

**FIPS 140-2 Non-Proprietary Security Policy  
for Aruba AP-214, AP-215, AP-274, AP-275, AP-277 and  
AP-228  
Wireless Access Points**


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a Hewlett Packard  
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<b>1</b>	<b>INTRODUCTION</b>	<b>5</b>
1.1	ACRONYMS AND ABBREVIATIONS	5
<b>2</b>	<b>PRODUCT OVERVIEW</b>	<b>6</b>
2.1	AP-214	6
2.1.1	<i>Physical Description</i>	6
2.1.1.1	Dimensions/Weight	7
2.1.1.2	Interfaces	7
2.2	AP-215	8
2.2.1	<i>Physical Description</i>	9
2.2.1.1	Dimensions/Weight	9
2.2.1.2	Interfaces	9
2.3	AP-274	10
2.3.1	<i>Physical Description</i>	11
2.3.1.1	Dimensions/Weight	11
2.3.1.2	Interfaces	11
2.4	AP-275	12
2.4.1	<i>Physical Description</i>	12
2.4.1.1	Dimensions/Weight	13
2.4.1.2	Interfaces	13
2.5	AP-277	13
2.5.1	<i>Physical Description</i>	14
2.5.1.1	Dimensions/Weight	14
2.5.1.2	Interfaces	14
2.6	AP-228	16
2.6.1	<i>Physical Description</i>	17
2.6.1.1	Dimensions/Weight	17
2.6.1.2	Interfaces	17
2.6.1.3	Indicator LEDs	17
<b>3</b>	<b>MODULE OBJECTIVES</b>	<b>19</b>
3.1	SECURITY LEVELS	19
3.2	PHYSICAL SECURITY	19
3.2.1	<i>Applying TELs</i>	19
3.2.2	<i>TELs Placement</i>	20
3.2.2.1	TELs Placement on the AP-214	20
3.2.2.2	TEL Placement on the AP-215	21
3.2.2.3	TEL Placement on the AP-274	22
3.2.2.4	TEL Placement on the AP-275	24

3.2.2.5	TEL Placement on the AP-277 .....	25
3.2.2.6	TEL Placement on the AP-228 .....	26
3.2.2.7	To detect opening of the chassis cover: .....	26
3.2.2.8	To detect access to restricted ports .....	26
3.2.3	<i>Inspection/Testing of Physical Security Mechanisms</i> .....	29
3.3	OPERATIONAL ENVIRONMENT.....	29
3.4	LOGICAL INTERFACES .....	29
<b>4</b>	<b>ROLES, AUTHENTICATION AND SERVICES.....</b>	<b>31</b>
4.1	ROLES .....	31
4.1.1	<i>Crypto Officer Authentication</i> .....	31
4.1.2	<i>User Authentication</i> .....	31
4.1.3	<i>Wireless Client Authentication</i> .....	32
4.1.4	<i>Strength of Authentication Mechanisms</i> .....	32
4.2	SERVICES .....	33
4.2.1	<i>Crypto Officer Services</i> .....	33
4.2.2	<i>User Services</i> .....	34
4.2.3	<i>Wireless Client Services</i> .....	34
4.2.4	<i>Unauthenticated Services</i> .....	35
4.2.5	<i>Service Available in Non-FIPS Mode</i> .....	35
<b>5</b>	<b>CRYPTOGRAPHIC ALGORITHMS .....</b>	<b>36</b>
<b>6</b>	<b>CRITICAL SECURITY PARAMETERS.....</b>	<b>38</b>
<b>7</b>	<b>SELF TESTS.....</b>	<b>44</b>
<b>8</b>	<b>SECURE OPERATION.....</b>	<b>46</b>

# 1 Introduction

This document constitutes the non-proprietary Cryptographic Module Security Policy for the Aruba AP-214, AP-215, AP-274, AP-275, AP-277 and AP-228 Wireless Access Points with FIPS 140-2 Level 2 validation from Aruba Networks. This security policy describes how the AP meets the security requirements of FIPS 140-2 Level 2, and how to place and maintain the AP in a secure FIPS 140-2 mode. This policy was prepared as part of the FIPS 140-2 Level 2 validation of the product.

FIPS 140-2 (Federal Information Processing Standards Publication 140-2, *Security Requirements for Cryptographic Modules*) details the U.S. Government requirements for cryptographic modules. More information about the FIPS 140-2 standard and validation program is available on the National Institute of Standards and Technology (NIST) Web-site at:

<http://csrc.nist.gov/groups/STM/cmvp/index.html>

This document can be freely distributed.

## 1.1 Acronyms and Abbreviations

<b>AES</b>	Advanced Encryption Standard
<b>AP</b>	Access Point
<b>CBC</b>	Cipher Block Chaining
<b>CLI</b>	Command Line Interface
<b>CO</b>	Crypto Officer
<b>CPSec</b>	Control Plane Security protected
<b>CSEC</b>	Communications Security Establishment Canada
<b>CSP</b>	Critical Security Parameter
<b>ECO</b>	External Crypto Officer
<b>EMC</b>	Electromagnetic Compatibility
<b>EMI</b>	Electromagnetic Interference
<b>FE</b>	Fast Ethernet
<b>GE</b>	Gigabit Ethernet
<b>GHz</b>	Gigahertz
<b>HMAC</b>	Hashed Message Authentication Code
<b>Hz</b>	Hertz
<b>IKE</b>	Internet Key Exchange
<b>IPsec</b>	Internet Protocol security
<b>KAT</b>	Known Answer Test
<b>KEK</b>	Key Encryption Key
<b>L2TP</b>	Layer-2 Tunneling Protocol
<b>LAN</b>	Local Area Network
<b>LED</b>	Light Emitting Diode
<b>SHA</b>	Secure Hash Algorithm
<b>SNMP</b>	Simple Network Management Protocol
<b>SPOE</b>	Serial & Power Over Ethernet
<b>TEL</b>	Tamper-Evident Label
<b>TFTP</b>	Trivial File Transfer Protocol
<b>WLAN</b>	Wireless Local Area Network

## 2 Product Overview

This section introduces the various Aruba Wireless Access Points, providing a brief overview and summary of the physical features of each model covered by this FIPS 140-2 security policy.

The tested versions of the firmware are: **ArubaOS 6.4.4-FIPS** and **ArubaOS 6.5.0-FIPS**

### 2.1 AP-214



Figure 1 - Aruba AP-214

This section introduces the Aruba AP-214 Wireless Access Point (AP) with FIPS 140-2 Level 2 validation. It describes the purpose of the AP, its physical attributes, and its interfaces.

These compact and cost-effective dual-radio APs deliver wireless data rates of up to 1.3 Gbps to 5-GHz devices with 802.11ac technology. They also support 3×3 MIMO with three spatial streams as well as 2.4-GHz 802.11n clients at data rates up to 450 Mbps. 2.4-GHz (450 Mbps max rate) and 5-GHz (1.3 Gbps max rate) radios, each with 3×3 MIMO and three combined, duplexed (dual-band) external RP-SMA antenna connectors.

When managed by Aruba Mobility Controllers, AP-214 offers centralized configuration, data encryption, policy enforcement and network services, as well as distributed and centralized traffic forwarding.

#### 2.1.1 Physical Description

The Aruba AP-214 Access Point is a multi-chip standalone cryptographic module consisting of hardware and software, all contained in a hard, opaque plastic case. The module contains 802.11 a/b/g/n/ac transceivers and supports external antennas through three N-type female connectors for external antennas.

The case physically encloses the complete set of hardware and software components and represents the cryptographic boundary of the module.

The module hardware version is:

- HW: AP-214-F1

### 2.1.1.1 Dimensions/Weight

The AP has the following physical dimensions:

- 18 cm (W) x 18c cm (D) x 4.5 cm (H)
- 0.61 kg (1.34 lbs)

### 2.1.1.2 Interfaces

The module provides the following network interfaces:

- One 10/100/1000BASE-T Ethernet network interface (RJ-45)
- Auto-sensing link speed and MDI/MDX
- 802.3az Energy Efficient Ethernet (EEE)
- USB 2.0 host interface (Type A connector)
- Serial console interface (disabled in FIPS mode by TEL)
- 802.11a/b/g/n/ac Antenna interfaces (External)
- Visual indicators (LEDs):
  - Power/system status
  - Ethernet link status (ENET)
  - Radio status (two; RAD0, RAD1)
- Reset button

The module provides the following power interfaces:

- Power-over-Ethernet (POE)
- 12V DC power interface

**Table 2.1- AP-214 Indicator LEDs**

Label	Function	Action	Status
PWR	AP power / ready status	Off	No power to AP
		Red	Initial power-up condition
		Flashing – Green	Device booting, not ready
		On – Green	Device ready
		Orange	AP operating in PoE Power Saving Mode
ENET	Ethernet Network Link Status / Activity	Off	Ethernet link unavailable
		On – Amber	10/100Mbs Ethernet link negotiated
		On – Green	1000Mbps Ethernet link negotiated
		Flashing	Ethernet link activity

Label	Function	Action	Status
2.4GHz	2.4GHz Radio Status	Off	2.4GHz radio disabled
		On – Amber	2.4GHz radio enabled in non-HT WLAN mode
		On – Green	2.4GHz radio enabled in HT WLAN mode
		Flashing – Green	2.4GHz Spectrum or Air Monitor
5GHz	5GHz Radio Status	Off	5GHz radio disabled
		On – Amber	5GHz radio enabled in non-HT WLAN mode
		On – Green	5GHz radio enabled in HT WLAN mode
		Flashing – Green	5GHz Spectrum or Air Monitor

## 2.2 AP-215



Figure 2 - Aruba AP-215

This section introduces the Aruba AP-215 Wireless Access Point (AP) with FIPS 140-2 Level 2 validation. It describes the purpose of the AP, its physical attributes, and its interfaces.



