AirMagnet SmartEdge Sensor A5200, A5205, A5220, and A5225 Security Policy

FIPS 140-2 Level 2 Validation

June 15, 2010

Version 1.4

1 Introduction

This document is the Security Policy for AirMagnet SmartEdge Sensor A5200, A5205, A5220, and A5225 cryptographic modules. This Security Policy specifies the security rules under which the module shall operate to meet the requirements of FIPS 140-2 Level 2. It describes how the module functions to meet the FIPS requirements, and the actions that operators must take to maintain the security of the module.

This Security Policy describes the features and design of AirMagnet SmartEdge Sensor A5200, A5205, A5220, and A5225 cryptographic modules using the terminology contained in the FIPS 140-2 standard. *FIPS 140-2, Security Requirements for Cryptographic Modules* specifies the security requirements that must be satisfied by a cryptographic module utilized within a security system protecting sensitive but unclassified information. The NIST-CSEC Cryptographic Module Validation Program (CMVP) validates cryptographic modules to FIPS 140-2 and other cryptography-based standards. Validated products are accepted by the Federal agencies of both the USA and Canada for the protection of unclassified sensitive information.

The FIPS 140-2 standard, and information on the CMV program, can be found at http://csrc.nist.gov/groups/STM/cmvp/index.html. More information describing the sensor application can be found at http://www.AirMagnet.com.

In this document, the AirMagnet SmartEdge Sensor A5200, A5205, A5220, and A5225 devices are also referred to as “the module” or “the sensor”.

This Security Policy contains only non-proprietary information. All other documentation submitted for FIPS 140-2 conformance testing and validation is “AirMagnet - Proprietary” and is releasable only under appropriate non-disclosure agreements.

The AirMagnet SmartEdge Sensor A5200, A5205, A5220, and A5225 cryptographic modules meet the overall requirements applicable to Level 2 security for FIPS 140-2.

Table 1. Cryptographic Module Security Requirements.

Security Requirements Section	*Level*
Cryptographic Module Specification	2
Cryptographic Module Ports and Interfaces	2
Roles and Services and Authentication	2
Finite State Machine Model	2
Physical Security	2
Operational Environment	N/A
Cryptographic Key Management	2
EMI/EMC	2
Self-Tests	2
Design Assurance	2
Mitigation of Other Attacks	N/A
Cryptographic Module Security Policy	2

1.1 Acronyms and Abbreviations

AES	Advanced Encryption Standard
CBC	Cipher Block Chaining
CFB	Cipher Feedback
CMVP	Cryptographic Module Validation Program
CSEC	Communications Security Establishment Canada
CSP	Critical Security Parameter
DES	Data Encryption Standard
EDC	Error Detection Code
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
FIPS	Federal Information Processing Standard
HMAC	Keyed-Hash Message Authentication Code
KAT	Known Answer Test
LAN	Local Area Network
LED	Light Emitting Diode
MIB	Management Information Block
NIST	National Institute of Standards and Technology
PRNG	Pseudo Random Number Generator
PUB	Publication
RAM	Random Access Memory
RC4	Rivest Cipher 4
RFC	Request for Comment
ROM	Read Only Memory
RNG	Random Number Generator
RSA	Rivest Shamir and Adleman Public Key Algorithm
SHA-1	Secure Hash Algorithm
TDES	Triple DES
WEP	Wired Equivalent Privacy

2 AirMagnet SmartEdge Sensor A5200, A5205, A5220, and A5225

2.1 Functional Overview

AirMagnet Enterprise Sensors provide a distributed wireless security and integrity management system that brings control over your enterprise wireless network, and provides IT staff with the information and tools needed to support any number of WLANs throughout the entire network lifecycle.

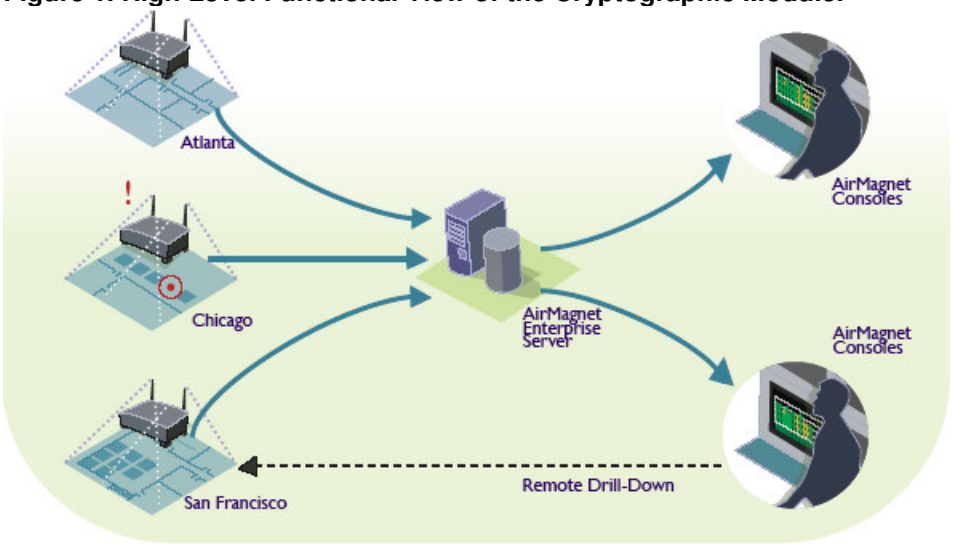
AirMagnet Enterprise Sensors are positioned within the range of one or more wireless Internet networks (802.11-A, 802.11-B, 802.11-G or 802.11-N) throughout an enterprise. Each sensor monitors wireless network traffic and periodically reports collected traffic statistics, identified access points and stations, performance anomalies, and security anomalies to a centralized server over a wired HTTPS connection. Authorized operators view the collected statistics of all sensors using the AirMagnet Enterprise Management Console program that accesses the centralized server over HTTPS. In the event of unusual or suspicious traffic, operators can invoke the console's Remote AirMagnet Program to view the live data being collected by any one sensor, connecting directly to the sensor over HTTPS. An authorized operator can also access the sensor via HTTPS using a web browser.

