WLAN (WEC 8500 and WEC 8050)

System Description

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CHAPTER 1. INTRODUCTION

Purpose

This manual gives an overview of the Samsung Wireless Enterprise Control Systems, the WEC8500 and WEC8050. You will find the specifications and functions of the hardware in this document.

Document Content and Organization

CHAPTER 1. INTRODUCTION

This chapter talks about document content and organization and conventions.

CHAPTER 2. Introduction to Samsung's Wireless Enterprise

This chapter introduces and provides an overview how Samsung's WLAN Controller integrates with your network and its components.

CHAPTER 3. WLAN Controller Specifications

This chapter explains the system capacities and specifications of the WEC8500 and WEC8050.

CHAPTER 4. Features and Functions

This chapter introduces the main features and functions of the WEC8500/WEC8050.

CHAPTER 5. WLAN Hardware

This chapter introduces WEC8500/WEC8050 hardware characteristics:

CHAPTER 6. Samsung Access Points (WE WLAN AP)

This chapter explains available access points and their Specs (WE WLAN AP's)

CHAPTER 7. System Service Scenario

This chapter explains the system building scenario and the using scenario of Samsung WE WLAN and introduces each feature.

CHAPTER 8. Wireless Enterprise Manager (WEM)

This chapter explains the functions and uses of the Wireless Enterprise Manager.

CHAPTER 9. Wireless Enterprise Security (WES)

This chapter explains the functions and uses of the Wireless Enterprise Security product.

CHAPTER 10. Outdoor Access Point

This chapter describes the product specifications and interfaces of the WEA 453e Access Point.

ABBREVIATION

This provides the acronyms in this manual and their explanations.

Conventions

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

NOTE

Indicates additional information as a reference.

WEEE Symbol Information

This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g. charger, headset, and USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

Revision History

VERSION	DATE OF ISSUE	REMARKS
2.0	02.2015	Updated for US Market to support software v2.4.19R
1.0	10.2014	Combined 8050 and 8500 for US Market

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CHAPTER 2. Introduction to Samsung's Wireless Enterprise

This chapter introduces and provides an overview how Samsung's WLAN Controller integrates with your network and its components.

- Samsung Wireless Enterprise (herein after referred to as 'WE')

2.1 Samsung Wireless Enterprise Solution

Samsung Wireless Enterprise (WE) solution provides a variety of data and telecommunication services required by clients in the wireless environment.
It allows for collaboration of applications that have been used in the conventional wired environment to be used on a wireless terminal such as smart phone, tablet PC, or laptop.

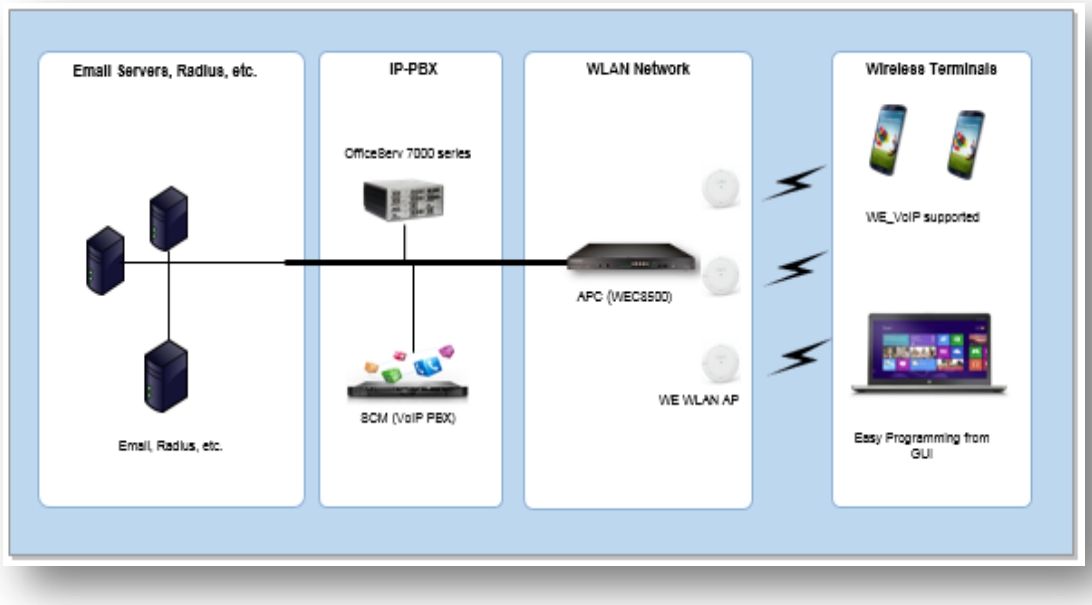

Figure 1. WE System Structure Diagram

The WE solution collectively means that a variety of enterprise applications provided by wireless and wired infrastructure products and wireless terminals as shown in Figure 1. Among them, the WLAN network as a wireless infrastructure solution provides the mobility in the enterprise environment using a WE WLAN Access Point (AP), and AP Controller (APC).

The WEC8500 and WEC8050 Controllers in use with WE WLAN AP are the core equipment items to provide various services including user authentication, wireless management, voice and data services in the 802.11-based Wi-Fi environment.

2.2 Deployment Outlook

Here is an example of what a Samsung Wireless Enterprise deployment could look like:

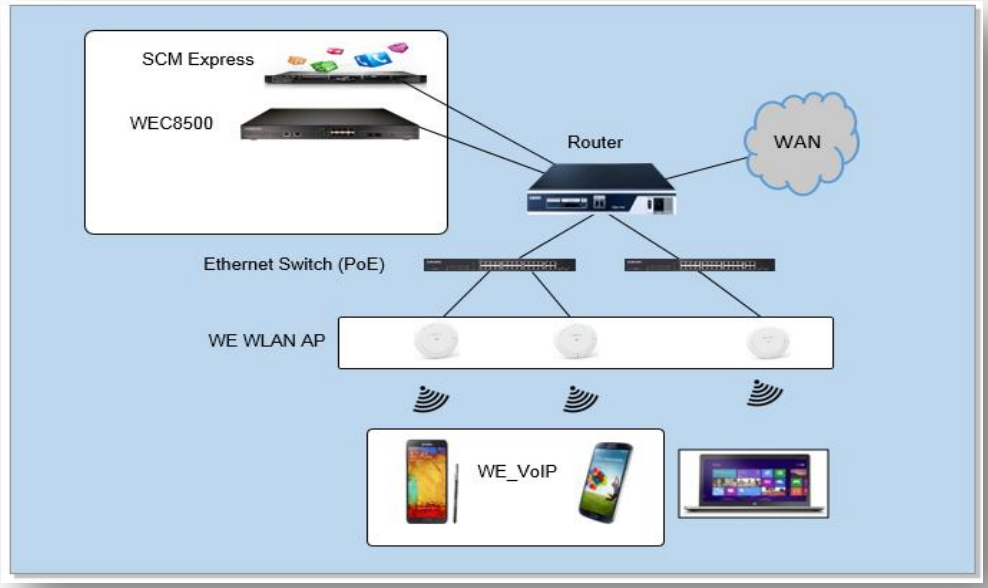

Figure 2. WE Network Configuration

SCM-Express

The SCM is an enterprise call manager, it is a VoIP-PBX required to provide WE_VoIP for the wireless terminal (as an option).

APC (WEC8500/WEC8050)

APC is a device to manage all WE WLAN APs installed in the enterprise and manage the user information and the traffic. Because the WE WLAN network configuration uses the centralized structure for tunneling the traffic of all wireless users between WE WLAN APs, the APC is one of the most important elements relating to the management and performance in the WE environment.
The APC is generally installed at the location connected with the in-network backbone switch or core switch or routers. It controls the WE WLAN AP and provides handover, QoS, security and authentication.

WE WLAN AP

WE WLAN AP is a device to provide a wireless access service for a user terminal.
It must be installed considering the service area or region desired to be provided in the enterprise environment. In general, the quantity depends on the size and number of users of the region to secure the service coverage.

Ethernet Switch (Ubigate iES 4028FP/4024GP)

In general, AP uses a Power over Ethernet (PoE) switch that does not require any separate power cable in consideration of the external view because it is installed in the user area. Considering the power capacity of the current consumption and the PoE switch before installation, the WE WLAN AP must be placed. In addition, if the distance between the switch and WE WLAN AP is too far because the lowering of electric power may occur, the relationship must be also considered. In general, the lowering of the electric power does not occur only if the distance between the two is 100 m or less.

Wireless Terminal/WE_VOIP Client

It means a terminal providing 802.11a/b/g/n interfaces including smart phone, table PC, and laptop. The WE_VoIP application for enterprise equipping Samsung Voice engine in Android smart phone is a WE_VOIP client.
(The WE_VOIP client is provided as an option.)

IP Application Service

The IP application servers including Dynamic Host Configuration Protocol (DHCP) server, DNS server, web server, RADIUS authentication server, etc. required in the existing wired network are used as they are even in the WE environment. In particular, the DHCP server and the RADIUS authentication server handle very important roles in the wireless environment.

WEM (Future Release)

In the WE WLAN environment, various services are provided through the complicated network configuration. With many users, management is complicated and difficult and it is difficult for a general network manager to respond for management work as well as problem occurrence at the normal state. The WEM is a network management system (NMS) to effectively manage the WE WLAN network and service environment.
It performs a function of managing the WLAN network and viewing and setting the status

WES

In the WE environment, a variety of application services other than the basic wireless access service are required.
In the enterprise environment, the Wireless Enterprise Security (WES) provides a security service as one of the most important elements in the enterprise environment.
The WES allows the wireless access service safely through the security service preventing from the illegal network components including illegal terminal, illegal AP, ad-hoc access blocking, etc.

Outdoor Access Point (WEA 453e)

The WEA453e is an outdoor Wireless Enterprise AP that supports 802.11a/b/g/n/ac specifications. It connects the UE that supports wireless LAN, such as a smartphone, tablet, or notebook, to a wired network in an outdoor environment.

CHAPTER 3. WLAN Controller Specifications

This chapter explains the system capacities and specifications of the WEC8500 and WEC8050.

3.1 System Capacities

Index		WEC8050	WEC8500
Scalability	Maximum # of APs	75	1000 (Centralized), 3000 (Distributed)
	# of Client	1500	20,000
H/W, Interface	Network I/F	4 X 10/100/1000 mbps, 1 Console	2 10GE(SFP+), 8 GE(SFP), 1 Console
	USB	No	1
	System Redundancy	Yes	Yes
	Redundant Power	No	Yes, Optional
	Form Factor	1 RU	1 RU
Network	Routing	Yes	Yes
	VLANs	128	1024
	VLANs per SSID	50	50
	DHCP	Server, Relay	Server, Relay
	QoS	Shaping, Policing, 802.1p, Voice Quality Monitoring	Shaping, Policing, 802.1p, Voice Quality Monitoring
Security	Firewall	Yes, License required	Yes, License required
	Authentication	802.1x	802.1x
	MAC Filtering, ACL	Yes	Yes
	Encryption	DTLS	DTLS
	AAA	Radius Server and Internal Radius Server	Radius Server and Internal Radius Server
RF Manager	RRM	Power, Channel, Coverage Hole	Power, Channel, Coverage Hole
	RF Spectrum Analysis	Yes	Yes
Handover	L2	Inter/Intra Controller	Inter/Intra Controller
	L3	Inter/Intra Controller	Inter/Intra Controller
Management	CLI	Yes	Yes
	GUI	Yes	Yes
	SNMP	Yes	Yes
	Syslog	Yes	Yes

Item	Specifications	
	8050	8500
Maximum processing capacity under system configuration	Use of 1000 BASE-T 4 Ports: 1.5 Gbps	- When using the 10 GBASE-SR/LR 2 port: 20 Gbps - When using the 1000 BASE-SX/LX 8 port: 8 Gbps
Maximum number of AP Groups	75	3000
Maximum number of APs per AP Group	75	1000
Maximum number of WLANs	255	255
Maximum number of stations (clients) per AP	127	127
Maximum number of SSID	240	240
Maximum Number of SSID (WLAN) per AP	16	16
Maximum Number of MAC Addresses	12K	12K
Maximum Number of IPv4 Unicast Routers	10K	10K
Maximum Number of System BSSIDs	2,400	16K
Firewall Throughput	1.5 Gbps	20 Gbps

3.2 Product Specification for WEC8500

Item	Specifications
Dimensions (mm)	435 (W) × 44 (H) × 500 (D)
Weight (kg)	- When 1 power module is installed: 8.48 - When 2 power modules are installed: 9.46
System memory	16 GB
SSD memory	16 GB
Booting ROM	16 MB
Power supply	AC 100~240 V, 50~60 Hz
Operating temperature	0~45°C (32~113°F)
Storage temperature	-25~70°C (-13~158°F)
Operating humidity	10~90 %, non-condensable
Altitude	0~4018 m (0~13123 ft)
Specification & safety compliance	- FCC Part 15 Class A - IEC/EN 60950-1 - UL60950 - EN55022/EN55024

3.2.1 Electrical Specification

The electrical specifications by item for the WEC8500 are as follows:

10 GBASE-SR/LR Optic Signal Specifications

Item	Specifications
Transmission Speed	10 Gbps
Transmission Encoding	64B/66B Data encoding
Standard Specifications	IEEE 802.3ae
Access Control	CSMA/CD
Transmission Device	- SR: MMF (Multimode Fiber) - LR: SMF (Single Mode Fiber)
No. of Optical Fibers	2 strings
Maximum Transmission Distance	- SR: 300 m - LR: 10 km

1000 BASE-X (BASE-SX/LX) Optic Signal Specifications

Item	Specifications
Transmission Speed	1 Gbps
Transmission Encoding	8B/10B Data Encoding
Standard Specifications	IEEE 802.3z
Access Control	CSMA/CD
Transmission Device	- SX: MMF - LX: MMF/SMF
No. of Optical Fibers	2 strings
Maximum Transmission Distance	- SX: Max 550 m - LX: Max 5 km

3.2.2 LAN Signal Specification

[10 BASE-T]

Item	Specifications
Transfer rate	10 Mbits/s ±50 ppm
Transmission code	Manchester coding
Standard specifications	IEEE802.3
Access control method	CSMA/CD (Carrier Sense Multiple Access/Collision Detect)
Transmission media	UTP (Unshielded Twisted Pair) CAT3, CAT4, CAT5, STP (Shielded Twisted Pair)
Number of UTP pairs	2 pairs
Characteristic resistance	100 Ω

[100 BASE-TX]

Item	Specifications
Transfer rate	100 Mbits/s ±50 ppm
Transmission code	4B/5B + MLT-3
Standard specifications	IEEE 802.3u
Access control method	CSMA/CD
Transmission media	UTP CAT5, STP
Number of UTP pairs	2 pairs
Characteristic resistance	100 Ω

[1000 BASE-TX]

Item	Specifications
Transfer rate	1000 Mbits/s
Transmission code	8B1Q4
Standard specifications	IEEE 802.3ab
Access control method	CSMA/CD
Transmission media	UTP CAT5 (maximum transmission distance: 100 m)
Number of UTP pairs	4 pairs
Characteristic resistance	100 Ω

USB Signal Specifications

Item	Specifications
Transmission Speed	480 Mbits/s
Transmission Encoding	NRZI
Standard Specifications	TDM
Transmission Device	Shielded Twisted Pair
No. of Cables	4 strings (including Power, GND)
Property Resistance	90 Ω
Cable Thickness	28 AWG

3.2.3 Power Specification

WEC8500 is operated with AC input power and supplies the power of +12 V to the system cabinet. The power supply device can be formed redundantly.

Power Supply		Specifications
Power supply module (APC180)	Input power	AC 100~240 V - Frequency: 50~60 Hz - Power consumption: 168 W
	Output power	DC +12 V, 14 A

3.3 Product Specification for WEC8050

Item	Specifications
Dimensions (mm)	290 (W) × 44 (H) × 280 (D)
Weight (kg)	2.4
System memory	4 GB
SSD memory	16 GB
Booting ROM	16 MB
Power supply	AC 100~240 V, 50~60 Hz
Operating temperature	0~45°C (32~113°F)
Storage temperature	-25~70°C (-13~158°F)
Operating humidity	10~90 %, non-condensable
Altitude	0~4018 m (0~13123 ft)
Specification & safety compliance	- FCC Part 15 Class A - IEC/EN 60950-1 - UL60950 - EN55022/EN55024

3.3.1 Electrical Specification

The electrical specifications by item for the WEC8050 are as follows:

LAN Signal Specification

[10 BASE-T]

Item	Specifications
Transfer rate	10 Mbits/s ±50 ppm
Transmission code	Manchester coding
Standard specifications	IEEE802.3
Access control method	CSMA/CD (Carrier Sense Multiple Access/Collision Detect)
Transmission media	UTP (Unshielded Twisted Pair) CAT3, CAT4, CAT5, STP (Shielded Twisted Pair)
Number of UTP pairs	2 pairs
Characteristic resistance	100 Ω

[100 BASE-TX]

Item	Specifications
Transfer rate	100 Mbits/s ±50 ppm
Transmission code	4B/5B + MLT-3
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[1000 BASE-TX]

Item	Specifications
Transfer rate	1000 Mbits/s
Transmission code	8B1Q4
Standard specifications	IEEE 802.3ab
Access control method	CSMA/CD
Transmission media	UTP CAT5 (maximum transmission distance: 100 m)
Number of UTP pairs	4 pairs
Characteristic resistance	100 Ω

3.3.2 Power Specification

WEC8050 is operated with AC input power and supplies the power of +12 V to the system cabinet.

Power Supply		Specifications
Power supply module (APC60)	Input power	AC 100~240 V - Frequency: 50~60 Hz - Power consumption: 60 W
	Output power	DC +12 V, 5 A

CHAPTER 4. Features and Functions

This chapter introduces the main features and functions of the WEC8500/WEC8050.

4.1 System Features List

Air Move	802.11a/b/n/ac
Self-Organizing Network	802.11h
Intelligent Beam Selectable Antenna	802.1x
Syslog	802.1p
Air Equalizer	IPWATCH
Voice Aware Traffic Scheduling	Protocol Independent Multicast
RF Monitoring	IP Multicast Routing
Remote Management Using Smartphones	QoS using ACL
11ac Access Points - WEA400 Series	OS-AWARE
11n Access Points – WEA300 Series	Multicast to Unicast
Firewall	IGMP Snooping
SNMP v1, v2 and v3	CAPWAP
Statistics Gathering	AP Registration (Auto Discovery)
Rogue Detection	RBAC
Internal DHCP Server	User QoS
Internal 802.1x	Mobility Management (WE_VoIP)
Spanning Tree	Captive Portal
Layer 2/3 Protocols	Station Tracking
SIP ALG	VoIP Monitoring
Repeater Service	Dynamic TX Power Control
Broadcast/Multicast Filtering	Dynamic Channel Selection
Radio Resource Management	Coverage Hole Detection Control
Voice Call Admission Control	Multicast Stream Admission Control
Video Call Admission Control	Station Admission Control
Web Passthrough	Web Authentication
Band Steering	Spectrum Analysis
Deep Packet Inspection	Split Tunneling
Energy Saving	Automatic Scheduled Database Backup

4.2 Functions of a Wireless Enterprise Controller

The WEC8500/WEC8050 is a WLAN APC provided by Samsung WE Solution.
It is a system that controls and manages WE WLAN APs and does not operate with non-Samsung WE WLAN APs.
It will provide L2/L3 seamless roaming and performs QoS. As a security function, it also provides authentication (802.1x) and WPA/WPA2 functions.

4.2.1 WLAN Functions

4.2.1.1 Connection and Management of Wireless Terminal

Connection Function

Each wireless terminal may connect to WE WLAN APs through 802.11a/b/g/n protocols. For this, procedures such as connection and authentication are necessary, various access request messages delivered to WE WLAN AP by the wireless terminal are delivered to WEC8500/WEC8050, instead of direct handling of WE WLAN AP. WEC8500/WEC8050 performs load balancing or access control depending on the system status, and allows or rejects the connection of the wireless terminal or leads the connection to another WEC8500/WEC8050 system.
In addition, WEC8500/WEC8050 provides an encryption function for security and data traffic by using a variety of Extensible Authentication Protocol (EAP) types such as open security because it provides a variety of authentication algorithms by wireless terminal.
For the various connection functions of the wireless terminal, WEC8500/WEC8050 provides the following functions as well:

- It uses the RADIUS server for the policy management of the wireless terminal. WEC8500/WEC8050 provides the function of the internal RADIUS server and also the connection function with the external RADIUS server. By using the RADIUS server function, it may allot the VLAN and QoS policy by wireless terminal.
- WEC8500/WEC8050 may allot static or dynamic IP address to wireless terminal.
- It performs Call Admission Control (CAC) for the application such as voice service and provides additional functions such as QoS.
- When it is a guest wireless terminal, it provides the guest service through the exclusive WLAN.

Managing Function

WEC8500/WEC8050 provides Command Line Interface (CLI) and Web User Interface (UI) for various settings and views. In addition, complicated information may be easily managed and viewed by using WEM. The managing function provided by WEC8500/WEC8050 is shown as follows:
It provides the status of the wireless terminal as shown below.

Item	Description
IP Address	IP address of the wireless terminal
MAC Address	MAC address of the wireless terminal
Host Name	Name of the wireless terminal
AP Name	The name of the connected WE WLAN AP
AP MAC Address	MAC address of the connected WE WLAN AP
AP Map Location	Location of the connected WE WLAN AP
Controller Name	Name of the connected WEC8500/WEC8050
Controller IP Address	IP address of the connected WEC8500/WEC8050
SSID	WLAN service identifier (up to 32 bytes used)
VLAN	VLAN ID of the wireless terminal
Protocol	802.11 protocol of the wireless terminal
Association	Connection of the wireless terminal
Association Time	Time of starting the connection of the wireless terminal
Session Length	The connection time of the wireless terminal
Authentication Type	Authentication type of the wireless terminal
Authenticated	Authentication of the security protocol of the wireless terminal
EAP Type	EAP type used for the authentication of the wireless terminal
Encryption Cipher	Types of encryption mechanism applied to the wireless terminal
Branch Authentication	Branch AP authentication of the wireless terminal
RSSI	Received Signal Strength Indication (RSSI) of the traffic of the wireless terminal
SNR	Signal to Noise Ratio (SNR) of the traffic of the wireless terminal

- It may set the blacklist. This function allows the system to eliminate a problem waiting to happen by removing the wireless terminal that has a potential problem.
- It checks the status of the wireless terminal by WE WLAN AP and eliminates the terminal in the WLAN if it is deactivated for a specific time.
- It provides the statistical information including data traffic by wireless terminal.
- It manages the history of association by wireless terminal. It may track the history of 10 WE WLAN APs as default values and the history information is as shown below.
- Association Time, Duration, User Name, MAC Address, IP Address, AP Name, BSSID, Controller Name, AP Map Location, SSID, Protocol, Traffic, Handover Reason
- It provides an alarm by event of the wireless terminal.