These compact and cost-effective dual-radio APs deliver wireless data rates of up to 1.3 Gbps to 5-GHz devices with 802.11ac technology. They also support 3×3 MIMO with three spatial streams as well as 2.4-GHz 802.11n clients at data rates up to 450 Mbps.

AP-215: Six integrated downtilt omni-directional antennas for 3×3 MIMO with maximum antenna gain of 4.0 dBi in 2.4 GHz and 4.5 dBi in 5 GHz. Built-in antennas are optimized for horizontal ceiling mounted orientation of the AP. Downtilt angle for maximum gain is roughly 30 degrees.

When managed by Aruba Mobility Controllers, AP-215 offers centralized configuration, data encryption, policy enforcement and network services, as well as distributed and centralized traffic forwarding.

## 2.2.1 Physical Description

The Aruba AP-215 Access Point is a multi-chip standalone cryptographic module consisting of hardware and software, all contained in a hard, opaque plastic case. The module contains 802.11 a/b/g/n/ac transceivers and six internal antennas.

The case physically encloses the complete set of hardware and software components and represents the cryptographic boundary of the module.

The module hardware version is:

- HW: AP-215-F1

### 2.2.1.1 Dimensions/Weight

The AP has the following physical dimensions:

- 18 cm (W) x 18 cm (D) x 4.5 cm (H)
- 0.61 kg (1.34 lbs)

### 2.2.1.2 Interfaces

The module provides the following network interfaces:

- One 10/100/1000BASE-T Ethernet network interface (RJ-45)
- Auto-sensing link speed and MDI/MDX
- 802.3az Energy Efficient Ethernet (EEE)
- USB 2.0 host interface (Type A connector)
- Serial console interface (disabled in FIPS mode by TEL)
- 802.11a/b/g/n/ac Antenna interfaces (Internal)connections
- Visual indicators (LEDs):
  - Power/system status
  - Ethernet link status (ENET)
  - Radio status (two; RAD0, RAD1)
- Reset button

The module provides the following power interfaces:

- Power-over-Ethernet (POE)
- 12 DC power interface

#### Table 2.2- AP-214 Indicator LEDs

Label	Function	Action	Status
PWR	AP power / ready status	Off	No power to AP
		Red	Initial power-up condition
		Flashing – Green	Device booting, not ready
		On – Green	Device ready
ENET	Ethernet Network Link Status / Activity	Orange	AP operating in PoE Power Saving Mode
		Off	Ethernet link unavailable
		On – Amber	10/100Mbs Ethernet link negotiated
		On – Green	1000Mbps Ethernet link negotiated
2.4GHz	2.4GHz Radio Status	Flashing	Ethernet link activity
		Off	2.4GHz radio disabled
		On – Amber	2.4GHz radio enabled in non-HT WLAN mode
		On – Green	2.4GHz radio enabled in HT WLAN mode
5GHz	5GHz Radio Status	Flashing – Green	2.4GHz Spectrum or Air Monitor
		Off	5GHz radio disabled
		On – Amber	5GHz radio enabled in non-HT WLAN mode
		On – Green	5GHz radio enabled in HT WLAN mode
		Flashing – Green	5GHz Spectrum or Air Monitor

## 2.3 AP-274



Figure 3 - Aruba AP-274

This section introduces the Aruba AP-274 Wireless Access Point (AP) with FIPS 140-2 Level 2 validation. It describes the purpose of the AP, its physical attributes, and its interfaces.

The innovative and aesthetically-designed AP-274 outdoor wireless access point delivers gigabit Wi-Fi performance to 802.11ac mobile devices under any weather conditions. Purpose-built to survive in the harshest outdoor environments, AP-274 AP withstands exposure to extreme high and low temperatures, persistent moisture and precipitation, and are fully sealed to keep out airborne contaminants. All electrical interfaces include industrial-strength surge protection. With a maximum data rate of 1.3 Gbps in the 5-GHz band and 600 Mbps in the 2.4-GHz band, AP-274 outdoor AP supports concurrent dual-radio operation at speeds that greatly exceed Fast Ethernet.

When managed by Aruba Mobility Controllers, the AP-274 offers centralized configuration, data encryption, policy enforcement and network services, as well as distributed and centralized traffic forwarding.

### 2.3.1 Physical Description

The Aruba AP-274 Access Point is a multi-chip standalone cryptographic module consisting of hardware and software, all contained in a metal case. The module contains 802.11 a/b/g/n/ac transceivers and supports external antennas through six N-type female connectors for external antennas.

The metal case physically encloses the complete set of hardware and software components and represents the cryptographic boundary of the module.

The module hardware version is:

- HW: AP-274-F1

#### 2.3.1.1 Dimensions/Weight

The AP has the following physical dimensions:

- 23 cm (W) x 24 cm (D) x 19 cm (H)
- 2.7 kg (6 lbs)

#### 2.3.1.2 Interfaces

The module provides the following network interfaces:

- 2 x 10/100/1000 Base-T Ethernet (RJ45) Ports
- 802.11a/b/g/n/ac Antenna (External)
- 1 x micro-USB console interface (disabled in FIPS mode by TEL)

The module provides the following power interfaces:

- Power-over-Ethernet (POE)
- 110/220V AC power connector
- **Table 2.3 - AP-274 Indicator LEDs**

Label	Action	Status
System LED	Off	No power to AP
System LED	Red	Initial power-up condition
	Flashing – Green	Device booting, not ready

Label	Action	Status
	On – Green	Device ready in 1000Mbps mode. (LED turns off after 1200 seconds)
	Green-Yellow 6 sec.	Device ready in 10/100Mbps mode (LED turns off after 1200 seconds)
	Red	General Fault
	Red – 1 blink off every 3 seconds	Radio 0 fault (5GHz)
	Radio 1 Fault (2.4 GHz)	1000Mbps Ethernet link negotiated

## 2.4 AP-275



Figure 4 - Aruba AP-275

This section introduces the Aruba AP-275 Wireless Access Point (AP) with FIPS 140-2 Level 2 validation. It describes the purpose of the AP, its physical attributes, and its interfaces.

The innovative and aesthetically-designed AP-275 outdoor wireless access point delivers gigabit Wi-Fi performance to 802.11ac mobile devices under any weather conditions. Purpose-built to survive in the harshest outdoor environments, AP-275 AP withstands exposure to extreme high and low temperatures, persistent moisture and precipitation, and are fully sealed to keep out airborne contaminants. All electrical interfaces include industrial-strength surge protection. With a maximum data rate of 1.3 Gbps in the 5-GHz band and 600 Mbps in the 2.4-GHz band, AP-275 outdoor AP supports concurrent dual-radio operation at speeds that greatly exceed Fast Ethernet.

When managed by Aruba Mobility Controllers, the AP-275 offers centralized configuration, data encryption, policy enforcement and network services, as well as distributed and centralized traffic forwarding.

### 2.4.1 Physical Description

The Aruba AP-275 Access Point is a multi-chip standalone cryptographic module consisting of hardware and software, all contained in a metal and plastic case. The module contains 802.11 a/b/g/n/ac transceivers and internal antennas

The metal case physically encloses the complete set of hardware and software components and represents the cryptographic boundary of the module.