Features of the firmware include:

- Wireless Blocking renders a WI-FI device unable to make or maintain any wireless connections, effectively locking it out of the network. Both Clients and Access Points can be selectively targeted and blocked without impacting the normal operation of the network.
- Strong data encryption protects sensor data traveling on the wire between the sensor and the AirMagnet Enterprise Server, the Enterprise Management Console, or Web UI (user interface).
- Wired Side Blocking. AirMagnet Enterprise also includes the ability to block threats at the wired port. This complementary layer of protection shields the wired network from threats in the WLAN.
- Device Tracing. When a threatening device is identified in the network, AirMagnet can launch an active analytical trace to expose where the device is attached to the customer's wired infrastructure. Traces can span multiple switches, ensuring that every corner of the network is inspected.

Figure 1 illustrates the module operation. Sensors report collected statistics to the AirMagnet Enterprise Server. Operators at the console view the reported data from each sensor. Remote drill-down capabilities let operators connect to any sensor to view its live data as well as initiate blocking and tracing operations.

Figure 1. High Level Functional View of the Cryptographic Module.[1]



[1] The Enterprise Server, Management Console, and Web UI are external to the module and are not addressed by this validation

2.2 Module Description

The AirMagnet SmartEdge Sensor A5200, A5205, A5220, and A5225 cryptographic modules are multi-chip standalone cryptographic modules containing a WI-FI subsystem that passes signals to an analyzer subsystem. The A5220 and A5225 models have an additional internal spectrum analyzer receive-only card and supporting firmware; otherwise they are identical to the A5200 and A5205 models, respectively. The A5200 and A5220 models have external antennas; otherwise they are identical to the A5205 and A5225 models, respectively. A web server and a web client handle HTTPS communications between the module and both the AirMagnet Enterprise Server and remote monitoring systems.

The module has a limited operational environment. The firmware executes on a Linux operating system but access to operating system operations is logically prevented. The module consists of production-grade components encased within an opaque hard production-grade enclosure. The removable cover is protected by tamper evident security seals in accordance with FIPS 140-2 Level 2 requirements. The module provides authentication, cryptographic key management, and firmware integrity services assuring operators of a valid firmware state within the module and privacy services for the secure storage of data, cryptographic keys, and CSPs. The module does not have a bypass or maintenance mode. The firmware version is 8.5.0-12097.

The module meets applicable Federal Communication Commission (FCC) Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) requirements as defined in FCC requirements for radios (FCC Rule Part 15E).

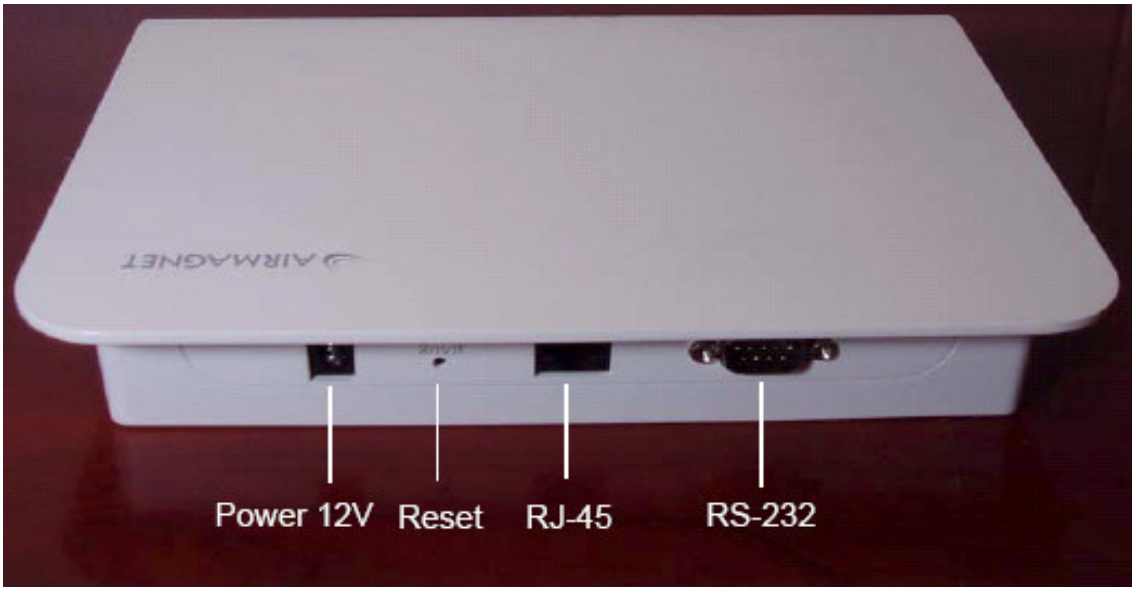
Figures 2-1 and 2-2 show A5200/A5220 and A5205/A5225 models of the sensor.

