESS CONSECUTIVE RETRY COUNT	0	88	303	348
STATION KICKOUT COUNT	0	0	0	0

13) Check the statistics of wireless packet loss (by AP/Radio).

ex.) by AP/Radio

[Monitoring] > [Statistics] > [Network Quality] > [by AP] > [802.11a/n/ac] > **Data Traffic**

※ To change a radio, press 'Convert Radio' button by using the tab on the top of the right.

Wireless Packet Loss Statistics				
	5 MIN	1 HOUR	1 DAY	TOTAL
FAILURE COUNT, RATE +	5(2.02%)	933(1.36%)	1,922(0.94%)	2,487(0.98%)
RETRY COUNT, RATE +	239(96.37%)	24,959(36.25%)	89,720(43.72%)	104,983(41.34%)
TX COUNT +	248	68,852	205,224	253,953



ANNEX A. CLI Command Structure

The structure of CLI command is as follows.

A.1 configure

```
-- configure
|   |-- spectrum-analysis
|   |   |-- ap
|   |   |   |-- service
|   |   |   |-- channel-request
|   |   |   |   |-- channel-interval
|   |   |   |   |-- channel-control
|   |   |   |   |   |-- dot11b
|   |   |   |   |   |-- dot11aLow
|   |   |   |   |   |-- dot11aMid
|   |   |   |   |   |-- dot11aHigh
|   |   |   |-- configuration-request
|   |   |   |   |-- sample
|   |   |   |   |-- interference
|   |   |   |   |-- duty-cycle
|   |-- interferer
|   |   |-- 80211a
|   |   |   |-- continuous_transmitter
|   |   |   |-- cordless_phone
|   |   |   |-- video_camera
|   |   |   |-- dsss_wireless_phone
|   |   |   |-- narrow_wireless_jammer
|   |   |   |-- wide_band_jammer
|   |   |   |-- possible_interference
|   |   |-- 80211b
|   |   |   |-- bluetooth
|   |   |   |-- microwave_oven
|   |   |   |-- continuous_transmitter
|   |   |   |-- cordless_phone
|   |   |   |-- video_camera
|   |   |   |-- zigbee
```

```

| | | |-- dsss_wireless_phone
| | | |-- narrow_band_jammer
| | | |-- wide_band_jammer
| | | |-- inverter_microwave_oven
| | | |-- xbox_controller
| | | |-- wireless_analog_phone
| | | |-- baby_monitor
| | | |-- s_band_motion_detector
| | | |-- possible_interference
| | |-- unknown
| |-- hostname
| |-- call-fail-detect
| |-- mgmt-user
| |-- configuration-sync
| | |-- activeactive-role
| | |-- mode
| | |-- add-apc
| | |-- del-apc
| | |-- del-apc-all
| |-- telnet-timeout
| |-- console-timeout
| |-- system
| | |-- monitor
| | | |-- cpu
| | | | |-- threshold
| | | | |-- memory
| | | | |-- threshold
| | |-- license
| | | |-- install-key
| | | |-- analyze-key
| | | |-- activate
| | | |-- analyze
| |-- qos
| | |-- description
| | |-- max-dot1p
| | |-- ac
| | |-- bw-contract-downstream
| | |-- bw-contract-upstream
| |-- dpi
| | |-- profile
| | | |-- rule
| | | | |-- action
| | | | |-- mark
| | | | |-- bw-contract

```



```

|   |   |   |-- enable
|   |   |-- app-group
|   |   |-- application
|   |   |-- description
|   |-- country
|   |   |-- set-global
|   |   |-- set-ap
|   |   |-- set-group
|   |-- handover
|   |   |-- time
|   |   |   |-- ho-decision
|   |   |   |-- command
|   |   |   |-- scan-suppress
|   |   |-- mode
|   |   |-- opmode
|   |   |-- scan-report-level
|   |   |-- buffered-forwarding
|   |   |-- decision-delta
|   |   |-- num_neighbor
|   |   |-- inter-apc
|   |   |-- legacy-buffered-forwarding
|   |-- station
|   |   |-- disallow
|   |   |-- number-of-assoc-tracking
|   |   |-- stats-req
|   |   |-- device_type
|   |   |-- mgmtframe-rate
|   |   |   |-- set-limit
|   |   |   |-- CIR
|   |   |-- ipaddress-valid-check-time
|   |   |-- vlan-assignment-staticip
|   |   |-- ssl
|   |   |-- ssl-roam-param-control
|   |-- security
|   |   |-- radius
|   |   |   |-- auth
|   |   |   |-- acct
|   |   |   |-- serverIp
|   |   |   |-- secret
|   |   |   |-- fo-retransmit-count
|   |   |   |-- retransmit-count
|   |   |   |-- retransmit-interval
|   |   |   |-- use-vip
|   |   |   |-- internal-server

```

```

|   |   |   |-- mac-auth-pw-type
|   |   |   |-- mac-auth-delimiter
|   |   |   |-- mac-auth-case
|   |   |   |-- coa
|   |   |-- advanced
|   |   |   |-- eap-retransmit-interval
|   |   |   |-- eap-retransmit-count
|   |   |   |-- eap-key-retransmit-interval
|   |   |   |-- eap-key-retransmit-interval-1st
|   |   |   |-- eap-key-retransmit-count
|   |   |   |-- allow-last-eap-key-timeout
|   |   |   |-- rsn-ie-ptksa-replay-counter
|   |   |   |-- rsn-ie-gtksa-replay-counter
|   |   |   |-- sta-info-free-timer-after-disassoc
|   |   |   |-- log-mic-error
|   |   |   |-- sta-auth-session-limit
|   |   |   |-- eap-failure-quiet-period
|   |   |   |-- wpa-ie-trace
|   |   |   |-- ignore-wpa-ie-mismatch
|   |   |   |-- multicast-to-active-apc-only
|   |   |   |-- eapol-start-wait-timeout
|   |   |   |-- radius-coa-flag
|   |   |   |-- radius-coa-time-window
|   |   |   |-- radius-coa-nas-check
|   |   |   |-- pmf-for-legacy-ap
|   |   |-- captive-portal
|   |   |   |-- web-auth-users
|   |   |   |   |-- add
|   |   |   |   |-- delete
|   |   |   |   |-- detail
|   |   |   |       |-- fullname
|   |   |   |       |-- company
|   |   |   |       |-- email
|   |   |   |       |-- phone
|   |   |   |       |-- max-allowed-stations
|   |   |   |       |-- enable
|   |   |   |       |-- comment
|   |   |   |       |-- sponsor
|   |   |   |       |-- name
|   |   |   |       |-- department
|   |   |   |       |-- email
|   |   |   |       |-- phone
|   |   |   |       |-- comments
|   |   |-- web-page

```

```

| | | | |-- title
| | | | |-- content
| | | | |-- footer
| | | | |-- color
| | | | |-- self-registration
| | | | | |-- enable
| | | | | |-- fullname
| | | | | |-- phone
| | | | | |-- company
| | | | | |-- custom-label
| | | | | |-- email
| | | | | |-- lifetime
| | | |-- web-auth-cache-list
| | | | |-- delete
| | | |-- host
| | | |-- address
| | |-- mac-filter
| | | |-- policy
| | | |-- mac
| | | |-- name
| | | |-- import
| | | |-- filter
| | | | |-- mac-auth
| | | | |-- mac-auth-time
| | | | |-- malicious-station
| | | | |-- malicious-station-time
| | | | |-- abnormal-station
| | | | |-- abnormal-station-time
| | |-- ext-wips
| | | |-- enable
| | | |-- interval
| | | |-- primary
| | | |-- secondary
| | | |-- port
| | | |-- user
| | | |-- password
| | |-- tacacs
| | | |-- server-ip
| | | |-- server-port
| | | |-- shared-secret
| | | |-- retransmit-count
| | | |-- retransmit-interval
| | | |-- source-ip
| | | |-- enable

```

```

|      |      |-- byod
|      |      |      |-- enable
|      |      |      |-- address1
|      |      |      |-- address2
|      |      |      |-- https-reurl
|      |      |      |-- db-sync
|      |-- ap-group
|      |      |-- add-wlan
|      |      |-- add-ap
|      |      |-- group-type
|      |      |-- profile
|      |      |      |-- description
|      |      |      |-- ap-mode
|      |      |      |-- location
|      |      |      |-- ip-mode
|      |      |      |-- shutdown
|      |      |      |-- discovery
|      |      |      |-- primary-apc
|      |      |      |-- secondary-apc
|      |      |      |-- tertiary-apc
|      |      |      |-- echo-interval
|      |      |      |-- discovery-interval
|      |      |      |-- report-interval
|      |      |      |-- statistics-timer
|      |      |      |-- retransmit-interval
|      |      |      |-- max-retransmit
|      |      |      |-- echo-retransmit-interval
|      |      |      |-- max-echo-retransmit
|      |      |      |-- telnet-enable
|      |      |      |-- ssh-enable
|      |      |      |-- console-enable
|      |      |      |-- dtls-policy
|      |      |      |-- led-config
|      |      |      |-- poe-type
|      |      |      |-- vlan-support
|      |      |      |-- native-vlanId
|      |      |      |-- overwrite-ap-mode
|      |      |      |-- overwrite-location
|      |      |      |-- overwrite-ip-mode
|      |      |      |-- overwrite-state
|      |      |      |-- overwrite-redundancy
|      |      |      |-- overwrite-apc-ap-timer
|      |      |      |-- overwrite-telnet-ssh
|      |      |      |-- overwrite-console

```

```

| | | |-- overwrite-dtls
| | | |-- overwrite-led-control
| | | |-- overwrite-poe-type
| | | |-- overwrite-vlan
| | | |-- overwrite-link-aggregation
| | | |-- link-aggregation
| | | |-- overwrite-uplink-bandwidth
| | | |-- uplink-bandwidth
| | | |-- temperature-alarm-control-type
| | |-- airmove
| | | |-- enable
| | | |-- target-ap
| | | |-- scan-trigger-level
| | | |-- scan-time-channel
| | | |-- scan-time-service
| | | |-- scan-time-interleave
| | | |-- number-of-proreq
| | | |-- number-of-channel
| | | |-- decision-delta
| | |-- sta-ssl
| | | |-- enable
| | | |-- target-ap
| | | |-- scan-trigger-level
| | | |-- scan-time-channel
| | | |-- scan-time-service
| | | |-- scan-time-interleave
| | | |-- number-of-proreq
| | | |-- number-of-channel
| | | |-- decision-delta
| | |-- ip-sec
| | | |-- overwrite-ip-sec
| | | |-- enable
| | | |-- primary-ip
| | |-- load-balancing
| | | |-- radio
| | | | |-- enable
| | | | |-- threshold
| | | | |-- rssi-high
| | | | |-- rssi-low
| | | | |-- interval
| | | | |-- kickout-timeout
| | | | |-- no-probe-timeout
| | | | |-- sticky-interval
| | |-- remote

```

```

| | | |-- send-remote-acl-to-ap
| | | |-- primary-radius
| | | |-- secondary-radius
| | | |-- tertiary-radius
| | | |-- overwrite-localbridging
| | | |-- local-bridging
| | | |-- overwrite-tunnel-forwarding
| | | |-- tunnel-forwarding
| | | |-- delete-user
| | | |-- add-user
| | | |-- send-user-list
| | | |-- acl-profile
| | | |-- upgrade
| | | | |-- enable
| | | | |-- start
| | | | |-- stop
| | | | |-- force
| | | | |-- max-retry
| | | | |-- select-package
| | | | |-- delete-package
| | | | |-- select-masterAP
| | | | |-- delete-masterAP
| | | |-- reboot
| |-- if-group
| | |-- description
| | |-- add-if
| |-- wlan
| | |-- band-steering
| | |-- load-balancing
| | |-- multicast-to-unicast
| | | |-- enable
| | | |-- discard
| | |-- enable
| | |-- guest-flag
| | |-- radio
| | |-- ssid
| | |-- security
| | | |-- apply
| | | |-- wpa
| | | |-- psk
| | | |-- wpa2
| | | |-- ieee8021x
| | | |-- keymgmt
| | | |-- wep

```

```

|   |   |   |-- okc
|   |   |   |-- dynamicVlan
|   |   |   |-- setDefault
|   |   |   |-- grpRekeyTime
|   |   |   |-- pmkLifeTime
|   |   |   |-- radius-server
|   |   |   |   |-- auth-servers
|   |   |   |   |-- acct-servers
|   |   |   |-- eapReauthTime
|   |   |   |-- eapolVersion
|   |   |   |-- radiusPrimaryRetryInterval
|   |   |   |-- acct_interim_interval
|   |   |   |-- pmf
|   |   |   |-- pmf-sa-query-max-timeout
|   |   |   |-- pmf-sa-query-retry-timeout
|   |   |   |-- layer3
|   |   |   |   |-- web-policy
|   |   |   |   |-- pre-auth-acl
|   |   |   |   |-- redirect-URL-override
|   |   |   |   |-- cache-duration
|   |   |   |   |-- server-type
|   |   |   |   |-- web-page-type
|   |   |   |   |   |-- internal
|   |   |   |   |   |-- download
|   |   |   |   |   |-- customized
|   |   |   |   |   |-- external
|   |   |   |   |-- radius-servers
|   |   |   |   |-- after-auth
|   |   |   |   |-- after-auth-redirect-url
|   |   |   |-- mac-authentication
|   |   |   |-- mac-filter
|   |   |-- iuts
|   |   |   |-- mode
|   |   |   |-- latency
|   |   |   |-- queue-length
|   |   |   |-- filter-mode
|   |   |   |-- codec-list
|   |   |-- if-group
|   |   |-- if-group-os
|   |   |-- acl
|   |   |-- aaa-override
|   |   |-- tunnel-mode
|   |   |-- qos-class
|   |   |-- ext-wips