The module hardware version is:

- HW: AP-275-F1

#### 2.4.1.1 Dimensions/Weight

The AP has the following physical dimensions:

- 23 cm (W) x 24 cm (D) x 27 cm (H)
- 2.4 kg (5.3 lbs)

#### 2.4.1.2 Interfaces

The module provides the following network interfaces:

- 2 x 10/100/1000 Base-T Ethernet (RJ45) Ports
- 802.11a/b/g/n/ac Antenna Interfaces (Internal)
- 1 x micro-USB console interface (disabled in FIPS mode by TEL)

The module provides the following power interfaces:

- Power-over-Ethernet (POE)
- 110/220V AC power connector

**Table 2.4 - AP-275 Indicator LEDs**

Label	Action	Status
System LED	Off	No power to AP
System LED	Red	Initial power-up condition
	Flashing – Green	Device booting, not ready
	On – Green	Device ready in 1000Mbps mode. (LED turns off after 1200 seconds)
	Green-Yellow 6 sec.	Device ready in 10/100Mbps mode (LED turns off after 1200 seconds)
	Red	General Fault
	Red – 1 blink off every 3 seconds	Radio 0 fault (5GHz)
	Radio 1 Fault (2.4 GHz)	1000Mbps Ethernet link negotiated

## 2.5 AP-277



Figure 5 - Aruba AP-277

This section introduces the Aruba AP-277 Wireless Access Point (AP) with FIPS 140-2 Level 2 validation. It describes the purpose of the AP, its physical attributes, and its interfaces.

The innovative and aesthetically-designed AP-277 outdoor wireless access points delivers gigabit Wi-Fi performance to 802.11ac mobile devices under any weather conditions. Purpose-built to survive in the harshest outdoor environments, AP-277 AP withstands exposure to extreme high and low temperatures, persistent moisture and precipitation, and are fully sealed to keep out airborne contaminants. All electrical interfaces include industrial-strength surge protection. With a maximum data rate of 1.3 Gbps in the 5-GHz band and 600 Mbps in the 2.4-GHz band, AP-277 outdoor AP supports concurrent dual-radio operation at speeds that greatly exceed Fast Ethernet.

When managed by Aruba Mobility Controllers, AP-277 offers centralized configuration, data encryption, policy enforcement and network services, as well as distributed and centralized traffic forwarding.

## 2.5.1 Physical Description

The Aruba AP-277 Access Point is a multi-chip standalone cryptographic module consisting of hardware and software, all contained in a metal and plastic case. The module contains 802.11 a/b/g/n/ac transceivers and connectors for external antennas

The metal case physically encloses the complete set of hardware and software components and represents the cryptographic boundary of the module.

The module hardware version is:

- HW: AP-277-F1

### 2.5.1.1 Dimensions/Weight

The AP has the following physical dimensions:

- 23 cm (W) x 24 cm (D) x 27 cm (H)
- 2.0 kg (4.4 lbs)

### 2.5.1.2 Interfaces

The module provides the following network interfaces:

- 2 x 10/100/1000 Base-T Ethernet (RJ45) Ports
- 802.11a/b/g/n/ac Antenna Interfaces (Internal)
- 1 x micro-USB console interface (disabled in FIPS mode by TEL)

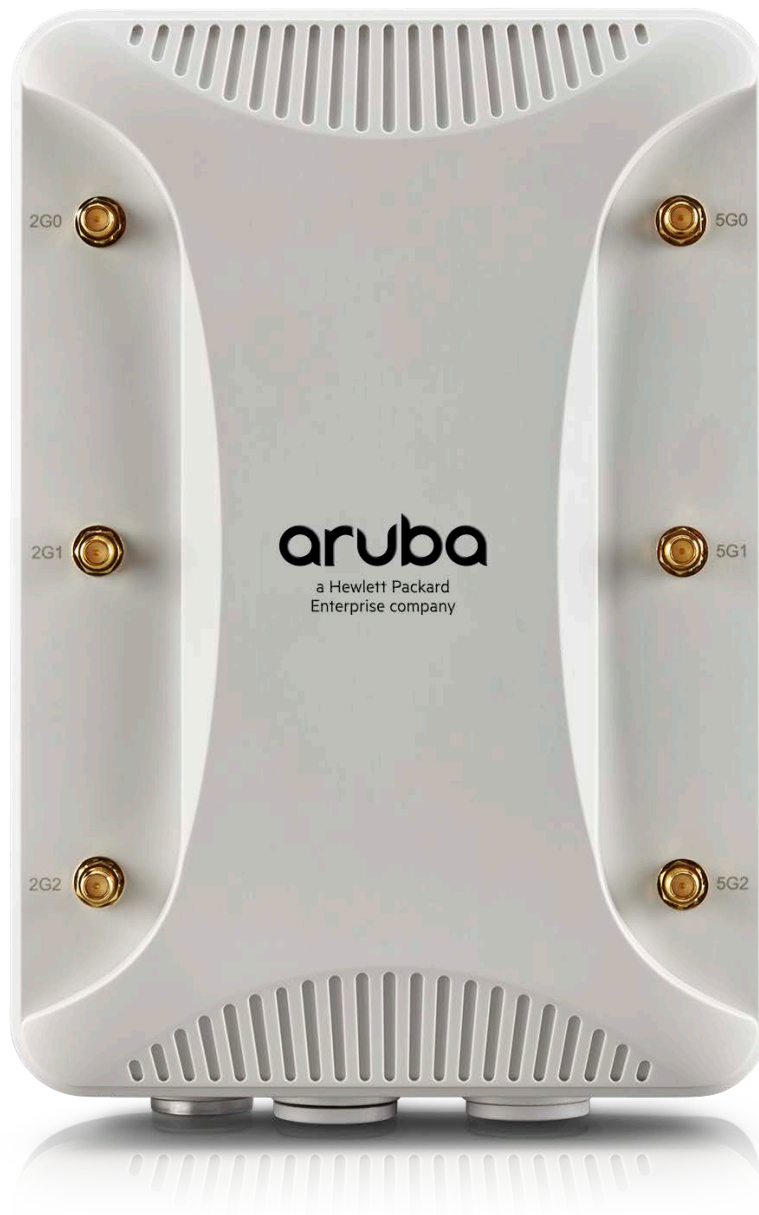
The module provides the following power interfaces:

- Power-over-Ethernet (POE)
- 110/220V AC power connector

**Table 2.5 - AP-277 Indicator LED**

Label	Action	Status
System LED	Off	No power to AP
System LED	Red	Initial power-up condition
	Flashing – Green	Device booting, not ready
	On – Green	Device ready in 1000Mbps mode. (LED turns off after 1200 seconds)
	Green-Yellow 6 sec.	Device ready in 10/100Mbps mode (LED turns off after 1200 seconds)
	Red	General Fault
	Red – 1 blink off every 3 seconds	Radio 0 fault (5GHz)
	Radio 1 Fault (2.4 GHz)	1000Mbps Ethernet link negotiated

## 2.6 AP-228



This section introduces the Aruba AP-228 Wireless Access Point (AP) with FIPS 140-2 Level 2 validation. It describes the purpose of the AP, its physical attributes, and its interfaces.



The Aruba AP-228 is high-performance 802.11ac (3x3:3) MIMO, dual-radio (concurrent 802.11a/n/ac + b/g/n/ac) indoor wireless access points capable of delivering combined wireless data rates of up to 1.9 Gbps. These multi-function access points provide wireless LAN access, air monitoring, and wireless intrusion detection and prevention over the 2.4-2.5GHz and 5GHz RF spectrum. The access points work in conjunction with Aruba Mobility Controllers to deliver high-speed, secure user-centric network services in education, enterprise, finance, government, healthcare, and retail applications

## 2.6.1 Physical Description

The Aruba AP-228 series Access Point is a multi-chip standalone cryptographic module consisting of hardware and software, all contained in a hard plastic case. The module contains 802.11 a/b/g/n/ac transceivers and supports external antennas through 6 x dual-band (RP-SMA) antenna interfaces for supporting external antennas.

The plastic case physically encloses the complete set of hardware and software components and represents the cryptographic boundary of the module.

The Access Point configuration validated during the cryptographic module testing included:

- AP-228-F1
- FIPS Kit
  - 4011570-01(Part number for Tamper Evident Labels)

### 2.6.1.1 Dimensions/Weight

The AP has the following physical dimensions:

- 222 mm (L) x 150 mm (W) x 75 mm (H), 8.5” (L) x 6” (W) x 2.5” (H)
- 1.225 kg/2.700 lbs

### 2.6.1.2 Interfaces

The module provides the following network interfaces:

- 2 x 10/100/1000 Base-T Ethernet (RJ45) Ports
- 802.11a/b/g/n/ac Antenna (External)
  - 6x RP-SMA antenna interfaces (supports up to 3x3 MIMO with spatial diversity)
- 1 x micro-USB console interface (disabled in FIPS mode by TEL)

The module provides the following power interfaces:

- Power-over-Ethernet (POE)
- 110/220V AC power connector

### 2.6.1.3 Indicator LEDs

**Table 2.6 - AP-228 Indicator LED**

Label	Action	Status
System LED	Off	No power to AP
System LED	Red	Initial power-up condition
	Flashing – Green	Device booting, not ready

<b>Label</b>	<b>Action</b>	<b>Status</b>
	On – Green	Device ready in 1000Mbps mode. (LED turns off after 1200 seconds)
	Green-Yellow 6 sec.	Device ready in 10/100Mbps mode (LED turns off after 1200 seconds)
	Red	General Fault
	Red – 1 blink off every 3 seconds	Radio 0 fault (5GHz)
	Radio 1 Fault (2.4 GHz)	1000Mbps Ethernet link negotiated

## 3 Module Objectives

This section describes the assurance levels for each of the areas described in the FIPS 140-2 Standard. .