4.2.1.2 Handover

Handover means disconnecting to the old AP and connecting to a new AP and allows the wireless terminal to connect seamlessly to the WLAN. WEC8500/WEC8050 provides the handover based on 802.11 Standard and AIRMOVE handover (Network Controlled handover) as Samsung's specialized function.
All decisions on the handover on the 802.11 standard are performed independently by the wireless terminal. On the contrary, the AIRMOVE handover in the hand on the 802.11 standard may allow the wireless terminal to perform the function of being independently performed through the cooperation between WEC8500/WEC8050 and the wireless terminal. Therefore, the handover function may be optimized. On smart phones such as Galaxy S3, Galaxy Note 2 and Galaxy S4 launched after the S3 now provided by Samsung, the AIRMOVE handover function is provided when used with the SCM-Express.

WEC8500/WEC8050 performs the following functions when a new access request comes from the wireless terminal:

- Load balancing and access control depending on the system status at the request for the re-connection of the wireless terminal to decide re-connection.
- Opportunistic Key Caching (OKC) to reduce the handover time. OKC reduces the time of deciding the re-connection at handover by eliminating the Extensible Authentication Protocol (EAP) authentication course with the Remote Authentication Dial In User Service (RADIUS).
- Not only intra APC handover but also inter APC handover. The intra APC handover is the handover between WE WLAN APs belonging to the WLAN managed by one WEC8500/WEC8050, and the inter APC handover means the handover between WE WLAN APs connected to different WEC8500/WEC8050s.
- Viewing the moving path by wireless terminal through the handover history management function.

4.2.2 Wi-Fi Functions

WEC8500/WEC8050 provides the following Wi-Fi functions:

Parameter Management Related to Wireless Resource of WE WLAN AP

WEC8500/WEC8050 provides CLI and Web UI to set channels and wireless transmission and receiving power for 802.11a/b/g/n wireless resources of WE WLAN AP.

Integrated Wireless Resource Management

WEC8500/WEC8050 guarantees the transmission quality of WLAN by optimally managing the wireless resources of all WE WLAN APs connected in the following method:

- Dynamic power control: Periodically collecting wireless data and automatically setting optimal wireless transmission power in consideration of noise, interference, and congestion degree of each WE WLAN AP
- Dynamic channel selection: Periodically collecting wireless data and automatically setting an optimal channel in consideration of noise, interference, signal strength, etc. of each WE WLAN AP
- Coverage hole detection & correction: When detecting a coverage hole where the signals of the WLAN between WE WLAN APs are not easily caught, gradually increasing the transmission power of the neighboring APs. Compensating and checking until the coverage hole is loosened or it reaches the permissible transmission power level to the maximum.

Setting of Power Constraint and Channel Swift Announcement

The 802.11h standard supported by the WE WLAN APs may give wireless terminals information on channel swift and limit the transmission power of the wireless terminals. For this, WEC8500/WEC8050 may set power constraint and channel switch announcement of the WE WLAN APs.

Load Balancing

WEC8500/WEC8050 provides load balancing to effectively distribute the wireless terminals accessing the WE WLAN APs as follows:

- Distribution by number of terminals: When the number of terminals accessing to specific WE WLAN APs is larger than or equal to the threshold set by the operator, consider that the WE WLAN AP is busy. At the time, the WEC8500/WEC8050 leads the access to the WE WLAN APs where the number of wireless terminals is less than the threshold.
- Spectrum load balancing: Basically, the wireless terminals access to the AP whose strength of the signal is higher. However, when the spectrum load balancing is set, lead terminals to access to the APs whose utilization capacity is sufficient based on the utilization capacity of the current channel.

Band Steering

When the performance degradation occurs due to many wireless terminals to the bandwidth of

2.4 GHz, this converts the bandwidth to the 5 GHz where there are many channels and interference is relatively less. To use this function, the bandwidth of 2.4 GHz and 5 GHz must be supported in the wireless terminals and WE WLAN APs.

Spectrum Analysis

Non-802.11 devices such as microwave oven, Bluetooth, and Closed Circuit Television (CCTV) degrade the performance of sending and receiving data by causing interference in the WLAN environment. Spectrum analysis as a function of measuring surrounding interference helps to rapidly solve the interference problem by analyzing the wireless or radio frequency (RF) signal in the real time.
The spectrum analysis of the WEC8500/WEC8050 provides following data:

- Sample Reporting: Wireless capture data converted to Fast Fourier Transform (FFT)
- Duty Cycle Reporting: Channel usage
- Interference Reporting: Information on the interference signals

Country Code Set Control

By setting the country code of the WE WLAN AP, it is possible to change frequency band, wireless interface, channel, and transmission power fit for each country code.

Location Tracking

The WEC8500/WEC8050 provides a function of tracking the location of several terminals in the WLAN network based on the wireless data collected in the managed WE WLAN APs.

4.2.2.1 Voice Quality Improvement

It provides Call Admission Control (CAC) to protect voice calls conventionally maintained from ones flowing from new WLAN. WEC8500/WEC8050 does not allow additional voice calls when it reaches the permissible voice calls to the maximum per radio.
The calls where handover is executed are not affected by CAC.

4.2.3 WLAN Security

4.2.3.1 WLAN Standard Security

The WE WLAN equipment supports the security specified in IEEE 802.11 based WLAN security standard as follows:

- WEP (Wired Equivalent Privacy)
- WPA (Wi-Fi Protected Access)
- WPA2 (Wi-Fi Protected Access Version 2)

WEP

IEEE 802.11 is an initial WLAN standard enacted in 1997 and WEP is a security algorithm specified in this standard. WEP is a security method for encrypting transmission data by using a key of 64 bits or 128 bits that combines a secret key for sharing wireless transmission data sent and received by APs connected to the WLAN and the terminal.
Now, as WEP is known to be weak in security, the standards, including WPA/WPA2, whose security has been enhanced through IEEE 802.11 working group have been enacted.

WPA/WPA2

IEEE 802.11i provides a function of more enhanced authentication and data encryption with the wireless standard enacted in 2004. It describes the WPA/WPA2 security specification based on EAP and 802.1X authentication, and includes the security mechanism in the WLAN authentication and encryption methods by classification.

The WLAN authentication method is as follows:

- WPA-Personal: Use the method for authenticating the Pre-Shared Key (PSK).
  The PSK authentication method is generally a method used in the small-sized network where there is no separate authentication server.
- WPA-Enterprise: A method for authenticating through certification servers such as Remote Authentication Dial-In User Service (RADIUS) server. WEC8500/WEC8050 supports a separate external authentication server and integrates a self-authentication server usable in the small-sized WLAN environment.

The WLAN encryption method is as follows:

- Temporal Key Integrity Protocol (WPA TKIP): TKIP is based on RC4 encryption algorithm in the encryption method used in the WPA specification of IEEE 802.11i.
- WPA2 Counter mode encryption with CBC-MAC Protocol (CCMP): CCMP is an encryption method used in the WPA-2 specification of IEEE 802.11i. It is based on the method for encrypting Advanced Encryption Standard (AES) blocks in the Counter mode encryption with CBC-MAC (CCM).

WLAN Security Service

The WE WLAN equipment provides the services of detecting and blocking illegal APs or wireless terminals as a WLAN security service. This is a function of detecting and blocking the illegally installed APs without permission of the administrator in the WLAN service zone under operation and wireless terminals connected thereto. It is important to manage because information exposure or attempts at several attacks are possible through illegal APs.

Detection

By using the self-sensor function of the WE WLAN AP, it is possible to basically search all packets in the WLAN and provides basic information required to detect illegal APs and wireless terminals with APCs such as WEC8500/WEC8050. WEC8500/WEC8050 detects illegal APs and wireless terminals through the information provided by the AP and the set policy and creates relevant alarms and logs. The detected illegal APs are classified under the set classification policy as follows:

Classification Type	Description
Managed AP	An AP allowed to be used by the administrator among illegal APs detected - Possible to set the managed AP classification policy. - The administrator may classify a specific AP among the detected rouge APs manually detected as a managed AP.
Unmanaged AP	An AP among the detected rouge APs that is not allowed to be used by the administrator or that may be used for a malicious intention - Possible to set the unmanaged AP classification policy. - The administrator may classify a specific AP among the detected rouge APs manually detected as a unmanaged AP.

Main information provided for illegal APs is as follows:

- MAC address
- SSID
- Channel Information
- Strongest AP RSSI
- SNR
- Classification Type: Managed, Unmanaged AP
- Blocking State
- Number of connected wireless terminals
- Detection time

Blocking

WEC8500/WEC8050 attempts at blocking under the set policy for illegal APs. The blocking of illegal APs is made by transmitting de-authentication packets to APs wirelessly.

4.2.4 Data Networking

4.2.4.1 L2 Network Managing

It provides L2 network management as follows:

VLAN

A Virtual Local Area Network (VLAN) is a function of switching by grouping similar terminals in a work group under the LAN operating policy regardless of the location of terminals. By separating and processing them as virtual LAN only in the group, it may eliminate the influence over unnecessary broadcasting packets and configure the stabilized switching subnet.

STP/RSTP/MSTP

To prevent the packet forwarding loop from occurring in the L2 network, a forwarding tree is configured by a spanning tree algorithm. It may prevent a loop by VLAN from occurring by using a STP/RSTP algorithm or Multiple Spanning-Tree Protocol (MSTP) by VLAN.

Link Aggregation Control Protocol (LACP)

As it is possible to use several switch ports logically like one interface by providing the LACP, it may create the bandwidth largely that may be used in the interface.

Internet Group Management Protocol (IGMP) Snooping

The L2 switch without IGMP (a switch in the lower IP router layer) works as if it were a group member and the group member as if it were an IP router by using the IGMP message in the location between IP router and multicast group member (host). The operation made by the L2 switch at the time is called as IGMP snooping. By reflecting information on a multicast group in an IP layer included in the IGMP message on the MAC filtering database as its switching database, WEC8500/WEC8050 processes it in a form of MAC multicast address responding to the IP multicast address.

4.2.4.2 L3 Network Managing

Static Routing

By configuring a fixed routing table between network interfaces, it may process static routing all the time. The change in the dynamic routing table is not performed by a routing protocol and a certain routing service is provided under the set routing policy.

Routing Information Protocol (RIP)

It is a protocol widely used to manage routing information in the small or midsized independent network such as groups interconnected by LANs.

Open Shortest Path First (OSPF)

It is a routing protocol used to put priority on RIP in the large autonomy network.
A router detecting change in a routing table or network must be allowed to have routing information such as all routers by informing all other routers in the network of the information immediately.

IGMP

IGMP is an internet protocol that allows IP terminal or internet computer to provide the means informing neighboring routers of multicast groups. Multicasting allows one host computer in the internet to send contents to other IP terminals or computers to the internet.

Protocol Independent Multicast-Sparse Mode (PIM-SM)

PIM-SM is a protocol for multicast routing. After checking the interface to send a multicast packet first, it transmits the multicast packet only with the confirmed interface.

Virtual Router Redundancy Protocol (VRRP)

When there occurs a fault in a router, VRRP allows the telecommunication service by using the backup router in the same network. When there occurs a fault in a master router, it detects such fault and allows the backup router to use an IP address such as master router.

4.2.4.3 Network Interface Managing

The following IP addresses may be allotted to the physical or logistic interface of the system:

- Fixed IP address
- Dynamic IP address
- Secondary IP address

4.2.4.4 Network QoS and ACL Managing

By using the QoS, the operator may provide users with different quality of services.
In addition, Access Control List (ACL) is allowed to provide each user with an access authority to a different network. The ACL analyzes packet information by using several filtering techniques to control the network traffic and provides a function of processing the packet in the method as designated by the operator.
The supporting functions in relation to the ACL are as follows:

- Filtering IPv4 address and MAC address
- Supporting IP, TCP, UDP, and ICMP
- Supporting the destination IP address and port, the source IP address and port as well as a protocol and the IP address and the port may be entered by designating the wildcard format and the scope, respectively
- WEC8500/WEC8050 possible to control the packet as a final destination by supporting Admin ACL
- Supporting various operators

4.2.4.5 Network Solution Managing

It provides the network solution management as follows:

Monitoring CAPWAP Data Channel

To inspect validity in the data packet channel used at the Control And Provisioning of Wireless Access Point (CAPWAP), it periodically sends and receives keep-alive messages. When the keep-alive message fails to be received, it monitors the abnormal status of the CAPWAP channel.

Network Address Translation (NAT)

NAT performs a function of converting a private IP address and a public IP address in the network that requires security.

- Inbound: Forwarding the packet from the WAN to an IP address and port of the LAN designated in the NAT/PT conversion table
- Outbound: A function of transmitting a packet from the internal LAN to the WAN by converting the IP address of the sender to the global IP address by the NAT/PT conversion table
- Exclusive: Used for the IP address to which the NAT/PT conversion is not applied.
- Redirect: If a DNS IP address in the data server control sector is changed, a function of each IP terminal using the DNS IP address before being changed and registering the changed DNS IP address to the redirect table to change the IP address.

Firewall

Firewall is a function to block the traffic which is not desired from the external network. For this, it provides connection filtering, DeMilitarized Zone (DMZ), and port forwarding, and other functions.

- Connection filtering: It means a function of blocking the access to the unauthorized IP address. Used to control the access of the resources not disclosed outside and also control the external resources where members in the LAN must connect.
- DMZ function: Used when the connection is allowed from the outside while the connection control service by the firewall is offered. Separately from the LAN network that the firewall blocking the web server or email server that requires free connection from the outside is not applied even though it is a LAN network protected by the firewall, it is connected to a separate subnet.
- Port forwarding: It is a similar function like DMZ, but a function of being connected to a specific network without using a separate DMZ port. It may give an extra network service accessible to the intranet through the Internet outside with the DMZ function. Provided that it must be careful of security in the intranet during the extra network service.

4.2.5 Managing Function

The managing function is required to control WLAN APs that provide the service through WEC8500/WEC8050 and to make the wireless terminals connected to the WE WLAN AP set network information required in the wireless environment.

WEC8500/WEC8050 Management

It is possible to manage information on various configurations and options required to operate WEC8500/WEC8050.

AP Management

- It may monitor the status of the WE WLAN APs and confirm normal operation.
  It may set and view the information on the WE WLAN AP remotely and provide even a function of collecting performance and statistical information. In addition, APs consider signal interference by wireless frequency characteristics and the normal operation of the WE WLAN APs by using the information.
- When there occurs an alarm or event in the WE WLAN APs, it may view the concerned information. As such, when the WEM requests information, it views the information and delivers the result.
- It provides a function of controlling or viewing software package by WE WLAN AP or for all APs.
- Based on the issued license, it performs the number of allowed WE WLAN APs, firewall, VQM service support and the management of WE WLAN APs differently.

AP Group Management

The operator may make various configurations directly for individual WE WLAN APs, but provide the configuration by group for flexible management.

WLAN Management

WEC8500/WEC8050 can set various QoS and security functions in order to provide a particular service to the user terminal.

4.2.6 System Management

The function carries out the following system management functions:

System Configuration Data Management

The system configuration data includes the current configuration status of the system. WEC8500/WEC8050 may store, manage or initialize the data.

- Save: Because the configuration data of the current system by CLI/Management Information Base (MIB) may be saved, it prevents data loss under the situation of system restarting, etc.
- Configuration sharing: It may import or export the configuration to other WEC8500/WEC8050 systems.
- System initialization to factory settings: It may initialize the system.

Software Management Functions

To boot the system, it performs a function of initializing other software modules by being invoked first and monitoring and managing the status of the initialized software modules. Furthermore, it provides the function of upgrading the system software package and viewing the package information.

System Log Management

When the error occurs, it may restart or stop the software and the log processing module reports the error to the event manager. It provides even the self-log saving function by preparing against the error status of the event manager. It provides even the function of interoperating Simple Network Management Protocol (SNMP) Trap and syslog.

System Device Management

It provides a function of managing and viewing the usage rate of CPU, memory and disk, information on the revolution per minute (RPM) of the fan, and the information on the status of the internal temperature sensor and hardware of the system.

System Statistics Management

It provides a function of managing and viewing the statistical information of the system and the WE WLAN APs.

4.2.7 IP Application Management

DHCP Management

- DHCP client function: It provides a function of setting the dynamic IP address to the interface.
- DHCP proxy function: It hides the location of the DHCP server from the wireless terminals and allows it to connect to the server.
- DHCP relay function: It provides a function of connecting the DHCP request of the wireless terminals to the server.

DNS Management

- DNS settings: It provides a function of setting the external DNS server referred to by WEC8500/WEC8050.
- DNS relay: It provides the relay function with the cache function responding to the DNS request of the wireless terminals.

Time Management

It provides a function of synchronizing the time of the external network time protocol (NTP) server, the internal WE WLAN AP and the wireless terminal.

- Manually time setting
- NTP time setting: Setting the time from the external NTP server
- NTP server: NTP proxy function operating like a server to synchronize time of the internal WE WLAN AP and the wireless terminal

Session Management

It may connect to WEC8500/WEC8050 through Telnet or SSH protocol from the outside by using the terminal or to other Telnet server from WEC8500/WEC8050.

File Management

- FTP server/client function
- SFTP server/client function

IP Utility

It provides the following functions:

- Ping: A function of confirming the connection of the network by transmitting the ICMP message
- Trace route: A function of being able to trace the route path to the destination
- TCP dump: A function of confirming the network packet from WEC8500/WEC8050

4.2.8 Operator Interface Managing

It provides user interface that manages several functional blocks of the system to the CLI and Web UI.
Besides, it provides the interoperable interface with the NMS products through the SNMP agent.
In particular, WEC8500/WEC8050 provides the configuration, performance and real-time alarm information in connection with the WEM.

CLI

It performs a function of managing the configuration of the system and viewing the information and monitoring and collecting the operating status of the functional block in the system through Telnet or connection to the console.

Web UI

Web UI is a tool for configuring and managing WEC8500/WEC8050 and the WE WLAN AP. It offers the function of configuration and security management required to provide the WLAN service and WLAN performance monitoring through the web-based GUI.

Figure 3. Web UI Map

Below are the functions the Web UI provides.

- Monitoring: Possible to indicate various configurations, status, wireless terminal information, etc. and monitor statistical information.
- WEC8500/WEC8050 configuration: Possible to set various policies applied to interface, Layer2, Layer3, Multicast, and WEC8500/WEC8050.
- Setup of WE WLAN AP configuration: Possible to set up profile management, various configurations and policies of the WE WLAN AP.
- Wireless terminal management: As a function of managing the wireless terminal connecting to the WE WLAN AP, setting the mobility group and its policy.
- WEC8500/WEC8050 system management: It provides protocol setting, user management, log management, file management, software package management, etc. applied to WEC8500/WEC8050.

4.2.9 CAPWAP Function

It creates the secured tunnel and transmits the data by using CAPWAP as a standard protocol between WEC8500/WEC8050 and WE WLAN AP. It provides high security due to the use of the encrypted data in all wired and wireless sections.
CAPWAP is composed of the control channel and the data channel. The control channel processes the messages of provisioning, various settings, and control while the data channel delivers the data traffic sent to, and received from, wireless terminals through CAPWAP tunneling.
The control channel basically provides the retransmission function, because the data loss does not occur due to the delivery of the WLAN configuration information in the control channel. Also, for security of the transmitted information, Datagram Transmission Layer Security (DTLS) must be used. In contrast, data channel requires faster response than the packet transmission reliability as the users' data traffic is transmitted, the retransmission function is not provided. Also, the DTLS function is provided as optional.

The functions provided through CAPWAP are as follows:

IP discovery Function

- WEC8500/WEC8050 IP discovery based on unicast, multicast, and broadcast
- WEC8500/WEC8050 IP discovery by using the DHCP option information
- Auto Discovery function
  - Static IP mode: Last connected APC → Broadcast → Multicast
  - DHCP IP mode: Last connected APC → DHCP option → DNS → Broadcast → Multicast

Provisioning Function

- Radio parameter and WLAN profile provisioning
- Firmware downloading and upgrading

Security Function

- CAPWAP tunneling
- DTLS for control channel and data channel of CAPWAP
- Authentication based on 802.1x, and PSK

QoS Function

- QoS mapping of the wired and wireless network by wireless terminal
- QoS marking of CAPWAP tunnel header

Failover Function

- Failover at the keep-alive error
- Fallback function

Configuration Function

Configuring 802.11 WLAN and radio parameter

Statistics Function

- Various statistics by WE WLAN AP and wireless resource
- Real-time or periodical statistics

Handover Function

Handover of Network Controlled (NC)

4.2.10 Additional Service Function

WEC8500/WEC8050 provides Voice Quality Monitoring (VQM) as an additional service. By using this, it is possible to check and manage the statistics of voice calls that pass the WLAN section now and voice status and provide the status information by monitoring the quality of the voice traffic.

CHAPTER 5. WLAN Hardware

This chapter introduces WEC8500/WEC8050 hardware characteristics:

5.1 Hardware Features of WEC8500

The hardware of WEC8500 has the following features:

Safety

The materials and parts used in the hardware are mechanically robust and satisfy mechanical and electrical characteristics required for the telecommunication system.

- It is a stabilized and robust structure of the steel plate-welded assembly by complying with the industrial standards.
- It does not generate toxic or corrosive gases that may give harm to the human body or give influence over the system operation.
- It is made of the materials considering the Electro-Magnetic Interference (EMI) specifications.
- To prevent the damage due to overvoltage, it has a safety device.

Power Redundancy

The power supply device of the hardware is redundant.

- Even if a power module is faulty, the service can be operated normally without stopping it with the other power module.
- The power module is in the plug-in form so it can be easily installed and uninstalled.

Maintenance

It is designed to allow easy and safe maintenance activities.

- It complies with the rack specification that may install the unit with the width of 482.6 mm, and the rack is designed to maintain the full strength.
- With each port connected to the outside in the front panel, it is easy to connect the cable.
- The power and the fan module are designed as the tray type so that it can be changed conveniently when an error occurs.
- There is a LED at the front of each module indicating its operation status and fault status, helping the operator to identify the status of the system easily.
- On the rear part of the rack, there is a ground hole that may connect the wrist-straps to

prevent static electricity.

- The electronic devices are designed not to be damaged by the external environment during installation or maintenance.

Fire Resistance and Exothermal Process

The fire-resistant materials and parts are used against fire and it is designed to prevent heat generated from the inside of the system from being influenced over the performance.

- The special heating part in the hardware is blocked not to give any influence over the component parts sensitive to temperature.
- It discharges the internal air outside by installing four 40 mm fans for cooling.
- The parts installed to the module are placed in consideration of heat distribution.