```

```

| | | -- suppress-ssid
| | | -- local-vlan
| | | -- max-associated-stations
| | | -- 80211a
| | | | -- rate
| | | | | -- basic
| | | | | -- supported
| | | | -- mcs-11n
| | | | -- mcs-11ac
| | | -- 80211b
| | | | -- rate
| | | | | -- basic
| | | | | -- supported
| | | | -- mcs-11n
| | | -- vdm
| | | | -- multicast-info
| | | | -- station-policy
| | | | -- mode
| | | | -- threshold
| | | | -- default-policy
| | | | -- join-gap
| | | | -- session-timeout
| | | | -- multiframing_threshold
| | | | -- limit
| | | | -- retry-limit
| | | | -- schedule-interval
| | | | -- min-mux-packets
| | | | -- mux-skip-limit
| | | | -- station-queue-limit
| | | | -- packet-lifetime
| | | | -- pifs-access
| | | | -- tx-rate
| | | | -- retry-ratio-update-period
| | | | -- stop-threshold
| | | | -- stop-interval
| | | | -- start-rssi
| | | | -- seq-list-size
| | | | -- nack-interval
| | | | -- rx-timeout
| | | -- sds
| | | | -- weight
| | | -- dhcp-override
| | | -- ampdu
| | | -- reject-probe-mode

```



```

|      |      |-- broadcast-enable
|      |      |-- multicast-enable
|      |      |-- static-address-disallowed
|      |      |-- dpi-profile
|      |      |-- derivation-profile
|      |      |-- preferred-vlan
|      |      |      |-- enable
|      |      |      |-- add
|      |      |-- voice-enterprise-80211k
|      |      |-- mDNS-snoop-profile
|      |-- outdoor-ap
|      |-- ap
|      |      |-- profile
|      |      |      |-- dtls-policy
|      |      |      |-- poe-type
|      |      |      |-- discovery
|      |      |      |-- mac
|      |      |      |-- location
|      |      |      |-- name
|      |      |      |-- echo-interval
|      |      |      |-- discovery-interval
|      |      |      |-- report-interval
|      |      |      |-- statistics-timer
|      |      |      |-- retransmit-interval
|      |      |      |-- max-retransmit
|      |      |      |-- echo-retransmit-interval
|      |      |      |-- max-echo-retransmit
|      |      |      |-- ap-mode
|      |      |      |-- ip-mode
|      |      |      |-- static-ip
|      |      |      |-- primary-apc
|      |      |      |-- secondary-apc
|      |      |      |-- tertiary-apc
|      |      |      |-- ap-stats-history-enable
|      |      |      |-- vlan-support
|      |      |      |-- native-vlanId
|      |      |      |-- console-enable
|      |      |      |-- telnet-enable
|      |      |      |-- ssh-enable
|      |      |      |-- led-config
|      |      |      |-- edge-ap
|      |      |      |-- edge-ap-opmode
|      |      |      |-- edge-ap-threshold
|      |      |      |-- edge-ap-window

```

```

| | | |-- fragment-size
| | | |-- client-ip
| | | |-- repeater-whitelist
| | | |-- tunnel-forwarding
| | | |-- local-bridging
| | | |-- time-config
| | | | |-- timezone
| | | |-- link-aggregation
| | | |-- uplink-bandwidth
| | |-- reboot
| | |-- upgrade-request
| | |-- tech-support
| | | |-- get-all
| | | |-- get-crash-file
| | | |-- get-coredump
| | | |-- get-log-file
| | | |-- get-system-report
| | |-- syslog-config
| | |-- shutdown
| | |-- airmove
| | | |-- config-priority
| | | |-- scan-trigger-level
| | | |-- scan-time-channel
| | | |-- scan-time-service
| | | |-- scan-time-interleave
| | | |-- number-of-prereq
| | | |-- number-of-channel
| | | |-- decision-delta
| | |-- sta-ssl
| | | |-- config-priority
| | | |-- scan-trigger-level
| | | |-- scan-time-channel
| | | |-- scan-time-service
| | | |-- scan-time-interleave
| | | |-- number-of-prereq
| | | |-- number-of-channel
| | | |-- decision-delta
| | |-- send-remote-acl-to-ap
| | |-- packet-capture
| | |-- load-balancing
| | | |-- overwrite
| | | |-- radio
| | | | |-- enable
| | | | |-- threshold

```

```

|      |      |      |      |-- rssi-high
|      |      |      |      |-- rssi-low
|      |      |      |      |-- interval
|      |      |      |      |-- kickout-timeout
|      |      |      |      |-- no-probe-timeout
|      |      |      |      |-- sticky-interval
|      |      |-- ip-sec
|      |      |      |-- enable
|      |      |      |-- primary-ip
|      |      |      |-- right-subnet
|      |      |      |-- right-subnet-mask
|      |      |      |-- ike-version
|      |      |      |-- ike-lifetime
|      |      |      |-- ipsec-lifetime
|      |      |      |-- auth-mode
|      |-- ap-all
|      |      |-- upgrade
|      |      |      |-- transfer-protocol
|      |      |      |-- start
|      |      |      |-- stop
|      |      |      |-- max-retry
|      |      |      |-- max-download
|      |      |      |-- select-package
|      |      |      |-- delete-package
|      |      |      |-- target
|      |      |-- reboot
|      |-- apc
|      |      |-- apc-list
|      |      |      |-- add-apc
|      |      |      |-- del-apc
|      |      |      |-- change-name
|      |      |      |-- change-mac
|      |      |-- ap-mgmt-if
|      |      |-- capwap
|      |      |      |-- ctr-src-port
|      |      |      |-- window-size
|      |      |      |-- change-state-pending-timer
|      |      |      |-- data-check-timer
|      |      |      |-- dtls-session-delete
|      |      |      |-- retransmit-interval
|      |      |      |-- wait-dtls-timer
|      |      |      |-- wait-join-timer
|      |      |      |-- discovery-del-timer
|      |      |      |-- max-retransmit

```

```

| | | |-- discovery-by-multicast
| | | |-- add-multicast-if
| | | |-- discovery-by-broadcast
| | | |-- auto-discovery
| | | |-- auto-discovery-ap-group
| | |-- tech-support
| | | |-- mode
| | | |-- max-retry
| | |-- ap-stats-history
| | | |-- mode
| | | |-- period
| | | |-- max-retry
| | | |-- enable
| | |-- ap-if-stats
| | | |-- period
| | |-- ap-time-config
| | | |-- add-ntp
| | | |-- ntp-interval
| | | |-- mode
| | | |-- ac-stamp-interval
| | |-- ap-account
| | |-- repeater-service
| | |-- public-port
| | | |-- ftp
| | | |-- sftp
| | | |-- http
| | | |-- https
| |-- redundancy
| | |-- fallback-enable
| | |-- fallback-interval
| | |-- add-apc
| | |-- del-apc
| |-- 80211a
| | |-- max-associated-stations
| | |-- edca-parameters
| | |-- qos
| | | |-- protocol
| | | |-- edca-profile
| | | | |-- cw-min
| | | | |-- cw-max
| | | | |-- aifsn
| | | | |-- txop-limit
| | | | |-- msdu-lifetime
| | | |-- policy

```

```

|   |   |   |   |   |-- dot1p
|   |   |   |   |   |-- enable
|   |   |   |   |   |-- policy
|   |   |   |   |   |-- dscp
|   |   |   |   |   |-- enable
|   |   |   |   |   |-- policy
|   |   |   |   |-- dot1p-tag
|   |   |   |   |-- dscp-tag
|   |   |   |   |-- ap-tags
|   |   |   |   |-- qap-missing-ack-retry-limit
|   |   |   |   |-- edca-avg-period
|   |   |   |   |-- reset-edca-profiles
|   |   |-- cac
|   |   |   |-- voice
|   |   |   |   |-- acm
|   |   |   |   |-- reserved-ho-calls
|   |   |   |   |-- max-calls
|   |   |   |   |-- alarming-count
|   |   |   |-- video
|   |   |   |   |-- acm
|   |   |   |   |-- method
|   |   |   |   |-- reserved-ho-calls
|   |   |   |   |-- reserved-ho-chan-util
|   |   |   |   |-- max-calls
|   |   |   |   |-- max-chan-util
|   |   |-- msac
|   |   |   |-- acm
|   |   |   |-- method
|   |   |   |-- max-streams
|   |   |   |-- max-chan-util
|   |   |   |-- reserved-ho-streams
|   |   |   |-- reserved-ho-chan-util
|   |   |-- multi-antenna
|   |   |   |-- mode
|   |   |   |-- default-comb
|   |   |-- rate
|   |   |   |-- basic
|   |   |   |-- supported
|   |   |-- txPower
|   |   |-- channel
|   |   |-- 11n-support
|   |   |   |-- enable
|   |   |   |-- mcs
|   |   |   |-- guard-interval

```

```

|   |   |   |-- rifs
|   |   |   |-- phy-format
|   |   |   |-- ldpc
|   |   |   |-- tx-stbc
|   |   |   |-- rx-stbc
|   |   |   |-- beamforming
|   |   |   |-- tx-mcs-set
|   |   |   |-- protection
|   |   |   |-- spatial-stream
|   |   |-- retry-limit
|   |   |   |-- short
|   |   |   |-- long
|   |   |-- threshold
|   |   |   |-- rts
|   |   |   |-- fragmentation
|   |   |-- msdu-lifetime
|   |   |   |-- tx
|   |   |   |-- rx
|   |   |-- beacon
|   |   |   |-- period
|   |   |-- ofdm
|   |   |   |-- channel-width
|   |   |   |-- channel-starting-factor
|   |   |   |-- ti-threshold
|   |   |-- enable
|   |   |-- cvo
|   |   |   |-- enable
|   |   |   |-- local-call-enable
|   |   |   |-- set-profile
|   |   |-- rate-control
|   |   |   |-- voice
|   |   |   |   |-- max-rate
|   |   |   |   |-- probe-interval
|   |   |   |   |-- weight
|   |   |   |   |-- threshold
|   |   |   |-- video
|   |   |   |   |-- max-rate
|   |   |   |   |-- probe-interval
|   |   |   |   |-- weight
|   |   |   |   |-- threshold
|   |   |-- antenna
|   |   |-- station-kickout
|   |   |-- bandwidth
|   |   |-- 11ac-support

```

```

|   |   |   |-- enable
|   |   |   |-- mcs
|   |   |   |-- guard-interval
|   |   |-- extra-features
|   |   |   |-- peak-detector
|   |   |-- external-antenna-gain
|   |   |-- hybrid-mode
|   |   |   |-- hybrid-mode
|   |   |   |-- home-channel-time
|   |   |   |-- off-channel-dwell-time
|   |   |   |-- max-off-channel-scan-time
|   |   |   |-- scan-interleave-time
|   |   |   |-- traffic-idle-time
|   |   |-- hybrid-sa-mode
|   |   |   |-- hybrid-sa-mode
|   |   |   |-- hybrid-sa-time
|   |   |   |-- sa-home-channel-time
|   |   |   |-- sa-off-channel-dwell-time
|   |-- 80211bg
|   |   |-- max-associated-stations
|   |   |-- edca-parameters
|   |   |-- qos
|   |   |   |-- protocol
|   |   |   |-- edca-profile
|   |   |   |   |-- cw-min
|   |   |   |   |-- cw-max
|   |   |   |   |-- aifsn
|   |   |   |   |-- txop-limit
|   |   |   |   |-- msdu-lifetime
|   |   |   |-- policy
|   |   |   |   |-- dot1p
|   |   |   |   |   |-- enable
|   |   |   |   |   |-- policy
|   |   |   |   |-- dscp
|   |   |   |   |   |-- enable
|   |   |   |   |   |-- policy
|   |   |   |-- dot1p-tag
|   |   |   |-- dscp-tag
|   |   |   |-- ap-tags
|   |   |   |-- qap-missing-ack-retry-limit
|   |   |   |-- edca-avg-period
|   |   |   |-- reset-edca-profiles
|   |   |-- cac
|   |   |-- voice

```

```

| | | | -- acm
| | | | -- reserved-ho-calls
| | | | -- max-calls
| | | | -- alarming-count
| | | | -- video
| | | | -- acm
| | | | -- method
| | | | -- reserved-ho-calls
| | | | -- reserved-ho-chan-util
| | | | -- max-calls
| | | | -- max-chan-util
| | | -- msac
| | | | -- acm
| | | | -- method
| | | | -- max-streams
| | | | -- max-chan-util
| | | | -- reserved-ho-streams
| | | | -- reserved-ho-chan-util
| | | -- multi-antenna
| | | | -- mode
| | | | -- default-comb
| | | -- rate
| | | | -- basic
| | | | -- supported
| | | -- txPower
| | | -- channel
| | | -- 11n-support
| | | | -- enable
| | | | -- mcs
| | | | -- guard-interval
| | | | -- rifs
| | | | -- phy-format
| | | | -- ldpc
| | | | -- tx-stbc
| | | | -- rx-stbc
| | | | -- beamforming
| | | | -- tx-mcs-set
| | | | -- protection
| | | | -- spatial-stream
| | | -- 11g-support
| | | | -- enable
| | | -- retry-limit
| | | | -- short
| | | | -- long