### 3.1 Security Levels

**Table 3.1 - Security Levels**

Section	Section Title	Level
1	Cryptographic Module Specification	2
2	Cryptographic Module Ports and Interfaces	2
3	Roles, Services, and Authentication	2
4	Finite State Model	2
5	Physical Security	2
6	Operational Environment	N/A
7	Cryptographic Key Management	2
8	EMI/EMC	2
9	Self-tests	2
10	Design Assurance	2
11	Mitigation of Other Attacks	N/A
<b>Overall</b>	<b>Overall module validation level</b>	<b>2</b>

### 3.2 Physical Security

The Aruba Wireless AP is a scalable, multi-processor standalone network device and is enclosed in a robust metal housing. The AP enclosure is resistant to probing (please note that this feature has not been validated as part of the FIPS 140-2 validation) and is opaque within the visible spectrum. The enclosure of the AP has been designed to satisfy FIPS 140-2 Level 2 physical security requirements.

#### 3.2.1 Applying TELs

The Crypto Officer must apply Tamper-Evident Labels (TELs) to the AP to allow detection of the opening of the device, and to block the serial console port (on the bottom of the device). The TELs shall be installed for the module to operate in a FIPS Approved mode of operation. Vendor provides FIPS 140 designated TELs which have met the physical security testing requirements for tamper evident labels under the FIPS 140-2 Standard. TELs are not endorsed by the Cryptographic Module Validation Program (CMVP). Aruba provides double the required amount of TELs with shipping and additional replacement TELs can be obtained by calling customer support and requesting part number 4011570-01.

The Crypto Officer is responsible for securing and having control at all times of any unused tamper evident labels. If evidence of tampering is found with the TELs, the module must immediately be powered down and the administrator must be made aware of a physical security breach. The Crypto Officer should employ TELs as follows:

- Before applying a TEL, make sure the target surfaces are clean and dry.
- Do not cut, trim, punch, or otherwise alter the TEL.

- Apply the wholly intact TEL firmly and completely to the target surfaces.
- Ensure that TEL placement is not defeated by simultaneous removal of multiple modules.
- Allow 24 hours for the TEL adhesive seal to completely cure.
- Record the position and serial number of each applied TEL in a security log.
- To obtain additional or replacement TELS, please order Aruba Networks part number: 4011570-01.

Once applied, the TELs included with the AP cannot be surreptitiously broken, removed or reapplied without an obvious change in appearance:



Each TEL has a unique serial number to prevent replacement with similar label. To protect the device from tampering, TELs should be applied by the Crypto Officer as pictured below:

### 3.2.2 TELs Placement

This section displays all the TELs locations on each of module.

#### 3.2.2.1 TELs Placement on the AP-214

The AP-214 requires 3 TELs. One on each edge (labels 1 and 2) and one covering the console port (label 3). See figures 6, and 7 for placement.



Figure 6 - Top View of AP-214 with TELs



Figure 7 – Bottom View of AP-214 with TELs

### 3.2.2.2 TEL Placement on the AP-215

The AP-215 requires 3 TELs. One on each edge (labels 1 and 2) and one covering the console port (label 3). See figures 8 and 9 for placement.



Figure 8 – Top View of AP-215 with TELs



Figure 9 – Bottom View of AP-215 with TELs

### 3.2.2.3 TEL Placement on the AP-274

The AP-274 requires a minimum of 6 TELS. Two sealing the top plate (labels 1 and 2), see Figure 10. One covering the console port (label 3) and one securing the body to the bottom (label 4), see Figure 11. Finally apply one label to each side sealing it to the bottom (labels 5 & 6), see figures 12 and 13 for placement.

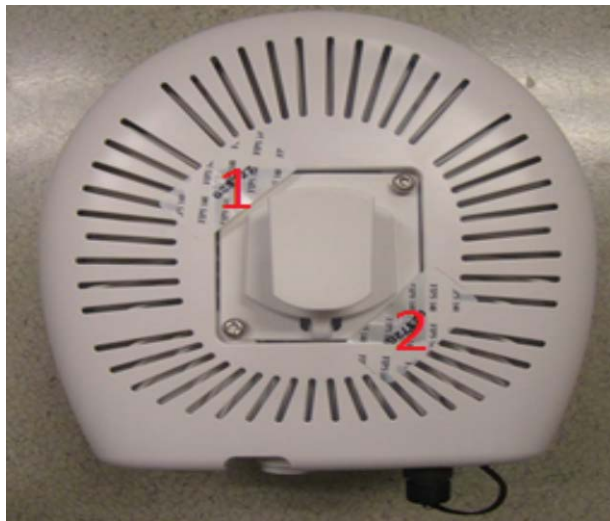


Figure 10 – Top View of AP-274 with TELs



Figure 11 – Rear View of AP-274 with TELs



Figure 12 – Right Side View of AP-274 with TELs



Figure 13 – Left Side View of AP-274 with TELs

### 3.2.2.4 TEL Placement on the AP-275

The AP-275 requires a minimum of 6 TELs. Two sealing the top plate (labels 1 and 2), see Figure 14. One covering the console port (label 3) and one securing the body to the bottom (label 4), see Figure 15. Finally apply one label to each side sealing it to the bottom (labels 5 & 6), see figures 16 and 17 for placement.

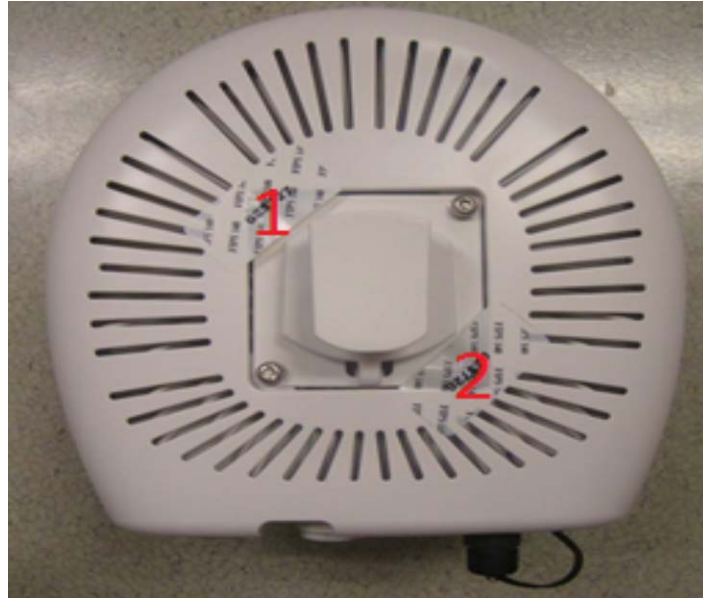


Figure 14 – Top View of AP-275 with TELs



Figure 15 – Rear View of AP-275 with TELs





Figure 16 – Right Side View of AP-275 with TELs



Figure 17 – Left Side View of AP-275 with TELs

### 3.2.2.5 TEL Placement on the AP-277

The AP-277 requires a minimum of 3 TELs. One covering the console port (label 1) see Figure 17. Apply one label to each side sealing it to the bottom (labels 2 & 3), see figures 18 and 19 for placement.



Figure 18 – Top View of AP-277 with TELs

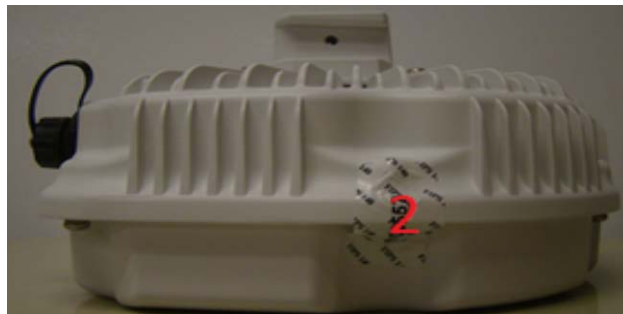


Figure 19 – Right Side View of AP-277 with TELs



Figure 20 – Left Side View of AP-277 with TELs

### 3.2.2.6 TEL Placement on the AP-228

This section displays all the TEL locations of the Aruba AP-228. The AP-228 requires a minimum of 3 TELs to be applied as follows:

#### 3.2.2.7 To detect opening of the chassis cover:

- Spanning the bottom and top chassis covers and placed on the left, right of the unit