5.1.1 Total Configuration

WEC8500 is composed of the cabinet with 1U size installed on the 482.6 mm wide rack and the functional server operating outside. The external configuration is as shown in the figure below.

Front Side

Rear Side

Figure 4. WEC8500 Configuration

5.1.2 External Interface

The external interface is as below.

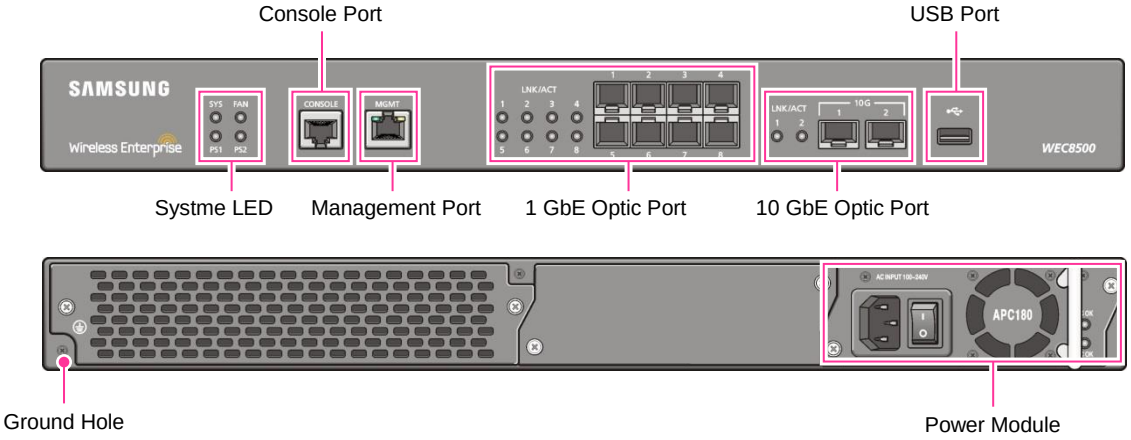


Figure 5. WEC8500 Interface-front/back

System LED

The system LED that displays various statuses of the system is provided. Information below is displayed for each LED.

Figure 6. System LED Formation

LED	Status	Description
SYS	Green	System normally operating
	Orange	System rebooting
	Red	Preparing system reboot
FAN (Fan Module)	Green	The fan module is normally installed and is operating normally
	Orange	System rebooting
	Red	Error occurred to the fan module
PS1 (Power Module 1)	Green	The power module 1 is normally installed and is operating normally
	Orange	The power module 1 is installed but the power is OFF or there is an error
	Red	The power module 1 is not installed
PS2 (Power Module 2)	Green	The power module 2 is normally installed and is operating normally
	Orange	The power module 2 is installed but the power is OFF or there is an error
	Red	The power module 2 is not installed

Console Port (RS232C)

The console port is provided in order to check the operation status of WEC8500 and to enter the CLI. It is connected with the terminal program in the speed of 115 kbps.

Management Port

Ethernet 10/100/1000 base-T UTP port is provided for management.

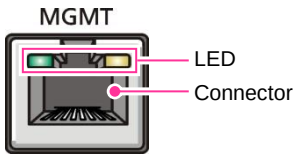


Figure 7. Management Port Formation

Formation List	Status	Description
LED	Green	Shown when the link is connected
	Yellow	Flickers when transmitting/receiving data
Connector	-	UTP cable connection connector

Optic Port

Eight ports of 1 GbE Optic ports and two ports of 10 GbE Optic ports are provided and the operation status of each port is shown by the LED.

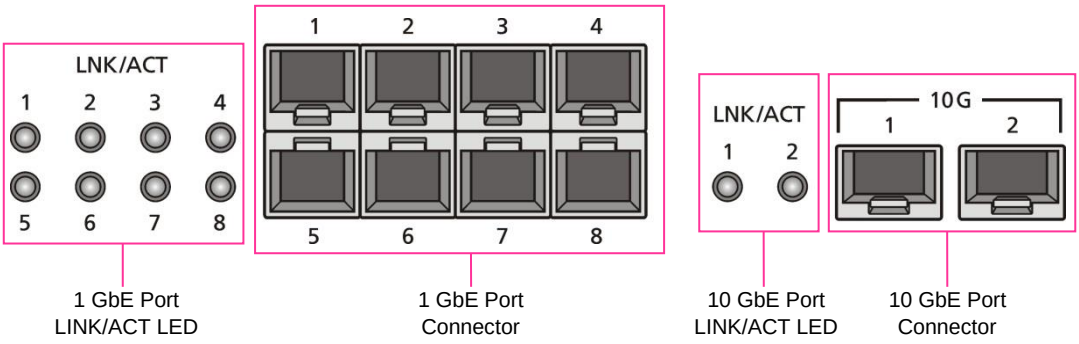


Figure 8. Optic Port Formation

Formation List	Port and LED	Description
10 GbE port	LINK/ACT 1, LINK/ACT 2	LINK/ACT status of each port is shown - Turns on when the link is connected - Flickers when transmitting/receiving data
	10G 1, 10G 2	10 GE Optic module connector
1 GbE port	LINK/ACT 1~LINK/ ACT 8	The LINK/ACT status of each port is shown - Turns on when the link is connected - Flickers when transmitting/receiving data
	1G 1~1G 8	1 GE Optic module connector

USB Port (Host 2.0)

The USB host port is provided to support WEC8500 operation software upgrade. The general USB memory stick is supported.

Power Module

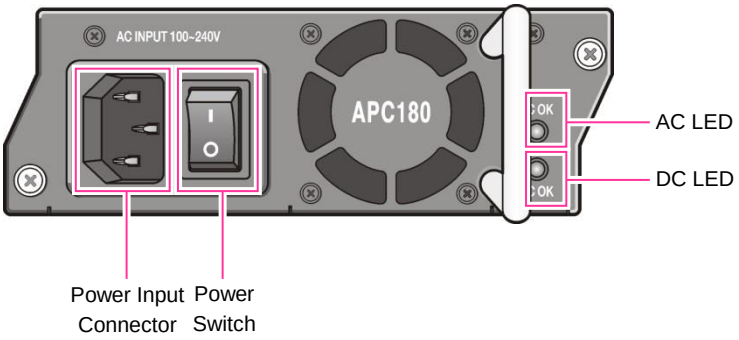


Figure 9. Power Module Interface Formation

Formation List	Description
Power Input Connector	A connector for connecting power cables
Power Switch	A switch that turns power on/off
AC LED	Shown when the AC power is input normally
DC LED	Shown when the DC power is output normally

5.2 Hardware Features of WEC8050

The hardware of WEC8050 has the following features:

Safety

The materials and parts used in the hardware are mechanically robust and satisfy mechanical and electrical characteristics required for the telecommunication system.

- It is a stabilized and robust structure of the steel plate-welded assembly by complying with the industrial standards.
- It does not generate toxic or corrosive gases that may give harm to the human body or give influence over the system operation.
- It is made of the materials considering the Electro-Magnetic Interference (EMI) specifications.
- To prevent the damage due to overvoltage, it has a safety device.

Maintenance

It is designed to allow easy and safe maintenance activities.

- It complies with the rack specification that may install the unit with the width of 482.6 mm, and the rack is designed to maintain the full strength.
- With each port connected to the outside in the front panel, it is easy to connect the cable.
- There is a LED at the front of each module indicating its operation status and fault status, helping the operator to identify the status of the system easily.
- On the rear part of the rack, there is a ground hole that may connect the wrist-straps to prevent static electricity.
- The electronic devices are designed not to be damaged by the external environment during installation or maintenance.

Fire Resistance and Exothermal Process

The fire-resistant materials and parts are used against fire and it is designed to prevent heat generated from the inside of the system from being influenced over the performance.

- The special heating part in the hardware is blocked not to give any influence over the component parts sensitive to temperature.
- It discharges the internal air outside by installing two 40 mm fans for cooling.
- The parts installed to the module are placed in consideration of heat distribution.

5.2.1 Total Configuration

WEC8050 is composed of the cabinet with 1U size installed on the 482.6 mm wide rack and the functional server operating outside. The external configuration is as shown in the figure below.

Figure 10. WEC8050 Configuration

5.2.2 External Interface

The external interface is as shown below.

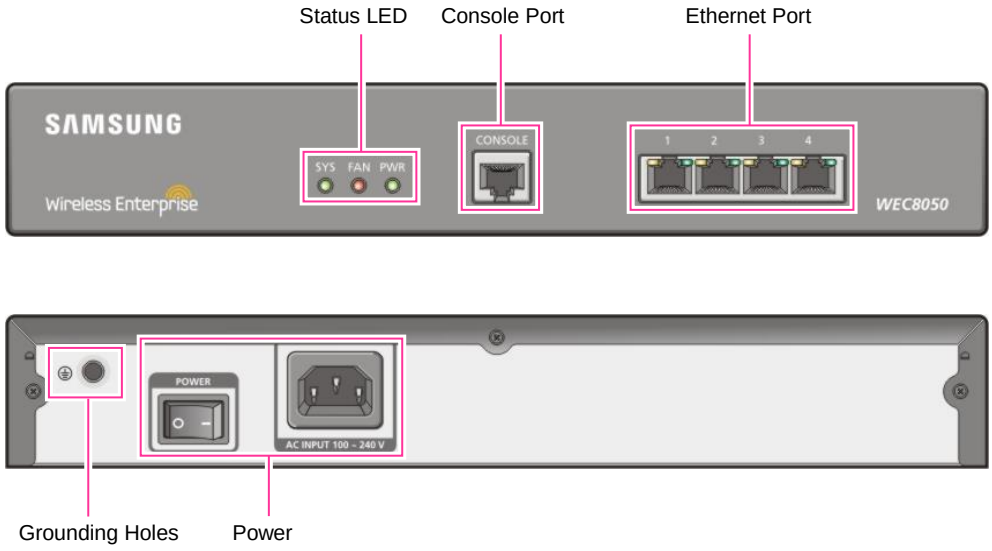


Figure 11. WEC8050 Interface-Front/Back

Status LED

The system LED that indicates various conditions of the system is provided. The following information is displayed by LED.

Figure 12. System Status LED Configuration

LED	Status	Description
SYS	Green on	The system is normally operating.
	Orange on	The system is booting.
	Red on	The system is ready for booting.
Fan	Green on	The installed fan is normally operating.
	Orange on	The system is booting.
	Red on	Fault occurred to the fan.
PWR	Green on	Thanks to the power supply, it is normally operating.
	Off	The power is off or is not supplied.

Console Port (RS232C)

The console port is provided to check the operating status of WEC8050 and input the CLI. It is connected to the terminal program at the speed of 115 kbps.

Ethernet Port

It provides four 10/100/1000 base-T Ethernet ports.

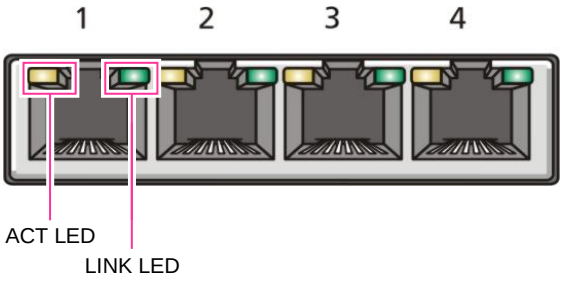


Figure 13. Ethernet Port Configuration

Configuration Item	Status	Description
ACT	Blinking Orange	Transmitting/receiving data
	Off	No transmitting/receiving data
LINK	Green on	LINK connection
	Off	Link disconnection

CHAPTER 6. Samsung Access Points (WE WLAN AP)

This chapter explains available access points and their Specs (WE WLAN AP's)

6.1 WE WLAN AP

The current WE AP is provided in two models: 300 Series and 400 Series.

- WEA300 Series: WEA302i/303i/303e
- WEA400 Series: WEA403i/412i

6.1.1 Product Overview (WE AP)

The WEA300 Series and WEA400 Series are APs for Samsung Wireless Enterprise (WE) wireless LAN. The WEA300 Series supports the IEEE802.11a/b/g/n and the WEA400 Series supports the IEEE 802.11a/b/g/n/ac. They connect a device that supports wireless LAN such as a smart phone, tablet PC, or notebook to a wired network. The WE AP supports the 2x2 or 3x3 Multiple Input Multiple Output (MIMO) for each model.

Depending on hardware characteristics, the WEA300 Series AP differs as follows:

- The WEA302i has built-in antenna and supports 2x2 stream.
- The WEA303i has built-in antenna and supports 3x3 stream.
- The WEA303e has external antenna and supports 3x3 stream.

Depending on hardware characteristics, the WEA400 Series AP differs as follows:

- The WEA412i has built-in antenna and supports 2x2 stream.
- The WEA403i has built-in antenna and supports 3x3 stream.

The WE AP has additional antennas to support multi-antenna.

The WE AP can provide up to a 1Gbps UTP Ethernet interface and console port to connect to a wired network.

The WEA400 Series provides an additional 1Gbps UTP Ethernet interface. The power is provided through the Ethernet cable to the PoE and an external power adaptor (12 V/2 A) can be used optionally.

There is an LED that indicates operational status.

6.1.2 WE AP Quick Capacity Table

WEA300 Series

		WEA302i	WEA303i	WEA303e
Wireless	Standard	802.11a/b/g/n	802.11a/b/g/n	802.11a/b/g/n
	# of radio	Dual Concurrent Radio	Dual Concurrent Radio	Dual Concurrent Radio
	Frequency	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz
	Antennas	Internal Type	Internal Type	Internal/External Type
	MIMO	2 X 2 MIMO, 2 Spatial Streams	3 X 3 MIMO, 3 Spatial Streams	3 X 3 MIMO, 3 Spatial Streams
	PHY Rate	300 Mbps	450 Mbps	450 Mbps
H/W	Network I/F	1 GE (RJ45), 1 Console (RJ45)	1 GE (RJ45), 1 Console (RJ45)	1 GE (RJ45), 1 Console (RJ45)
	PoE	802.3af/802.3at	802.3af/802.3at	802.3af/802.3at
	Environment Class	Indoor	Indoor	Indoor
Dimension	Diameter / Height	174 mm / 34.1 mm	174 mm / 34.1 mm	174 mm / 34.1 mm
	Weight	560 g	640 g	640 g
Security	Standard	802.11i, WPA/WPA2	802.11i, WPA/WPA2	802.11i, WPA/WPA2
	Multi SSID	Maximum 16	Maximum 16	Maximum 16
	# of Multi VLAN over SSID	Maximum 1,024	Maximum 1,024	Maximum 1,024
	Encryption	DTLS	DTLS	DTLS
QoS	Standard	802.11e	802.11e	802.11e
	WMM	Yes	Yes	Yes
Management	Operation	Controller Based	Controller Based	Controller Based
Certification	Wi-Fi Certified	WPA/WPA2, WMM, WMM-PS	WPA/WPA2, WMM, WMM-PS	WPA/WPA2, WMM, WMM-PS
	KC	Yes	Yes	Yes

WEA400 Series

		WEA412i	WEA403i
Wireless	Standard	802.11a/b/g/n/ac	802.11a/b/g/n/ac
	# of radio	Dual Concurrent Radio	Dual Concurrent Radio
	Frequency	2.4 GHz, 5 GHz	2.4 GHz, 5 GHz
	Antennas	Internal Type	Internal Type
	MIMO	2 X 2 MIMO, 2 Spatial Streams	3 X 3 MIMO, 3 Spatial Streams
	PHY Rate	867 Mbps	1.3 Gbps
H/W	Network I/F	2 GE (RJ45), 1 Console (RJ45)	2 GE (RJ45), 1 Console (RJ45)
	PoE	802.3af/802.3at	802.3at
	Environment Class	Indoor	Indoor
Dimension	Diameter / Height	205 mm / 45 mm	206 mm / 45 mm
	Weight	820 g	920 g
Security	Standard	802.11i, WPA/WPA2	802.11i, WPA/WPA2
	Multi SSID	Maximum 16	Maximum 16
	# of Multi VLAN over SSID	Maximum 1,024	Maximum 1,024
	Encryption	DTLS	DTLS
QoS	Standard	802.11e	802.11e
	WMM	Yes	Yes
Management	Operation	Controller Based	Controller Based
Certification	Wi-Fi Certified	WPA/WPA2, WMM, WMM-PS	WPA/WPA2, WMM, WMM-PS
	KC	Yes	Yes

6.1.3 WE APs have the Following Characteristics

802.11a/b/g/n Standard Support-WEA300 Series

The WEA300 Series supports the standard functions of the 802.11a/b/g/n which is the wireless LAN specification. The 802.11n provides higher bandwidth for data and voice/video services. The WEA300 Series supports the MIMO for multipath transmission/reception and can set the 40 MHz bandwidth using channel bonding.
Also, packet aggregation and block ACL function are provided for improving MAC efficiency.

802.11a/b/g/n/ac Standard Support-WEA400 Series

The WEA400 Series supports the 802.11ac function alongside the 802.11a/b/g/n standard which is the existing wireless LAN specification. The 802.11ac provides higher bandwidth than the existing 11n. The WEA400 Series supports the MIMO for multipath transmission/reception and can set the 80 MHz bandwidth using channel bonding.
Also, packet aggregation and block ACL function are provided for improving MAC efficiency.

Dual Radio Support

To support the 2.4 GHz and 5 GHz wireless services at the same time, it has two WLAN modules.

Multiple Antenna Support

For TX/Rx per stream, it is possible to select either of two physical antennas.
By configuring the antenna combination through the paths, it provides the optimal wireless service.

RF Monitoring Support

Other than the WLAN modules for user services, the WLAN sensor modules for monitoring the wireless environment are additionally built. The module provides the functions of monitoring the wireless environment and detecting interference to detect illegal APs, manage RF, and trace the paths. WEA302i performs a function of monitoring the independent wireless environment instead of giving hindrance to the function or performance of the WLAN under the service.

Supporting the CAPWAP Standard

As a standard protocol for controlling and provisioning WE WLAN APs and WEC8500s, it performs various control functions for the 802.11 WLAN.

Radio Functions

The following radio-related functions are performed:

- Creating and deleting the radio interface
- Allotting a channel
- Setting the basic rate and the supported rate
- Setting Modulation and Coding Scheme (MCS)
- Setting the transmit power
- Packet aggregation
- Supporting 2 and 3 stream terminals by configuration
- Setting channel bonding (20 MHz, 40 MHz) for the 802.11n mode
- Short guard interval (GI) of PHY
- Regulatory domain support by country

WLAN Functions

The following WLAN functions are performed:

- Creating and deleting WLAN (VAP)
- Hidden SSID
- Release of connection of a specific terminal through the de-authentication messages
- Fragmentation and defragmentation of the WLAN frame
- Setting the RTS threshold value

Voice-Aware Traffic Scheduling (VATS)

VATS, as a technology of controlling the WLAN traffic in consideration of the characteristics of the voice traffic, provides Samsung's indigenous VATS to allow more VoIP call services in the WLAN environment.

NC Handover

WE AP provides NC handover as Samsung's unique function to minimize the disconnection of the communication at the transfer between cells. NC handover delivers commands such as the handover time, WE WLAN AP to transfer, channel, etc. to the wireless terminals from the WE WLAN AP and WEC8500/WEC8050 and causes the terminal to be handed over.
Because this provides the handover conditions in the optimal method, Samsung WE WLAN solution may apparently improve problems such as the call drop that might occur at a shadow area or during moving when a VoIP network is configured.

Samsung Downlink Scheduler (SDS) Support

WE AP defines four access categories depending on each service class by supporting the 802.11e standard and transmits the data in order of higher priorities. Without any separate scheduling, it is processed in a First-in and First-out (FIFO) method by an allotted queue by access category. Besides, to provide the priority service to multiple terminals, it provides the best service fit for the service class by supporting the admission control, queuing by terminal, and fairness services, etc.

Virtual Access Point (VAP)

VAP is a virtual network interface that provides the actual WLAN service. WE AP provides two radio interfaces (5 GHz, 2.4 GHz) and may create up to 16 VAPs by radio interface.

Beacon Generation

WE AP must create and transmit a beacon frame at an accurate cycle at the set beacon interval. Receiving the beacon transmitted by the fixed cycle, the wireless terminals connected to WE AP check the status of WE AP and view whether they have data delivered to themselves.

Repeater Service

When an AP is installed for the WLAN service, a shadow area may occur. There is a place where the Ethernet (802.3) interface among the shadow areas cannot be installed, but it may provide a wireless service by using the Wireless Distribution Service (WDS).
WE AP supports the repeater service that changes the general WDS to process the CAPWAP data and manage the configuration of WEC8500. The operating mode to support the repeater service is as follows:

Operating Mode	Function
Root AP	- Provides VAP to which the repeater AP can access. - Local bridge for the user data received from the repeater AP
Repeater AP	- Connects to the root AP (Station Mode) - Possible to transmit the user data of the wireless terminal accessing the AP to the root AP.

Spectrum Analysis

Spectrum analysis is a service to measure the interference of non-082.11 devices including a wireless phone for households or wirelessly connected camera. By analyzing wireless and RF signals in real time, it helps to solve interference problems.

Managing Function

It performs various diagnoses, faults, and statistical data for WE AP and, if necessary, carries out the role in reporting to WEC8500 by collecting the data.

Standalone Mode

The Samsung WE AP can be connected to APC (AP Controller) and controlled. Generally, it is managed through the AP WEB, WEM server or CLI of APC and offers various services in the Wireless Enterprise environment. In this case, the own setting information is not stored separately, and if the APC is disconnected or restarted, all settings (such as the wireless settings information) except the network information is automatically deleted.

In order to provide the services in difficult situations to connect to the APC such as small (1~2) site, self-testing or pilot test, Samsung WE AP separately provides the Standalone mode, and own setting functions by connecting to the CLI and WEB server, which enable it to offer basic wireless services(In this mode, storing configuration information).