```



```

|      |      |-- threshold
|      |      |      |-- rts
|      |      |      |-- fragmentation
|      |      |-- msdu-lifetime
|      |      |      |-- tx
|      |      |      |-- rx
|      |      |-- beacon
|      |      |      |-- period
|      |      |-- cca
|      |      |      |-- mode
|      |      |      |-- threshold
|      |      |-- enable
|      |      |-- cvo
|      |      |      |-- enable
|      |      |      |-- local-call-enable
|      |      |      |-- set-profile
|      |      |-- rate-control
|      |      |      |-- voice
|      |      |      |      |-- max-rate
|      |      |      |      |-- probe-interval
|      |      |      |      |-- weight
|      |      |      |      |-- threshold
|      |      |      |-- video
|      |      |      |      |-- max-rate
|      |      |      |      |-- probe-interval
|      |      |      |      |-- weight
|      |      |      |      |-- threshold
|      |      |-- antenna
|      |      |-- station-kickout
|      |      |-- extra-features
|      |      |      |-- peak-detector
|      |      |-- external-antenna-gain
|      |      |-- hybrid-mode
|      |      |      |-- hybrid-mode
|      |      |      |-- home-channel-time
|      |      |      |-- off-channel-dwell-time
|      |      |      |-- max-off-channel-scan-time
|      |      |      |-- scan-interleave-time
|      |      |      |-- traffic-idle-time
|      |      |-- hybrid-sa-mode
|      |      |      |-- hybrid-sa-mode
|      |      |      |-- hybrid-sa-time
|      |      |      |-- sa-home-channel-time
|      |      |      |-- sa-off-channel-dwell-time

```

```

|  |-- 80211h
|  |  |-- channel-switch
|  |  |-- power-constraint
|  |-- alarm
|  |  |-- level
|  |  |-- group
|  |  |-- logsize
|  |  |-- logcount
|  |  |-- dump
|  |  |-- stdout
|  |  |-- current-terminal
|  |-- event-filter
|  |  |-- enable
|  |-- web-service-port
|  |-- wireless-multicast-proxy
|  |-- ipv6
|  |  |-- route
|  |  |-- neighbor
|  |-- ip
|  |  |-- dhcp
|  |  |  |-- pool
|  |  |  |  |-- network
|  |  |  |  |-- range
|  |  |  |  |-- lease
|  |  |  |  |-- domain-name
|  |  |  |  |-- dns-server
|  |  |  |  |-- default-router
|  |  |  |  |-- fix-address
|  |  |  |  |-- ntp-server
|  |  |  |  |-- user-option
|  |  |  |  |-- ping-check
|  |  |  |  |-- capwap-dhcp-option
|  |  |  |-- enable
|  |  |  |-- server-ip
|  |  |-- dhcp-proxy
|  |  |  |-- timeout
|  |  |  |-- default-dhcp-server
|  |  |  |-- enable
|  |  |  |-- proxy-ip
|  |  |-- 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
|      |      |-- mdns
|      |      |      |-- snoop
|      |      |      |      |-- enable
|      |      |      |-- service
|      |      |      |-- profile
|      |      |      |      |-- service
|      |-- access-list
|      |-- http
|      |-- https
|      |-- arp
|      |-- firewall
|      |-- wlan-arp-mode
|      |-- package
|      |      |-- upgrade
|      |-- stats-report
|      |      |-- enable
|      |      |-- upload

```

```

|      |      |-- target
|      |      |-- current-stats
|      |-- telnet-server
|      |      |-- enable
|      |      |-- port
|      |-- ssh-server
|      |      |-- enable
|      |      |-- port
|      |-- sftp-server
|      |      |-- enable
|      |      |-- chguser
|      |-- ftp-server
|      |      |-- enable
|      |      |-- port
|      |      |-- chguser
|      |      |-- idle-timeout
|      |-- clock
|      |      |-- set
|      |      |-- timezone
|      |-- ntp
|      |      |-- server
|      |      |      |-- enable
|      |      |-- client
|      |      |      |-- enable
|      |      |      |-- interval
|      |      |      |-- server-addr
|      |      |      |      |-- ip
|      |      |      |      |-- hostname
|      |-- syslog
|      |      |-- enable
|      |      |-- add
|      |      |-- del
|      |      |-- level
|      |-- bridge
|      |      |-- protocol
|      |      |      |-- ieee
|      |      |      |-- mstp
|      |      |      |-- rstp
|      |      |-- ageing-time
|      |      |-- address
|      |      |      |-- discard
|      |      |      |      |-- vlan
|      |      |      |-- forward
|      |      |      |-- vlan

```

```

|      |      |-- max-age
|      |      |-- forward-time
|      |      |-- hello-time
|      |      |-- instance
|      |      |-- max-hops
|      |      |-- spanning-tree
|      |      |      |-- enable
|      |      |      |-- errdisable-timeout
|      |      |      |      |-- enable
|      |      |      |      |-- interval
|      |      |      |-- portfast
|      |      |      |-- bpdu-filter
|      |      |      |-- bpdu-guard
|      |      |-- rapid-spanning-tree
|      |      |      |-- enable
|      |      |-- multiple-spanning-tree
|      |      |      |-- enable
|      |      |-- priority
|      |      |-- transmit-holdcount
|      |-- spanning-tree
|      |      |-- bridge
|      |      |      |-- instance
|      |      |      |      |-- vlan
|      |      |      |-- region
|      |      |      |-- revision
|      |-- vlan
|      |      |-- vlan
|      |-- interface
|      |      |-- switchport
|      |      |      |-- mode
|      |      |      |-- access
|      |      |      |-- trunk
|      |      |      |      |-- add
|      |      |      |      |-- except
|      |      |      |      |-- remove
|      |      |      |      |-- all
|      |      |      |      |-- none
|      |      |      |-- hybrid
|      |      |      |      |-- allowed
|      |      |      |      |      |-- add
|      |      |      |      |      |-- remove
|      |      |      |      |      |-- all
|      |      |      |      |      |-- none
|      |      |      |-- vlan

```

```

| | | -- static-channel-group
| | | -- channel-group
| | | -- flowcontrol
| | | -- storm-control
| | | | -- level
| | | -- bridge-group
| | | | -- instance
| | | | | -- path-cost
| | | | | -- priority
| | | | -- priority
| | | | -- path-cost
| | | -- mirror
| | | | -- interface
| | | | | -- direction
| | | -- ip
| | | | -- address
| | | | -- igmp
| | | | | -- ra-option
| | | | | -- access-group
| | | | | -- immediate-leave
| | | | | -- last-member-query-count
| | | | | -- last-member-query-interval
| | | | | -- limit
| | | | | | -- except
| | | | | -- mroute-proxy
| | | | | -- querier-timeout
| | | | | -- query-interval
| | | | | -- query-max-response-time
| | | | | -- robustness-variable
| | | | | -- snooping
| | | | | | -- fast-leave
| | | | | | -- mrouter
| | | | | | -- querier
| | | | | | -- report-suppression
| | | | | -- static-group
| | | | | | -- interface
| | | | | | -- source
| | | | | | | -- interface
| | | | | -- version
| | | | -- pim
| | | | | -- sparse-mode
| | | | | -- bsr-border
| | | | | -- dr-priority
| | | | | -- exclude-genid

```

```

|      |      |      |      |-- hello-holdtime
|      |      |      |      |-- hello-interval
|      |      |      |      |-- neighbor-filter
|      |      |      |      |-- propagation-delay
|      |      |      |      |-- unicast-bsm
|      |      |      |-- access-group
|      |      |      |-- nat
|      |      |      |-- proxy-arp
|      |      |      |-- tcp-adjust-mss
|      |      |      |-- 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
|      |      |-- ipv6
|      |      |      |-- address
|      |      |      |-- nd
|      |      |      |-- dad-attempts
|      |      |      |-- suppress-ra
|      |      |      |-- ra-interval

```

```

| | | | -- ra-interval-min
| | | | -- ns-interval
| | | | -- curhoplimit
| | | | -- linkmtu
| | | | -- ra-lifetime
| | | | -- reachable-time
| | | | -- managed-config-flag
| | | | -- other-config-flag
| | | | -- prefix
| | | | -- enable
| | | -- shutdown
| | | -- traffic-shape
| | | -- service-policy
| | | -- dhcp
| | | | -- server
| | | | -- option-82
| | | -- arp-ageing-timeout
| | | -- speed-duplex
| | | -- mtu
| | | -- spanning-tree
| | | | -- autoedge
| | | | -- edgeport
| | | | -- force-version
| | | | -- guard
| | | | -- hello-time
| | | | -- instance
| | | | -- path-cost
| | | | -- priority
| | | | -- restricted-role
| | | | -- restricted-tcn
| | | | -- link-type
| | | | -- path-cost
| | | | -- portfast
| | | | -- bpdu-filter
| | | | -- bpdu-guard
| | | | -- priority
| | | | -- restricted-role
| | | | -- restricted-tcn
| | | | -- transmit-holdcount
| | | -- mDNS-snoop-profile
| | -- vrrp
| | -- router
| | | -- 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
|   |   |   |-- 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
|      |      |      |-- tag
|      |      |      |-- router-id
|      |      |      |-- summary-address
|      |      |      |-- timers
|      |      |      |-- spf
|      |      |      |      |-- exp
|      |      |-- vrrp
|      |      |-- advertisement-interval
|      |      |-- circuit-failover
|      |      |-- disable
|      |      |-- enable
|      |      |-- preempt-mode
|      |      |-- preempt-delay
|      |      |-- priority
|      |      |-- virtual-ip
|      |-- os-aware
|      |      |-- os-aware
|      |      |-- delete
|      |      |-- update
|      |-- ipwatch
|      |-- ftp
|      |-- stationtracking
|      |      |-- station
|      |      |-- on
|      |      |-- off
|      |-- fqm-mode
|      |      |-- access-list
|      |      |-- class-map
|      |      |-- match

```

```

|   |   |   |   |-- access-group
|   |   |   |   |-- class
|   |   |   |   |-- cos
|   |   |   |   |-- dst
|   |   |   |   |-- ip
|   |   |   |   |   |-- dscp
|   |   |   |   |   |-- precedence
|   |   |   |   |   |-- tos
|   |   |   |   |-- protocol
|   |   |   |   |-- src
|   |   |   |-- match-type
|   |   |-- policy-map
|   |   |   |-- class
|   |   |   |   |-- police
|   |   |   |   |   |-- cir
|   |   |   |   |-- mark
|   |   |   |   |   |-- cos
|   |   |   |   |   |-- ip
|   |   |   |   |   |   |-- dscp
|   |   |   |   |   |   |-- precedence
|   |   |   |   |   |-- priority
|   |   |   |   |-- bandwidth
|   |   |   |   |-- shape-peak
|   |   |   |   |-- queue-limit
|   |   |-- ip
|   |   |-- time-profile
|   |   |   |-- day-start
|   |   |-- update
|   |   |   |-- access-list
|   |   |-- acl-dns-query-interval
|   |-- if-arbiter
|   |-- sipalg
|   |   |-- enable
|   |   |-- sip-error-resp-enable
|   |   |-- monitor-port
|   |   |-- sip-detect-long-call-enable
|   |   |-- sip-long-call-timeout
|   |-- rrm
|   |   |-- enable
|   |   |-- 80211a
|   |   |   |-- dpc
|   |   |   |-- enable
|   |   |   |-- periodic-interval
|   |   |   |-- rssi-threshold

```

```

| | | | -- rssi-threshold-for-stn
| | | | -- txPower
| | | | -- dcs
| | | | -- enable
| | | | -- periodic-interval
| | | | -- anchor-time
| | | | -- interference-level-threshold
| | | | -- channel-utilization-threshold
| | | | -- my-utilization-threshold
| | | | -- channel
| | | | -- aware-option
| | | | -- delayed-channel-change
| | | | -- joint-algo-enable
| | | | -- chdc
| | | | -- enable
| | | | -- statsCollectEnable
| | | | -- statsWarningEnable
| | | | -- statsActionEnable
| | | | -- statsCollectInterval
| | | | -- rssi-threshold
| | | | -- min-failed-client-count
| | | | -- percent-failed-client-count
| | | | -- min-idle-timeout-count
| | | | -- neighbor-list
| | | | -- wlan-neighbor-priority
| | | -- 80211b
| | | | -- dpc
| | | | -- enable
| | | | -- periodic-interval
| | | | -- rssi-threshold
| | | | -- rssi-threshold-for-stn
| | | | -- txPower
| | | | -- dcs
| | | | -- enable
| | | | -- periodic-interval
| | | | -- anchor-time
| | | | -- interference-level-threshold
| | | | -- channel-utilization-threshold
| | | | -- my-utilization-threshold
| | | | -- channel
| | | | -- aware-option
| | | | -- delayed-channel-change
| | | | -- joint-algo-enable
| | | | -- chdc