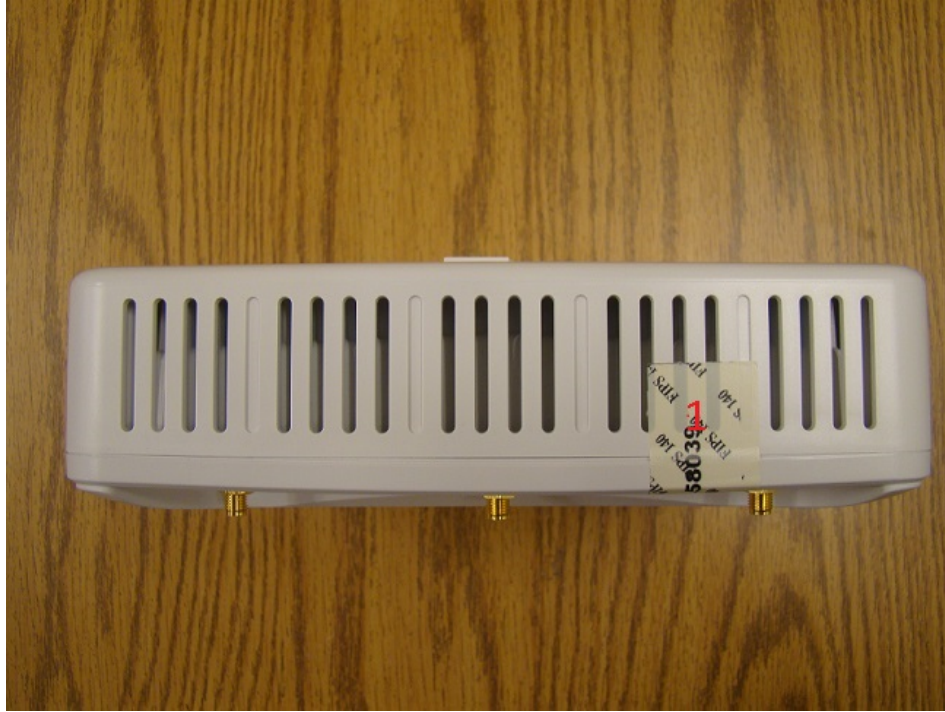
#### 3.2.2.8 To detect access to restricted ports

- Spanning the console port

Following is the TEL placement for the AP-228:



Figure 1: AP-228 Front/Top view



**Figure 2: AP-228 Edge View to show TEL wrapping.**



**Figure 3: AP-228 End view to show console port coverage**

### 3.2.3 Inspection/Testing of Physical Security Mechanisms

**Table 3.2 - Inspection/Testing of Physical Security Mechanisms**

Physical Security Mechanism	Recommended Test Frequency	Guidance
Tamper-evident labels (TEs)	Once per month	Examine for any sign of removal, replacement, tearing, etc. See images above for locations of TEs
Opaque module enclosure	Once per month	Examine module enclosure for any evidence of new openings or other access to the module internals.

### 3.3 Operational Environment

The FIPS 140-2 Operational Environment requirements are not applicable because the module is designated as a non-modifiable operational environment. The module only allows the loading of trusted and verified firmware that is signed by Aruba.

### 3.4 Logical Interfaces

The physical interfaces are divided into logical interfaces defined by FIPS 140-2 as described in the following table.

**Table 3.3 - Logical Interfaces**

FIPS 140-2 Logical Interface	Module Physical Interface
Data Input Interface	<ul style="list-style-type: none"> <li>• 10/100/1000 Ethernet Ports</li> <li>• 802.11a/b/g/n/ac Antenna Interfaces</li> <li>• USB 2.0 Interface (AP-214/215)</li> </ul>
Data Output Interface	<ul style="list-style-type: none"> <li>• 10/100/1000 Ethernet Ports</li> <li>• 802.11a/b/g/n/ac Antenna Interfaces</li> <li>• USB 2.0 Interface (AP-214/215)</li> </ul>
Control Input Interface	<ul style="list-style-type: none"> <li>• 10/100/1000 Ethernet Ports</li> <li>• 802.11a/b/g/n/ac Antenna Interfaces</li> <li>• Reset button (AP-214/215)</li> </ul>
Status Output Interface	<ul style="list-style-type: none"> <li>• 10/100/1000 Ethernet Ports</li> <li>• 802.11a/b/g/n/ac Antenna Interfaces</li> <li>• USB 2.0 Interface (AP-214/215)</li> </ul>
Power Interface	<ul style="list-style-type: none"> <li>• Power Input</li> <li>• Power-over-Ethernet (POE)</li> </ul>

Data input and output, control input, status output, and power interfaces are defined as follows:

- Data input and output are the packets that use the networking functionality of the module.

- Control input consists of manual control inputs for power and reset through the power interfaces (power supply or POE). It also consists of all of the data that is entered into the access point while using the management interfaces. A reset button is present which is used to reset the AP to factory default settings.
- Status output consists of the status indicators displayed through the LEDs, the status data that is output from the module while using the management interfaces, and the log file.
  - LEDs indicate the physical state of the module, such as power-up (or rebooting), utilization level, and activation state. The log file records the results of self-tests, configuration errors, and monitoring data.
- The module may be powered by an external power supply. Operating power may also be provided via Power Over Ethernet (POE) device, when connected, the power is provided through the connected Ethernet cable.
- Console port is disabled when operating in FIPS mode by TEL.

The module distinguishes between different forms of data, control, and status traffic over the network ports by analyzing the packet headers and contents.

## 4 Roles, Authentication and Services

### 4.1 Roles

The module supports the roles of Crypto Officer, User, and Wireless Client; no additional roles (e.g., Maintenance) are supported. Administrative operations carried out by the Aruba Mobility Controller map to the Crypto Officer role. The Crypto Officer has the ability to configure, manage, and monitor the module, including the configuration, loading, and zeroization of CSPs.

Defining characteristics of the roles depend on whether the module is configured as in either Remote AP FIPS mode or in Control Plane Security (CPSec) Protected AP FIPS mode. There are two FIPS approved modes of operations, which are Remote AP FIPS mode and Control Plane Security (CPSec) Protected AP FIPS mode. Please refer to section 8 in this documentation for more information.

- **Remote AP FIPS mode:**
  - Crypto Officer role: the Crypto Officer is the Aruba Mobility Controller that has the ability to configure, manage, and monitor the module, including the configuration, loading, and zeroization of CSPs.
  - User role: in the configuration, the User operator shares the same services and authentication techniques as the Mobility Controller in the Crypto Officer role.
  - Wireless Client role: in Remote AP FIPS mode configuration, a wireless client can create a connection to the module using 802.11i and access wireless network access/bridging services. When Remote AP cannot communicate with the controller, the wireless client role authenticates to the module via 802.11i Pre-shared secret only.
  
- **CPSec Protected AP FIPS mode:**
  - Crypto Officer role: the Crypto Officer is the Aruba Mobility Controller that has the ability to configure, manage, and monitor the module, including the configuration, loading, and zeroization of CSPs.
  - User role: in the configuration, the User operator shares the same services and authentication techniques as the Mobility Controller in the Crypto Officer
  - Wireless Client role: in CPsec Protected AP FIPS mode configuration, a wireless client can create a connection to the module using 802.11i Pre-shared secret and access wireless network access services.

#### 4.1.1 Crypto Officer Authentication

In each of FIPS approved modes, the Aruba Mobility Controller implements the Crypto Officer role. Connections between the module and the mobility controller are protected using IPSec. Crypto Officer's authentication is accomplished via either Pre-shared secret (IKEv1), RSA digital certificate (IKEv1/IKEv2) or ECDSA digital certificate (IKEv2).

#### 4.1.2 User Authentication

When the module is configured as a Remote AP FIPS mode and CPsec protected AP FIPS mode, the User role is authenticated via the same Pre-shared secret (IKEv1), RSA digital certificate (IKEv1/IKEv2) or ECDSA digital certificate (IKEv2) that is used by the Crypto Officer.

### 4.1.3 Wireless Client Authentication

The wireless client role defined in each of FIPS approved modes authenticates to the module via 802.11i. Please notice that WEP and TKIP configurations are not permitted in FIPS mode. When Remote AP cannot communicate with the controller, the wireless client role authenticates to the module via 802.11i Pre-shared secret only.

### 4.1.4 Strength of Authentication Mechanisms

The following table describes the relative strength of each supported authentication mechanism.