Figure 2-1. AirMagnet SmartEdge Sensor A5200/A5220 and A5205/A5225 Physical Views.

A5200/A5220

A5205/A5225

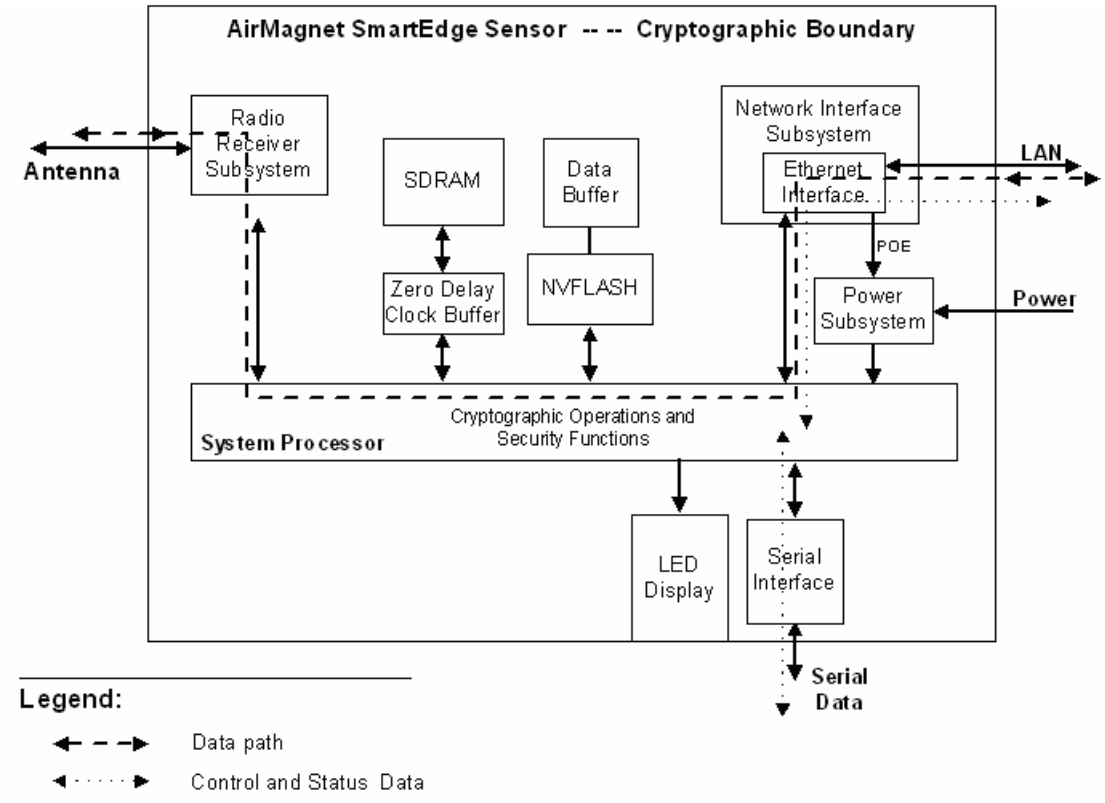
Figure 2-2. AirMagnet SmartEdge Sensor A5200/A5220/A5205/A5225 connectors.



2.2.1 Hardware Block Diagram

Figure 3 is a hardware block diagram showing the cryptographic and physical boundaries of the module and the module hardware subsystems. The figure shows the flow of data through the module as well as the module physical ports and interfaces.

Figure 3. High Level Hardware Block Diagram Showing Cryptographic and Physical Boundaries.



2.3 Module Ports and Interfaces

Table 2 lists the physical ports, their functions, and the logical FIPS 140-2 interfaces of the cryptographic module. Where distinct logical interfaces share the same physical port (Ethernet Port, Serial Port), communication protocols logically separate and isolate these interfaces from one another. The system processor manages data as it passes through the module. The module relies on programmatic functionality and the system processor to ensure that logically distinct categories of data do not occupy the data path at the same time.

Table 2. Physical Ports and Logical FIPS 140-2 Interfaces.

Physical Port	*FIPS 140-2 Logical Interface*
Ethernet port	Data input, data output, control input, status output, power (Power over Ethernet (POE)).
Serial port	Control input, Status output.

Physical Port	*FIPS 140-2 Logical Interface*
LEDs	Status output.
Power port	Power input enters the module via the power connector. Alternatively, power may enter the module using the Power over Ethernet (POE) port. The Power over Ethernet (POE) port is physically isolated from the data input and output using dedicated pins within the Ethernet port.
Antenna interface	Data input, data output
Reset Button	Control Input.

The FIPS 140-2 logical interfaces correspond to physical ports as described in Table 3.

Table 3. FIPS 140-2 Logical Interfaces.