```

```

|   |   |   |   |-- enable
|   |   |   |   |-- statsCollectEnable
|   |   |   |   |-- statsWarningEnable
|   |   |   |   |-- statsActionEnable
|   |   |   |   |-- statsCollectInterval
|   |   |   |   |-- rssi-threshold
|   |   |   |   |-- min-failed-client-count
|   |   |   |   |-- percent-failed-client-count
|   |   |   |   |-- min-idle-timeout-count
|   |   |   |-- neighbor-list
|   |   |   |-- wlan-neighbor-priority
|   |   |-- rf-group-name
|   |   |-- sub-channel-group
|   |   |-- sleep-cell-detect
|   |   |   |-- enable
|   |   |   |-- apc-threshold
|   |   |   |-- ap-threshold
|   |   |   |-- period_1st
|   |   |   |-- period_2nd
|   |   |   |-- period_all
|   |   |-- energy-saving-group
|   |   |   |-- enable
|   |   |   |-- group-name
|   |   |   |-- apc-threshold
|   |   |   |-- weekday
|   |   |   |-- weekend
|   |   |   |-- add-ap
|   |   |   |-- del-ap
|   |   |   |-- radio_off_unconditionally
|   |   |   |-- neighbor-ap-on
|   |   |-- energy-saving-auto-class
|   |   |   |-- enable
|   |   |   |-- apc-threshold
|   |   |   |-- weekday
|   |   |   |-- weekend
|   |   |   |-- radio_off_unconditionally
|   |   |   |-- neighbor-ap-on
|   |   |-- exception-group
|   |   |   |-- name
|   |   |   |-- add-ap
|   |   |   |-- del-ap
|   |   |   |-- type
|   |-- cluster
|   |   |-- keep-alive-interval

```

```

| | | -- keep-alive-retry-count
| | | -- enable
| | | -- add-apc
| | | -- del-apc
| | | -- del-apc-all
| | -- wids
| | | -- enable
| | | -- device
| | | | -- remove
| | | | -- move
| | | | -- modify-state
| | | | -- ap
| | | | | -- ap-blacklist-check
| | | | | -- invalid-security
| | | | | -- invalid-channel
| | | | | -- managed-ap-valid-channel
| | | | | -- adhoc-connection
| | | | | -- honeypot
| | | | | -- hidden-ssid
| | | | | -- invalid-channel-fake-ap
| | | | | -- mac-spoofing
| | | | | -- honeypot-with-unmanaged-station
| | | | | -- invalid-uic-fake-ap
| | | | | -- user_defined_managed
| | | | | -- unclassified
| | | | -- station
| | | | | -- auth-request-det
| | | | | -- probe-request-det
| | | | | -- deauth-request-det
| | | | | -- assoc-fail-det
| | | | | -- auth-fail-det
| | | | | -- oneXauth-fail-det
| | | | | -- webauth-fail-det
| | | | | -- staBlack-list
| | | | | -- unclassified
| | | | | -- allowed-limit
| | | | -- rule
| | | | | -- add-managed
| | | | | -- del-managed
| | | | | -- modify-managed
| | | | | -- add-unmanaged
| | | | | -- del-unmanaged
| | | | | -- modify-unmanaged
| | | -- lists

```

```

| | | |-- channel-validation
| | | | |-- enable
| | | | |-- add
| | | | |-- delete
| | | |-- ap-blacklist
| | | |-- station-blacklist
| | | |-- managed-oui
| | | |-- managed-neighbor-ap
| | |-- containment
| | | |-- enable
| | | |-- auto
| | | | |-- unmanaged-ap-uses-managed-ssid
| | | | |-- adhoc-connection
| | | | |-- unmanaged-ap-associated-with-managed-station
| | | | |-- unmanaged-ap
| | | | |-- neighbor-ap-associated-with-managed-station
| | | |-- manual
| | |-- expiration-timeout
| |-- monitor-radio
| | |-- scan-interval
| | |-- periodic-interval
| |-- snmp
| | |-- ap
| | | |-- enable
| | | |-- ro-community
| | | |-- rw-community
| | | |-- port
| | | |-- user
| | |-- community
| | |-- user
| | |-- trap
| | |-- trap-source-ip
| |-- pcap
| | |-- save-mode
| | |-- operation-mode
| | |-- filtering-mode
| | |-- trigger-value
| | |-- start-service
| | |-- enable-capwap-tunneling
| | |-- config-filter
| | | |-- station-mac
| | | |-- enable-station-mac
| | | |-- enable-ap-mac
| | | |-- ap-mac

```

```

|   |   |-- config-ftp
|   |   |-- ipv4-address
|   |   |-- stop-current-forcibly
|   |   |-- remote-file-path
|   |   |-- login-id
|   |-- network
|   |   |-- broadcast
|   |   |-- enable
|   |   |-- acl-name
|   |   |-- multicast
|   |   |-- enable
|   |   |-- acl-name
|   |   |-- dhcp-snooping
|   |-- wlan-radio-service
|   |   |-- sta-idle-timeout
|   |   |-- wmm-mode
|   |   |-- dtim
|   |   |-- default-qos
|   |-- preferred-calls
|   |   |-- add
|   |   |-- del
|   |-- locationtrack
|   |   |-- autotrace
|   |   |-- algorithm
|   |   |-- enable
|   |   |-- ap
|   |   |-- station
|   |   |-- rogueap
|   |   |-- roquestation
|   |   |-- expiryhistory
|   |   |-- scan-result-type
|   |   |-- num-req-ap-list
|   |   |-- scan-report-intv
|   |   |-- num-report-cnt
|   |-- smart-handover
|   |   |-- scme-if
|   |   |-- enable
|   |   |-- vccout-cancel
|   |-- voice
|   |   |-- vqm
|   |   |-- connection-limit
|   |   |-- reporting-mode
|   |   |-- rtp-port-range
|   |   |-- alarm

```



```

| | | | |-- enable
| | | | |-- enable-packet-capture
| | | | |-- threshold
| | | |-- upload
| | | | |-- enable
| | | | |-- server
| | | | |-- interval
| | | | |-- mode
| | | | |-- user-login
| | | | |-- target-directory
| | | | |-- file-size
| | | | |-- immediate-upload
| | | |-- filter
| | | | |-- prefix
| |-- router-id
| |-- radiuscm
| | |-- add-local-userdb
| | |-- modify-local-userdb
| | |-- delete-local-userdb
| | |-- export-local-userdb
| | |-- import-local-userdb
| | |-- remove-all-local-userdb
| |-- rbac
| | |-- role-profile
| | | |-- acl
| | | |-- qos
| | | |-- vlan
| | | |-- url
| | | |-- dpi
| | |-- acl-profile
| | | |-- add-acl
| | |-- sync-config
| | | |-- all
| | | |-- remote-ap-group
| | | |-- ap
| | |-- derivation-profile
| | | |-- condition
| |-- airinsight
| | |-- add-station
| | |-- del-station
| | |-- set
| |-- network-stats
| | |-- statistics
| | | |-- voip

```

					-- enable
					-- rf-value
					-- enable
					-- station
					-- enable
					-- data
					-- enable
					-- alert
					-- voip
					-- call-setup
					-- enable
					-- interval
					-- threshold
					-- drop-call
					-- enable
					-- interval
					-- threshold
					-- voice-quality
					-- enable
					-- interval
					-- threshold
					-- rf-value
					-- threshold
					-- 80211a
					-- channel-utilization
					-- air-quality
					-- rx-utilization
					-- tx-utilization
					-- noise-level
					-- 80211b
					-- channel-utilization
					-- air-quality
					-- rx-utilization
					-- tx-utilization
					-- noise-level
					-- enable-alert
					-- channel-utilization
					-- air-quality
					-- noise-level
					-- count-alert
					-- min5-threshold
					-- hour1-threshold
					-- day1-threshold
					-- station

```

| | | | |-- kick-out
| | | | |-- scan
| | | | |-- enable
| | | | |-- assoc-success-blacklist
| | | | |-- ho-success-blacklist
| | | | |-- alert-duration
| | | | |-- alert-assoc-rate
| | | | |-- alert-handover-rate
| | | | |-- alert-assoc-try
| | | | |-- alert-disassoc-try
| | | | |-- alert-handover-try
| | | | |-- alert-assoc-rssi
| | | | |-- alert-max-db
| | | |-- data
| | | | |-- packet-loss-alert
| | | | | |-- enable
| | | | | |-- interval
| | | | | |-- threshold
| | | | |-- packet-retry-alert
| | | | | |-- enable
| | | | | |-- interval
| | | | | |-- threshold
| | |-- upload-info
| | | |-- enable
| | | |-- target
| |-- periodic-backup
| | |-- enable
| | |-- target
| | |-- schedule
| |-- load-balancing
| | |-- calibration
| | | |-- pc
| | | |-- moblie
| | | |-- others
| | |-- enable
| | |-- active
| | |-- interval
| | |-- allow-channel
| | |-- idle-station
| | |-- idle-station-time
| | |-- max-target
| | |-- ssl-ho
| |-- wips
| | |-- group-enable

```

```
|      |      |-- group-disable
|      |      |-- group-size
|      |      |-- group-threshold
|      |      |-- upload-info
|      |      |      |-- enable
|      |      |      |-- target-delete
|      |      |-- data-collection
|      |      |      |-- enable
|      |      |      |-- interval
|      |-- onetime-redirect
|      |-- flood-protect
|      |      |-- arp
|      |      |-- icmp
|      |      |-- enable
|      |-- site-profiling
|      |      |-- create-xml
|      |      |-- apply-xml
```

A.2 show

```

|-- show
|   |-- band-steering
|   |-- load-balancing
|   |   |-- history
|   |   |   |-- summary
|   |   |   |-- detail
|   |   |-- summary
|   |   |-- group
|   |   |   |-- detail
|   |   |   |-- ap
|   |   |   |-- station
|   |   |-- stats
|   |   |-- debug-stats
|   |   |-- wlan
|   |-- air-quality
|   |   |-- count
|   |   |   |-- interferers
|   |   |   |-- worst-interferers
|   |-- spectrum-analysis
|   |   |-- config
|   |   |   |-- ap
|   |   |-- report
|   |   |   |-- duty_cycle
|   |   |   |   |-- ap
|   |   |   |-- sample
|   |   |   |   |-- ap
|   |   |   |-- interference
|   |   |   |   |-- ap
|   |-- mgmt-users
|   |-- configuration-sync
|   |   |-- conf
|   |   |-- current-stats-all
|   |   |-- current-stats-apc
|   |   |-- list-apc
|   |   |-- summary-stats-all
|   |   |-- summary-stats-apc
|   |-- command-log
|   |-- cli-idle-timeout
|   |-- cli-sessions
|   |-- country
|   |   |-- global-config
|   |   |-- ap-config

```

```

| | | -- group-config
| | | -- information
| | -- voip
| | | -- config
| | -- smart-handover
| | | -- connect-status
| | | -- vccout-cancel
| | -- 80211a
| | | -- cac
| | | | -- voice
| | | | | -- configuration
| | | | -- video
| | | | | -- configuration
| | | -- msac
| | | | -- configuration
| | | | -- stats
| | | -- multi-antenna
| | | -- summary
| | | -- qos
| | | | -- policy
| | | | -- ac-profile
| | | | -- edca-parameters
| | | | -- radio-configuration
| | | -- radio-config
| | | -- voip-stats
| | | -- cvo
| | | | -- profile
| | | | -- config
| | | -- extra-features
| | | -- hybrid-mode
| | | -- hybrid-sa-mode
| | -- 80211bg
| | | -- cac
| | | | -- voice
| | | | | -- configuration
| | | | -- video
| | | | | -- configuration
| | | -- msac
| | | | -- configuration
| | | | -- stats
| | | -- multi-antenna
| | | -- summary
| | | -- qos
| | | | -- policy

```

```

|      |      |      |-- ac-profile
|      |      |      |-- edca-parameters
|      |      |      |-- radio-configuration
|      |      |-- radio-config
|      |      |-- voip-stats
|      |      |-- cvo
|      |      |      |-- profile
|      |      |      |-- config
|      |      |-- extra-features
|      |      |-- hybrid-mode
|      |      |-- hybrid-sa-mode
|      |-- 80211h
|      |      |-- configuration
|      |      |-- prohibit-channels
|      |-- qos
|      |      |-- profile
|      |-- wlan-radio-service
|      |      |-- config
|      |-- handover
|      |-- airmove
|      |      |-- ap
|      |      |-- group
|      |-- sta-ssl
|      |      |-- ap
|      |      |-- group
|      |-- station
|      |      |-- stats
|      |      |      |-- management_frame
|      |      |      |      |-- all
|      |      |      |-- airmove
|      |      |      |      |-- all
|      |      |      |-- IAHO
|      |      |      |      |-- all
|      |      |      |-- debug
|      |      |      |      |-- all
|      |      |      |-- ap-80211-stats
|      |      |-- association
|      |      |      |-- history
|      |      |-- mgmtframe-rate-limit
|      |      |      |-- all
|      |      |-- summary
|      |      |      |-- ap
|      |      |      |-- bssid
|      |      |      |-- wlan

```

```

| | | -- detail
| | | -- ipaddress-valid-check-time
| | | -- vlan-assignment-staticip
| | -- system
| | | -- info
| | | -- uptime
| | | -- load
| | | -- cpu
| | | -- memory
| | | -- disk
| | | -- fan
| | | -- temp
| | | -- threshold
| | | | -- cpu
| | | | -- memory
| | | | -- disk
| | | | -- fan
| | | | -- temp
| | | -- fancontrol
| | | -- license-key
| | -- remote-ap-group
| | | -- summary
| | | -- user-state
| | | -- detail
| | | -- groupname
| | | -- upgrade
| | | | -- config
| | | | -- list
| | -- ap-group
| | | -- remote-forwarding
| | | -- summary
| | | -- detail
| | | -- ip-sec
| | -- ap
| | | -- upgrade
| | | | -- summary
| | | | -- list
| | | -- summary
| | | -- packet-capture
| | | -- detail
| | | -- remote-forwarding
| | | -- stats-history
| | | -- if-stats
| | | -- join-stats