6.2 Detailed AP Specifications

6.2.1.1 Data Capacity

WEA300 Series

Item	WEA302i	WEA303i	WEA303e
Capacity	- 2.4 GHz: 144 Mbps @ 20 MHz, 2 SS, Short GI - 5 GHz: 300 Mbps @ 40 MHz, 2 SS, Short GI	- 2.4 GHz: 214 Mbps @ 20 MHz, 3 SS, Short GI - 5 GHz: 450 Mbps @ 40 MHz, 3 SS, Short GI	

WEA400 Series

Item	WEA412i	WEA403i
Capacity	- 2.4 GHz: 144 Mbps @ 20 MHz, 2 SS, Short GI - 5 GHz: 867 Mbps @ 80 MHz, 2 SS, Short GI	- 2.4 GHz: 214 Mbps @ 20 MHz, 3 SS, Short GI - 5 GHz: 1300 Mbps @ 80 MHz, 3 SS, Short GI

6.2.1.2 Hardware Spec

WEA300 Series

Item	WEA302i	WEA303i	WEA303e
Dimensions (mm)	174 (H) × 174 (W) × 34.1 (D)		
Weight (g)	560	640	650
System memory	256 MB		
Booting ROM	128 MB		
Power supply	AC/DC 12 V/2 A adaptor supporting PoE (optional)		
WLAN I/F	IEEE802.11a/b/g/n (supporting 2.4 GHz and 5 GHz simultaneously)		
Operating temperature	0 to 45°C (32 to 113°F)		
Operating humidity	5 to 95 %, non-condensable		

WEA400 Series

Item	WEA412i	WEA403i
Dimensions (mm)	205 (H) × 205 (W) × 45 (D)	
Weight (g)	820	920
System memory	256 MB	
Booting ROM	128 MB	

Power supply	PoE supported AC/DC 48V/0.75 A adaptor (optional)
WLAN I/F	IEEE802.11a/b/g/n/ac (supporting 2.4 GHz and 5 GHz simultaneously)
Operating temperature	0 to 45°C (32 to 113°F)
Operating humidity	5 to 95 %, non-condensable

6.2.1.3 WE Standalone AP

Standalone AP Specifications

Categories		Features	Remark
Radio	WLAN Assignment	Support configuration of Multiple SSIDs(up to 16)	
		Support configuration of Multiple Basic SSIDs (BSSID)	Automatically Assigned during production
		Each WLAN SSID supports 2.4GHz, 5GHz or both bands	
		Beacon Interval Timing Difference Level is maintained at ±3% after long term operation (even in case of 16 Multiple SSIDs)	
	Radio Band	Support 2.4GHz, 5GHz Dual Concurrent service	
		Support enabling or disabling of the radio interfaces	
	Data Settings	Support configuration of Radio Data Rates	
		Support configuration of Radio MCS Rates	
		Support configuration of the Maximum Data Retries	
	Radio Settings	Support configuration of Radio Transmit Power of a AP	
		Support configuration of Radio Channel Settings(channel number, channel widths, DFS, Guard Interval)	
		Support Auto Channel Selection feature(Selection of channel that has minimum channel interference)	
		Support Carrier Busy Test (to check the radio activity on wireless channels)	
		Support enabling or disabling of of 802.11d	
		Support enabling or disabling of Short Preamble	
	Beacon	Support configuration of Beacon Period	

		and DTIM interval	
		Support enabling or disabling of WLAN SSID Broadcast	
	Fragmentation	Support configuration of the Fragmentation Threshold	
	WLAN Settings	Support enabling or disabling of each WLAN SSID service	
		Support configuration of different Authentication and Encryption methods for each WLAN SSID	
		Allow special characters and space character in SSID	
	Session Management	Support Idle Timeout (client session is disconnected if there is no packet detected for specific duration)	
		Support configuration of Max Associated# of Clients for a radio/WLAN(SSID)	
		Support Session Termination in case of wireless link disconnection	
Security	Attack	Session for System management should be maintained even in overloaded situation	
		System is not affected by TCP Syn Attack	
		System is not affected by TCP Port Scan Attack	
	Wi-Fi Security	Support WPA/WPA2 - PSK(Personal) mode	
		Support WPA/WPA2 - 1x(Enterprise) mode	
		Support WPA/ WPA2 Both Mode and TKIP/AES Both Mode	
	Encryption	Support Static/Dynamic WEP 64/ 128bit Encryption	
		Support Key Index 1~4 in Static WEP(including 128bit)	
		Support WPA-TKIP/WPA-AES(or Both)	
		Support WPA2-AES(Do not support TKIP in WPA2 anymore)	Wi-Fi Certification
		Support WPA Broadcast Key Update(Group Key Renewal)	
		Support entering of WEP and WPA Keys in both ASCII and hex mode	
		Allow special characters and space character for encryption key	

		Support key length checking during key input(in ASCII and Hex mode)	
	Authentication	Open mode Authentication	
		Shared Authentication mode	
		Support Hostapd features(Authenticator)	
		Support configuration of External Authentication server(ip, port, shared secret)	
		Selecting Local/External Authentication server	
		Support configuration of Local Authentication Server as Backup Server of External Authentication Server	
		Support RADIUS Client feature	Authentication only
		Informing Authentication Server of IP address for a station	
		Block station's internet connection without Authentication using IP and port assigned to a station	
Network	NAT	Support NAT services	L3 only
		Provide more than 32 Static-mapping table for easy Application Service	Port Forwarding
		Packet Processing Performance of NAT/Bridge - NAT : 50% performance compared to wireless L2 performance - Bridge : 150Mbps(2x2), 220M(3x3)	
		Support ALG(Application Level Gateway) for applications in stations	Support FTP/TFTP/PPTP By default (configuration of ALG Not Supported)
		Support Firewall for internet PING, Trace route and Attack Pattern((SYN Flooding, IP Spoofing, Smurf Attack, Ping of Death, DoS ...) Support enabling or disabling of Firewall	
		Support Packet Filtering	L3 only
		Support ALG or Pass-through for VPN Traffic using PPTP and IPSec	AP does not support IPsec and PPTP itself (Station)
		Support ACL for each WLAN SSID	L3 only
	IP Assign	Support configuration of DHCP or Static IP for WAN	
		Support DHCP Client/Server	Proxy and Relay Not

			Supported
		Support configuration of DHCP Pool for Private Network (Default IP Range for DHCP Pool, Subnet Mask, Default Gateway and DNS Server for Private Network are Configured during Production)	- 1 DHCP Pool - Support DHCP only in L3(NAT)
		C-Class IP addresses are assigned for Private Network	
		Support Resetting WLAN I/F to re-assign IP address to connected stations if IP assign policy is changed for wireless station	
QoS	Settings	Support configuration of QoS Using the Web-Browser Interface	
	QoS Mapping	Support classification and scheduling by DSCP, ToS field in Packets	
	WMM	Support WMM-EDCF feature for WLAN QoS	
		Support configuration of WMM QoS Category Mapping Polices for WLAN Traffic	
		WLAN WMM Settings are applied to all WLAN SSID equally	
		Support enabling or disabling of WMM for a WLAN SSID	
		Support Adjusting Radio Access Category	
Operation & Management	WEB Browser	Support configuration of and monitoring of AP using the Web-Browser Interface	
		Support configuration of WEB Server Port	Default HTTP(80), HTTPS(443)
	Accounts	Preventing Unauthorized WEB Connection using Account Password	14/3 : 1-ID/PW (1-Session), '14/5 : 3-ID/PW (1-Session)
	CLI	Provide AP CLI command	
	SSH	Support Secure Shell Connection	
	Time	Support System Clock Synchronization using NTP	Not support Manual Clock Settings
		Support configuration of Time Zone	
		Display Date and Time information (WEB)	
	Logging	Support System Message Logging	
		Support Logging to Remote Syslog Server, Support disabling/enabling Logging to	

		Remote Server	
		Support console severity settings	
		Support remote syslog server severity settings	
		Support Monitoring MAC, IP, Duration, Current Data Traffic Information for Connected Station	WEB or CLI
	Upgrade	Support FTP Client feature	
		Support upgrading firmware image using FTP	
		Support configuration of FTP server	
		Support configuration of firmware version and firmware file for upgrading	
		Upgrading Firmware Image Using WEB Browser interface	
		Support changing mode between Managed Mode AP and Standalone Mode AP	One Package
	Configuration	Support importing/exporting of system configuration	
		Support clearing system configuration	
		Support saving system configuration	
	Initialization	Support for Factory Reset feature	
Samsung Unique Feature	Samsung Unique Feature	Air Equalizer Feature	Enable / Disable
		VoIP Optimization Feature	Enable / Disable
		VoIP Uplink Traffic Shaping (IUTS) Feature	Enable / Disable
		Intelligent Beam Selectable Antenna(IBSA, Multi-Antenna)	Enable / Disable

6.2.1.4 Electrical Specifications

LAN Signal Specification

[10 BASE-T]

Item	Specifications
Transfer rate	10 Mbits/s ±50 ppm
Transmission code	Manchester coding
Standard specifications	IEEE 802.3
Access control method	CSMA/CD
Transmission media	UTP (Unshielded Twisted Pair) CAT3, CAT4, CAT5, STP (Shielded Twisted Pair)
Number of UTP pairs	2 pairs
Characteristic resistance	100 Ω
Cable thickness	Diameter: 0.51 mm (24 AWG), outer diameter: 5 mm

[100 BASE-TX]

Item	Specifications
Transfer rate	100 Mbits/s ±50 ppm
Transmission code	4B/5B + MLT-3
Standard specifications	IEEE 802.3u
Access control method	CSMA/CD
Transmission media	UTP CAT5, STP
Number of UTP pairs	2 pairs
Characteristic resistance	100 Ω
Cable thickness	Diameter: 0.51 mm (24 AWG), outer diameter: 6 mm

[1000 BASE-TX]

Item	Specifications
Transfer rate	1000 Mbits/s
Transmission code	8B1Q4
Standard specifications	IEEE 802.3ab
Access control method	CSMA/CD
Transmission media	UTP CAT5 (maximum transmission distance: 100 m)
Number of UTP pairs	4 pairs
Characteristic resistance	100 Ω
Cable thickness	Diameter: 0.51 mm (24 AWG), outer diameter: 6 mm

WLAN Signal Specification

[802.11a]

Item	Specifications
Wireless connection type	CSMA/CA
Frequency	5.15~5.825 GHz ISM band
Channel transmission output	20 dBm
Reception sensitivity	- At the 54 Mbps Mode, -79 dBm or less - At the 6 Mbps Mode, -93 dBm or less
Standard specifications	IEEE 802.11a

[802.11b]

Item	Specifications
Wireless connection type	CSMA/CA
Frequency	2.412~2.483 GHz ISM band
Channel transmission output	20 dBm
Reception sensitivity	At the 11 Mbps Mode, -89 dBm or less
Standard specifications	IEEE 802.11b

[802.11g]

Item	Specifications
Wireless connection type	CSMA/CA
Frequency	2.412~2.483 GHz ISM band
Channel transmission output	20 dBm
Reception sensitivity	- At the 54 Mbps Mode, -78 dBm or less - At the 6 Mbps Mode, -92 dBm or less
Standard specifications	IEEE 802.11g

[802.11n]

Item	WEA302i/WEA301	WEA303i	WEA303e
Wireless connection type	CSMA/CA		
Frequency	- g/n: 2.412~2.483 GHz ISM band - a/n: 5.150~5.825 GHz ISM band		
Channel transmission output	20 dBm		
Reception sensitivity	- MCS0 (802.11g/n): -92 dBm or less - MCS7 (802.11g/n): -74 dBm or less - MCS0 (802.11a/n): -93 dBm or less		

	- MCS7 (802.11a/n): -75 dBm or less	
No. of supporting channels	- 20 MHz bandwidth: 13 - 40 MHz bandwidth: 9	
Antenna	2Tx2R MIMO supported	3Tx3R MIMO supported
Standard specifications	IEEE 802.11n	

[802.11ac]-WEA400 Series

Item	Specifications
Wireless connection type	CSMA/CA
Frequency	ac: 5.150 to 5.825 GHz ISM band
Channel transmission output	23 dBm
Receiving sensitivity	- MCS8 (802.11ac, VHT20): -65 dBm or less - MCS8 (802.11ac, VHT40): -63 dBm or less - MCS9 (802.11ac, VHT40): -61 dBm or less - MCS8 (802.11ac, VHT80): -60 dBm or less - MCS9 (802.11ac, VHT80): -58 dBm or less
Standard specifications	IEEE 802.11ac

6.2.1.5 Power Specification

The WE AP is operated with PoE input power. The WE AP receives -48 to 57 V from the PoE Switch (PSE) and supports the PoE specifications listed below. Optional AC/DC adaptor can be used.

- WEA300 Series PoE supporting specification: IEEE 802.3af
- WEA300 Series AC/DC adaptor supporting specification: 12 V/2 A
- WEA400 Series PoE supporting specification: IEEE 802.3at
- WEA400 Series AC/DC adaptor supporting specification: 48 V/0.75 A

6.3 Integrated Antenna Descriptions

This section will explain the details characteristics for the Samsung WE Antennas.

6.3.1 Model Descriptions

Model	Description	Gain
WEA 302i (2X2) Integrated antenna	10 low profile antennas integrated in an AP. Four antennas for 2.4GHz, four antennas for 5 GHz and two dual band antennas for monitoring wireless channel. Designed for IBSA® which provides higher performance in various wireless channel environments.	**Service ANT:** 4 dBi@ 2.4 GHz 5.5 dBi@ 5 GHz **Monitoring ANT:** 3 dBi@ 2.4 GHz 4.5 dBi@ 5 GHz
WEA 303i (3X3) Integrated antenna	14 low profile antennas integrated in an AP. Six antennas for 2.4GHz, Six antennas for 5 GHz and two dual band antennas for monitoring wireless channel. Designed for IBSA® which provides higher performance in various wireless channel environments.	**Service ANT:** 3.5 dBi@ 2.4 GHz 5 dBi@ 5 GHz **Monitoring ANT:** 2.5 dBi@ 2.4 GHz 4.5dBi@ 5 GHz
WEA 403i (3X3) Integrated antenna	15 low profile antennas integrated in an AP. Six antennas for 2.4GHz, Six antennas for 5 GHz and Three dual band antennas for monitoring wireless channel. Designed for 802.11ac and IBSA® which provides higher performance and security in various wireless channel environments.	**Service ANT:** 4 dBi@ 2.4 GHz 6 dBi@ 5 GHz **Monitoring ANT:** 5.5 dBi@ 2.4 GHz 6.5dBi@ 5 GHz
WEA 412i (2X2) Integrated antenna	4 low profile antennas integrated in an AP. Two antennas for 2.4GHz, two antennas for 5 GHz wireless channel. Designed for 802.11ac and 2x2 MIMO which provides high quality services.	**Service ANT:** 3 dBi@ 2.4 GHz 5.5 dBi@ 5 GHz

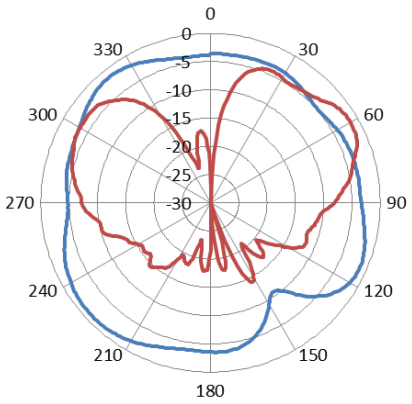
6.3.2 Radiation Patterns

WEA 302i Integrated Antenna

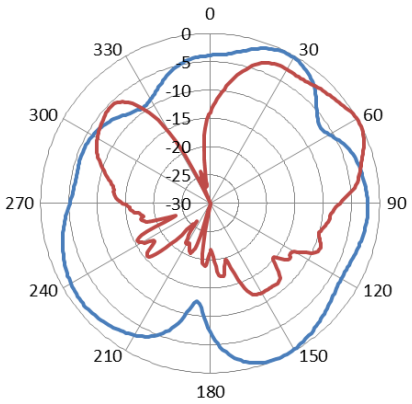
Features/Specifications		
Frequencies [MHz]	2,400-2,483/4,905-5,845	
Configuration	4 of 2.4GHz, 4 of 5GHz 2 of dual band	
Gain [dBi]	Service ANT: 4 @2.4GHz/ 5.5 @5GHz Monitoring ANT: 3 @2.4GHz/ 4.5 @5GHz	
VSWR (max)	1.8 @2.4GHz/ 2 @5GHz	
Polarization	Linear (Vertical)	
Antenna Type	Omni-directional	
Mounting	Integrated	

Radiation Patterns

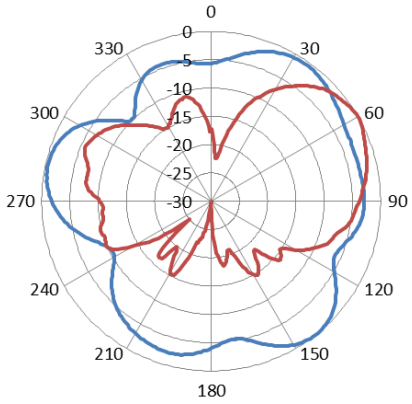
Service A1 5GHz



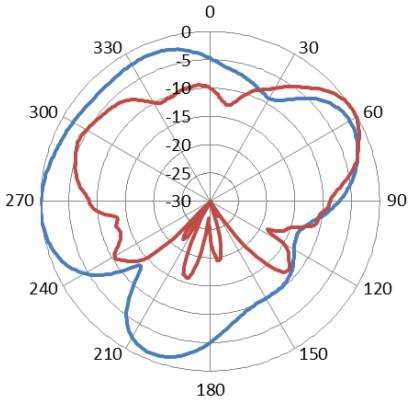
Service A2 5GHz



Service A3 5GHz

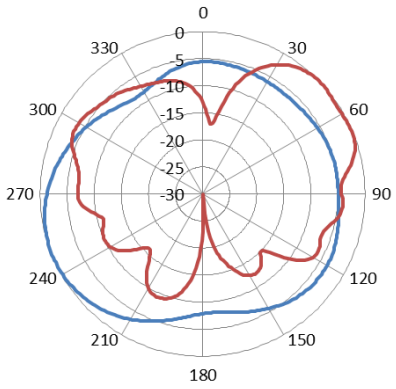


Service A4 5GHz



Service A5 2.4GHz

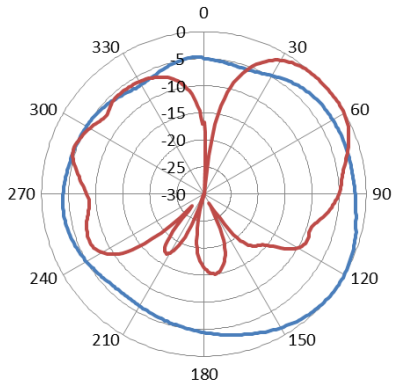
Service A6 2.4GHz



WEA302i Service A5 2.4GHz

Azimuth
Elevation

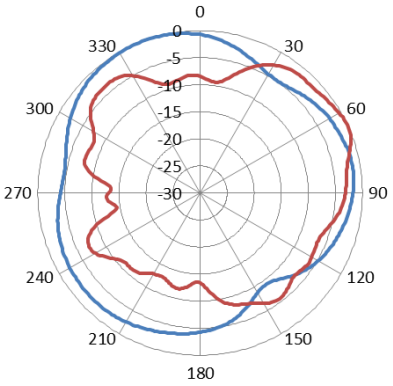
Service A7 2.4GHz



WEA302i Service A6 2.4GHz

Azimuth
Elevation

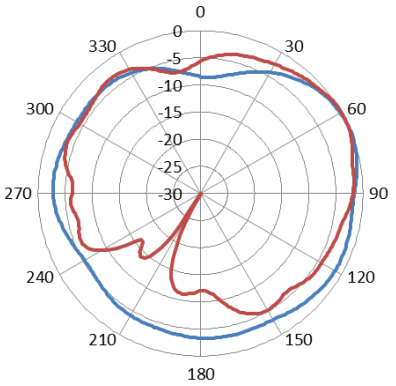
Service A8 2.4GHz



WEA302i Service A7 2.4GHz

Azimuth
Elevation

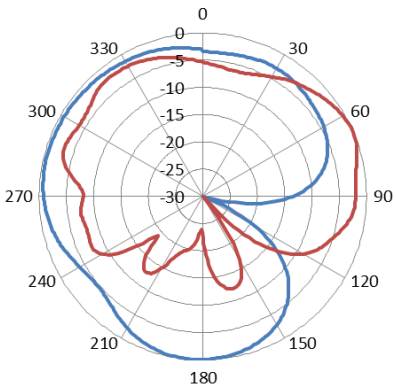
Monitoring M1 2.4GHz



WEA302i Service A8 2.4GHz

Azimuth
Elevation

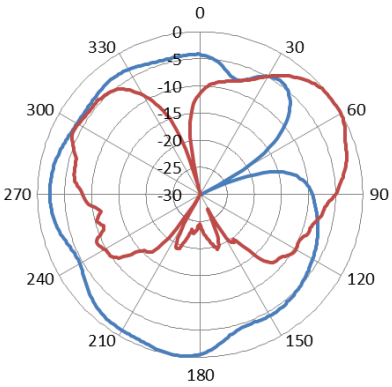
Monitoring M1 5GHz



WEA302i Monitoring M1 2.4GHz

Azimuth
Elevation

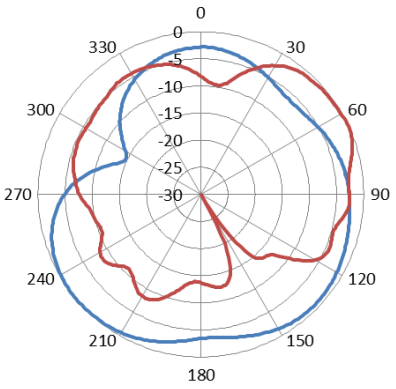
Monitoring M2 2.4GHz



WEA302i Monitoring M1 5GHz

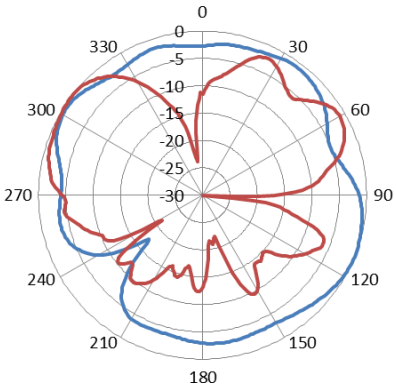
Azimuth
Elevation

Monitoring M2 5GHz



WEA302i Monitoring M2 2.4GHz

Azimuth
Elevation



WEA302i Monitoring M2 5GHz

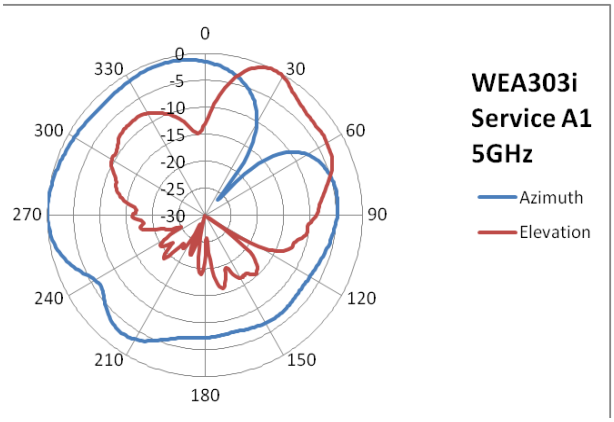
Azimuth
Elevation

WEA 303i Integrated Antenna

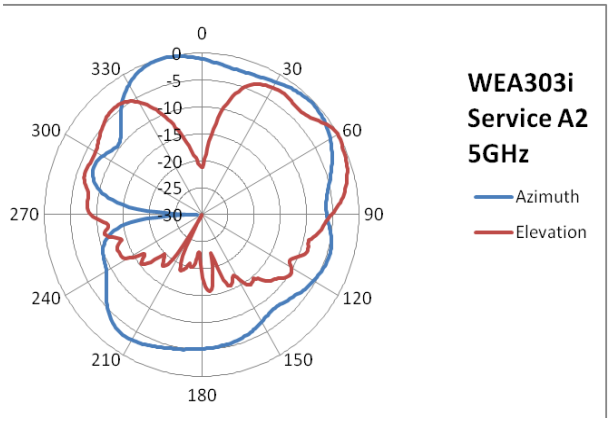
Features/Specifications		
Frequencies [MHz]	2,400-2,483/4,905-5,845	
Configuration	6 of 2.4GHz, 6 of 5GHz 2 of dual band	
Gain [dBi]	Service ANT: 3.5 @2.4GHz/ 5 @5GHz Monitoring ANT: 2.5 @2.4GHz/4.5 @5GHz	
VSWR (max)	1.8 @2.4GHz/ 2 @5GHz	
Polarization	Linear (Vertical)	
Antenna Type	Omni-directional	
Mounting	Integrated	