Logical Interface	*Description*
Data input	The data input consists of the antenna input to the module. Data input also consists of ciphertext data entering the cryptographic module via the Ethernet interface for the purpose of being decrypted and delivered to the sensor subsystems.
Data output	The data output consists of all data exiting the cryptographic module via the Ethernet interface in the form of periodic analyzer reports or as live data requested from a remote monitoring application. Data output also includes all instrumentation data (transmission tracing and blocking) that is directed to the antenna output.
Control input	Control input from remote operators enters the module using the Ethernet interface. Control input from local operators enters the module using the serial port or Reboot/Reset Button. Control input commands consist of module commands such as changing the shared key, module reset, network setup, and status requests.
Status output	The status output consists of module status returned from status requests by module operators and other module outputs indicating module conditions. Examples of status data include module version information, module identifier, network address, results of the power on self-test, and whether the module is in FIPS Approved Mode. Status output exits the module via the Ethernet interface, the serial port, and via the LEDs on the module physical perimeter that indicate module operational parameters.

The LEDs have definitions shown on Figure 4-1.

Figure 4-1. A5200/A5220/A5205/A5225 LED Definitions.

LED	Color	Status	Description
Power	Green	Steady	The Sensor is powered up and ready.
	Green	Flickering	The Sensor is not ready, e.g., configuration in progress.
		Off	The Sensor is powered off.
LAN	Green	Flickering	The Sensor is powered up and working properly.
		Off	The Sensor is powered off or its LAN port is experiencing a connection problem.
WLAN	Green	On	The Sensor is in *Monitor Mode*, i.e., receiving packets.
	Amber	On	The Sensor is in *Client Mode*, i.e., sending packets.
		Off	The Sensor is powered off.

3 Security Functions

The sensor cryptographic module implements the security functions described in Table 4.

Table 4. Module Security Functions.

Approved Security Functions	*Certificate*
Symmetric Key Encryption	
AES (FIPS PUB 197) ECB(e/d; 128) Encryption and decryption of the Shared Key and the Integrity HMAC/SHA-1 Secret Key for storage.	331
TDES in the CBC mode (FIPS 46-3) (e/d; KO 1,2,3) Encryption and decryption within the SSL/TLS protocol between the module and a remote monitoring and control system, or the Enterprise server.	395
Asymmetric Key Signature	
RSA (FIPS PUB 186-2) ALG[RSASSA-PKCS1_V1_5]; SIG(gen); SIG(ver); 2048, SHS: SHA-1 Digital signatures within the SSL/TLS protocol.	111
Hashing	
SHA-1 (FIPS PUB 180-2) This function is used with HMAC for the firmware load test, firmware integrity check, authentication within the SSL/TLS protocol. SHA-1 is not used as a separate service.	406
Message Authentication Code	
HMAC–SHA-1 (FIPS PUB 198) (Key Size Ranges: KS < BS) Firmware load test, firmware integrity check, authentication within the SSL/TLS protocol.	135
Random Number Generation	
RNG (ANSI X9.31) Generation of SSL/TLS session keys.	152

Non-Approved Security Function	*Certificate*
Diffie-Hellman (can be used in FIPS mode, provides 80 bits of encryption strength) Key agreement within the SSH (non-approved mode), and SSL/TLS protocols.	N/A
RSA key transport (can be used in FIPS mode, provides 112 bits of encryption strength) Key transfer within the SSL/TLS protocol.	N/A

Non-Approved Security Function	*Certificate*
RC4 (can be used in FIPS mode) Backward-compatibility within the SSL protocol (non-approved mode) and passive monitoring of non-sensitive wireless network data.	N/A
RC2 Backward-compatibility within the SSL protocol (non-approved mode).	N/A
MD5 and **HMAC-MD5** SSH protocol processing (non-approved mode), and backward-compatibility within the SSL protocol (non-approved mode).	N/A
DES Backward-compatibility within the SSL protocol (non-approved mode).	N/A
TDES SSH protocol processing (non-approved mode). Listed as non-Approved since no certificate has been issued.	N/A
AES SSH protocol processing (non-approved mode). Listed as non-Approved since no certificate has been issued.	N/A
DSS Backward-compatibility within the SSL protocol (non-approved mode). Listed as non-Approved since no certificate has been issued.	N/A
IDEA Backward-compatibility within the SSL protocol (non-approved mode). Listed as non-Approved since no certificate has been issued.	N/A
Blowfish SSH protocol processing (non-approved mode).	N/A
Twofish SSH protocol processing (non-approved mode).	N/A

4 FIPS Approved Mode of Operation

The module's approved mode of operation is restricted to performing FIPS-approved cryptographic algorithms and security functions for protection of sensitive data. RC4 is not an approved cryptographic algorithm and its use is limited to the passive monitoring of wireless data traffic that is not considered "sensitive or protected data" within the context of FIPS 140-2. The local crypto officer enables approved mode by entering the *show fipsmode* command at the serial port, and, if FIPS mode is disabled, entering *set fipsmode* command. The remote crypto officer enables approved mode via Web UI by navigating to *Configuration->Network Setup* and selecting "Enable" in the "FIPS Mode" drop-down menu. The approved mode disables use of telnet and SSH, and sets the module to use TLS (disabling the non-approved SSL) communication for HTTPS access. The module can only enter the approved mode after the power-on self-tests complete successfully. In the approved mode the crypto officer initializes the module for use and changes module operating characteristics and CSPs. The crypto officer must reset the module shared key whenever the module switches from one mode to the other. The tamper evident seals shall be applied by the crypto officer as shown in Section 9. Module users receive and send information from/to the module.

Additional information is provided in Appendix H of AirMagnet Enterprise User Guide.