```



```

|      |-- capwap-stats
|      |-- radio-stats
|      |-- tech-support
|      |-- time-config
|      |-- syslog-config
|      |-- load-balancing
|      |-- ip-sec
|  |-- apc
|      |-- summary
|      |-- list
|      |-- capwap
|          |-- summary
|      |-- ap-if-stats
|      |-- ap-account
|      |-- ap-time-config
|      |-- public-port
|  |-- redundancy
|      |-- summary
|      |-- priority-list
|  |-- wlan
|      |-- summary
|      |-- if-group-os
|      |-- detail
|      |-- voice-enterprise-80211k
|      |-- security
|          |-- summary
|          |-- detail
|      |-- preferred-vlan-info
|  |-- vap
|  |-- if-group
|  |-- alarm
|      |-- info
|      |-- conf
|      |-- list
|          |-- all
|          |-- level
|          |-- group
|      |-- history
|          |-- all
|          |-- level
|          |-- group
|      |-- backup
|  |-- event
|  |-- running-config

```

```
| | |-- system
| | |-- cli-idle-timeout
| | |-- alarm
| | |-- network
| | |-- snmp
| | |-- wifim
| | |-- vqm
| | |-- voice-vqm
| | |-- apc
| | |-- capwap
| | |-- if-group
| | |-- wlan
| | |-- wlan-security
| |-- tech-support
| | |-- version
| | |-- timezone
| | |-- clock
| | |-- uptime
| | |-- system
| | |-- cpu
| | |-- load
| | |-- memory
| | |-- disk
| | |-- process
| | |-- processlog
| | |-- processmemory
| | |-- coredump
| | |-- crash
| | |-- swm-log
| | |-- alarm
| | |-- event-filter
| | |-- debug
| | |-- cluster
| | |-- redundancy
| | |-- cli-idle-timeout
| | |-- network
| | |-- snmp
| | |-- wifim
| | |-- vqm
| | |-- apc
| | |-- capwap
| | |-- if-group
| | |-- wlan
| | |-- wlan-security
```

```

|      |      |-- rrm
|      |      |-- alarmhistory
|      |      |-- event
|      |      |-- wids
|      |-- ip
|      |      |-- dhcp
|      |      |      |-- pool
|      |      |      |-- lease
|      |      |      |-- proxy-lease
|      |      |      |-- statistics
|      |      |      |-- process
|      |      |-- dhcp-proxy
|      |      |-- dns
|      |      |      |-- name-server
|      |      |-- igmp
|      |      |      |-- groups
|      |      |      |-- interface
|      |      |      |-- snooping
|      |      |      |      |-- mroute
|      |      |      |      |-- statistics
|      |      |      |-- ssm-map
|      |      |-- route
|      |      |-- interface
|      |      |-- 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
|   |   |-- mdns
|   |   |-- snoop
|   |   |-- service
|   |   |-- profile
|   |   |   |-- summary
|   |   |   |-- detail
|   |   |   |-- wlan
|   |   |   |-- interface
|   |   |-- service-cache
|   |-- ipv6
|   |   |-- route
|   |   |-- interface
|   |   |-- neighbors
|   |-- access-list
|   |-- arp
|   |-- wireless-acl-list
|   |-- multi2uni-list
|   |-- interface
|   |-- vlan
|   |-- mirror
|   |-- reboot
|   |-- processes
|   |   |-- status
|   |   |-- log
|   |   |-- memory
|   |-- version
|   |-- syslog
|   |-- debug
|   |   |-- coredump
|   |   |   |-- summary
|   |   |-- reboot
|   |   |-- info
|   |   |-- summary

```

```

|      |      |      |-- export
|      |      |-- log
|      |      |-- all
|      |      |-- level
|      |      |-- module
|      |      |-- conf
|      |      |-- backup
|      |      |-- keyword
|      |      |-- detail
|      |      |      |-- all
|      |      |      |-- level
|      |      |      |-- module
|      |      |      |-- backup
|      |      |      |-- conf
|      |      |      |-- keyword
|      |      |      |-- before
|      |      |      |-- after
|      |      |      |-- start-time
|      |      |-- before
|      |      |-- after
|      |      |-- start-time
|      |      |-- rate
|      |      |-- swm-log
|      |      |-- processes
|      |      |-- license
|      |      |      |-- backup-file
|      |      |      |-- invalid-file
|      |      |      |-- uptime
|      |      |      |-- code-book
|      |-- ssh-server
|      |-- telnet-server
|      |-- ftp-server
|      |-- filter
|      |-- filter-stats
|      |-- policy-map
|      |-- class-map
|      |-- firewall
|      |-- sftp-server
|      |-- ntp
|      |-- timezone
|      |-- clock
|      |-- event-filter
|      |-- security
|      |      |-- radius-server

```

```

|   |   |   |-- summary
|   |   |   |-- detail
|   |   |   |-- stats
|   |   |-- advanced
|   |   |-- hapd-stats
|   |   |-- hapd-ap-stats
|   |   |-- captive-portal
|   |   |   |-- summary
|   |   |   |-- web-auth-cache-list
|   |   |   |-- web-auth-users
|   |   |   |   |-- summary
|   |   |   |   |-- detail
|   |   |-- mac-filter
|   |   |   |-- summary
|   |   |   |-- detail
|   |   |-- ext-wips
|   |   |   |-- config
|   |   |   |-- list
|   |   |-- tacacs
|   |   |   |-- config
|   |   |   |-- detail
|   |   |-- byod
|   |   |   |-- configuration
|   |   |   |-- list
|   |-- vrrp
|   |-- static-channel-group
|   |-- bridge
|   |-- etherchannel
|   |-- spanning-tree
|   |   |-- mst
|   |   |   |-- config
|   |   |   |-- detail
|   |   |   |   |-- interface
|   |   |   |   |-- instance
|   |   |   |   |-- interface
|   |   |   |-- interface
|   |   |-- interface
|   |-- sipalg
|   |   |-- configuration
|   |-- rrm
|   |   |-- config-summary
|   |   |-- help
|   |   |-- neighbor-list
|   |   |-- channel-status

```

```

| | |-- rrm-history
| | |-- sub-channel-group
| | |-- sleep-cell-detect
| | |-- energy-saving-group
| | |-- energy-saving-auto-class
| | |-- exception-group
| |-- locationtrack
| | |-- help
| | |-- config
| | |-- ap
| | |-- floor
| | |-- station
| | |-- rogueap
| | |-- roquestation
| |-- debugging
| | |-- lacp
| |-- port
| |-- lacp
| |-- http
| |-- https
| |-- snmp
| | |-- community
| | |-- user
| | |-- trap
| | |-- ap
| |-- pcap
| | |-- current-config
| |-- network
| | |-- current-status
| |-- cluster
| | |-- config
| | |-- current-stats-all
| | |-- current-stats-apc
| | |-- help
| | |-- list-apc
| | |-- list-station
| | |-- summary-stats-all
| | |-- summary-stats-apc
| |-- wids
| | |-- help
| | |-- statistics
| | |-- current-config
| | |-- lists
| | | |-- managed-ap

```

```

|   |   |   |-- ap-blacklist
|   |   |   |-- managed-station
|   |   |   |-- station-blacklist
|   |   |   |-- managed-neighbor-ap
|   |   |   |-- managed-oui
|   |   |   |-- managed-ssid
|   |   |-- device
|   |   |   |-- ap
|   |   |   |-- current-config
|   |   |   |-- list
|   |   |   |-- detail
|   |   |-- station
|   |   |   |-- current-config
|   |   |   |-- allow-limit
|   |   |   |-- list
|   |   |   |-- detail
|   |   |-- adhoc
|   |   |   |-- list
|   |   |   |-- detail
|   |   |-- rule
|   |   |   |-- managed
|   |   |   |-- unmanaged
|   |   |-- containment
|   |   |   |-- current-config
|   |-- stats-report
|   |   |-- conf
|   |   |-- current-stats
|   |-- periodic-backup
|   |-- stationtracking
|   |   |-- station
|   |   |-- conf
|   |-- preferred-calls
|   |-- vdm
|   |   |-- config
|   |   |-- policy-for-station
|   |-- config-files
|   |-- rate-control
|   |-- tx-power-range
|   |-- os-aware
|   |-- os-aware-all
|   |-- onetime-redirect
|   |-- monitor-radio
|   |-- voice
|   |   |-- station

```



```

|      |      |      |-- summary
|      |      |      |-- detail
|      |      |      |-- mac
|      |      |      |-- ip
|      |      |      |-- user-name
|      |      |      |-- tel-no
|      |      |-- active-call
|      |      |-- summary
|      |      |-- detail
|      |      |-- mac
|      |      |-- ip
|      |      |-- user-name
|      |      |-- tel-no
|      |-- complete-call
|      |-- summary
|      |-- detail
|      |-- mac
|      |-- ip
|      |-- user-name
|      |-- tel-no
|      |-- vqm
|      |-- help
|      |-- current-config
|      |-- summary-stats
|      |-- debug-stats
|      |-- current-stats
|      |-- history-stats
|      |-- alarms
|      |-- statistics
|      |-- ap
|      |-- radio
|      |-- wlan
|      |-- device
|      |-- station
|      |-- event
|      |-- sipmsg-log
|      |-- device
|      |-- bss-if
|      |-- radiuscm
|      |-- username
|      |-- all-user
|      |-- rbac
|      |-- role-profile
|      |-- summary

```

```

|      |      |-- acl-profile
|      |      |      |-- summary
|      |      |      |-- detail
|      |      |-- remote-group
|      |      |      |-- summary
|      |      |-- derivation-profile
|      |      |      |-- summary
|      |      |      |-- detail
|      |      |-- station
|      |      |      |-- summary
|      |      |-- wlan-derivation-config
|      |-- airinsight
|      |-- network-stats
|      |      |-- statistics
|      |      |      |-- voip
|      |      |      |      |-- configuration
|      |      |      |      |-- ap
|      |      |      |      |-- radio
|      |      |      |      |-- wlan
|      |      |      |      |-- device
|      |      |      |-- rf-value
|      |      |      |      |-- summary
|      |      |      |      |-- channel-utilization
|      |      |      |      |-- air-quality
|      |      |      |      |-- rx-utilization
|      |      |      |      |-- tx-utilization
|      |      |      |      |-- noise-level
|      |      |      |-- station
|      |      |      |      |-- association
|      |      |      |      |      |-- num-of-attempt-assoc
|      |      |      |      |      |      |-- ap
|      |      |      |      |      |      |-- wlan
|      |      |      |      |      |      |-- radio
|      |      |      |      |      |      |-- device
|      |      |      |      |-- num-of-fail-by-reason
|      |      |      |      |      |-- ap
|      |      |      |      |      |-- wlan
|      |      |      |      |      |-- radio
|      |      |      |      |      |-- device
|      |      |      |-- rssi
|      |      |      |      |-- ap
|      |      |      |      |-- wlan
|      |      |      |      |-- radio
|      |      |      |      |-- device

```

```

|      |      |      |      |      |      |-- success-rate
|      |      |      |      |      |      |-- ap
|      |      |      |      |      |      |-- wlan
|      |      |      |      |      |      |-- radio
|      |      |      |      |      |      |-- device
|      |      |      |      |      |-- latency
|      |      |      |      |      |-- ap
|      |      |      |      |      |-- wlan
|      |      |      |      |      |-- radio
|      |      |      |      |      |-- device
|-- hand-over
|      |      |      |      |-- num-of-attempt-ho
|      |      |      |      |-- ap
|      |      |      |      |-- wlan
|      |      |      |      |-- radio
|      |      |      |      |-- device
|      |      |      |      |-- ho-type
|-- num-of-fail-by-reason
|      |      |      |      |-- ap
|      |      |      |      |-- wlan
|      |      |      |      |-- radio
|      |      |      |      |-- device
|      |      |      |      |-- ho-type
|-- rssi
|      |      |      |      |-- ap
|      |      |      |      |-- wlan
|      |      |      |      |-- radio
|      |      |      |      |-- device
|-- success-rate
|      |      |      |      |-- ap
|      |      |      |      |-- wlan
|      |      |      |      |-- radio
|      |      |      |      |-- device
|      |      |      |      |-- ho-type
|-- latency
|      |      |      |      |-- ap
|      |      |      |      |-- wlan
|      |      |      |      |-- radio
|      |      |      |      |-- device
|      |      |      |      |-- ho-type
|-- trace
|      |      |      |-- ap-packet-loss
|      |      |      |-- ap
|      |      |-- ap-packet-loss-raw