Radiation Patterns

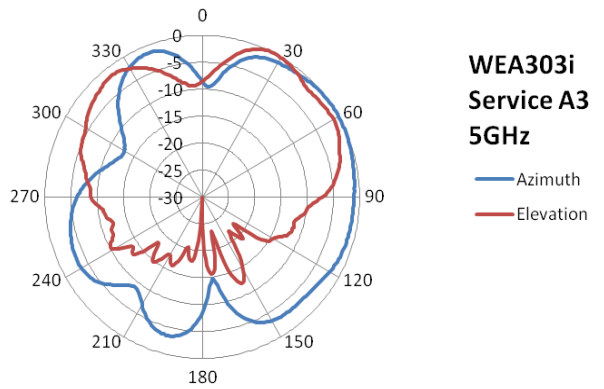
Service A1 5GHz



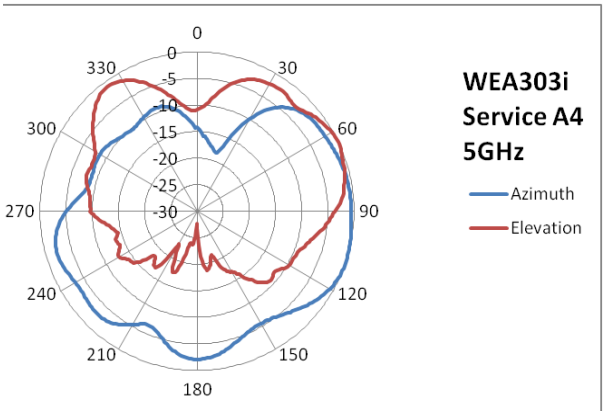
Service A2 5GHz



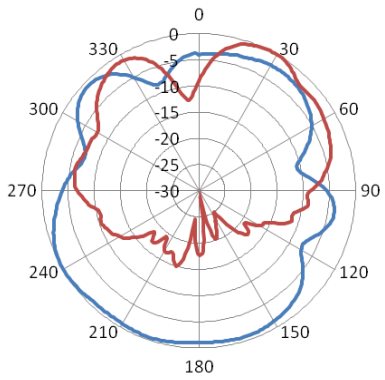
Service A3 5GHz



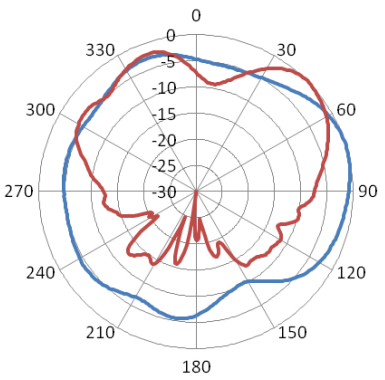
Service A4 5GHz



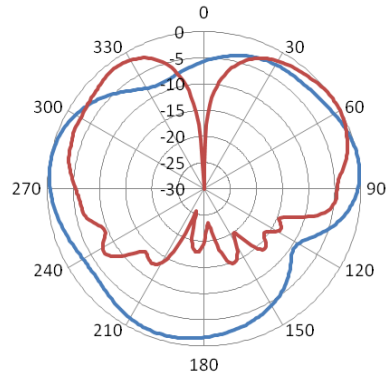
Service A5 5GHz



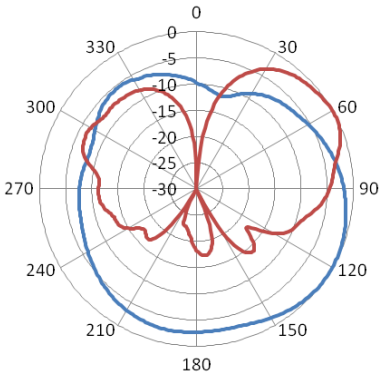
Service A6 5GHz



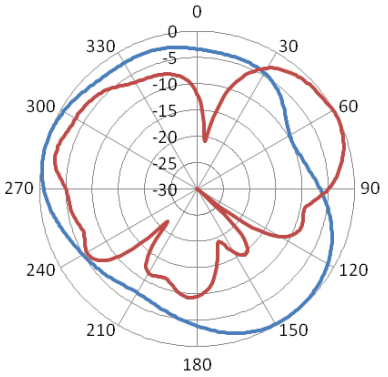
Service A7 2.4GHz



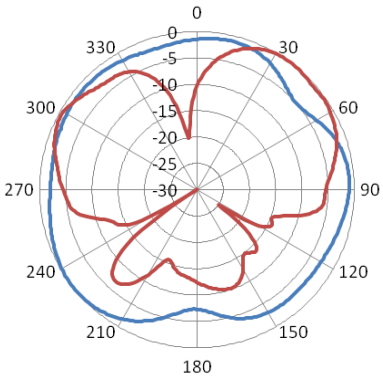
Service A8 2.4GHz



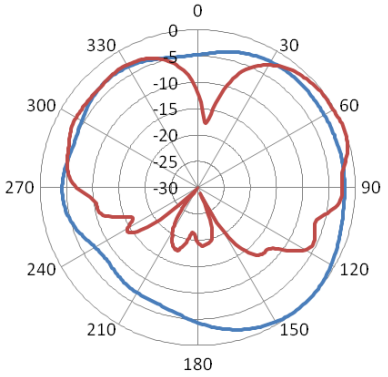
Service A9 2.4GHz



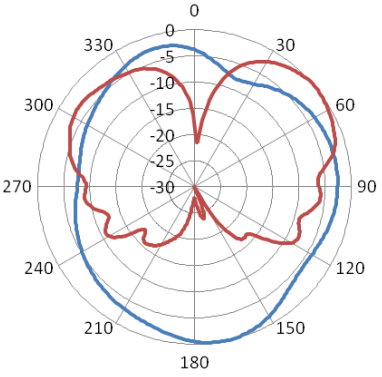
Service A10 2.4GHz



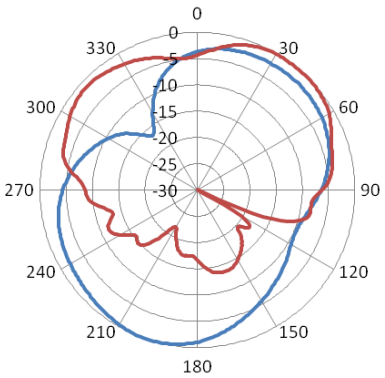
Service A11 2.4GHz



Service A12 2.4GHz



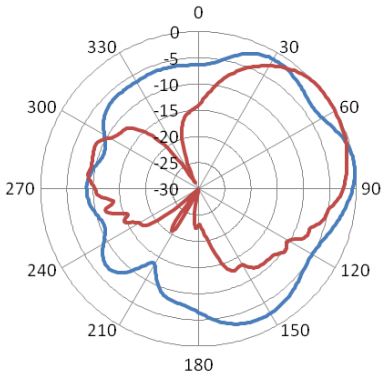
Monitoring M1 2.4GHz



WEA303i Monitoring M1 2.4GHz

Azimuth
Elevation

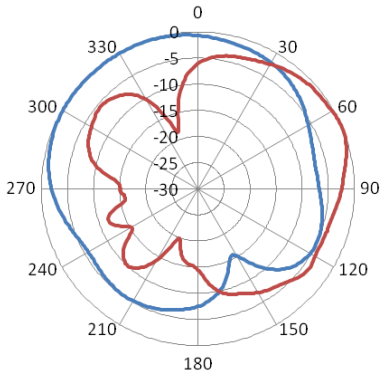
Monitoring M1 5GHz



WEA303i Monitoring M1 5GHz

Azimuth
Elevation

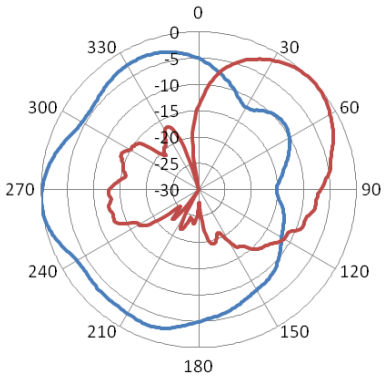
Monitoring M2 2.4GHz



WEA303i Monitoring M2 2.4GHz

Azimuth
Elevation

Monitoring M2 5GHz



WEA303i Monitoring M2 5GHz

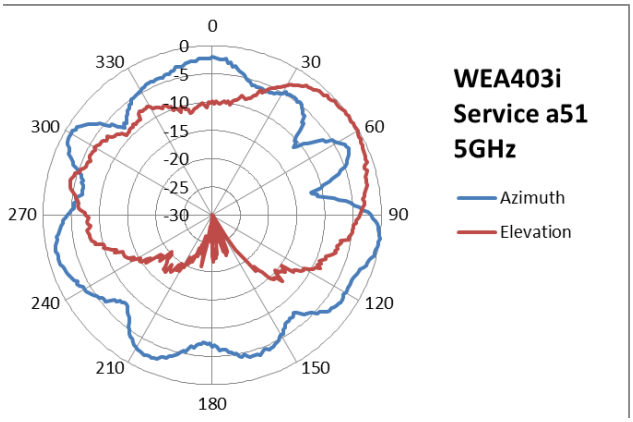
Azimuth
Elevation

WEA 403i Integrated Antenna

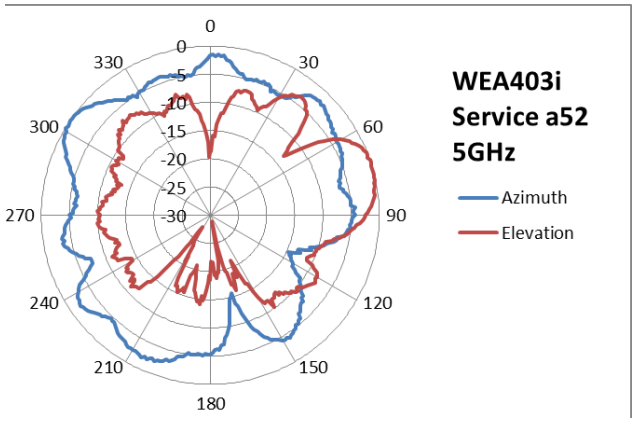
Features/Specifications		
Frequencies [MHz]	2,400-2,483/4,905-5,845	
Configuration	6 of 2.4GHz, 6 of 5GHz 3 of dual band	
Gain [dBi]	Service ANT: 4 @2.4GHz/ 6 @5GHz Monitoring ANT: 5.5 @2.4GHz/ 6.5 @5GHz	
VSWR (max)	2.2 @2.4GHz/ 2.2 @5GHz	
Polarization	Linear (Vertical)	
Antenna Type	Omni-directional	
Mounting	Integrated	

Radiation Patterns

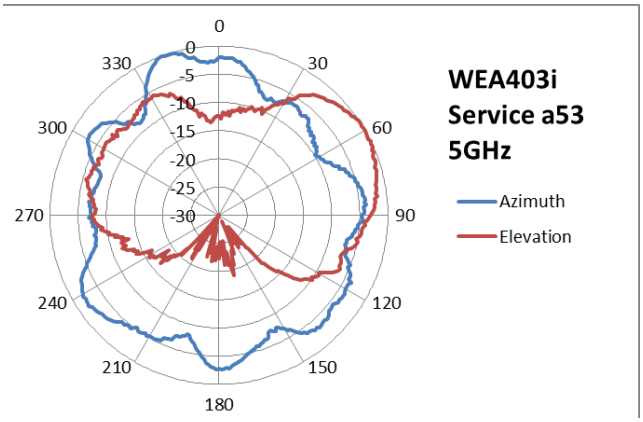
Service a51 5GHz



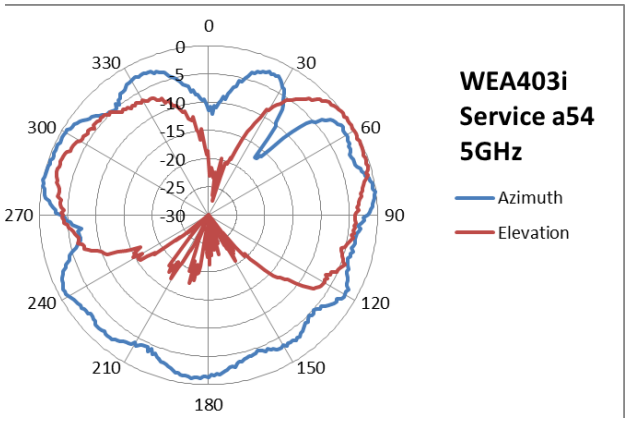
Service a52 5GHz



Service a53 5GHz

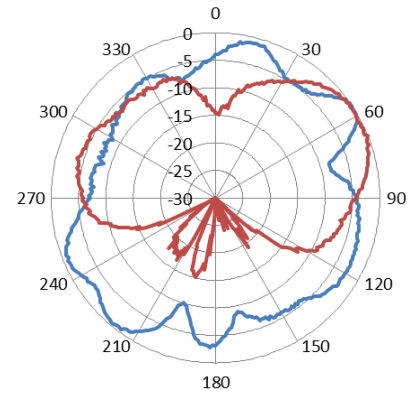


Service a54 5GHz

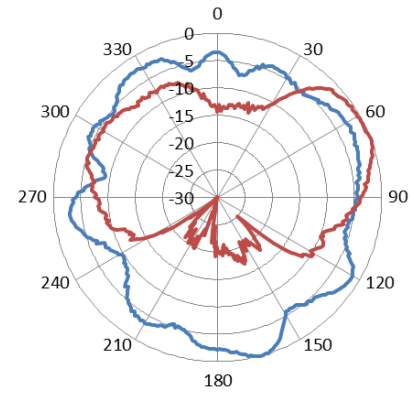


Service a55 5GHz

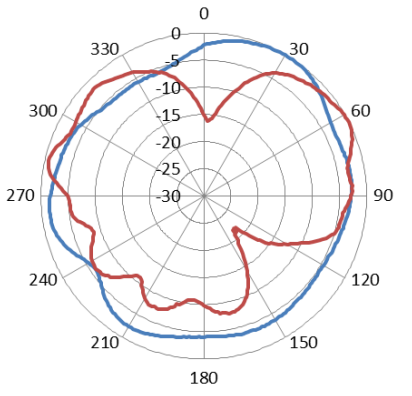
Service a56 5GHz



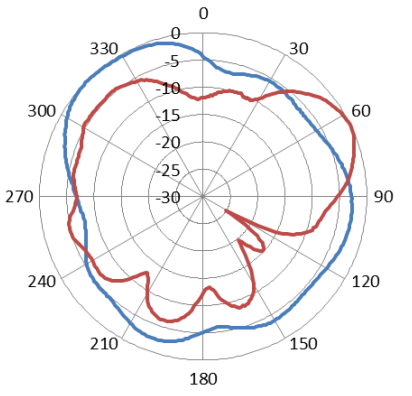
Service A21 2.4GHz



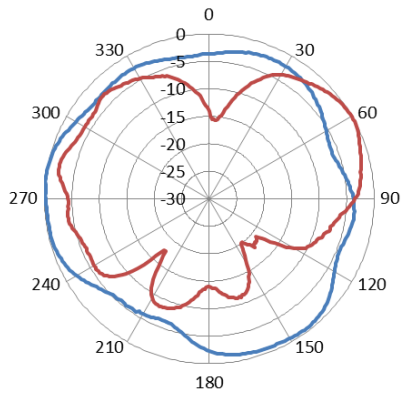
Service A22 2.4GHz



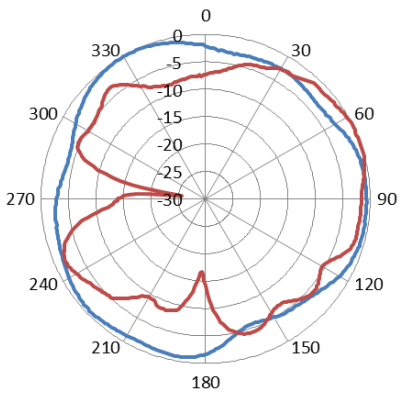
Service A23 2.4GHz



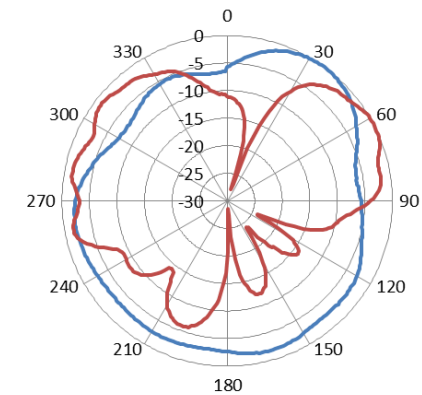
Service A24 2.4GHz



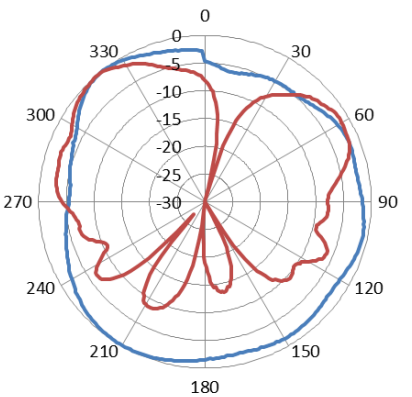
Service A25 2.4GHz



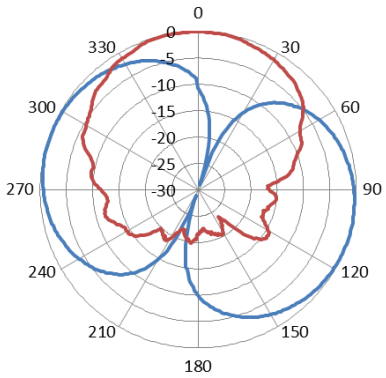
Service A26 2.4GHz



Monitoring M1 2.4GHz

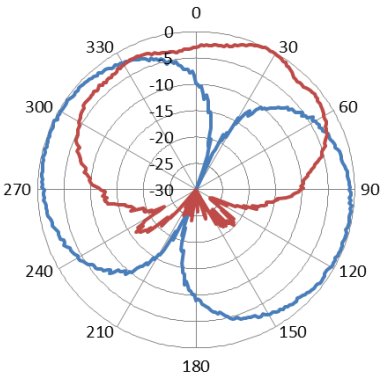


Monitoring M1 5GHz



WEA403i Monitoring M1 2.4GHz

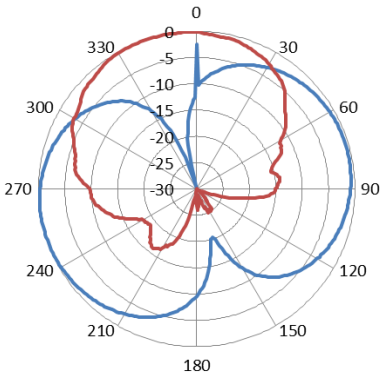
Azimuth
Elevation



WEA403i Monitoring M1 5GHz

Azimuth
Elevation

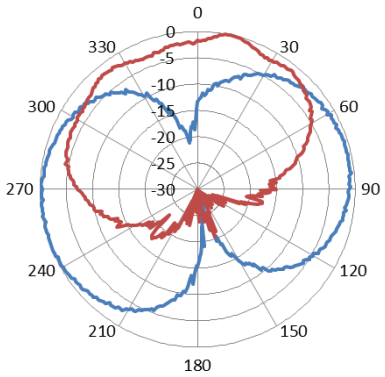
Monitoring M2 2.4GHz



WEA403i Monitoring M2 2.4GHz

Azimuth
Elevation

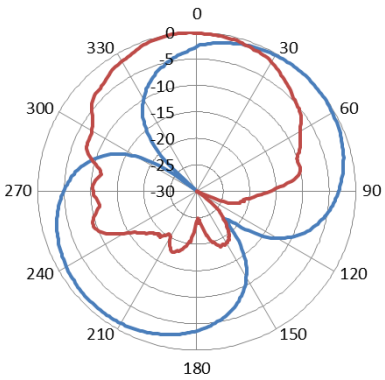
Monitoring M2 5GHz



WEA403i Monitoring M2 5GHz

Azimuth
Elevation

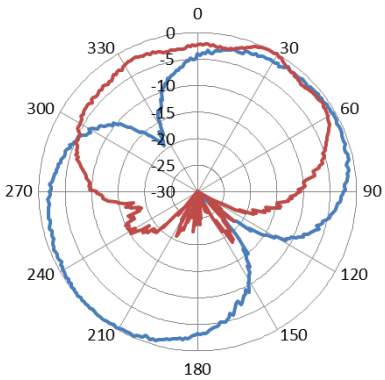
Monitoring M3 2.4GHz



WEA403i Monitoring M3 2.4GHz

Azimuth
Elevation

Monitoring M3 5GHz



WEA403i Monitoring M3 5GHz

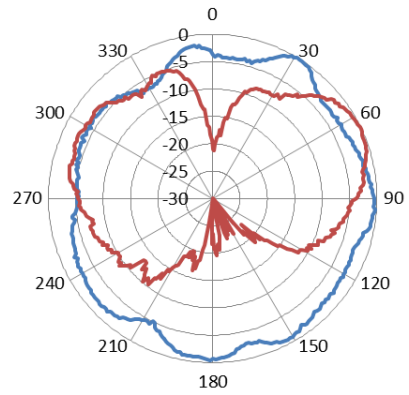
Azimuth
Elevation

WEA 412i Integrated Antenna

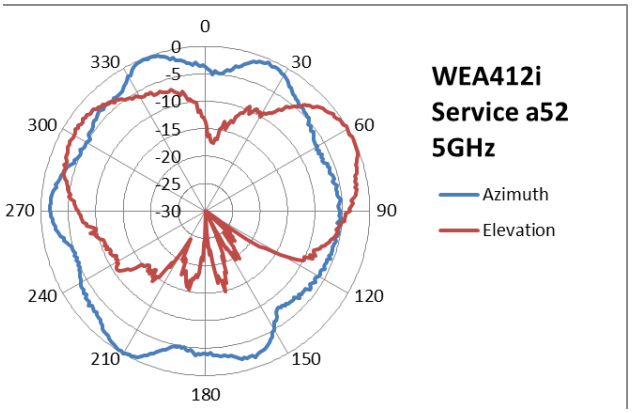
Features/Specifications	
Frequencies [MHz]	2,400-2,483/4,905-5,845
Configuration	2 of 2.4GHz, 2 of 5GHz
Gain [dBi]	3 @2.4GHz/ 5.5 @5GHz
VSWR (max)	2.2 @2.4GHz & 5GHz
Polarization	Linear (Vertical)
Antenna Type	Omni-directional
Mounting	Integrated

Radiation Patterns

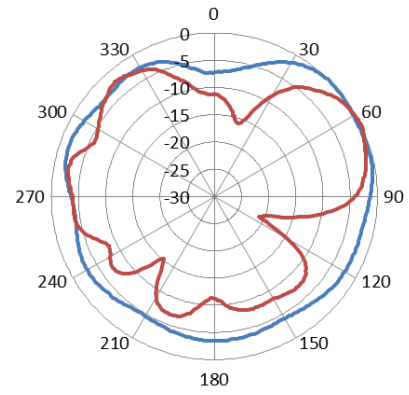
Service a51 5GHz



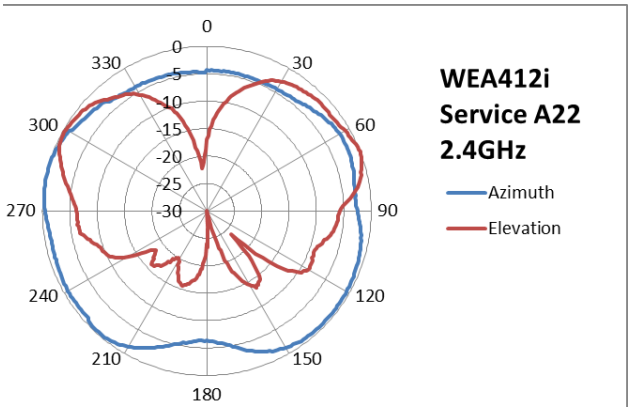
Service a52 5GHz



Service A21 2.4GHz



Service A22 2.4GHz



6.4 Hardware Features

The hardware of WE AP has the following features:

Safety

The materials and parts used in the hardware are mechanically robust and satisfy mechanical and electrical characteristics required for the telecommunication system.