The module also has a non-approved mode. The non-approved mode enables use of telnet, SSH, and SSL for communication with the cryptographic module.

Whenever the module switches from one mode to the other, the module is rebooted to delete the TDES key used for TLS bulk data encryption, the HMAC secret key used for TLS bulk data authentication, and other sensitive data.

5 Authentication

The module supports a local crypto officer role, a remote crypto officer role, and a user role. Local crypto officers, remote crypto officers and users may be different people or they may be the same person performing role-specific module operations. The module uses role-based authentication.

The *AirMagnet Enterprise User Guide* specifies three remote roles: Administrator, Power User, and Basic User. These roles correlate to the following roles within FIPS 140-2.

- Administrator using the Web user interface correlates to the remote crypto officer role.
- Power User and Basic User correlate to the user role.

An authorized administrator using the serial port correlates to the local crypto officer role. The administrator assumes the local crypto officer role by logging in to the serial port of the sensor using the shared key.

An operator assumes the remote crypto officer role by logging in to the sensor remotely using a remote administrator's user name and password.

An operator assumes the user role by logging in to the sensor remotely using the username and password of a remote Power User or remote Basic User. Authenticated users may read data from the module's instrumentation data channel. Users cannot modify the module cryptographic keys or CSPs.

The module design imposes certain restrictions on concurrent operators and re-authentication is required to change roles. Assumption of a role is achieved by requiring operator authentication before granting access to services offered by a particular role. The firmware then programmatically separates roles and services during module use by providing role-specific services to operators authenticated within a specific role. The module does not display the password that is entered into the module. Access to the authorized roles is restricted as explained in Table 5.

Table 5. Roles and Required Identification and Authentication.

Role	Type of Authentication	Authentication Data
Local Crypto Officer	Role-based	An operator must enter the correct shared key via the module serial port to assume the local crypto officer role.
Remote Crypto Officer	Role-based	An operator must enter the correct user name and password of a remote Administrator via TLS to assume the remote crypto officer role.
User	Role-based	An operator must enter the correct user name and password of a remote Power User or remote Basic User via TLS to assume the user role.

The module does not require any physical maintenance. The strength of the operator authentication, per the above roles, is as follows in Table 6.

Table 6. Strength of Authentication.

Authentication Mechanism	Strength of Mechanism
Shared Key	A local crypto officer authenticates using the shared key. The shared key must be at least 6 characters and at most 36 characters in length. Numbers, special characters, lower and uppercase letters can be used in the password. This yields a minimum of 95^6 (over 735 billion) possible combinations; thus, the possibility of correctly guessing a password is less than 1 in 1,000,000. The possibility of randomly guessing the shared key in 60 seconds is less than 1 in 100,000 as the shared key is entered via the 115,200 bit per second serial port and the minimum shared key length is 6 characters.
User Name/Password	Users and remote crypto officers must authenticate using a password that is at least 6 characters and at most 36 characters. Numbers, special characters, lower and uppercase letters can be used in the password. This yields a minimum of 95^6 (over 735 billion) possible combinations; thus, the possibility of correctly guessing a password is less than 1 in 1,000,000. The possibility of randomly guessing a password in 60 seconds is less than 1 in 100,000 due to the performance limitation of the embedded web server that is used to enter the password.

When the cryptographic module is powered off and subsequently powered on, the results of previous authentications (the decrypted Shared Key) is cleared from memory. When the module is powered up again, operators must re-authenticate, entering the correct user name/password or shared key.

6 Cryptographic Keys and CSPs

The following table identifies the cryptographic keys and critical security parameters (CSPs) used within the module. Plaintext cryptographic keys and CSPs are never output from the module.

Table 7. Cryptographic Keys and CSPs.

Data Item	*Description*
RSA Private Key (RSA priv)	This 2048 bit key is used for key transfer and digital signatures within the TLS protocol. The key is created when the module is manufactured. The key is stored in plaintext form in non-volatile flash memory. The key is zeroized (overwritten with zeros) in the flash memory on a zeroize command. The key is also stored in plaintext form in SDRAM while in use.
RSA Public Key (RSA pub)	This 2048 bit key is used for key transfer and digital signatures within the TLS protocol. The key is created when the module is manufactured. The key is included in a certificate that is stored in plaintext form in non-volatile flash memory. The key is zeroized (overwritten with zeros) in the flash memory on a zeroize command. The key is also stored in plaintext form in SDRAM while in use.
TLS TDES Key	A dynamic 192-bit TDES key performs encryption and decryption within the TLS protocol between the module and a remote monitoring and control system, or the Enterprise server. For each TLS session initiated by the module, the dynamic 192-bit TDES key is generated on the module using an approved RNG. For each TLS session initiated by a remote monitoring and control system, or the Enterprise server, the dynamic 192-bit TDES key is generated off the module (by a remote monitoring and control system or the Enterprise server). The key is stored in plaintext form in SDRAM. The key is deleted whenever the TLS session concludes, on power-down, reboot, or any command that is followed by a reboot, such as switching between non-approved and approved modes, zeroization, restore factory settings and reset shared key.
Shared Key	The shared key is a password chosen by the local crypto officer during module initialization. The shared key authenticates communications between the sensor and the server. It also authenticates local crypto officer operations. The local crypto officer establishes the shared key on module initialization and whenever required by the organization's security policy. The key is stored in AES encrypted form in non-volatile flash memory. The key is also stored in plaintext form in SDRAM during the module operation. The shared key is zeroized (overwritten with zeros) in the flash memory on a zeroize command. The shared key is restored to the default value on Restore Shared Key command, and on Restore factory settings command.
Remote users' names and passwords	Remote users' names and passwords are downloaded from the server and cached on the sensor at boot time and whenever a remote user authenticates and the server is available. They are stored in SDRAM in plaintext and are deleted from memory on power-down, reboot, or any command that is followed by a reboot, such as switching between non-approved and approved modes, zeroization, restore factory settings, and reset shared key.
AES Storage Key	This 128-bit key encrypts and decrypts the shared key and the integrity HMAC/SHA-1 key, for storage in non-volatile flash memory. The key is created and loaded onto the module as part of the manufacturing process. This key is stored in plaintext form in non-volatile flash memory. The key is also stored in plaintext form in SDRAM while in use. It is zeroized (overwritten with zeros) in the flash memory on a zeroize command, making the shared key irretrievable.
RNG Seed	Random number generator obtains its seed by reading bytes from the /dev/urandom device. The seed is stored in SDRAM in plaintext while in use and is deleted from memory on power-down, reboot, or any command that is followed by a reboot, such as switching between non-approved and approved modes, zeroization, restore factory settings, and reset shared key.