**Table 4.1 - Strength of Authentication Mechanisms**

<b>Authentication Mechanism</b>	<b>Mechanism Strength</b>
IKEv1 Pre-shared secret based authentication (CO/User role)	<p>A 64 ASCII (128 HEX) characters pre-shared secret is randomly chosen by the administrator. It may consist of upper and lower case alphabetic characters, numeric characters and 32 special characters.</p> <p>The probability of randomly guessing the correct sequence is one (1) in <math>94^{64}</math>. This calculation is based on the assumption that the typical standard American QWERTY computer keyboard has 10 Integer digits, 52 alphabetic characters, and 32 special characters providing 94 characters to choose from in total. Therefore, the associated probability of a successful random attempt, with no restrictions on character usage, is approximately 1 in <math>94^{64}</math>, which is less than 1 in 1,000,000 required by FIPS 140-2.</p>
802.11i Pre-shared secret based authentication (Wireless Client role)	<p>The secret is required to be a minimum of eight characters and a maximum of 32 with a minimum of one letter and one number. If eight characters are chosen with a minimum of one letter and one number, the probability of randomly guessing the correct sequence is one (1) in 358,732,286,149,120 (this calculation is based on the assumption that the typical standard American QWERTY computer keyboard has 10 Integer digits, 52 alphabetic characters, and 32 special characters providing 94 characters to choose from in total. The calculation should be <math>94 \times 94 \times 94 \times 94 \times 94 \times 94 \times 52 \times 10 = 358,732,286,149,120</math>). Therefore, the associated probability of a successful random attempt is approximately 1 in 358,732,286,149,120, which is less than 1 in 1,000,000 required by FIPS 140-2.</p>
RSA Certificate based authentication (CO/User role)	<p>The module supports 2048-bit RSA keys authentication during IKEv1/IKEv2. RSA 2048 bit keys correspond to 112 bits of security. Assuming the low end of that range, the associated probability of a successful random attempt is 1 in <math>2^{112}</math>, which is less than 1 in 1,000,000 required by FIPS 140-2.</p>
ECDSA Certificate based authentication (CO/User role)	<p>ECDSA signing and verification is used to authenticate to the module during IKEv2. Either P-256 or P-384 curves are supported. ECDSA P-256 provides 128 bits of equivalent security, and P-384 provides 192 bits of equivalent security. Assuming the low end of that range, the associated probability of a successful random attempt is 1 in <math>2^{128}</math>, which is less than 1 in 1,000,000 required by FIPS 140-2.</p>



## 4.2 Services

The module provides various services depending on role. These are described below.

### 4.2.1 Crypto Officer Services

The CO role in each of FIPS modes defined in section 3.3 has the same services.

**Table 4.2 - Crypto Officer Services**

<b>Services</b>	<b>Description</b>	<b>CSPs Accessed</b> (see section 6 below for a complete description to each CSP and the associated cryptographic algorithms)
FIPS mode enable/disable	The CO selects/de-selects FIPS mode as a configuration option.	None.
Key Management	The CO can configure/modify the IKEv1 shared secret (The RSA private key is protected by non-volatile memory and cannot be modified) and the 802.11i Pre-shared secret (used in advanced Remote AP configuration). Also, the CO/User implicitly uses the KEK to read/write configuration to non-volatile memory.	13 and 25(write)
Remotely reboot module	The CO can remotely trigger a reboot	None
Self-test triggered by CO/User reboot	The CO can trigger a programmatic reset leading to self-test and initialization	None.
Update module firmware	The CO can trigger a module firmware update	12 (write)
Configure non-security related module parameters	CO can configure various operational parameters that do not relate to security	None.
Creation/use of secure management session between module and CO	The module supports use of IPSec for securing the management channel.	13 and 27(write)
System Status	CO may view system status information through the secured management channel	See creation/use of secure management session above.

Services	Description	CSPs Accessed (see section 6 below for a complete description to each CSP and the associated cryptographic algorithms)
Zeroization	The cryptographic keys stored in SDRAM memory can be zeroized by rebooting the module. The cryptographic keys (IKEv1 Pre-shared secret and 802.11i Pre-shared secret) stored in the flash can be zeroized by using command 'ap wipe out flash' or by overwriting with a new secret. The other keys/CSPs (KEK, RSA/ECDSA public key/private key and certificate) stored in Flash memory can be zeroized by using command 'ap wipe out flash'.	All CSPs will be destroyed.

#### 4.2.2 User Services

The User services defined in Remote AP FIPS mode and CPSec protected AP FIPS mode shares the same services with the Crypto Officer role, please refer to Section 4.2.1, "Crypto Officer Services".

#### 4.2.3 Wireless Client Services

The following module services are provided for the Wireless Client role in Remote AP FIPS mode and CPSec protected AP FIPS mode.

**Table 4.3- Wireless Client Services**

Service	Description	CSPs Accessed (see section 6 below for a complete description to each CSP and the associated cryptographic algorithms)
Generation and use of 802.11i cryptographic keys	In all modes, the links between the module and wireless client are secured with 802.11i.	None
Use of 802.11i Pre-shared secret for establishment of IEEE 802.11i keys	When the module is in advanced Remote AP configuration, the links between the module and the wireless client are secured with 802.11i. This is authenticated with a shared secret only.	None
Wireless bridging services	The module bridges traffic between the wireless client and the wired network.	None

#### **4.2.4 Unauthenticated Services**

The module provides the following unauthenticated services, which are available regardless of role.

- System status – module LEDs
- Reboot module by removing/replacing power
- Self-test and initialization at power-on.

#### **4.2.5 Service Available in Non-FIPS Mode**

- IPSec/IKE with Diffie-Hellman 768/1024-bit modulus and MD5.

Please note that all CSPs will be zeroized automatically when switching from FIPS mode to non-FIPS mode, or from non-FIPS mode to FIPS mode.

## 5 Cryptographic Algorithms

The firmware in each module contains the following cryptographic algorithm implementations/crypto libraries to implement the different FIPS approved cryptographic algorithms that will be used for the corresponding security services supported by the module in FIPS mode:

- ArubaOS OpenSSL Module algorithm implementation
- ArubaOS Crypto Module algorithm implementation
- ArubaOS UBootloader algorithm implementation
- Aruba AP Hardware algorithm implementation

Below are the detailed lists for the FIPS approved algorithms and the associated certificate implemented by each crypto library

- ArubaOS OpenSSL Module algorithm implementation supports the following functions:
  - AES (Cert. #2900) <sup>1</sup>
  - CVL (Cert. #326) <sup>2</sup>
  - DRBG (Cert. #528)
  - ECDSA (Cert. #524)
  - HMAC (Cert. #1835)
  - KBKDF (Cert. #32)
  - RSA (Cert. #1528)
  - SHS (Cert. #2440)
  - Triple-DES (Cert. #1726)
- ArubaOS Crypto Module algorithm implementation:
  - AES (Cert. #2884) <sup>3</sup>
  - CVL (Cert #314) <sup>4</sup>
  - ECDSA (Cert. #519)
  - HMAC (Cert. #1818)
  - RSA (Cert. #1518)
  - SHS (Cert. #2425)
  - Triple-DES (Cert. #1720)
- ArubaOS UBOOT Bootloader algorithm implementation:
  - RSA (Cert. #1517) <sup>5</sup>
  - SHS (Cert. #2424)

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<sup>1</sup> Note that only AES-CBC and AES-CTR are active on the module

<sup>2</sup> Only the IKE v1 KDF is active on the module

<sup>3</sup> Note that only AES-CBC, AES-CTR and AES-GCM are active on the module

<sup>4</sup> Only the IKEv2 KDF is active on the module

<sup>5</sup> RSA cert. #1517 was only used for RSA Signature verification on the module

- Aruba AP Hardware algorithm implementation:
  - AES (Certs. #1648 and #1649) <sup>6</sup>
  - HMAC (Certs. #538 and #967)
  - SHS (Certs. #934 and #1446)
  - Triple-DES (Certs. #758 and #1075)

### **Non-FIPS Approved but Allowed Cryptographic Algorithms**

- Diffie-Hellman (key agreement; key establishment methodology provides 112 bits of encryption strength)
- EC Diffie-Hellman (key agreement; key establishment methodology provides 128 or 192 bits of encryption strength)
- NDRNG

### **Non-FIPS Approved Cryptographic Algorithms**

- Diffie-Hellman (less than 112 bits of encryption strength)
- MD5

NOTE: IKEv1 and IKEv2 protocols have not been reviewed or tested by the CAVP and CMVP.