- The device structure is a stabilized and robust structure of the die casting or press assembly by complying with the industrial standards.
- It does not generate toxic or corrosive gases that may give harm to the human body or give influence over the system operation.
- It was made of the materials considering the EMI specifications.
- To prevent the device from being damaged due to overvoltage, it has a safety device.

Power Structure

The power supply device of the hardware accepts two structures.

- The power supply is made in the PoE method through the Ethernet.
- If it is difficult to use PoE, it is possible to use the external 220 V power and the external AC/DC adaptor to supply the power.

Maintenance

It is designed to safely perform the maintenance activities.

- The device structure is designed to maintain the enough strength. Each port connected to the outside is firmly protected as a device structure to make it difficult for a user other than the operator or the staff at the installation to the ceiling or wall to remove freely.
- There is a LED to help the operator to identify the fault status of the system easily.
- The electronic devices are designed not to be damaged by the external environment during installation or maintenance.

Fire Resistance and Exothermal Process

The fire-resistant materials and parts are used against fire. In addition, it is designed to prevent heat generated from the inside of the system from being influenced over the performance.

- The special heating part in the hardware is blocked not to give any influence over the component parts sensitive to temperature.
- The parts installed to the module are placed in consideration of heat distribution.

6.4.1 Total Configuration

The WE AP product is composed of the front part where there are a LED and internal and external antennas and the rear part where various ports and interfaces exist.

WE AP Front

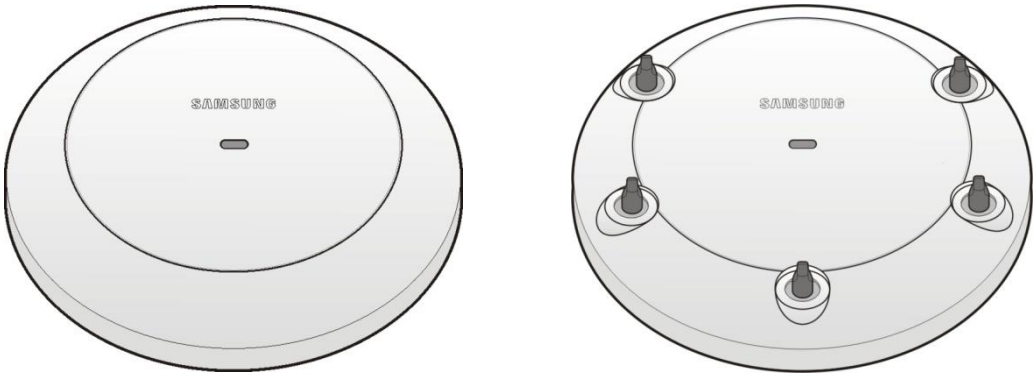


Figure 14. WE AP Front

WEA 300 Series Rear

Figure 15. WEA 300 Series Rear

WEA 400 Series Rear

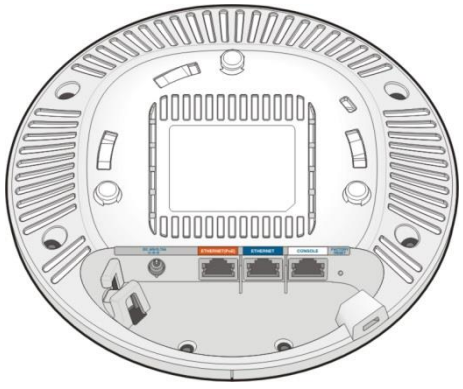


Figure 16. WEA 400 Series Rear

6.4.2 Hardware Structure

The WE AP is composed of a digital unit (DU) part and a radio unit (RU) part in the functional aspect and it is implemented in one board type in the hardware aspect.

DU Part

The DU part has a main CPU that controls the whole WE AP and does a role in recognizing the RU part and managing the download of the software. With the PoE function, it causes the -48 V power supplied through the Ethernet connected to the outside to be converted and then be used as the power supply for the DU part and the RU part.

RU Part

The RU part is controlled by the DU part. The RU part has 2.4 GHz and 5 GHz WLAN blocks for general service. For the 2.4/5 GHz bandwidth, the RU part includes an RF monitoring function that supports 2 × 2, 3 × 3 IEEE 802.11a/b/g/n/ac. (Supporting specifications vary by model.)
The RU part of WE AP supports two TX/RX radio structures and three TX/RX radio structures with 2.4 GHz and 5 GHz depending on the HW configuration and also supports each of 2 × 2 and 3 x 3 MIMO.

6.4.3 External Interface

The external interface is as shown below.

WE AP Front

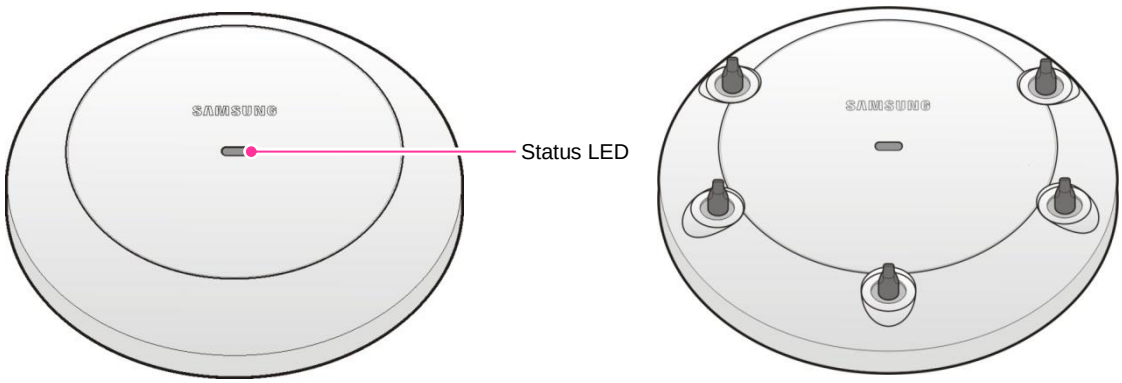


Figure 17. Front configuration of WE AP

WEA300 Series Rear

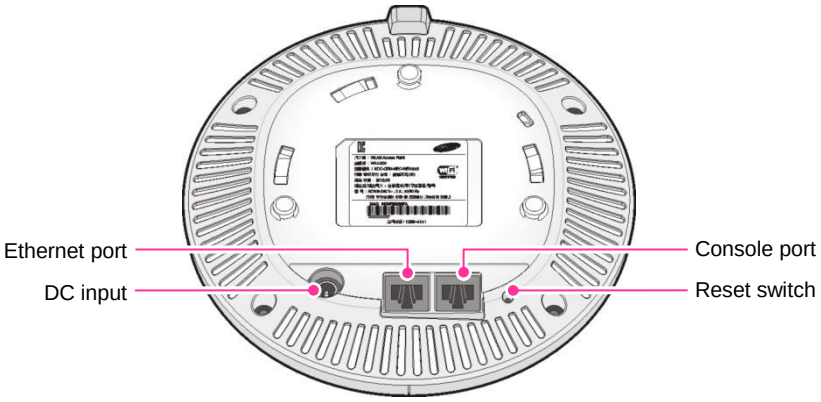


Figure 18. WEA300 Series Interface

WEA400 Series Rear

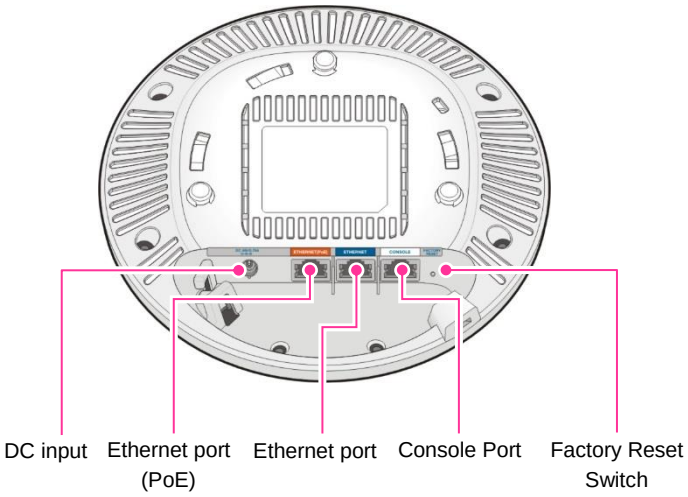


Figure 19. WEA400 Series Interface

Status LED

Category	LED State	Description
System starting status	Blue On	- Initial LED mode - Device initialization and testing
	Red On	Failure in booting (failure in device initialization)
Provisioning status	Red and Green Off in Turn	WEC8500 server connection in progress (Normal status of network link)
	Green Blinking	CAPWAP link connecting (Normal connection status of WEC8500 server)
Normal operating status	Green On	When there is no wireless terminal connected
	Blue On	When there is a wireless terminal connected
Upgrade	Blue Blinking	Software upgrade in progress
Fault status	Red Blinking	Abnormal network link (after disconnection or reconnection, the status of checking the link)
	Yellow Blinking	A collision of IP address occurring
	Violet Blinking	Failure in allocating dynamic IP address
	Green Blinking	Failure in checking the fixed IP
	Red and Blue Off in turn	Status of fault of wireless interface

Reset Switch

The reset switch can restart the WE AP externally to the WEA300 Series.

Factory Reset Switch

This switch can factory reset the WE AP externally to the WEA400 Series.

Console Port (RS232C)

A managing port that allows the operator of the WEA300/WEA400 Series to check and control the status of the WE AP.

Ethernet Port (with PoE)

The WEA300 Series supports the 1000 BASE-T Gigabit Ethernet and PoE IEEE 802.3af.
The WEA400 Series supports the 1000 BASE-T Gigabit Ethernet and PoE IEEE 802.3at.

Ethernet Port (without PoE)

The WEA400 Series supports the additional 1000 BASE-T Gigabit Ethernet 1 Port (for data only).

DC Input

A jack for optional DC power supply.
The WEA300 Series supports DC 12 V/2 A power supply as an option from outside.
The WEA400 Series supports DC 48 V/0.75 A power supply as an external option.

CHAPTER 7. System Service Scenario

This chapter explains the system building scenario and the using scenario of Samsung WE WLAN and introduces each feature.

7.1 Basic Configuration

To provide the wireless connection service by using the WLAN in the WE environment, WEC8500/WEC8050 is basically required to control WE WLAN AP to allow the terminal to connect to the network wirelessly and control them. In particular, the role of the controller is important to provide a function of quality guarantee and powerful security for various services in the enterprise environment. Besides, the WES server, the location server, etc. are required to provide the additional wireless application services. Because the WE environment requires various elements as such, it is necessary to organically and intuitively manage components through the WEM.

In addition, it may provide more convenient and more diverse mobile services for users by interoperating with IP application service servers such as authentication server, DHCP server or DNS server as basic network components included in the wired enterprise environment. As a typical example, there is a FMC service that offers the enterprise-class VoIP through the WLAN, and the wired and wireless integrated voice service there through.
The example of the service configuration by using the WE WLAN system is as shown in the figure below.

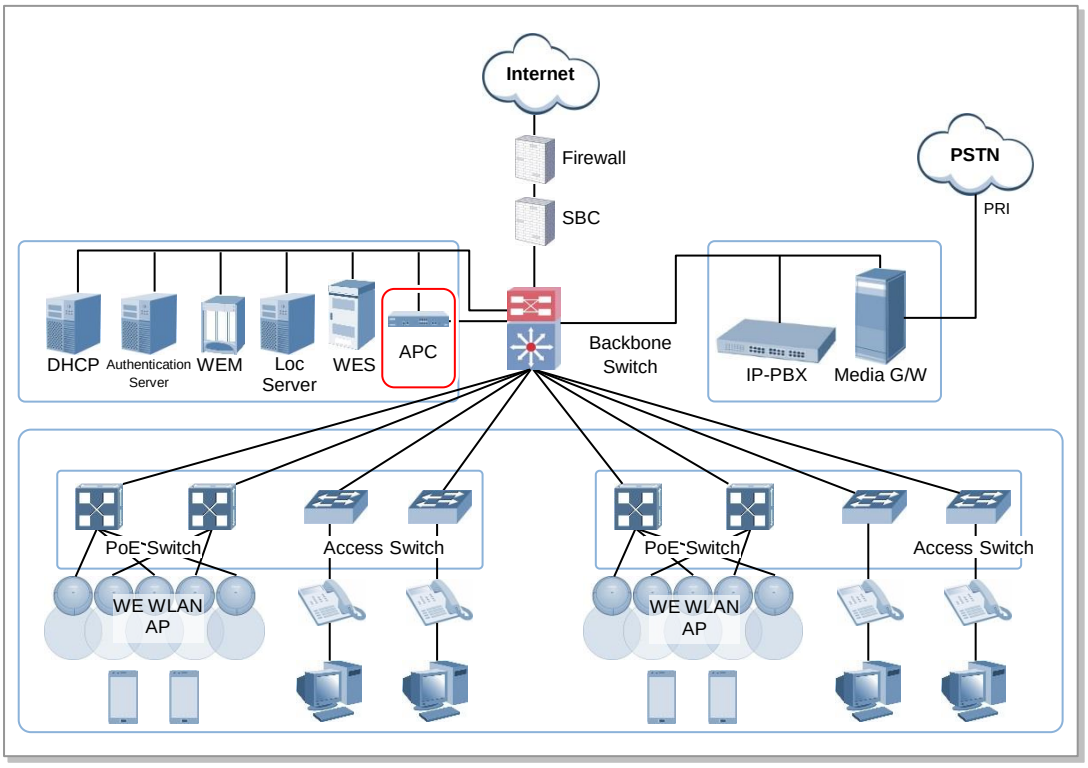


Figure 20. Basic Configuration of WE WLAN System

The basic configuration of the WE WLAN network is the centralized structure tunneling all wireless user traffics between the controller and WE WLAN AP. For the reason, the network information such as the subnet information allotted to wireless users depends on the setting of the backbone network connected to by controller. It provides the following advantages at the configuration and setting of the network.

- Installing the APC is a configuration of adding only APC in the data center or backbone network conventionally configured. Therefore, it may reduce the possibility of physical change in the core network.
  Besides, it is easy to design the separated wired and wireless networks with the boundary of the controller.
- It does not significantly change the network to install the WE WLAN AP.
  The AP installed in the user space is located to the various local network environments in the wide region. The new establishment or increased installation of the PoE switch will be inevitable, but the change in the local network configured already for the wired line user can be minimized.
- Because the controller relays the traffic of all users, it may restrict the influence by wireless line invader and it is easy to provide the differentiated service by user.

7.2 Multiple Configuration of WEC8500/WEC8050 for Redundancy

The role of the controller is very important to provide a function of quality guarantee and powerful security for various services in the WE environment. Accordingly, it is essential to secure the stability of the wireless network service to configure the APC to complement. The example of the service configuration is as shown in the figure below.

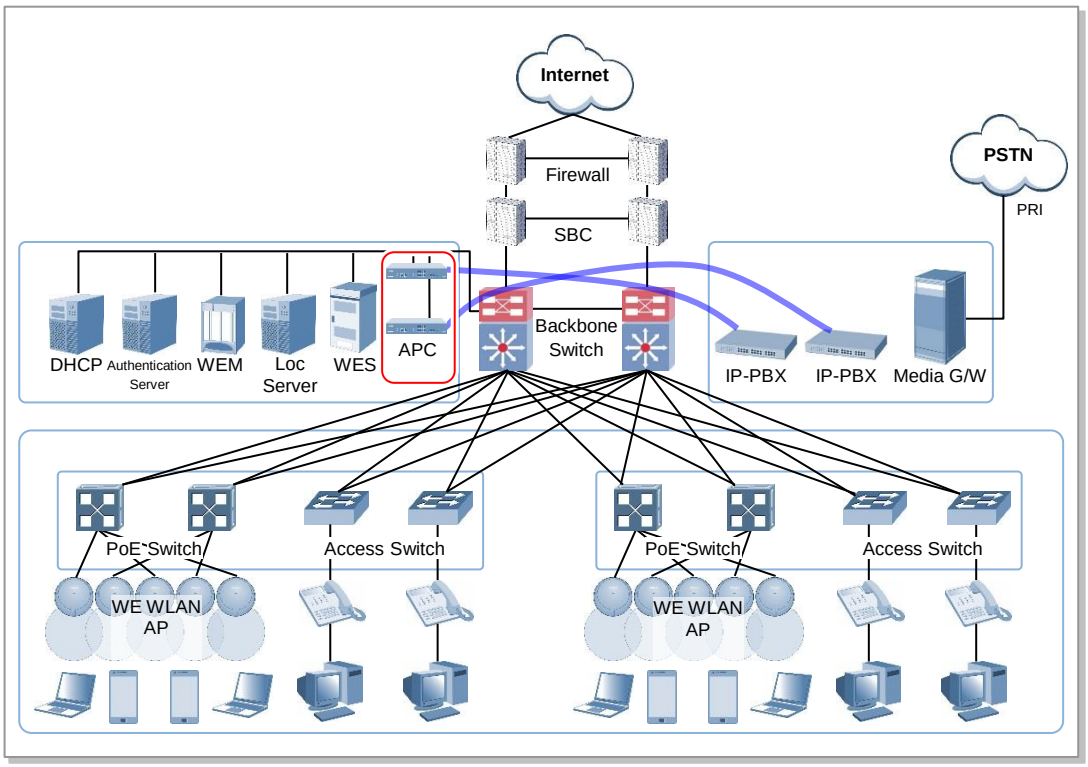


Figure 21. Configuration of WE WLAN System to Provide Redundancy

This method uses several APCs to minimize the service suspension and service consistency due to the disconnection of the controller.
Basically, for APC redundancy, one or more controllers must be installed in a same site. The method for configuring redundancy by using this can be largely divided into active-active, active-standby, and many-to-one configuration and it is possible to select which configuration will be used depending on the quantity of the available APCs and the redundancy level.

7.3 Clustering Configuration by Multiple WEC8500/WEC8050

The WE environment has various region sizes, user density, and number of users.
If it is possible to service only basically with one APC, it is possible to completely make the management in one APC and the complexity is not high in the aspect of network setting or management. In case of the acceptable capacity of one APC, the service must be made through several APCs. To implement the WE network in the environment where multiple wireless controllers are installed, the integrated management system and the user service must be provided through the clustering configuration among APCs. This allows the inter APC handover. By sharing mutual information through periodic information exchange among APCs configured as inter-clusters, it provides the service like a single APC. When several APCs are installed in one same site, two methods are available: distribution and centralization.


NOTE

Inter APC handover

The inter APC handover is a handover between APCs. It provides a function by using the clustering group, which means a virtual region. It is possible to tie up to 6 APCs in one group. The APC included in a specific group cannot be put in any other group. It provides the L3 handover and a handover at the move to an APC with a different subnet. The serving APC is called anchor APC, and the target APC is named a foreign APC. In the tunnel for control path and data traffic between APCs, its security is provided through IPSec. The inter APC handover provides a function both to a standard Wi-Fi handover and Samsung NC handover.

7.3.1 Configuration of Clustering Service in Distribution Type

The configuration of the cluster in a distribution type means a method for installing each APC respectively by building or local site depending on the capacity. If there is no backbone configuration integrated in the site or the network is separated by building, it may be selected and it is proper for the site made of several buildings locally far away.
If the seamless handover among APCs is unnecessary or there is few handover, it is favorable to configure in a separation shape for the performance of the wireless network.
The example of the service configuration is as shown in the figure below.