Data Item	Description
RNG Seed Key	Random number generator obtains its seed key by reading bytes from the /dev/urandom device. The seed key is stored in SDRAM in plaintext while in use and is deleted from memory on power-down, reboot, or any command that is followed by a reboot, such as switching between non-approved and approved modes, zeroization, restore factory settings, and reset shared key.
Integrity HMAC/SHA-1 Secret Key	An HMAC/SHA-1 secret key (128 bits) is maintained in the firmware image. The key is created off the module and loaded onto the module as part of the manufacturing process. It is stored in AES encrypted form in non-volatile flash memory. The key is also stored in plaintext form in SDRAM while in use. This key is used for the firmware integrity test and the verification of all validated firmware components when the components are externally loaded into a cryptographic module. The key is zeroized (overwritten with zeros) in the flash memory on a zeroize command.
TLS HMAC/SHA-1 Secret Key	The dynamic HMAC/SHA-1 secret key (128 bits) is used within the TLS protocol for authentication of session data between the module and a remote monitoring and control system, or the Enterprise server. The key is generated off the module (by a remote monitoring and control system or by the Enterprise server) for each TLS session initiated by a remote monitoring and control system, or by the Enterprise server. The key is generated on the module using an approved RNG for each TLS session initiated by the module. While in use, the key is stored in plaintext form in SDRAM. The key is deleted whenever the TLS session concludes, on power-down, reboot, or any command that is followed by a reboot, such as switching between non-approved and approved modes, zeroization, restore factory settings and reset shared key.
RC4 WEP Key	A 64 bit RC4 key used for passive monitoring of non-sensitive wireless network data is loaded onto the module by the Enterprise server over TLS. The key is stored in plaintext form in SDRAM. The key is deleted on power-down, reboot, or any command that is followed by a reboot, such as switching between non-approved and approved modes, zeroization, restore factory settings, and reset shared key.
Diffie-Hellman Private Key and Public Key	The dynamic Diffie-Hellman Private Key and Public Key (1024 bits) are used for key establishment within the TLS protocol. The keys are generated on the module using an approved RNG. While in use, the keys are stored in plaintext form in SDRAM. The keys are deleted whenever the TLS session concludes, on power-down, reboot, or any command that is followed by a reboot, such as switching between non-approved and approved modes, zeroization, restore factory settings and reset shared key.

7 Roles and Services

The module supports services that are available to operators in the local crypto officer role, the remote crypto officer role, and the user role. All of the services are described in detail in the module user documentation. Table 8 shows the services available to the various roles.

Table 8. Roles and Services.

Service	*Local Crypto Officer*	*Remote Crypto Officer*	*User*
Login	●	●	●
Change shared key	●	●	
Setup network	●	●	
Setup sensor	●	●	
Read instrumentation data		●	●
Run self-test	●	●	
Show status	●	●	●
Reboot	●	●	
Update firmware[1]	●	●	
Restore factory settings	●	●	
Restore Shared Key	●[2]	●	
Zeroize	●	●	
Set FIPS approved mode	●	●	

[1] The loading of non-validated firmware will invalidate the module's validation

[2] Service available on serial port only.

8 Access Control

Table 9 shows services that use or affect cryptographic keys or CSPs. For each service, the key or CSP is indicated along with the type of access.

R - The item is **read** or referenced by the service.
W - The item is **written** or updated by the service.
E - The item is **executed** by the service. (The item is used as part of a service.)
D - The item is **deleted** by the service.

Table 9. Access Control.