```

```

|      |      |      |      |      |-- ap
|      |      |      |      |-- num-of-station
|      |      |      |      |-- ap
|      |      |      |      |-- radio
|      |      |      |      |-- wlan
|      |      |      |-- disassoc-deauth
|      |      |      |-- ap
|      |      |      |-- wlan
|      |      |      |-- radio
|      |      |      |-- device
|      |      |-- configuration
|      |      |-- peak-count
|      |      |-- scan
|      |      |-- kick-out
|      |      |-- data-rate
|      |      |-- data
|      |      |-- current-config
|      |      |-- ap-stat
|      |      |-- apc-stat
|      |-- alert
|      |      |-- voip
|      |      |-- configuration
|      |      |-- rf-value
|      |      |-- threshold
|      |      |-- enable-alert
|      |      |-- count-alert
|      |      |-- history
|      |-- upload-info
|-- wips
|      |-- ap-summary
|      |-- group-config
|      |-- group-summary
|      |-- upload-info
|      |-- data-collection
|      |-- upload-status
|      |-- upload-list
|-- flood-protect-status
|-- dpi
|-- acl-dns-query
|-- site-profiling
|      |-- list
|      |-- detail

```

A.3 clear

```

|-- clear
|   |-- air-quality
|   |   |-- count
|   |   |   |-- interferers
|   |-- stats
|   |   |-- station
|   |   |   |-- globally
|   |   |   |-- individually
|   |-- interference
|   |   |-- report
|   |-- ip
|   |   |-- igmp
|   |   |   |-- group
|   |   |   |-- interface
|   |   |-- pim
|   |   |   |-- sparse-mode
|   |   |-- dhcp
|   |   |   |-- lease
|   |   |-- nat
|   |   |-- ospf
|   |   |-- mdns
|   |-- ipv6
|   |   |-- neighbors
|   |-- spanning-tree
|   |   |-- bridge
|   |   |-- interface
|   |-- cli-session
|   |-- interface
|   |-- arp-cache
|   |-- voice
|   |   |-- vqm
|   |   |   |-- all
|   |   |   |-- history-stats
|   |   |   |-- summary-stats
|   |   |   |-- current-stats
|   |   |   |-- history-file
|   |   |   |-- debug-stats
|   |   |-- event
|   |   |-- sipmsg-log
|   |-- pcap-stat
|   |-- security
|   |   |-- radius-server

```

```
| | | -- stats
| | | -- hapd-stats
| | | -- hapd-ap-stats
| | | -- captive-portal
| | | -- stats
| -- cluster
| | | -- clear-all
| | | -- clear-apc
| -- log
| | | -- debug
| | | | -- current
| | | | -- all
| | | | -- detail
| | | | | -- current
| | | | | -- all
| | | -- alarm
| | | -- actalarm
| | | -- alarminfo
| -- vrrp
| -- network-stats
| | | -- statistics
| | | -- station
| | | -- data
| -- dpi-stat
```

A.4 debug

```

|-- debug
|   |-- processes
|   |   |-- config
|   |-- crash
|   |-- igmp
|   |-- lacp
|   |-- fqm
|   |   |-- acl
|   |   |-- function
|   |   |-- message
|   |   |-- qos
|   |-- nsm
|   |   |-- all
|   |   |-- events
|   |   |-- kernel
|   |   |-- mcast
|   |   |-- packet
|   |-- mstp
|   |   |-- all
|   |   |-- cli
|   |   |-- packet
|   |   |-- protocol
|   |   |-- timer
|   |-- traceroute
|   |-- tcpdump
|   |-- ipwatch
|   |-- virtual-if
|   |-- msho
|   |-- irfm
|   |   |-- module
|   |-- rfsgw
|   |-- wids
|   |-- locationtracking
|   |-- log
|   |   |-- level
|   |   |-- logsize
|   |   |-- logcount
|   |   |-- on
|   |   |-- off
|   |   |-- detail
|   |   |   |-- level
|   |   |   |-- logsize

```

```

| | | -- logcount
| | | -- on
| | | -- off
| | | -- mstdout
| | | -- module
| | | -- level
| | | -- on
| | | -- off
| | | -- rate
| | -- dhcp-info
| | -- apm
| | | -- wlan
| | | | -- reject-probe
| | | | -- rssi
| | | | -- time
| | -- swxray
| | | -- swm
| | | -- db
| | | -- logd
| | | -- evm
| | | -- license
| | | -- filemgr
| | | -- filemib
| | | -- cm
| | | -- eqm
| | | -- rbac
| | | -- apccluster
| | | -- m2u_mng
| | | -- awmb
| | | -- awfb
| | | -- wssm
| | | -- apm
| | | -- apd
| | | -- capwap
| | | -- hostapd
| | | -- radiuscm
| | | -- wids
| | | -- cpm
| | | -- irfm
| | | -- rfsgw
| | | -- apclt
| | | -- pm
| | | -- httpd
| | | -- sipalg

```



```
|      |      |-- vem
|      |      |-- agsm
|      |      |-- snmpd
|      |      |-- WebAgent
|      |      |-- salbm
|      |      |-- bfm
|      |      |-- cgc
```