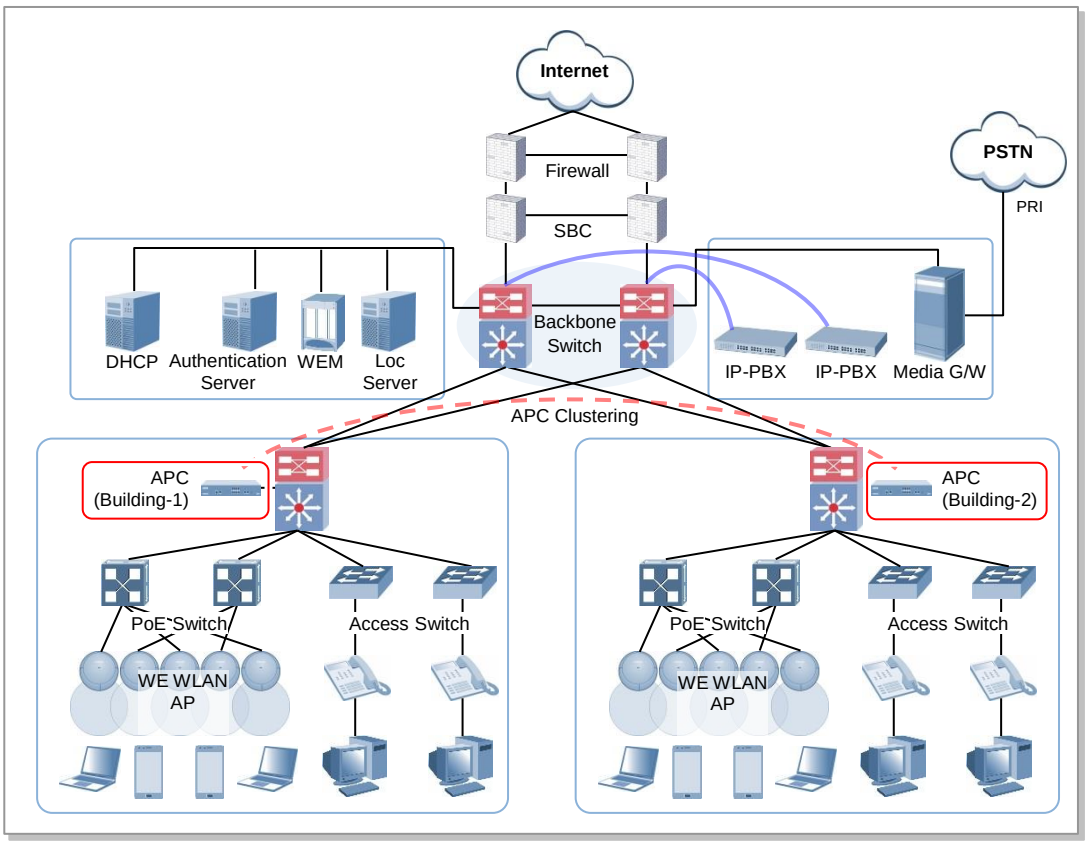


Figure 22. Configuration of WE WLAN System for Clustering Service in Distribution Type

7.3.2 Configuration of Clustering Service in Centralization Type

The cluster configuration in a centralization type is a method for collecting and installing all APCs in the site and if all networks in the site are configured in the center of backbone in the site, this may be selected.

This configuration is appropriate in a site consisting of several buildings that are locally neighboring or a large building with one or more APCs required for seamless handover services. If there is only one backbone network, it is a structure preferred even in the installation or management aspects thanks to the simple service configuration and favorably secured performance.

The example of the service configuration is as shown in the figure below.

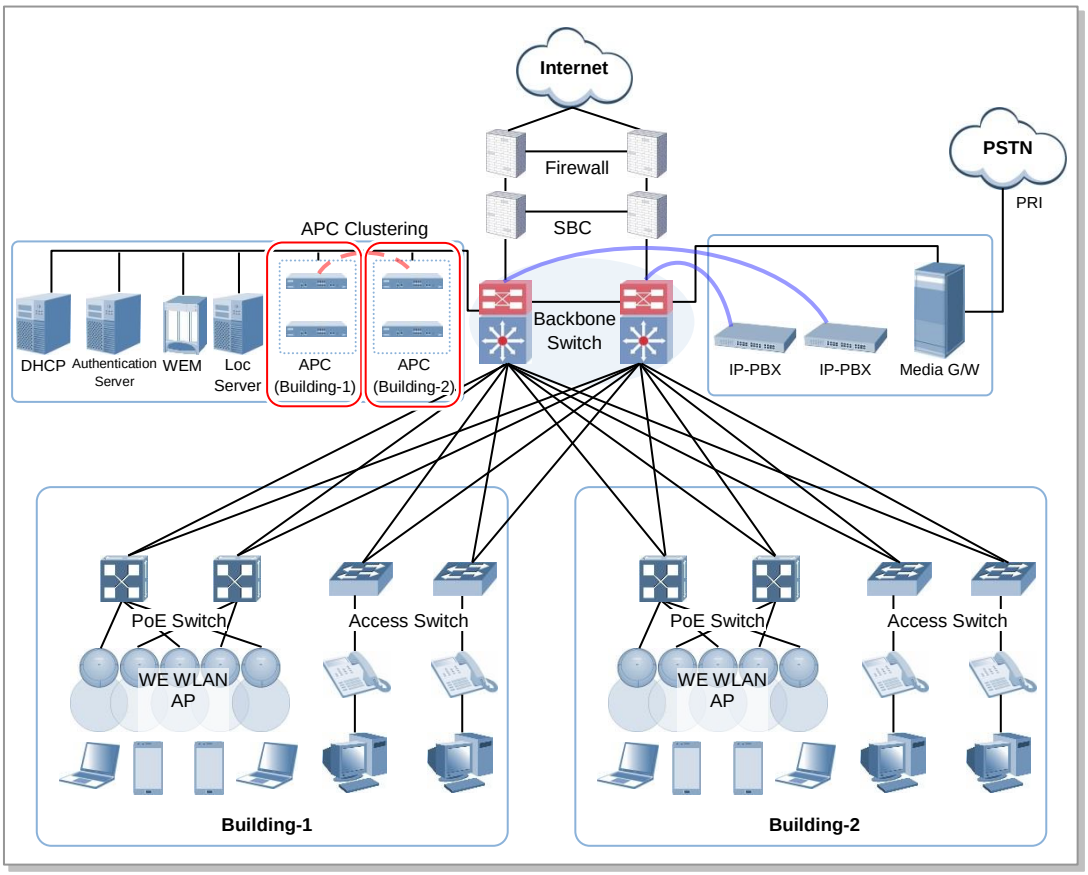


Figure 23. Configuration of WE WLAN System for Clustering Service in Centralization Type

7.4 Configuration of Multiple Sites with HQ and Branches

In the WE WLAN network configuration, there are many cases consisting of one headquarter and several branches.
In the case, the methods for configuring the network are divided into two ways:

- Hierarchical method: Installing APCs not only in the headquarter but also in the branches
- Remote AP method: Installing a APC only in the HQ and only WE WLAN APs in branches

The hierarchical method has an advantage that a different policy by branch may be applied, but it has a problem that many APCs with complicated management in the center and a low capacity must be installed.
Therefore, the remote AP method is mainly used. In the case, what is different from the structure such as the configuration of the basic WE WLAN is only that the WE WLAN AP installed in each branch is in the remote place.
It has the advantages that it is easy for the APC in the HQ to manage all WE WLAN APs under the same policy and it is low-cost.
The example of the service in the remote AP method is as shown in the figure below.

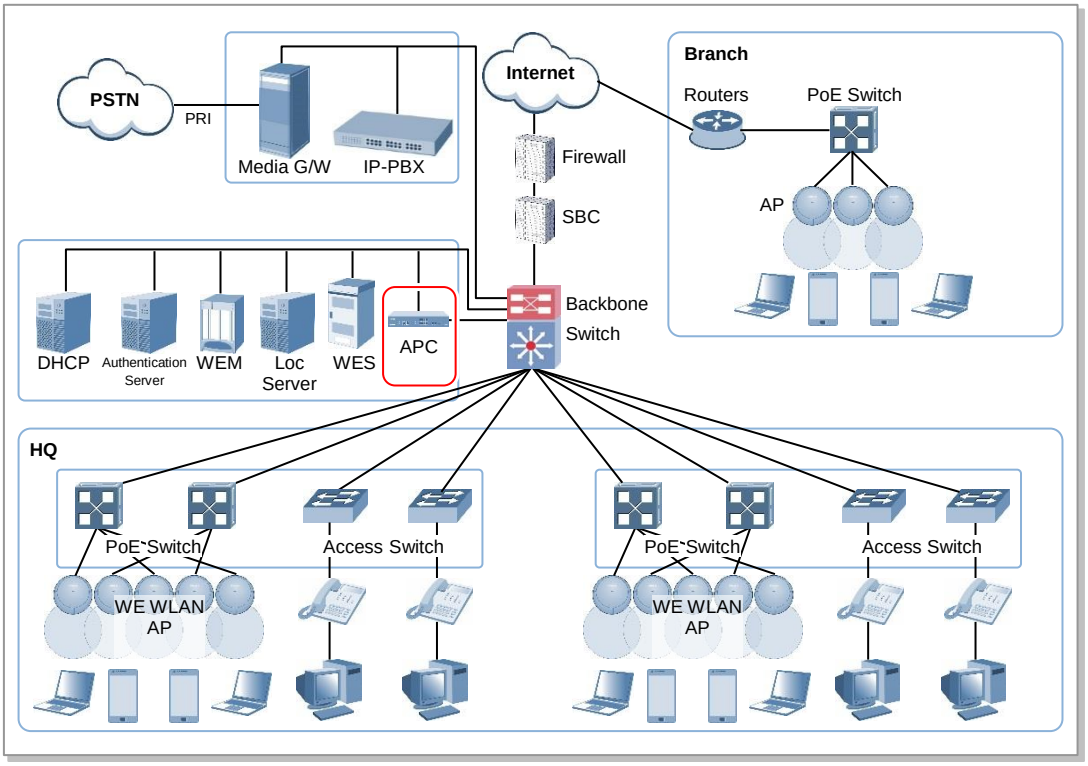


Figure 24. Configuration of WE WLAN System for Multiple Sites Composed of HQ and Branches

The APC installed in the HQ provides the WLAN service in the building of HQ and if there is a branch, the WLAN service will be provided for the remote WE WLAN AP installed in the branches.

In general, because a branch has few members, there are fewer APs to be installed by branch, but if there are many branches, the total quantity will be increased and the branches may be far away locally from the HQ. When the user traffic is focused to the APC in a centralization method, it is difficult to secure the performance due to the delay of the network arising from the packet transmitting time. Accordingly, in case of the configuration of the HQ and branches, it is configured to perform different operations depending on the location of the WE WLAN AP.

In other words, the local WE WLAN AP installed in the HQ tunnels the traffic to APC but the remote AP installed in branches is allowed to switch directly to the destination's address instead of tunneling the user traffic to APC. Even at the time, all WE WLAN APs and user management are made through APC of the HQ.

CHAPTER 8. Wireless Enterprise Manager (WEM)

As a tool for managing multiple APCs and WE WLAN APs that construct the WLAN, WEM provides the functions of configuration management, fault management, security management, performance management and WLAN performance detection through the web-based GUI. (Future Release)

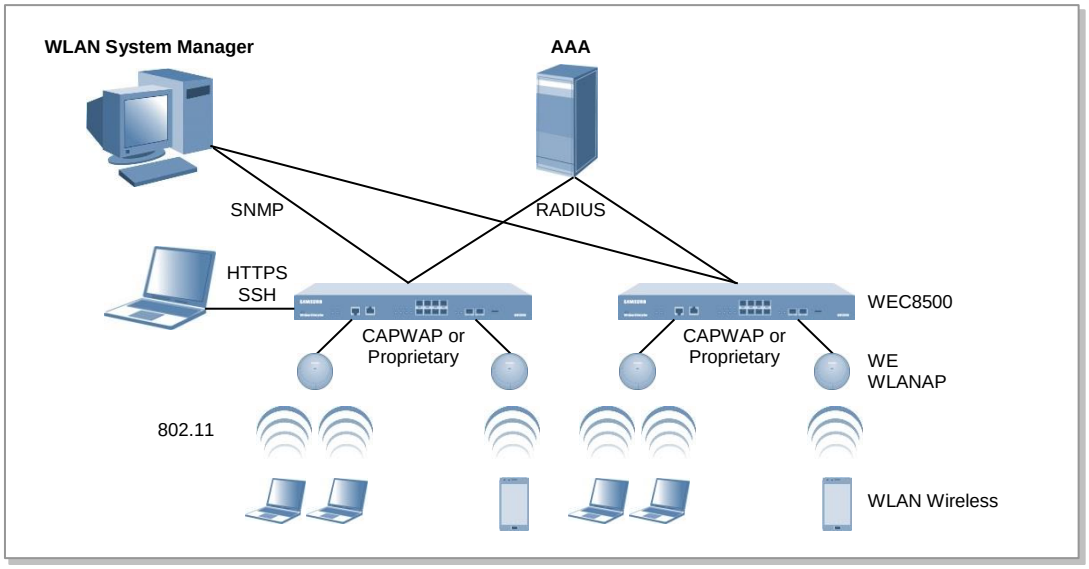


Figure 25. WEM Configuration

The functions provided by the WEM are given below.

General Management

It provides the function of managing the information on the performance and fault of the WEM server. It is composed of process monitoring, resource monitoring, self-server diagnosis, monitoring of each network component, database management, and scheduling activity management.

Security management

It provides account management and user access history as functions of account and password management required for the access to the WEM.

Fault management

It expresses the information on various faults of APCs and WE WLAN APs in progress and delivers it to various types to the operator. It is composed of real time fault monitoring, fault history management and statistics of faults.

Performance Management

As a function of managing the performance of APC and WE WLAN AP in operation, it has the function of collecting and making database the actual documents and creating reports by monitoring in real time and making the past data statistical.

Configuration Management

As a function of managing the information on the configuration of the system, the operator may see the current setting and configuration information of each device without directly connecting to such device. It is composed of system registration, individual setting, template setting, viewing the current setting status, and firmware management.

RF Map

It is a function of managing the current status of WE WLAN APs by area, building and floor through the map.
It is configured as a function of confirming the map configuration through the addition or deletion of the WE WLAN AP, the current location information of WE WLAN AP and wireless terminals and the strength of the signal by location.

WLAN Monitoring

As a function of monitoring the present status of WLAN services, it is composed of WES for illegal AP management, interference monitoring, configuration of dashboard, and performance index monitoring.

Troubleshooting

The following functions are provided to analyze the cause if a fault occurs:

- Spectrum analysis: Measures interference from the non-Wi-Fi device in the WE environment.
  By analyzing wireless and RF signals in real time, it provides information to rapidly solve the problem by checking the cause of the interference.
- VQM: It identifies the cause easily when a fault occurs by collecting and managing the call quality information (MOS, Jitter and Delay).
- Packet capture: The problem is possible to identify by checking the packet when the fault occurs because all packets can be captured by interface, port and protocol.

CHAPTER 9. Wireless Enterprise Security (WES)

The Samsung Wireless Enterprise Security product is an additional tool for detecting, blocking and managing threats and attacks on an Enterprise WLAN. WES provides device classification, threat detection, monitoring, attack containment, forensic reporting, and additional WLAN performance management features available via a web-based GUI.

Hardware Requirements

The Samsung WES server minimum requirements are as follows:

WES Server	Item	Minimum System Requirements
WES Sensor up to Qty: 200 (License required)	CPU	INTEL Pentium 1403v2 2.60 GHz
	MEM	8 GByte
	HDD	1 TByte
	Interface	1 GBps × 2, USB × 2, VGA, Console
	Power Supply	Dual Hot Plug Power Supplies 350W
WES Sensor up to Qty: 500 (License required)	CPU	INTEL Xeon E5-1410v2 2.80 GHz
	MEM	16 GByte
	HDD	1 TByte x 2, RAID
	Interface	1 GBps × 2, USB × 2, VGA, Console
	Power Supply	Dual Hot Plug Power Supplies 350W

The functions provided by the Samsung WES server are given below.

Device Classification

The Samsung WES monitors the RF environment of your Enterprise in order to identify any devices that are interacting or attempting to interact with the WLAN. The system allows for the detection of all kinds of wireless devices using the standard protocols of 802.11a/b/g/n/ac and detects ranges of 2.4 GHz and 5 GHz bandwidths simultaneously. The WES classifies all wireless devices into groups whereby operational policies can be applied. Employing event, security, and operational policies, the WES can effectively manage and secure enterprise wireless services. The table below provides examples of WES device classifications:

Item	Classifications
Access Points	Managed / Unmanaged / Rogue / Neighbor
User Stations	Managed / Unmanaged / Rogue / Temporary
Device Info	MAC / Vendor / SSID / Rogue / RSSI (Signal Strength)

Intrusion & Air Attack Detection

The Samsung WES can cope with a number of wireless security threats, prevent internal information leakages, and avoid security-related accidents before they affect the WLAN. WES can detect intentional network intrusions such as rogue AP's, MAC-spoofing AP's or stations, and ad-hoc devices. The WES system also detects a large amount of air attacks and identifies possible vulnerabilities:

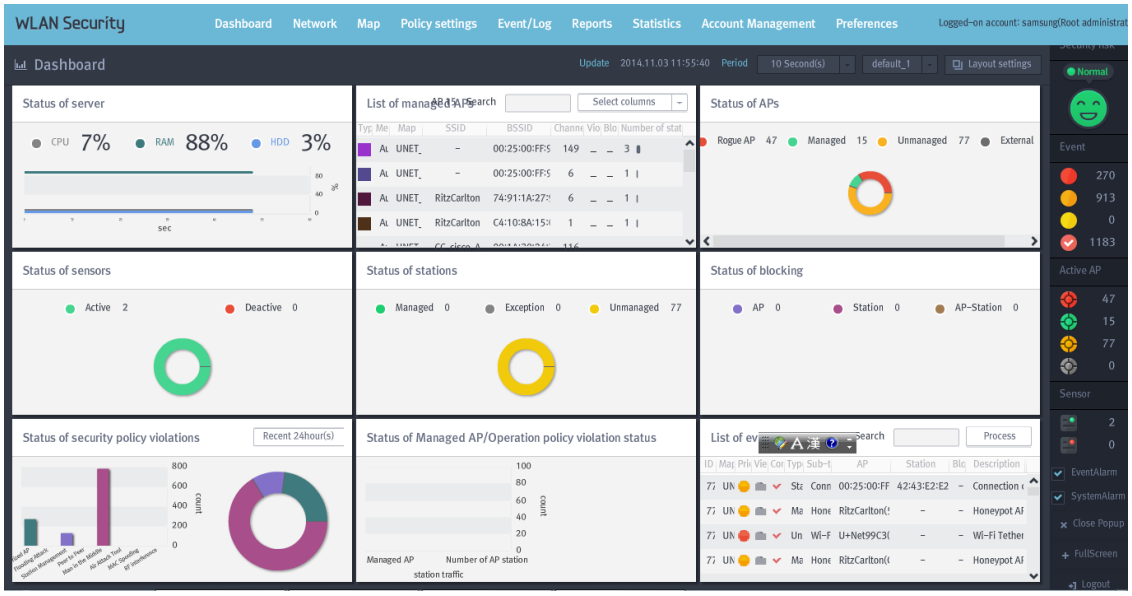
Attack Type	WES Detection Types
Network Intrusion	Rogue AP's / MAC Spoofing AP's and Stations / Ad-hoc Devices
Denial of Service	Association / Disassociation / Authentication / Deauthentication Broadcasting / PS-Poll / Probe Request / RTS / CTS / EAPOL
RF Jamming	Microwave / Bluetooth / Wireless Video / Zigbee / Unknown Interference
Specific Attacks	Man in the Middle / Honeypot / WEP Cracking / AP Flooding
Vulnerabilities	Mismatched AP's and Stations / Hotspot AP via Cellular / WiFi Direct Mismatched Encryption Types, Authentications, Data Rates Wrong or Hidden SSID's

Threat Containment

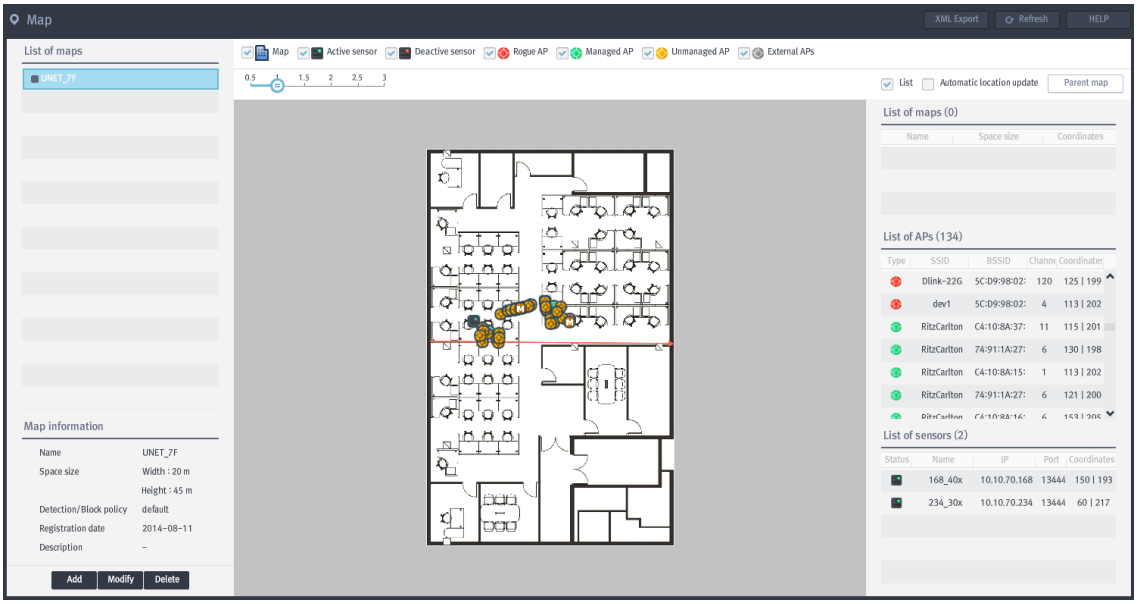
In addition to detecting threats the WES system also contains them quickly in real time. Employing configurable automatic and manual containment rules and policies, WES can react to threats as they happen.

Forensics & Location Tracking

WES provides an at-a-glance dashboard to view important information on the status of servers, wireless devices, and even policy violations. The dashboard puts the functions of network logging, statistics, and reports at the fingertips of system administrators and managers.



Using custom uploaded floor plans, the WES system allows location tracking of both legitimate network events as well as unplanned network activity. RF environment data can be seen overlaid upon the network floorplan in order to pinpoint the location of wireless threats as well as normal network activities.



WLAN Performance Management

The WES assists in overall WLAN performance management for your network, either alone or interconnected to your current APC and/or WEM. By detecting misconfigured or vulnerable areas of your network, the WES system provides the ability to control the communication volume and operation policies of your WLAN via location and/or threshold based policies. Such information can also be used as supplementary data for enhancing the performance of networks in the future, managing the life-cycle of traffic in devices, and can serve as a traffic monitoring tool for checking trends in traffic changes.