Key or CSP	*Service*	*Access Control*
RSA Private Key	Login (Crypto Officers and Users via TLS)	R,E
	Zeroize	W,D
RSA Public Key	Login (Crypto Officers and Users via TLS)	R,E
	Zeroize	W,D
AES Storage Key	Zeroize	W,D
	Reboot sensor	R,E
	Change Shared Key	R,E

Key or CSP	*Service*	*Access Control*
TLS TDES Key	Remote Crypto Officer and User Services	R,E
	Zeroize (includes a reboot)	D
	Set FIPS approved mode (includes a reboot)	D
	Restore factory settings; Reset Shared Key (either command includes a reboot)	D
	Reboot sensor	D
Shared Key	Change shared key	W
	Set FIPS approved mode	W
	Zeroize	W,D
	Restore factory settings; Reset Shared Key	W
	Read Instrumentation Data (Enterprise Management Console)	R,E
	Login (via Serial Port)	R,E
Remote users' names and passwords	Zeroize (includes a reboot)	D
	Reboot	D
	Login (Crypto Officers and Users via TLS)	R,E
	Set FIPS approved mode (includes a reboot)	D
	Restore factory settings; Reset Shared Key (either command includes a reboot)	D
Integrity HMAC/SHA-1 Secret Key	Zeroize	W,D
	Update firmware	R,E
RNG Seed and Seed Key	Zeroize; Restore factory settings; Reset Shared Key; Set FIPS approved mode (either command includes a reboot); Reboot sensor	R,E,D
RC4 WEP Key	Zeroize; Restore factory settings; Reset Shared Key; Set FIPS approved mode (either command includes a reboot); Reboot sensor	D
	Read instrumentation data	R,E
TLS HMAC/SHA-1 Secret Key	Reboot sensor	D
	Remote Crypto Officer and User Services	R,E
	Zeroize	D
	Set FIPS approved mode (followed by a reboot)	D
	Restore factory settings; Reset Shared Key (either command is followed by a reboot)	D
Diffie-Hellman Private Key and Public Key	Reboot sensor	D
	Remote Crypto Officer and User Services	R,E
	Set FIPS approved mode (followed by a reboot)	D
	Restore factory settings; Reset Shared Key (either command is followed by a reboot)	D
	Zeroize	D

9 Physical Security

The physical security of the cryptographic module meets FIPS 140-2 level 2 requirements. The cryptographic module consists of production-grade components that include standard passivation techniques. The module consists of production-grade components encased within an opaque hard production-grade enclosure (hard plastic cover and bottom). The removable cover is protected by tamper evident security seals in accordance with FIPS 140-2 Level 2 requirements. The module meets commercial-grade specifications for power, temperature, reliability, shock and vibration.

Tamper evident seals are placed over the sides of the module, such that any attempt to remove the cover will leave evidence of tampering. Each seal is identified by a unique serial number. The local crypto officer records these serial numbers after each application. These records are used during inspections to detect unauthorized replacement of seals. The local crypto officer shall periodically inspect the module for signs of tampering such as dents or scratches on the module enclosure, damage to, or incorrect serial numbers on the tamper evident seals. If tampering is detected, the crypto officer is instructed to perform the zeroize operation prior to discarding the module or returning it to the manufacturer.

To apply tamper evident seals:

1. Clean the area where you will apply the seals.
2. Apply the seals, one at a time, onto each side of the Sensor, as shown in Figures 5-1 and 5-2. Make sure that the seals are applied length-wise, starting from under the lip of the Sensor and extending all the way towards the bottom cover, as only one part of the seal needs to be removed to defeat the seal.
3. Firmly press the seal ends around the module sides to cover the seam between the module bottom and module cover.
4. Record the seal serial number and confirm their presence during later module inspections.
5. Allow 24 hours for the seal adhesive to dry completely.

Figures 5-1 and 5-2 show how the tamper evident seals are placed over the sides of the module.

Figure 5-1. A5200/A5220 Tamper Evident Seals

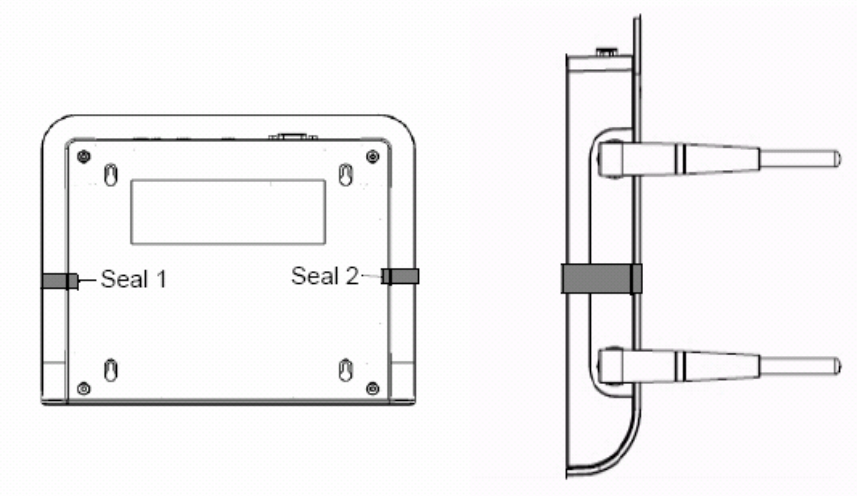
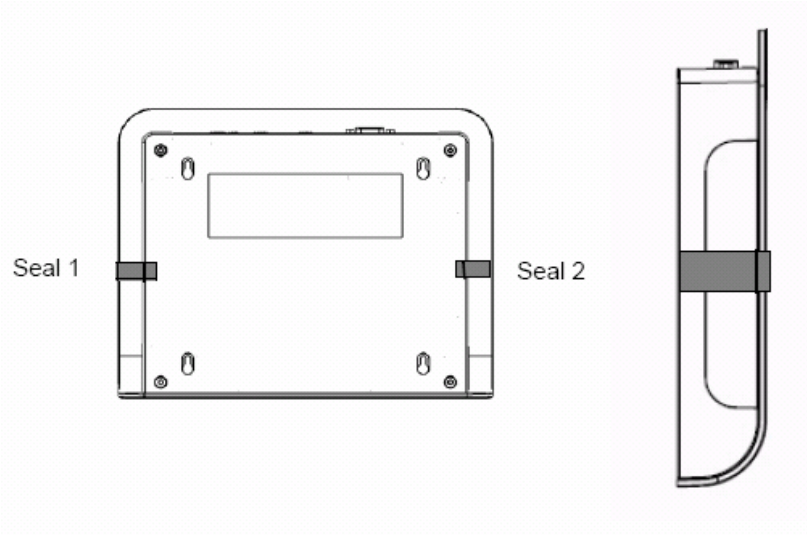