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
-- ping6
-- traceroute6
-- telnet
-- ssh
```

ANNEX B. Open Source Announcement (WEC8500/WEC8050)

Some software components of this product incorporate source code covered under the GNU General Public License (GPL), the GNU Lesser General Public License (LGPL) and BSD License etc.

Acknowledgement:

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)

The software included in this product contains copyrighted software that is licensed under the GPL/LGPL. You may obtain the complete Corresponding Source code from us for a period of three years after our last shipment of this product by sending email to: oss.request@samsung.com

If you want to obtain the complete Corresponding Source code in the physical medium such as CD-ROM, the cost of physically performing source distribution may be charged. You may also find a copy of the source at <http://www.samsungnetwork.com/Home/Opensource>

This offer is valid to anyone in receipt of this information.

Below is the list of components covered under GNU General Public License, the GNU Lesser General Public License and BSD License etc.

Open Source Software	License
Apache HTTP Server	Apache License 2.0
hostapd	BSD License
EventLog Library	BSD License
Net SNMP-net-snmp	BSD License
OpenSSH	BSD License
Pure-FTPd	BSD License
IP Utils	BSD License

Open Source Software	License
libnet-dev	BSD License
Libedit	BSD License
Octeon SDK	BSD License
lz4mt	BSD License
Telnet	BSD License
Cavium Networks Octeon SDK	BSD License
curl	Curl License
ISC DHCP	DHCP License
Free Radius	GPL 2.0
Dproxy-Caching DNS Proxy	GPL 2.0
IPwatchD	GPL 2.0
Traceroute for Linux	GPL 2.0
Sys V Init	GPL 2.0
linux-2.6	GPL 2.0
linux-netfilter-modules	GPL 2.0
NetHogs-'net top' per process	GPL 2.0
gzip	GPL 2.0
Linux Kernel	GPL 2.0
Das U-Boot-Universal Bootloader	GPL 2.0
GNU Core Utils	GPL 2.0
Avahi	LGPL 2.1
libnl-Netlink Library	LGPL 2.1
OSIP Library	LGPL 2.1
FTP Lib Alt	LGPL 2.1
Linux Kernel SCTP	LGPL 2.1
GNU C Library-glibc	LGPL 2.1
libxml2	libxml2 License
libxslt	MIT v2 with Ad Clause License
NTP-The Network Time Protocol	NTP License
OpenSSL	OpenSSL Combined License

Apache License

Version 2.0, January 2004

<http://www.apache.org/licenses/>

TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

1. Definitions.

“License” shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

“Licensor” shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

“Legal Entity” shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, “control” means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50 %) or more of the outstanding shares, or (iii) beneficial ownership of such entity. “You” (or “Your”) shall mean an individual or Legal Entity exercising permissions granted by this License. “Source” form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

“Object” form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

“Work” shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is included in or attached to the work (an example is provided in the Appendix below).

“Derivative Works” shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

“Contribution” shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner. For the purposes of this definition, “submitted” means any form of electronic, verbal, or written communication sent to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as “Not a Contribution.”

“Contributor” shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

2. Grant of Copyright License.

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.

3. Grant of Patent License.

Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses granted to You under this License for that Work shall terminate as of the date such litigation is filed.

4. Redistribution.

You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:

- (a) You must give any other recipients of the Work or Derivative Works a copy of this License; and
- (b) You must cause any modified files to carry prominent notices stating that You changed the files; and

- (c) You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and
- (d) If the Work includes a “NOTICE” text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and provide additional or different license terms and conditions use, reproduction, or distribution of Your modifications, or any such Derivative Works as a whole, provided Your use, reproduction, and distribution of the Work otherwise complies with the conditions stated in this License.

5. Submission of Contributions.

Unless You explicitly state otherwise, Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.

6. Trademarks.

This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

7. Disclaimer of Warranty.

Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an “AS IS” BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.

8. Limitation of Liability.

In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

9. Accepting Warranty or Additional Liability.

While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify, defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS

APPENDIX: How to apply the Apache License to your work.

To apply the Apache License to your work, attach the following boilerplate notice, with the fields enclosed by brackets “[]” replaced with your own identifying information. (Don't include the brackets!) The text should be enclosed in the appropriate comment syntax for the file format. We also recommend that a file or class name and description of purpose be included on the same “printed page” as the copyright notice for easier identification within third-party archives.

Copyright [yyyy] [name of copyright owner]

Licensed under the Apache License, Version 2.0 (the “License”); you may not use this file except in compliance with the License. You may obtain a copy of the License at

<http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an “AS IS” BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

BSD 2.0 License

Copyright(c) <YEAR>, <OWNER>

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of the <ORGANIZATION> nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Curl License

Copyright(c) 1996-2003, Daniel Stenberg, <daniel@haxx.se>.

All rights reserved.

Permission to use, copy, modify, and distribute this software for any purpose with or without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the name of a copyright holder shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization of the copyright holder.

DHCP License

Copyright(c) 2004 by Internet Systems Consortium, Inc. (“ISC”)

Copyright(c) 1996-2003 by Internet Software Consortium

Permission to use, copy, modify, and distribute this software for any purpose with or without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED “AS IS” AND ISC DISCLAIMS ALL WARRANTIES WITH REGARD TO THIS SOFTWARE INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. IN NO EVENT SHALL ISC BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

Internet Systems Consortium, Inc.

950 Charter Street

Redwood City, CA 94063

<info@isc.org>

<http://www.isc.org/>

GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

Copyright(c) 1989, 1991 Free Software Foundation, Inc.

51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it. For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps:

(1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software. Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software.

If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents.

We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The “Program”, below, refers to any such program or work, and a “work based on the Program” means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term “modification”.) Each licensee is addressed as “you”.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

- 1) You may copy and distribute verbatim copies of the Program’s source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program. You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
- 2) You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
 - a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.
 - b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.
 - c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole.

If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of

this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:
 - a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
 - b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
 - c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

- 4) You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

- 5) You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.
- 6) Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.
- 7) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License.

If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

- 8) If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

- 9) The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and “any later version”, you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation.
- If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.
- 10) If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 11) BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
- 12) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

<one line to give the program's name and a brief idea of what it does.>

Copyright(c) <year> <name of author>

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or(at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

Gnomovision version 69, Copyright(c) year name of author Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type 'show w'.

This is free software, and you are welcome to redistribute it under certain conditions; type 'show c' for details.

ISIC License (BSD -)

ISIC is Copyright(c) 1999 Mike Frantzen, Chicago, IL, USA.

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS ``AS IS'' AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

GNU LESSER GENERAL PUBLIC LICENSE

Version 2.1, February 1999

Copyright(c) 1991, 1999 Free Software Foundation, Inc.

51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code.

If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library.

Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License.

This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs. When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the “Lesser” General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a “work based on the library” and a “work that uses the library”. The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called “this License”). Each licensee is addressed as “you”.

A “library” means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The “Library”, below, refers to any such software library or work which has been distributed under these terms. A “work based on the Library” means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term “modification”.)

“Source code” for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

- 1) You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.
You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
- 2) You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
 - a) The modified work must itself be a software library.
 - b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
 - c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
 - d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful. (For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.) These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works.

But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it. Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library. In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices. Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

- 4) You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

- 5) A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a “work that uses the Library”. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a “work that uses the Library” with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a “work that uses the library”.

The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a “work that uses the Library” uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

- 6) As an exception to the Sections above, you may also combine or link a “work that uses the Library” with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer’s own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable “work that uses the Library”, as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)
- b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user’s computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.
- c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy. For an executable, the required form of the “work that uses the Library” must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

- 7) You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:
 - a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
 - b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.
- 8) You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.
- 9) You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.
- 10) Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties with this License.
- 11) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library. If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice. This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

- 12) If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.
- 13) The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and “any later version”, you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.
- 14) If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 15) BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

one line to give the library's name and an idea of what it does.

Copyright(c) year name of author

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU Lesser General Public License for more details.

You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a “copyright disclaimer” for the library, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library 'Frob' (a library for tweaking knobs) written by James Random Hacker.

Signature of Ty Coon, 1 April 1990 Ty Coon, President of Vice

That's all there is to it!

libsmi license

Copyright(c) 1999-2002 Frank Strauss, Technical University of Braunschweig.

This software is copyrighted by Frank Strauss, the Technical University of Braunschweig, and other parties. The following terms apply to all files associated with the software unless explicitly disclaimed in individual files.

The authors hereby grant permission to use, copy, modify, distribute, and license this software and its documentation for any purpose, provided that existing copyright notices are retained in all copies and that this notice is included verbatim in any distributions. No written agreement, license, or royalty fee is required for any of the authorized uses. Modifications to this software may be copyrighted by their authors and need not follow the licensing terms described here, provided that the new terms are clearly indicated on the first page of each file where they apply.

IN NO EVENT SHALL THE AUTHORS OR DISTRIBUTORS BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS SOFTWARE, ITS DOCUMENTATION, OR ANY DERIVATIVES THEREOF, EVEN IF THE AUTHORS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE AUTHORS AND DISTRIBUTORS SPECIFICALLY DISCLAIM ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT. THIS SOFTWARE IS PROVIDED ON AN "AS IS" BASIS, AND THE AUTHORS AND DISTRIBUTORS HAVE NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

libxml2 License

Except where otherwise noted in the source code (e.g. the files hash.c, list.c and the trio files, which are covered by a similar licence but with different Copyright notices) all the files are:

Copyright(c) 1998-2003 Daniel Veillard. All Rights Reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE DANIEL VEILLARD BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the name of Daniel Veillard shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization from him.

MIT v2 with Ad Clause License

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the names of the authors or their institutions shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization from the authors.

NTP License

Copyright(c) David L. Mills 1992-2001

Permission to use, copy, modify, and distribute this software and its documentation for any purpose with or without fee is hereby granted, provided that the above copyright notice appears in all copies and that both the copyright notice and this permission notice appear in supporting documentation, and that the name (TrademarkedName) not be used in advertising or publicity pertaining to distribution of the software without specific, written prior permission. (TrademarkedName) makes no representations about the suitability this software for any purpose. It is provided “as is” without express or implied warranty.

LICENSE ISSUES

The OpenSSL toolkit stays under a dual license, i.e. both the conditions of the OpenSSL License and the original SSLeay license apply to the toolkit. See below for the actual license texts. Actually both licenses are BSD-style Open Source licenses. In case of any license issues related to OpenSSL please contact openssl-core@openssl.org.

OpenSSL License

Copyright(c) 1998-2004 The OpenSSL Project. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3) All advertising materials mentioning features or use of this software must display the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)”
- 4) The names “OpenSSL Toolkit” and “OpenSSL Project” must not be used to endorse or promote products derived from this software without prior written permission. For written permission, please contact openssl-core@openssl.org.
- 5) Products derived from this software may not be called “OpenSSL” nor may “OpenSSL” appear in their names without prior written permission of the OpenSSL Project.
- 6) Redistributions of any form whatsoever must retain the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>)”

THIS SOFTWARE IS PROVIDED BY THE OpenSSL PROJECT “AS IS” AND ANY EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE OpenSSL PROJECT OR ITS CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).
This product includes software written by Tim Hudson (tjh@cryptsoft.com).

Original SSLeay License

Copyright(c) 1995-1998 Eric Young (eay@cryptsoft.com)
All rights reserved.

This package is an SSL implementation written by Eric Young (eay@cryptsoft.com).
The implementation was written so as to conform with Netscapes SSL.

This library is free for commercial and non-commercial use as long as the following conditions are adhered to. The following conditions apply to all code found in this distribution, be it the RC4, RSA, lhash, DES, etc., code; not just the SSL code. The SSL documentation included with this distribution is covered by the same copyright terms except that the holder is Tim Hudson (tjh@cryptsoft.com). Copyright remains Eric Young's, and as such any Copyright notices in the code are not to be removed. If this package is used in a product, Eric Young should be given attribution as the author of the parts of the library used.

This can be in the form of a textual message at program startup or in documentation (online or textual) provided with the package.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3) All advertising materials mentioning features or use of this software must display the following acknowledgement:

“This product includes cryptographic software written by Eric Young (eay@cryptsoft.com)”

The word ‘cryptographic’ can be left out if the routines from the library being used are not cryptographic related:-).

- 4) If you include any Windows specific code (or a derivative thereof) from the apps directory (application code) you must include an acknowledgement: “This product includes software written by Tim Hudson (tjh@cryptsoft.com)”

THIS SOFTWARE IS PROVIDED BY ERIC YOUNG “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The license and distribution terms for any publically available version or derivative of this code cannot be changed. i.e. this code cannot simply be copied and put under another distribution license **[including the GNU Public Licence.]**

ANNEX C. Open Source Announcement (WEA300/WEA400 Series)

Some software components of this product incorporate source code covered under the GNU General Public License (GPL), the GNU Lesser General Public License (LGPL) and BSD License etc.

Acknowledgement:

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)

The software included in this product contains copyrighted software that is licensed under the GPL/LGPL. You may obtain the complete Corresponding Source code from us for a period of three years after our last shipment of this product by sending email to: oss.request@samsung.com

If you want to obtain the complete Corresponding Source code in the physical medium such as CD-ROM, the cost of physically performing source distribution may be charged. You may also find a copy of the source at <http://www.samsungnetwork.com/Home/Opensource>

This offer is valid to anyone in receipt of this information.

Below is the list of components covered under GNU General Public License, the GNU Lesser General Public License and BSD License etc.

Component	License
Dhrystone	ACM Software Copyright and License
The libpcap project	BSD 3-clause "New" or "Revised" License
Net SNMP-net-snmp	BSD 3-clause "New" or "Revised" License
wpa_supplicant	BSD 3-clause "New" or "Revised" License
The tcpdump project	BSD 3-clause "New" or "Revised" License

Component	License
hostapd	BSD 3-clause "New" or "Revised" License
OpenSSH	BSD 3-clause "New" or "Revised" License
DHCPv6	BSD 3-clause "New" or "Revised" License
IPsec Tools	BSD 3-clause "New" or "Revised" License
IP Utils	BSD 3-clause "New" or "Revised" License
ppp-Pauls PPP Package	BSD 3-clause "New" or "Revised" License
Linux IPv6 Router Advertisement Daemon-radvd	BSD 3-clause "New" or "Revised" License
ISC DHCP	DHCP License
Cygwin-flex	Flex License (BSD 2.0 -)
memtester	GNU General Public License v2.0
module-init-tools	GNU General Public License v2.0
BusyBox	GNU General Public License v2.0
Bridge-Utils	GNU General Public License v2.0
BusyBox	GNU General Public License v2.0
GNU Core Utils	GNU General Public License v2.0
GAwk	GNU General Public License v2.0
gdb	GNU General Public License v2.0
GNU grep	GNU General Public License v2.0
mtt-utils	GNU General Public License v2.0
linux net-tools	GNU General Public License v2.0
NMAP	GNU General Public License v2.0
ntptclient	GNU General Public License v2.0
OProfile	GNU General Public License v2.0
procps	GNU General Public License v2.0
sed	GNU General Public License v2.0
socat	GNU General Public License v2.0
Sys K Logd	GNU General Public License v2.0
Sys Stat	GNU General Public License v2.0
Sys V Init	GNU General Public License v2.0
GNU Term Cap	GNU General Public License v2.0
Util-linux	GNU General Public License v2.0
Free Radius	GNU General Public License v2.0
wireless-tools	GNU General Public License v2.0
wput	GNU General Public License v2.0
Das U-Boot-Universal Bootloader	GNU General Public License v2.0
squashfs-a compressed fs for Linux	GNU General Public License v2.0

Component	License
Linux Kernel	GNU General Public License v2.0
binutils	GNU General Public License v2.0
gkernel-ethtool	GNU General Public License v2.0
LZ4 Compression CLI program	GNU General Public License v2.0
LZO real-time data compression library	GNU General Public License v2.0
strongSwan-IPsec for Linux	GNU General Public License v2.0
GNU wget	GNU General Public License v2.0
Das U-boot Universal Bootloader	GNU General Public License v2.0
Bash	GNU General Public License v3.0
inetutils	GNU General Public License v3.0
libnl-Netlink Library	GNU Lesser General Public License v2.1
7 Zip-LZMA SDK	GNU Lesser General Public License v2.1
GMP-GNU Multiple Precision Arithmetic Library	GNU Lesser General Public License v2.1
Iperf	Iperf License
NTP-The Network Time Protocol	NTP License
OpenSSL	OpenSSL Combined License
7 Zip-LZMA SDK	Public Domain
Vim	VIM Licnese
Popt	XConsortium License
zlib	zlib Licnese

ACM Software License Agreement

All software, both binary and source published by the Association for Computing Machinery (hereafter, Software) is copyrighted by the Association (hereafter, ACM) and ownership of all right, title and interest in and to the Software remains with ACM. By using or copying the Software, User agrees to abide by the terms of this Agreement.

Noncommercial Use

The ACM grants to you (hereafter, User) a royalty-free, nonexclusive right to execute, copy, modify and distribute both the binary and source code solely for academic, research and other similar noncommercial uses, subject to the following conditions:

- 1) User acknowledges that the Software is still in the development stage and that it is being supplied “as is,” without any support services from ACM. Neither ACM nor the author makes any representations or warranties, express or implied, including, without limitation, any representations or warranties of the merchantability or fitness for any particular purpose, or that the application of the software, will not infringe on any patents or other proprietary rights of others.

- 2) ACM shall not be held liable for direct, indirect, incidental or consequential damages arising from any claim by User or any third party with respect to uses allowed under this Agreement, or from any use of the Software.
- 3) User agrees to fully indemnify and hold harmless ACM and/or the author(s) of the original work from and against any and all claims, demands, suits, losses, damages, costs and expenses arising out of the User's use of the Software, including, without limitation, arising out of the User's modification of the Software.