High Availability & Survivability

The Samsung WES system can run in a single server stand-alone mode, but is also available to be configured and licensed in a dual server Active-Standby mode. This allows for the WES to be located and synced across two separate geographical locations for survivability to ensure that WLAN monitoring can achieve maximum uptime with a two second fail over.

CHAPTER 10. Outdoor Access Point

Samsung is pleased to release the Outdoor Access Point model WEA 453e. It connects the user end devices that support wireless LAN, such as a smartphone, tablet, or notebook, to a wired network in an outdoor environment. It supports the 802.11 a/b/g/n wireless specifications and the new 802.11 ac. This new AP model is compact and powerful with multiple spatial streams that deliver high speed data rate of up to 1.3 gbps.

Data Sheet

Item	Specification
Radio Specification	IEEE 802.11a/b/g/n/ac Dual concurrent radio 3×3 MIMO, 3 spatial streams PHY data rates up to 1.3Gbps Dynamic frequency selection(DFS) IEEE 802.11n high throughput (HT20/40) IEEE 802.11ac very high throughput (VHT20/40/80)
Operation Mode	Controlled Mode, Stand-alone Mode
Supported Wireless LAN Controllers	WEC8500 Series WEC8050 Series
Data Rates Supported	IEEE 802.11b : 1, 2, 5.5 and 11 Mbps IEEE 802.11a/g : 6, 9, 12, 18, 24, 36, 48, and 54 Mbps IEEE 802.11n : MCS 0 to MCS 23 (6.5Mbps ~ 450 Mbps) IEEE 802.11ac : MCS 0 to MCS 9 (6.5Mbps ~ 1.3 Gbps, NSS 1 to 3)
Frequency Band	IEEE 802.11b/g/n : 2.412GHz ~2.472GHz 13CH IEEE 802.11a/n/ac : 5.180GHz~5.825GHz 24CH *Available Channel is Compliant with local regulatory domain
Maximum Transmit Power	23dBm with 1 stream *The maximum transmit power will vary by channel and according to individual regulation
External Antenna (Sold Separately)	Omni-Directional Type : 2.4GHz 5dBi, 5GHz 8dBi Patch-Directional Type : 2.4GHz 6dBi, 5GHz 6dBi
Interfaces	Two 10/100/1000BASE-T Ethernet Autosensing (RJ-45) One Management Console Port(RJ-45)
Indicators	LED indicates AP status(booting, provisioning, service, upgrade, fault)
Dimensions (W × L × H)	267 × 184 × 58 (mm), 2.82L

Weight	2.6(kg)
Environmental	Storage Temperature : -40 ~ 70℃ Operating Temperature : -40 ~ 55℃ Operating Humidity: 5 ~ 100% (non-condensing)
Input Power Requirements	IEEE 802.3at PoE: 50 to 57 VDC
Powering Options (Sold Separately)	Local Power Supply: AC/DC power adapter (AC 100 ~ 240V, 1A, 50/60Hz, Output 48V)
Power Draw	< 25.5W
Compliance Standards	US & CANADA : FCC part 15B,C,E & IC / cUL
Part Numbers	WDS-A453E/XAR (US & CANADA)

Receive Sensitivity

Standard	Modulation	Data Rate	1			6			11		
		Mbps	RX0	RX1	RX2	RX0	RX1	RX2	RX0	RX1	RX2
11b	DSSS	1	-97	-97	-97	-97	-97	-97	-97	-97	-97
	CCK	11	-89	-89	-89	-89	-89	-89	-89	-89	-88
11a/g	OFDM	6	-93	-93	-93	-93	-93	-93	-93	-93	-93
	OFDM	9	-91	-91	-91	-92	-92	-91	-92	-91	-91
	OFDM	12	-90	-90	-90	-90	-90	-90	-90	-90	-90
	OFDM	18	-87	-87	-88	-88	-88	-87	-88	-87	-87
	OFDM	24	-84	-84	-84	-84	-84	-84	-84	-84	-84
	OFDM	36	-81	-81	-81	-81	-81	-81	-81	-81	-81
	OFDM	48	-76	-76	-77	-77	-77	-76	-77	-76	-76
	OFDM	54	-75	-75	-75	-75	-75	-75	-75	-75	-75
HT20S1	MCS0	6.5	-92	-92	-92	-92	-92	-92	-92	-92	-92
	MCS1	13	-88	-88	-88	-88	-88	-88	-88	-88	-88
	MCS2	19.5	-86	-86	-86	-86	-86	-86	-86	-86	-86
	MCS3	26	-82	-82	-83	-83	-83	-82	-83	-82	-82
	MCS4	39	-79	-79	-79	-79	-79	-79	-79	-79	-79
	MCS5	52	-75	-75	-75	-75	-75	-75	-75	-75	-75
	MCS6	58.5	-73	-73	-73	-73	-74	-73	-74	-73	-73
	MCS7	65	-72	-72	-72	-72	-72	-72	-72	-72	-72
HT20S2	MCS8	13	-89			-89			-89		
	MCS9	26	-85			-86			-86		
	MCS10	39	-83			-83			-83		
	MCS11	52	-80			-80			-80		
	MCS12	78	-76			-77			-76		
	MCS13	104	-72			-72			-72		
	MCS14	117	-70			-71			-71		

	MCS15	130	-69	-69	-69
HT20S3	MCS16	19.5	-87	-87	-87
	MCS17	39	-84	-84	-84
	MCS18	58.5	-82	-82	-82
	MCS19	78	-78	-79	-78
	MCS20	117	-75	-75	-75
	MCS21	156	-71	-71	-71
	MCS22	175.5	-69	-69	-69
	MCS23	195	-68	-68	-68

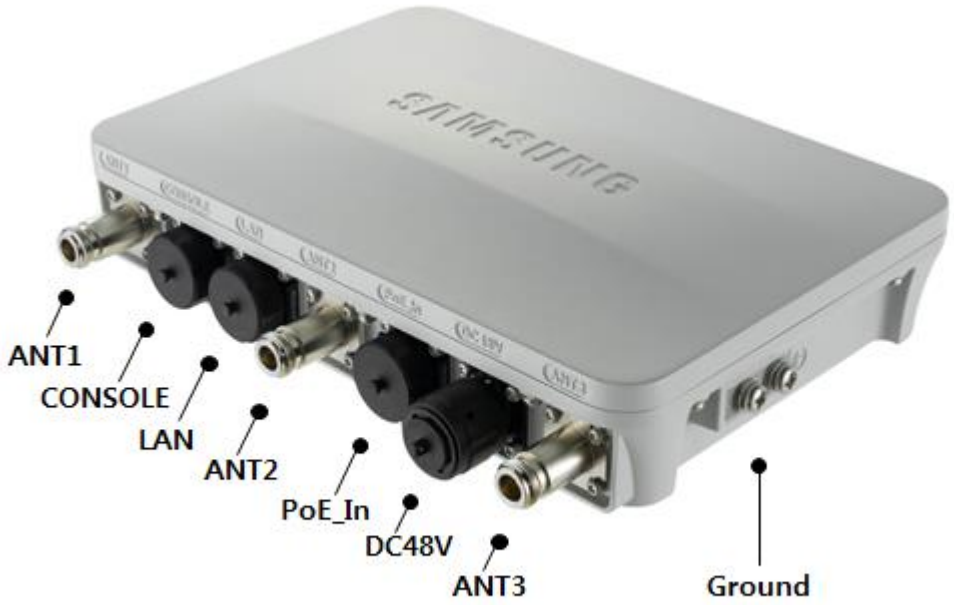
Standard	Modulation	Data Rate	36			100			161		
		Mbps	RX0	RX1	RX2	RX0	RX1	RX2	RX0	RX1	RX2
11a/g	OFDM	6	-94	-93	-93	-94	-93	-93	-93	-93	-93
	OFDM	9	-92	-92	-92	-92	-92	-92	-91	-91	-90
	OFDM	12	-90	-90	-90	-90	-90	-90	-87	-90	-90
	OFDM	18	-88	-88	-88	-88	-88	-88	-84	-87	-86
	OFDM	24	-84	-84	-84	-84	-84	-84	-81	-84	-84
	OFDM	36	-81	-81	-81	-81	-81	-81	-78	-81	-81
	OFDM	48	-77	-77	-77	-77	-77	-76	-76	-76	-76
	OFDM	54	-75	-75	-75	-75	-75	-75	-74	-74	-74
HT20S1	MCS0	6.5	-93	-93	-92	-93	-93	-93	-90	-92	-92
	MCS1	13	-89	-89	-88	-89	-89	-88	-88	-88	-88
	MCS2	19.5	-86	-86	-86	-86	-86	-86	-85	-86	-86
	MCS3	26	-83	-83	-83	-83	-83	-83	-81	-82	-82
	MCS4	39	-80	-80	-79	-80	-80	-80	-79	-79	-79
	MCS5	52	-76	-75	-75	-75	-75	-75	-74	-75	-75
	MCS6	58.5	-74	-74	-74	-74	-73	-74	-73	-73	-73
	MCS7	65	-72	-72	-72	-72	-72	-72	-71	-71	-71
HT20S2	MCS8	13	-89			-89			-87		
	MCS9	26	-86			-86			-85		
	MCS10	39	-83			-84			-81		
	MCS11	52	-80			-80			-78		
	MCS12	78	-77			-77			-74		
	MCS13	104	-72			-72			-70		
	MCS14	117	-70			-71			-68		
	MCS15	130	-69			-69			-66		
HT20S3	MCS16	19.5	-88			-88			-85		
	MCS17	39	-84			-85			-83		
	MCS18	58.5	-82			-82			-79		

		MCS19	78	-79			-79			-77			
		MCS20	117	-75			-75			-72			
		MCS21	156	-71			-71			-69			
		MCS22	175.5	-69			-69			-68			
		MCS23	195	-68			-68			-65			
	HT40S1	MCS0	13.5	-89	-89	-89	-90	-89	-89	-88	-89	-89	
		MCS1	27	-86	-86	-86	-86	-86	-86	-85	-85	-85	
		MCS2	40.5	-84	-84	-83	-83	-83	-83	-82	-83	-83	
		MCS3	54	-80	-80	-80	-80	-80	-80	-79	-80	-80	
		MCS4	81	-77	-77	-77	-77	-77	-77	-76	-76	-76	
		MCS5	108	-73	-73	-73	-72	-73	-72	-72	-72	-72	
		MCS6	121.5	-71	-71	-71	-71	-71	-71	-70	-70	-71	
		MCS7	135	-69	-69	-69	-69	-69	-69	-68	-69	-69	
	HT40S2	MCS8	27	-86			-86			-85			
		MCS9	54	-83			-83			-82			
		MCS10	81	-80			-80			-79			
		MCS11	108	-77			-77			-76			
		MCS12	162	-73			-74			-73			
		MCS13	216	-69			-69			-68			
		MCS14	243	-67			-68			-67			
		MCS15	270	-66			-66			-65			
	HT40S3	MCS16	40.5	-84			-84			-83			
		MCS17	81	-81			-81			-80			
		MCS18	121.5	-78			-79			-78			
		MCS19	162	-75			-75			-75			
		MCS20	243	-72			-72			-71			
		MCS21	324	-67			-68			-67			
		MCS22	364.5	-67			-66			-66			
		MCS23	405	-65			-62			-64			
	VHT20S1	MCS0NSS1	6.5	-92	-92	-92	-92	-92	-92	-90	-91	-91	
		MCS1NSS1	13	-88	-88	-88	-88	-88	-88	-88	-88	-88	
		MCS2NSS1	19.5	-86	-86	-86	-86	-86	-86	-85	-86	-85	
		MCS3NSS1	26	-83	-83	-83	-83	-83	-83	-81	-82	-82	
		MCS4NSS1	39	-80	-79	-79	-80	-79	-79	-78	-79	-79	
		MCS5NSS1	52	-75	-75	-75	-75	-75	-75	-74	-74	-75	
		MCS6NSS1	58.5	-73	-73	-73	-73	-73	-74	-73	-73	-73	
		MCS7NSS1	65	-72	-72	-72	-72	-72	-72	-70	-71	-71	
		MCS8NSS1	78	-67	-67	-67	-67	-67	-67	-65	-66	-67	
	VHT20S2	MCS0NSS2	13	-89			-89			-88			
		MCS1NSS2	26	-86			-86			-85			

		MCS2NSS2	39	-83			-84			-81		
		MCS3NSS2	52	-80			-80			-78		
		MCS4NSS2	78	-77			-77			-76		
		MCS5NSS2	104	-72			-72			-70		
		MCS6NSS2	117	-71			-71			-69		
		MCS7NSS2	130	-69			-69			-68		
		MCS8NSS2	156	-64			-64			-63		
	VHT20S3	MCS0NSS3	19.5	-88			-88			-86		
		MCS1NSS3	39	-85			-85			-84		
		MCS2NSS3	58.5	-82			-82			-80		
		MCS3NSS3	78	-79			-79			-78		
		MCS4NSS3	117	-76			-75			-74		
		MCS5NSS3	156	-71			-71			-69		
		MCS6NSS3	175.5	-69			-69			-67		
		MCS7NSS3	195	-68			-67			-67		
		MCS8NSS3	234	-62			-61			-60		
	VHT40S1	MCS0NSS1	13.5	-89	-89	-89	-89	-89	-89	-88	-89	-88
		MCS1NSS1	27	-85	-86	-85	-86	-86	-85	-84	-85	-85
		MCS2NSS1	40.5	-83	-83	-83	-83	-83	-83	-82	-83	-83
		MCS3NSS1	54	-80	-80	-80	-80	-80	-80	-79	-79	-80
		MCS4NSS1	81	-77	-77	-77	-77	-77	-76	-75	-76	-76
		MCS5NSS1	108	-71	-72	-72	-72	-72	-72	-71	-72	-72
		MCS6NSS1	121.5	-71	-71	-71	-71	-71	-70	-69	-70	-70
		MCS7NSS1	135	-68	-69	-69	-69	-69	-69	-67	-69	-69
		MCS8NSS1	162	-65	-65	-65	-65	-65	-64	-63	-64	-64
		MCS9NSS1	180	-64	-63	-63	-63	-63	-63	-61	-61	-61
	VHT40S2	MCS0NSS2	27	-86			-86			-85		
		MCS1NSS2	54	-82			-82			-82		
		MCS2NSS2	81	-79			-80			-79		
		MCS3NSS2	108	-76			-76			-76		
		MCS4NSS2	162	-73			-73			-72		
		MCS5NSS2	216	-69			-69			-68		
		MCS6NSS2	243	-67			-67			-66		
		MCS7NSS2	270	-66			-66			-65		
		MCS8NSS2	324	-61			-61			-60		
		MCS9NSS2	360	-59			-59			-58		
	VHT40S3	MCS0NSS3	40.5	-84			-84			-84		
		MCS1NSS3	81	-81			-81			-80		
		MCS2NSS3	121.5	-79			-78			-78		
		MCS3NSS3	162	-75			-75			-74		

		MCS4NSS3	243	-72			-70			-71		
		MCS5NSS3	324	-68			-66			-67		
		MCS6NSS3	364.5	-66			-66			-65		
		MCS7NSS3	405	-64			-65			-64		
		MCS8NSS3	486	-59			-57			-56		
		MCS9NSS3	540	-58			-58			-56		
	VHT80S1	MCS0NSS1	29.3	-85	-86	-86	-86	-86	-86	-85	-85	-85
		MCS1NSS1	58.5	-82	-82	-82	-82	-82	-82	-81	-81	-81
		MCS2NSS1	87.8	-79	-80	-80	-80	-80	-80	-78	-79	-79
		MCS3NSS1	117	-76	-76	-76	-76	-76	-76	-75	-76	-76
		MCS4NSS1	175.5	-73	-73	-73	-73	-73	-73	-72	-72	-73
		MCS5NSS1	234	-68	-69	-69	-69	-68	-68	-68	-68	-68
		MCS6NSS1	263.3	-67	-67	-67	-67	-67	-67	-66	-67	-67
		MCS7NSS1	292.5	-66	-66	-66	-66	-66	-66	-65	-66	-66
		MCS8NSS1	351	-62	-61	-62	-62	-62	-61	-61	-61	-61
		MCS9NSS1	390	-60	-60	-60	-60	-60	-60	-59	-59	-59
	VHT80S2	MCS0NSS2	58.5	-82			-82			-81		
		MCS1NSS2	117	-79			-79			-78		
		MCS2NSS2	175.5	-76			-76			-75		
		MCS3NSS2	234	-73			-73			-72		
		MCS4NSS2	351	-70			-70			-69		
		MCS5NSS2	468	-66			-66			-65		
		MCS6NSS2	526.5	-64			-64			-63		
		MCS7NSS2	585	-63			-63			-62		
		MCS8NSS2	702	-58			-58			-57		
		MCS9NSS2	780	-56			-56			-56		
	VHT80S3	MCS0NSS3	87.8	-81			-81			-79		
		MCS1NSS3	175.5	-78			-77			-77		
		MCS2NSS3	263.3	-75			-75			-74		
		MCS3NSS3	351	-72			-72			-71		
		MCS4NSS3	526.5	-68			-68			-67		
		MCS5NSS3	702	-64			-64			-63		
		MCS7NSS3	877.5	-62			-62			-61		
		MCS8NSS3	1053	-57			-57			-56		
		MCS9NSS3	1170	-56			-55			-54		

Interfaces



From	To	Cable
MGB	Outdoor AP	1) Ground Cable : AWG10, F-GV 4 mm^2 × 1C
AC/DC Adaptor	AC Distribution Box	2) Power Cable Assembly (DC) : AC Power Cable Assembly
Outdoor AP	AC/DC Adaptor	2) Power Cable Assembly (AC) : DC Power Cable Assembly
	PoE Switch	3) PoE Cable : S-FTP Cat.6, 4 Pair, ø8.1~ ø8.5
	Switch or Router	4) Ethernet Cable : S-FTP Cat.6, 4 Pair, ø8.1~ ø8.5
	Patch Antenna	5) Antenna Cable : Antenna Cable Assembly

LED Status Indicator

LED	Status	Description
System Start	White	Initial LED Status
	Blue	Device reset and diagnostic test in progress
	Red	Booting failure (device reset failure)
Provisioning	Repeating red and green	Connecting APC (network link normal)
	Blinking green	Connecting CAPWAP (APC server connection status normal)
Normal Operations	Green	No wireless UE connected
	Blue	Wireless UE connected
Upgrade	Blinking Blue	Upgrading software
Failure	Blinking red	Network connection failure (physical)
	Blinking orange	IP address conflict
	Blinking violet	Dynamic IP address allocation failure
	Blinking bluish green	Network connection failure (logical)
	Repeating Red and Blue	Wireless interface failure

ABBREVIATIONS

A

AAA	Authentication Authorization Accounting
ACL	Access Control List
AES	Advanced Encryption Standard
AP	Access Point
APC	Access Point Controller

B

BSS	Base Station System

C

CAC	Call Admission Control
CAPWAP	Control and Provisioning Wireless Access Point
CCK	Complementary Code Keying
CCM	Counter mode encryption with CBC-MAC
CCMP	Counter mode encryption with CBC-MAC Protocol
CCTV	Closed Circuit Television
CLI	Command Line Interpreter
CPU	Central Processing Unit
CRM	Customer Relationship Management
CSMA/CD	Carrier Sense Multiple Access/Collision Detect

D

DDR	Double Date Rate
DDR3	Double Data Rate Type 3
DHCP	Dynamic Host Configuration Protocol
DMZ	Demilitarized Zone
DNS	Domain Name System
DSSS	Direct-Sequence Spread Spectrum
DTLS	Datagram Transmission Layer Security
DU	Digital Unit

E

EAP	Extensible Authentication Protocol
EMI	Electro-Magnetic Interference
ERP	Enterprise Resource Planning

F

FFA	Field Force Automation
FFT	Fast Fourier Transform
FIFO	First-In-First-Out
FMC	Fixed Mobile Convergence
FTP	File Transfer Protocol

G

GbE	Giga Bit Ethernet
GI	Guard Interval
GUI	Graphic User Interface

H

HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol over SSL

I

ICMP	Internet Control Message Protocol
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPSec	Internet Protocol Security

L

LACP	Link Aggregation Control Protocol
LAN	Local Area Network
LED	Light Emitting Diode

M

MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MIB	Management Information Base
MIMO	Multiple Input Multiple Output
MLT-3	Multi Level Transmission-3
MOS	Mean Opinion Score
MSTP	Multiple Spanning-Tree Protocol

N

NAT	Network Address Translation
NC	Network Controlled
NMS	Network Management System
NRZI	Non-Return-to-Zero, Inverted
NTP	Network Time Protocol

O

OFDM	Orthogonal Frequency Division Multiplex
OKC	Opportunistic Key Caching
OSPF	Open Shortest Path First

P

PBX	Private Branch exchange
PC	Personal Computer
PHY	Physical layer
PIMS	Personal Information Management System
PIM-SM	Protocol Independent Multicast-Sparse Mode
PoE	Power over Ethernet
PRI	Primary Rate Interface
PSE	Power Sourcing Equipment
PSK	Pre-Shared Key
PSTN	Public Switched Telephone Network
PT	Port Translation

Q

QoS	Quality of Service

R

RADIUS	Remote Authentication Dial-In User Service
RF	Radio Frequency
RIP	Routing Information Protocol
RPM	Revolution Per Minute
RSSI	Received Signal Strength Indication
RSTP	Rapid Spanning Tree Protocol
RTS	Request To Send
RU	Radio Unit

S

SBC	Session Border Controller
SDS	Samsung Downlink Scheduler
SFA	Sales Forces Automation
SFTP	Secure FTP
SSH	Secure Shell
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SSD	Solid-State Drive
SSID	Service Set Identifier
STP	Signaling Transfer Point

T

TCP	Transmission Control Protocol
TDM	Time Division Multiplexer
TKIP	Temporal Key Integrity Protocol

U

UC	Unified Communications
UDP	User Datagram Protocol
UI	User Interface
UTP	Unshielded Twisted Pair

V

VAP	Virtual Access Point
VATS	Voice-Aware Traffic Scheduling
VLAN	Virtual Local Area Network
VoIP	Voice over IP
VQM	Voice Quality Monitoring
VRRP	Virtual Router Redundancy Protocol

W

WAN	Wide Area Network
WDS	Wireless Distribution Service
WE	Wireless Enterprise
WEC	Wireless Enterprise Controller
WEM	Wireless Enterprise WLAN Manager
WEP	Wired Equivalent Privacy
WES	Wireless Enterprise Security
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WPA	Wi-Fi Protected Access
WPA2	Wi-Fi Protected Access Version 2

WEC8500/WEC 8050

System Description