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<sup>6</sup> Note that only AES-CBC, AES-CTR, AES-CCM are active on the module

## 6 Critical Security Parameters

The following Critical Security Parameters (CSPs) are used by the module:

**Table 6.1 - Critical Security Parameters**

#	Name	Algorithm/Key Size	Generation/Use	Storage	Zeroization
<b>General Keys/CSPs</b>					
1	Key Encryption Key (KEK)	Triple-DES (192 bits)	Hardcoded during manufacturing. Used only to protect keys stored in the flash, not for key transport.	Stored in Flash memory (plaintext)	Zeroized by using command 'ap wipe out flash'.
2	DRBG entropy input	SP 800-90a CTR_DRBG (512 bits)	Entropy inputs to DRBG function used to construct the DRBG seed.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
3	DRBG seed	SP 800-90a CTR_DRBG (384-bits)	Input to the DRBG that determines the internal state of the DRBG. Generated using DRBG derivation function that includes the entropy input from the entropy source.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
4	DRBG Key	SP 800-90a CTR_DRBG (256 bits)	This is the DRBG key used for SP 800-90a CTR_DRBG.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
5	DRBG V	SP 800-90a CTR_DRBG V (128 bits)	Internal V value used as part of SP 800-90a CTR_DRBG.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
6	Diffie-Hellman private key	Diffie-Hellman Group 14 (224 bits)	Generated internally by calling FIPS approved DRBG (Cert. #528) to derive Diffie-Hellman shared secret used in both	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module

			IKEv1 and IKEv2.		
7	Diffie-Hellman public key	Diffie-Hellman Group 14 (2048 bits) Note: Key size of DH Group 1 (768 bits) and Group 2 (1024 bits) is not allowed in FIPS mode.	Derived internally in compliance with Diffie-Hellman key agreement scheme. Used for establishing DH shared secret.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
8	Diffie-Hellman shared secret	Diffie-Hellman Group 14 (2048 bits)	Established during Diffie-Hellman Exchange. Used for deriving IPsec/IKE cryptographic keys.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
9	EC Diffie-Hellman private key	EC Diffie-Hellman (Curves: P-256 or P-384).	Generated internally by calling FIPS approved DRBG (Cert #528) during EC Diffie-Hellman Exchange. Used for establishing ECDH shared secret.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
10	EC Diffie-Hellman public key	EC Diffie-Hellman (Curves: P-256 or P-384).	Derived internally in compliance with EC Diffie-Hellman key agreement scheme. Used for establishing ECDH shared secret.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
11	EC Diffie-Hellman shared secret	EC Diffie-Hellman (Curves: P-256 or P-384)	Established during EC Diffie-Hellman Exchange. Used for deriving IPsec/IKE cryptographic keys.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
12	Factory CA Public Key	RSA (2048 bits)	This is RSA public key. Loaded into the module during manufacturing. Used for Firmware verification.	Stored in Flash encrypted with KEK	Zeroized by using command 'ap wipe out flash'

**IPSec/IKE**

13	IKEv1 Pre-shared secret	Shared secret (64 ASCII or 128 HEX characters)	Entered by CO role. Used for IKEv1 peers authentication.	Stored in Flash memory encrypted with KEK	Zeroized by using command 'ap wipe out flash' or by overwriting with a new secret
14	skeyid	Shared Secret (160/256/384 bits)	A shared secret known only to IKEv1 peers. It was established via key derivation function defined in SP800-135 KDF (IKEv1). Used for deriving other keys in IKEv1 protocol implementation.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module.
15	skeyid_d	Shared Secret (160/256/384 bits)	A shared secret known only to IKEv1 peers. It was derived via key derivation function defined in SP800-135 KDF (IKEv1). Used for deriving IKEv1 session authentication key.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
16	SKEYSEED	Shared Secret (160/256/384 bits)	A shared secret known only to IKEv2 peers. It was derived via key derivation function defined in SP800-135 KDF (IKEv2) and it will be used for deriving other keys in IKEv2 protocol.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
17	IKE session authentication key	HMAC-SHA-1/256/384 (160/256/384 bits)	The IKE session (IKE Phase I) authentication key. This key is derived via key derivation function defined in SP800-135 KDF (IKEv1/IKEv2). Used for IKEv1/IKEv2 payload integrity verification.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module



18	IKE session encryption key	Triple-DES (192 bits) /AES (128/192/256 bits)	The IKE session (IKE Phase I) encrypt key. This key is derived via key derivation function defined in SP800-135 KDF (IKEv1/IKEv2). Used for IKE payload protection.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
19	IPSec session encryption keys	Triple-DES (192 bits) / AES and AES-GCM (128/192/256 bits)	The IPsec (IKE phase II) encryption key. This key is derived via a key derivation function defined in SP800-135 KDF (IKEv1/IKEv2). Used for IPSec traffics protection.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
20	IPSec session authentication keys	HMAC-SHA-1 (160 bits)	The IPsec (IKE Phase II) authentication key. This key is derived via using the KDF defined in SP800-135 KDF (IKEv1/IKEv2). Used for IPSec traffics integrity verification.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
21	IKE RSA Private Key	RSA private key (2048 bits)	This is the RSA private key. This key is generated by the module in compliance with FIPS 186-4 RSA key pair generation method. In both IKEv1 and IKEv2, DRBG (Cert. #528) is called for key generation. It is used for RSA signature signing in either IKEv1 or IKEv2.	Stored in Flash memory encrypted with KEK	Zeroized by using command 'ap wipe out flash'
22	IKE RSA public key	RSA public key (2048 bits)	This is the RSA public key. This key is derived in compliance with FIPS 186-4 RSA key pair generation method in the module. It is used for RSA signature verification in either IKEv1 or IKEv2. .	Stored in Flash memory encrypted with KEK	Zeroized by using command 'ap wipe out flash'

23	IKE ECDSA Private Key	ECDSA suite B (Curves: P-256 or P-384)	This is the ECDSA private key. This key is generated by the module in compliance with FIPS 186-4 ECDSA key pair generation method. In IKEv2, DRBG (Cert #528) is called for key generation. It is used for ECDSA signature signing in IKEv2.	Stored in Flash memory encrypted with KEK	Zeroized by using command 'ap wipe out flash'.
24	IKE ECDSA Public Key	ECDSA suite B (Curves: P-256 or P-384)	This is the ECDSA public key. This key is derived in compliance with FIPS 186-4 ECDSA key pair generation method in the module. It is used for ECDSA signature verification in IKEv2.	Stored in Flash memory encrypted with KEK	Zeroized by using command 'ap wipe out flash'
<b>802.11i</b>					
25	802.11i Pre-shared secret	Shared secret (8-63 characters)	Entered by CO role. Used for 802.11i client/server authentication.	Stored in Flash memory encrypted with KEK	Zeroized by using command 'ap wipe out flash' or by overwriting with a new secret.
26	802.11i Pair-Wise Master key (PMK)	Shared secret (256 bits)	The PMK is transported to the module, protected by IPsec secure tunnel. Used to derive the Pairwise Transient Key (PTK) for 802.11i communications.	Stored in SDRAM (plaintext)	Zeroized by rebooting the module
27	802.11i Pairwise Transient Key (PTK)	Shared secret (512 bits)	This key is used to derive 802.11i session key by using the KDF defined in SP800-108.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
28	802.11i session key	AES-CCM (128 bits)	Derived during 802.11i 4-way handshake by using the KDF defined in SP800-108.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module

29	802.11i Group Master Key (GMK)	Shared secret (256 bits)	Generated by calling DRBG (Cert. #528). Used to derive 802.11i Group Transient Key GTK.	Stored in SDRAM memory (plaintext)	Zeroized by rebooting the module
30	802.11i Group Transient Key (GTK)	AES-CCM (256 bits)	Derived from 802.11 GMK by using the KDF defined in SP800-108. The GTK is the 802.11i session key used for broadcast communications protection.	Stored in SDRAM memory (plaintext)	Used to protect multicast message

Please note that:

- AES GCM IV generation is performed in compliance with the Implementation Guidance A.5 scenario 2. FIPS approved DRBG (Cert #528) is used for IV generation and 96 bits of IV is supported.

## 7 Self Tests

The module performs Power On Self-Tests regardless the modes (non-FIPS mode, Remote AP FIPS mode or Control Plane Security (CPSec) Protected AP FIPS mode). In addition, the module also performs Conditional tests after being configured into either Remote AP FIPS mode or Control Plane Security (CPSec) Protected AP FIPS mode. In the event any self-test fails, the module enters an error state, logs the error, and reboots automatically.

The module performs the following power on self-tests:

- ArubaOS OpenSSL Module algorithm implementation power on self-tests:
  - AES (encrypt/decrypt) KATs
  - Triple-DES (encrypt/decrypt) KATs
  - DRBG KAT
  - RSA (sign/verify) KATs
  - ECDSA Pairwise Consistency Test
  - SHS (SHA1, SHA256, SHA384 and SHA512) KATs
  - HMAC (HMAC-SHA1, HMAC-SHA256, HMAC-SHA384 and HMAC-SHA512) KATs
- ArubaOS Crypto Module algorithm implementation power on self-tests:
  - AES (encrypt/decrypt) KATs
  - AES-GCM KAT
  - Triple-DES (encrypt/decrypt) KATs
  - SHS (SHA1, SHA256, SHA384 and SHA512) KATs
  - HMAC (HMAC-SHA1, HMAC-SHA256, HMAC-SHA384 and HMAC-SHA512) KATs
  - RSA (sign/verify) KATs
  - ECDSA Pairwise Consistency Test
- ArubaOS Uboot Bootloader Module algorithm implementation power on self-tests:
  - Firmware Integrity Test: RSA PKCS#1 v1.5 (2048 bits) signature verification with SHA-1
- Aruba AP Hardware algorithm implementation power on self-tests:
  - AES (encrypt/decrypt) KATs
  - AES-CCM (encrypt/decrypt) KATs
  - Triple-DES (encrypt/decrypt) KATs
  - HMAC-SHA1 KAT

The following Conditional Tests are performed in the module:

- ArubaOS OpenSSL Module algorithm implementation
  - CRNG Test to DRBG
  - ECDSA Pairwise Consistency Test
  - RSA Pairwise Consistency Test

- ArubaOS Crypto Module algorithm implementation
  - ECDSA Pairwise Consistency Test
  - RSA Pairwise Consistency Test
  
- ArubaOS Uboot BootLoader Module algorithm implementation
  - Firmware Load Test - RSA PKCS#1 v1.5 (2048 bits) signature verification
  
- CRNG test to NDRNG

These self-tests are run for the Freescale hardware cryptographic implementation as well as for the Aruba OpenSSL and ArubaOS cryptographic module implementations.