- 4) User may modify the Software and distribute that modified work to third parties provided that:
 - a) if posted separately, it clearly acknowledges that it contains material copyrighted by ACM
 - b) no charge is associated with such copies,
 - c) User agrees to notify ACM and the Author(s) of the distribution, and
 - d) User clearly notifies secondary users that such modified work is not the original Software.
- 5) User agrees that ACM, the authors of the original work and others may enjoy a royalty-free, non-exclusive license to use, copy, modify and redistribute these modifications to the Software made by the User and distributed to third parties as a derivative work under this agreement.
- 6) This agreement will terminate immediately upon User's breach of, or non-compliance with, any of its terms. User may be held liable for any copyright infringement or the infringement of any other proprietary rights in the Software that is caused or facilitated by the User's failure to abide by the terms of this agreement.
- 7) This agreement will be construed and enforced in accordance with the law of the state of New York applicable to contracts performed entirely within the State. The parties irrevocably consent to the exclusive jurisdiction of the state or federal courts located in the City of New York for all disputes concerning this agreement.

Commercial Use

Any User wishing to make a commercial use of the Software must contact ACM at permissions@acm.org to arrange an appropriate license. Commercial use includes

- 1) integrating or incorporating all or part of the source code into a product for sale or license by, or on behalf of, User to third parties, or
- 2) distribution of the binary or source code to third parties for use with a commercial product sold or licensed by, or on behalf of, User.

Revised 6/98

BSD 3-clause “New” or “Revised” License

Copyright(c) <YEAR>, <OWNER>

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of the <ORGANIZATION> nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

DHCP License

Copyright(c) 2004 by Internet Systems Consortium, Inc. (“ISC”) Copyright(c) 1996-2003 by Internet Software Consortium

Permission to use, copy, modify, and distribute this software for any purpose with or without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED “AS IS” AND ISC DISCLAIMS ALL WARRANTIES WITH REGARD TO THIS SOFTWARE INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. IN NO EVENT SHALL ISC BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

Internet Systems Consortium, Inc.
950 Charter Street
Redwood City, CA 94063
<info@isc.org>
<http://www.isc.org/>

Flex License

Copyright(c) 1990 The Regents of the University of California.

All rights reserved.

This code is derived from software contributed to Berkeley by Vern Paxson.

The United States Government has rights in this work pursuant to contract no. DE-AC03-76SF00098 between the United States Department of Energy and the University of California.

Redistribution and use in source and binary forms with or without modification are permitted provided that:

- 1) source distributions retain this entire copyright notice and comment, and
- 2) distributions including binaries display the following acknowledgement: “This product includes software developed by the University of California, Berkeley and its contributors” in the documentation or other materials provided with the distribution and in all advertising materials mentioning features or use of this software.

Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

GNU GENERAL PUBLIC LICENSE

Version 2, June 1991

Copyright(c) 1989, 1991 Free Software Foundation, Inc.
51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Library General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it. For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps:

(1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software. Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software.

If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents.

We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The “Program”, below, refers to any such program or work, and a “work based on the Program” means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term “modification”.) Each licensee is addressed as “you”.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

- 1) You may copy and distribute verbatim copies of the Program’s source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program. You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.
- 2) You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
- a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.
 - b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.
 - c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)
- These requirements apply to the modified work as a whole.

If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:
 - a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
 - b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,
 - c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

- 4) You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.
- 5) You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.
- 6) Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.
- 7) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License.

If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

- 8) If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

- 9) The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and “any later version”, you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation.
- If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.
- 10) If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 11) BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
- 12) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to the public, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

<one line to give the program's name and a brief idea of what it does.>

Copyright(c) <year> <name of author>

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

Gnomovision version 69, Copyright(c) year name of author Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type 'show w'.

This is free software, and you are welcome to redistribute it under certain conditions; type 'show c' for details.

GNU LESSER GENERAL PUBLIC LICENSE

Version 2.1, February 1999

Copyright(c) 1991, 1999 Free Software Foundation, Inc.

51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code.

If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library.

Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program.

We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License.

This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs. When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the “Lesser” General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances. For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a “work based on the library” and a “work that uses the library”. The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

- 0) This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called “this License”). Each licensee is addressed as “you”.
A “library” means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The “Library”, below, refers to any such software library or work which has been distributed under these terms. A “work based on the Library” means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term “modification”.)

“Source code” for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

- 1) You may copy and distribute verbatim copies of the Library’s complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

- 2) You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:
 - a) The modified work must itself be a software library.
 - b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
 - c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
 - d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful. (For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.) These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works.

But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it. Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library. In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

- 3) You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices. Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

- 4) You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

- 5) A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a “work that uses the Library”. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a “work that uses the Library” with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a “work that uses the library”.

The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a “work that uses the Library” uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

- 6) As an exception to the Sections above, you may also combine or link a “work that uses the Library” with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer’s own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable “work that uses the Library”, as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)
- b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user’s computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.
- c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

- e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy. For an executable, the required form of the “work that uses the Library” must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

- 7) You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:
 - a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
 - b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.
- 8) You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.
- 9) You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.
- 10) Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties with this License.

- 11) If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library. If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice. This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

- 12) If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.
- 13) The Free Software Foundation may publish revised and/or new versions of the Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and “any later version”, you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.
- 14) If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

NO WARRANTY

- 15) BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.
- 16) IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the “copyright” line and a pointer to where the full notice is found.

one line to give the library’s name and an idea of what it does.

Copyright(c) year name of author

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 2.1 of the License, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

See the GNU Lesser General Public License for more details.

You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA.

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a “copyright disclaimer” for the library, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the library ‘Frob’ (a library for tweaking knobs) written by James Random Hacker.

Signature of Ty Coon, 1 April 1990 Ty Coon, President of Vice

That’s all there is to it!

Iperf License

Copyright(c) 1999-2007, The Board of Trustees of the University of Illinois

All Rights Reserved.

Iperf performance test

Mark Gates

Ajay Tirumala

Jim Ferguson

Jon Dugan

Feng Qin

Kevin Gibbs

John Estabrook

National Laboratory for Applied Network Research

National Center for Supercomputing Applications

University of Illinois at Urbana-Champaign

<http://www.ncsa.uiuc.edu>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software (Iperf) and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimers.

Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimers in the documentation and/or other materials provided with the distribution.

Neither the names of the University of Illinois, NCSA, nor the names of its contributors may be used to endorse or promote products derived from this Software without specific prior written permission. THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE CONTRIBUTORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

NTP License

Copyright(c) David L. Mills 1992-2001

Permission to use, copy, modify, and distribute this software and its documentation for any purpose with or without fee is hereby granted, provided that the above copyright notice appears in all copies and that both the copyright notice and this permission notice appear in supporting documentation, and that the name University of Delaware not be used in advertising or publicity pertaining to distribution of the software without specific, written prior permission. University of Delaware makes no representations about the suitability this software for any purpose. It is provided “as is” without express or implied warranty.

LICENSE ISSUES

The OpenSSL toolkit stays under a dual license, i.e. both the conditions of the OpenSSL License and the original SSLeay license apply to the toolkit. See below for the actual license texts. Actually both licenses are BSD-style Open Source licenses. In case of any license issues related to OpenSSL please contact openssl-core@openssl.org.

OpenSSL License

Copyright(c) 1998-2004 The OpenSSL Project. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

- 3) All advertising materials mentioning features or use of this software must display the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)”
- 4) The names “OpenSSL Toolkit” and “OpenSSL Project” must not be used to endorse or promote products derived from this software without prior written permission. For written permission, please contact openssl-core@openssl.org.
- 5) Products derived from this software may not be called “OpenSSL” nor may “OpenSSL” appear in their names without prior written permission of the OpenSSL Project.
- 6) Redistributions of any form whatsoever must retain the following acknowledgment:
“This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>)”

THIS SOFTWARE IS PROVIDED BY THE OpenSSL PROJECT “AS IS” AND ANY EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE OpenSSL PROJECT OR ITS CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

This product includes cryptographic software written by Eric Young (ey@cryptsoft.com).
This product includes software written by Tim Hudson (tjh@cryptsoft.com).

Original SSLeay License

Copyright(c) 1995-1998 Eric Young (ey@cryptsoft.com)
All rights reserved.

This package is an SSL implementation written by Eric Young (ey@cryptsoft.com).
The implementation was written so as to conform with Netscape's SSL.

This library is free for commercial and non-commercial use as long as the following conditions are adhered to. The following conditions apply to all code found in this distribution, be it the RC4, RSA, lhash, DES, etc., code; not just the SSL code. The SSL documentation included with this distribution is covered by the same copyright terms except that the holder is Tim Hudson (tjh@cryptsoft.com). Copyright remains Eric Young's, and as such any Copyright notices in the code are not to be removed. If this package is used in a product, Eric Young should be given attribution as the author of the parts of the library used.

This can be in the form of a textual message at program startup or in documentation (online or textual) provided with the package.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- 1) Redistributions of source code must retain the copyright notice, this list of conditions and the following disclaimer.
- 2) Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- 3) All advertising materials mentioning features or use of this software must display the following acknowledgement:
 “This product includes cryptographic software written by Eric Young(eay@cryptsoft.com)”
 The word ‘cryptographic’ can be left out if the routines from the library being used are not cryptographic related:-).
- 4) If you include any Windows specific code (or a derivative thereof) from the apps directory (application code) you must include an acknowledgement: “This product includes software written by Tim Hudson (tjh@cryptsoft.com)”

THIS SOFTWARE IS PROVIDED BY ERIC YOUNG “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

The license and distribution terms for any publically available version or derivative of this code cannot be changed. i.e. this code cannot simply be copied and put under another distribution license [**including the GNU Public Licence.**]

VIM LICENSE

- I) There are no restrictions on distributing unmodified copies of Vim except that they must include this license text. You can also distribute unmodified parts of Vim, likewise unrestricted except that they must include this license text. You are also allowed to include executables that you made from the unmodified Vim sources, plus your own usage examples and Vim scripts.

- II) It is allowed to distribute a modified (or extended) version of Vim, including executables and/or source code, when the following four conditions are met:
1. This license text must be included unmodified.
 2. The modified Vim must be distributed in one of the following five ways:
 - i) If you make changes to Vim yourself, you must clearly describe in the distribution how to contact you. When the maintainer asks you (in any way) for a copy of the modified Vim you distributed, you must make your changes, including source code, available to the maintainer without fee. The maintainer reserves the right to include your changes in the official version of Vim. What the maintainer will do with your changes and under what license they will be distributed is negotiable. If there has been no negotiation then this license, or a later version, also applies to your changes. The current maintainer is Bram Moolenaar {Bram@vim.org}. If this changes it will be announced in appropriate places (most likely vim.sf.net, www.vim.org and/or comp.editors). When it is completely impossible to contact the maintainer, the obligation to send him your changes ceases. Once the maintainer has confirmed that he has received your changes they will not have to be sent again.
 - ii) If you have received a modified Vim that was distributed as mentioned under a) you are allowed to further distribute it unmodified, as mentioned at I). If you make additional changes the text under a) applies to those changes.
 - iii) Provide all the changes, including source code, with every copy of the modified Vim you distribute. This may be done in the form of a context diff. You can choose what license to use for new code you add. The changes and their license must not restrict others from making their own changes to the official version of Vim.
 - iv) When you have a modified Vim which includes changes as mentioned under c), you can distribute it without the source code for the changes if the following three conditions are met:
 - v) The license that applies to the changes permits you to distribute the changes to the Vim maintainer without fee or restriction, and permits the Vim maintainer to include the changes in the official version of Vim without fee or restriction.
 - You keep the changes for at least three years after last distributing the corresponding modified Vim. When the maintainer or someone who you distributed the modified Vim to asks you (in any way) for the changes within this period, you must make them available to him.
 - You clearly describe in the distribution how to contact you. This contact information must remain valid for at least three years after last distributing the corresponding modified Vim, or as long as possible.
 - vi) When the GNU General Public License (GPL) applies to the changes, you can distribute the modified Vim under the GNU GPL version 2 or any later version.
 3. A message must be added, at least in the output of the “:version” command and in the intro screen, such that the user of the modified Vim is able to see that it was modified. When distributing as mentioned under 2)e) adding the message is only required for as far as this does not conflict with the license used for the changes.

4. The contact information as required under 2)a) and 2)d) must not be removed or changed, except that the person himself can make corrections.
- III) If you distribute a modified version of Vim, you are encouraged to use the Vim license for your changes and make them available to the maintainer, including the source code. The preferred way to do this is by e-mail or by uploading the files to a server and e-mailing the URL. If the number of changes is small (e.g., a modified Makefile) e-mailing a context diff will do. The e-mail address to be used is {maintainer@vim.org}
- IV) It is not allowed to remove this license from the distribution of the Vim sources, parts of it or from a modified version. You may use this license for previous Vim releases instead of the license that they came with, at your option.

X Consortium License

Copyright(c) 1998 Red Hat Software

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE X CONSORTIUM BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the name of the X Consortium shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization from the X Consortium.

The zlib/libpng License

Copyright(c) <year> <copyright holders>

This software is provided ‘as-is’, without any express or implied warranty. In no event will the authors be held liable for any damages arising from the use of this software.

Permission is granted to anyone to use this software for any purpose, including commercial applications, and to alter it and redistribute it freely, subject to the following restrictions:

- 1) The origin of this software must not be misrepresented; you must not claim that you wrote the original software. If you use this software in a product, an acknowledgment in the product documentation would be appreciated but is not required.
- 2) Altered source versions must be plainly marked as such, and must not be misrepresented as being the original software.
- 3) This notice may not be removed or altered from any source distribution.

ABBREVIATION

A

ACL	Access Control List
AES	Advanced Encryption Standard
ALG	Application Layer Gateway
AP	Access Point
APC	Access Point Controller

B

BPDU	Bridge Protocol Data Unit
------	---------------------------

C

CAC	Call Admission Control
CAPWAP	Control And Provisioning Wireless Access Point
CCM	Counter mode encryption with CBC-MAC
CCMP	Counter mode encryption with CBC-MAC Protocol
CCTV	Closed Circuit Television
CDR	Crash Detect and Report
CHDC	Coverage Hole Detection and Control
CLI	Command Line Interface
CSMA/CD	Carrier Sense Multiple Access/Collision Detect
CVO	Controlled Voice Optimization

D

DCS	Dynamic Channel Selection
DECT	Digital Enhanced Cordless Telecommunications
DFS	Dynamic Frequency Selection
DHCP	Dynamic Host Configuration Protocol
DNAT	Destination NAT
DNS	Domain Naming Service
DPC	Dynamic Power control
DSCP	Differentiated Services Code Point
DTIM	Delivery Traffic Indication Message
DTLS	Datagram Transmission Layer Security

E

EAP	Extensible Authentication Protocol
EAPOL	EAP over LANs
EDCA	Enhanced Distributed Channel Access

F

FFT	Fast Fourier Transform
FIFO	First-In-First-Out
FMC	Fixed Mobile Convergence
FTP	File Transfer Protocol

G

GARP	Gratuitous Address Resolution Protocol
GbE	Giga Bit Ethernet
GI	Guard Interval

H

HO	Handover
----	----------

I

IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPWATCHD	IP WATCH Daemon
IV	Initial Vector

L

LACP	Link Aggregation Control Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LSA	Link State Advertisement

M

MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MIB	Management Information Base
MIMO	Multiple Input Multiple Output
MSTP	Multiple Spanning-Tree Protocol
MTU	Maximum Transmission Unit

N

NAT	Network Address Translation
NMS	Network Management System
NSSA	Not So Stubby Areas
NTP	Network Time Protocol

O

OKC	Opportunistic Key Caching
OSPF	Open Shortest Path First
OUI	Organizationally Unique Identifier

P

PHY	Physical layer
PIM-SM	Protocol Independent Multicast-Sparse Mode
PoE	Power over Ethernet
PMK	Pairwise Master Key
PSK	Pre-Shared Key

Q

QoS	Quality of Service
-----	--------------------

R

RADIUS	Remote Authentication Dial-In User Service
RF	Radio Frequency
RPM	Revolution Per Minute
RRM	Radio Resource Management
RSSI	Received Signal Strength Indication
RSTP	Rapid Spanning-Tree Protocol
RTP	Real-time Transport Protocol

S

SDS	Samsung Downlink Scheduler
SIP	Session Initiation Protocol
SNAT	Source NAT
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SSH	Secure Shell
SSID	Service Set Identifier
STP	Signaling Transfer Point

T

TBTT	Target Beacon Transmission Times
TKIP	Temporal Key Integrity Protocol

U

USB	Universal Serial Bus
UTC	Coordinated Universal Time
UTP	Unshielded Twisted Pair

V

VAP	Virtual Access Point
VATS	Voice-Aware Traffic Scheduling
VLAN	Virtual Local Area Network
VoIP	Voice over IP
VPN	Virtual Private Network
VQM	Voice Quality Monitoring
VRRP	Virtual Router Redundancy Protocol

W

WAN	Wide Area Network
WDS	Wireless Distribution Service
WEM	Wireless Enterprise WLAN Manager
WEP	Wired Equivalent Privacy
Wi-Fi	Wireless Fidelity
WIDS	Wireless Intrusion Detection System
WIPS	Wireless Intrusion Prevention System
WLAN	Wireless Local Area Network
WMM	WiFi Multimedia
WPA	Wi-Fi Protected Access
WPA2	Wi-Fi Protected Access Version 2

**Samsung Wireless Enterprise
Access Point Controllers (APC)
WEC8500 & WEC8050
Operation Manual**

©2013~2015 Samsung Electronics America.

All rights reserved.

Information in this manual is proprietary to SAMSUNG Electronics America.

No information contained here may be copied, translated, transcribed or duplicated by any form without the prior written consent of SAMSUNG.

Information in this manual is subject to change without notice.