In the event of a KATs failure, the AP logs different messages, depending on the error.

For an ArubaOS OpenSSL AP module and ArubaOS cryptographic module KAT failure:

```
AP rebooted [DATE][TIME] : Restarting System, SW FIPS KAT failed
```

For an AES Atheros hardware POST failure:

```
Starting HW SHA1 KAT ...Completed HW SHA1 AT
Starting HW HMAC-SHA1 KAT ...Completed HW HMAC-SHA1 KAT
Starting HW DES KAT ...Completed HW DES KAT
Starting HW AES KAT ...Restarting system.
```

## 8 Secure Operation

The module can be configured to be in the following FIPS approved modes of operations via corresponding Aruba Mobility Controllers that have been certified to FIPS level 2:

- Remote AP FIPS mode – When the module is configured as a Remote AP, it is intended to be deployed in a remote location (relative to the Mobility Controller). The module provides cryptographic processing in the form of IPsec for all traffic to and from the Mobility Controller.
- Control Plane Security (CPsec) Protected AP FIPS mode – When the module is configured as a Control Plane Security protected AP it is intended to be deployed in a local/private location (LAN, WAN, MPLS) relative to the Mobility Controller. The module provides cryptographic processing in the form of IPsec for all Control traffic to and from the Mobility Controller.

In addition, the module also supports a non-FIPS mode – an un-provisioned AP, which by default does not serve any wireless clients. The Crypto Officer must first enable and then provision the AP into a FIPS AP mode of operation.

This section explains how to place the module in each FIPS mode and how to verify that it is in FIPS mode. An important point in the Aruba APs is that to change configurations from any one mode to any other mode requires the module to be re-provisioned and rebooted before any new configured mode can be enabled.

The access point is managed by an Aruba Mobility Controller in FIPS mode, and access to the Mobility Controller’s administrative interface via a non-networked general purpose computer is required to assist in placing the module in FIPS mode. The controller used to provision the AP is referred to below as the “staging controller”. The staging controller must be provisioned with the appropriate firmware image for the module, which has been validated to FIPS 140-2, prior to initiating AP provisioning. The Crypto Officer shall perform the following steps:

### 8.1.1 Configuring Remote AP FIPS Mode

1. Apply TELs according to the directions in section 3.2
2. Log into the administrative console of the staging controller
3. Deploying the AP in Remote FIPS mode configure the controller for supporting Remote APs, For detailed instructions and steps, see Section “Configuring the Secure Remote Access Point Service” in Chapter “Remote Access Points” of the Aruba OS User Manual.
4. Enable FIPS mode on the controller. This is accomplished by going to the **Configuration > Network > Controller > System Settings** page (this is the default page when you click the **Configuration** tab), and clicking the **FIPS Mode for Mobility Controller Enable** checkbox.
5. Enable FIPS mode on the AP. This accomplished by going to the **Configuration > Wireless > AP Configuration > AP Group** page. There, you click the **Edit** button for the appropriate AP group, and then select **AP > AP System Profile**. Then, check the “Fips Enable” box, check “Apply”, and save the configuration.
6. If the staging controller does not provide PoE, either ensure the presence of a PoE injector for the LAN connection between the module and the controller, or ensure the presence of a DC power supply appropriate to the particular model of the module.
7. Connect the module via an Ethernet cable to the staging controller; note that this should be a direct connection, with no intervening network or devices; if PoE is being supplied by an injector, this represents the only exception. That is, nothing other than a PoE injector should be present between the module and the staging controller.
8. Once the module is connected to the controller by the Ethernet cable, navigate to the **Configuration > Wireless > AP Installation page**, where you should see an entry for the AP.

Select that AP, click the “Provision” button, which will open the provisioning window. Now provision the AP as Remote AP by filling in the form appropriately. Detailed steps are listed in section entitled “Provisioning an Individual AP” in the ArubaOS User Guide. Click “Apply and Reboot” to complete the provisioning process.

- a. During the provisioning process as Remote AP if Pre-shared secret is selected to be the Remote AP Authentication Method, the IKE Pre-shared secret (64 ASCII or 128 HEX characters) is input to the module during provisioning. In the initial provisioning of an AP, this key will be entered in plaintext; subsequently, during provisioning, it will be entered encrypted over the secure IPSec session. If certificate based authentication is chosen, the AP’s RSA or ECDSA key pair is used to authenticate AP to controller during IPSec.
9. Via the logging facility of the staging controller, ensure that the module (the AP) is successfully provisioned with firmware and configuration
10. Terminate the administrative session
11. Disconnect the module from the staging controller, and install it on the deployment network; when power is applied, the module will attempt to discover and connect to an Aruba Mobility Controller on the network.

### 8.1.2 Configuring Control Plane Security (CPSec) Protected AP FIPS mode

1. Apply TELs according to the directions in section 3.2
2. Log into the administrative console of the staging controller
3. Configure the staging controller with CPsec under **Configuration > Controller > Control Plane Security** tab. AP will authenticate to the controller using certificate based authentication (IKEv2) to establish IPSec. The AP is configured with an RSA key pair at manufacturing. The AP’s certificate is signed by Aruba Certification Authority (trusted by all Aruba controllers) and the AP’s RSA private key is stored in non-volatile memory. Refer to the “Configuring Control Plane Security” section in the ArubaOS User Manual for details on the steps.
4. Enable FIPS mode on the controller. This is accomplished by going to the **Configuration > Network > Controller > System Settings** page (this is the default page when you click the **Configuration** tab), and clicking the **FIPS Mode for Mobility Controller Enable** checkbox.
5. Enable FIPS mode on the AP. This accomplished by going to the **Configuration > Wireless > AP Configuration > AP Group** page. There, you click the **Edit** button for the appropriate AP group, and then select **AP > AP System Profile**. Then, check the “FIPS Enable” box, check “Apply”, and save the configuration.
6. If the staging controller does not provide PoE, either ensure the presence of a PoE injector for the LAN connection between the module and the controller, or ensure the presence of a DC power supply appropriate to the particular model of the module
7. Connect the module via an Ethernet cable to the staging controller; note that this should be a direct connection, with no intervening network or devices; if PoE is being supplied by an injector, this represents the only exception. That is, nothing other than a PoE injector should be present between the module and the staging controller.
8. Once the module is connected to the controller by the Ethernet cable, navigate to the **Configuration > Wireless > AP Installation** page, where you should see an entry for the AP. Select that AP, click the “Provision” button, which will open the provisioning window. Now provision the CPsec Mode by filling in the form appropriately. Detailed steps are listed in Section “Provisioning an Individual AP” of Chapter “The Basic User-Centric Networks” of the Aruba OS User Guide. Click “Apply and Reboot” to complete the provisioning process.

- a. For CPSec AP mode, the AP always uses certificate based authentication to establish IPSec connection with controller. AP uses the RSA key pair assigned to it at manufacturing to authenticate itself to controller during IPSec. Refer to “Configuring Control Plane Security” Section in Aruba OS User Manual for details on the steps to provision an AP with CPSec enabled on controller.
9. Via the logging facility of the staging controller, ensure that the module (the AP) is successfully provisioned with firmware and configuration
10. Terminate the administrative session
11. Disconnect the module from the staging controller, and install it on the deployment network; when power is applied, the module will attempt to discover and connect to an Aruba Mobility Controller on the network.

### **8.1.3 Verifying the FIPS mode**

For all the approved modes of operations in either Remote AP FIPS mode or Control Plane Security (CPSec) Protected AP FIPS mode, follow the steps below to verify the FIPS mode:

1. Log into the administrative console of the Aruba Mobility Controller
2. Verify that the module is connected to the Mobility Controller
3. Verify that the module has FIPS mode enabled by issuing command “show ap ap-name <ap-name> config”
4. Terminate the administrative session