Figure 5-2. A5205/A5225 Tamper Evident Seals



10 Self Tests

The module performs both power-on self test (POST) and conditional self tests to verify the integrity and correct operational functioning of the cryptographic module. If the system fails a self test, it reports status indicating that a failure and transition to an error state occured, blocking all data output via the data output interface and preventing use of any cryptographic keys, CSPs, cryptographic algorithms, and security functions.

While the module is performing any power on self-test, firmware rules permanently coded within the executable image prevent the module from entering a state where data output via the data output interface is possible. During any conditional tests, data output via the data output interface is prevented.

A crypto officer can run the POST on demand by rebooting or power cycling the module.

Table 10 summarizes the system self tests.

Table 10. Self Tests.

Self Test	***Description***
Power-up tests performed at power-up and on demand:	
Cryptographic Algorithm Known Answer Tests	Each cryptographic algorithm (AES, TDES, RSA, SHA-1, HMAC/SHA-1 and RNG) performed by the module, is tested using a “known answer” test to verify the operation of the function. SHA-1 and HMAC/SHA-1 tests are combined.
RSA Signature Generation/Verification Test	The module generates and verifies a digital signature to verify the operation of this function.
Firmware Integrity Test	The module uses a keyed-hash message authentication code (HMAC-SHA-1) to verify the integrity of the module firmware.
Conditional tests performed, as needed, during operation:	
Firmware load test	Whenever a firmware update is loaded onto the module, the module performs an HMAC/SHA-1 calculation to confirm the firmware authenticity.
Continuous RNG	This test is a “stuck at” test to check the RNG output data for failure to a constant value.
Manual Entry Test	The Shared Key must be entered twice. If the two inputs are not identical, the test fails.

Any self test success or failure messages are output to the serial port. Examples of POST success messages are:

```
Start FIPS Self Test for Encrypt Algorithm...
Passed.
AmWebserver Module Integrity Checking...
Passed.
AmMonitor Module Integrity Checking...
Passed.
AmConfig Module Integrity Checking...
Passed.
```

Examples of failure messages are:

```
HMAC_SHA1 Test Failed
AES Test Failed
RSA Signature Gen/Ver Test Failed
```

Known answer tests for encryption or hashing function by encrypting (or hashing) a string for which the calculated output is known and stored within the cryptographic module. An encryption or hashing test passes when the freshly calculated output matches the expected (stored) value. The test fails when the calculated outmatch does not match the expected value. Each known answer tests for encryption is followed by a similar decryption test that decrypts the ciphertext string. A decryption test passes when the freshly calculated output matches the plaintext value. A test fails when the calculated outmatch does not match the plaintext value.

The RSA known answer test for key transport uses the public key to encrypt a plaintext value. The resulting ciphertext value is compared to the original plaintext value. If the two values are equal, then the test fails. The ciphertext value is then compared to a known value. If the two values are not equal, then the test fails. If the two values are equal, then the private key is used to decrypt the ciphertext and the resulting value is compared to the original plaintext value. If the two values are not equal, the test fails.

The RSA signature generation/verification test is performed by the calculation and verification of a digital signature. If the digital signature cannot be verified, the test fails.

Known answer tests for Random Number Generators function by seeding the RNG with known values and checking that the output matches the pre-calculated value stored within the cryptographic module. The test passes when the freshly generated output matches the pre-calculated value. A test fails when the generated outmatch does not match the pre-calculated value.

The HMAC SHA-1 firmware integrity test functions by generating an HMAC-SHA-1 string for each module application and comparing the generated string against the HMAC-SHA-1 value stored when the firmware was loaded onto the module. If the generated and stored values do not match, the integrity test fails.

The HMAC SHA-1 firmware load test functions by generating an HMAC-SHA-1string for the entire downloaded image and comparing the generated string against the HMAC-SHA-1 value stored with the image. If the generated and stored values do not match, the firmware load test fails.

11 Mitigation of Attacks

The cryptographic module is not designed to mitigate specific attacks such as differential power analysis or timing attacks.

12 References

National Institute of Standards and Technology, *FIPS PUB 140-2: Security Requirements for Cryptographic Modules*, available at URL: http://csrc.nist.gov/groups/STM/cmvp/index.html.

National Institute of Standards and Technology, *FIPS 140-2 Annex A: Approved Security Functions*, available at URL: http://csrc.nist.gov/groups/STM/cmvp/index.html .

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National Institute of Standards and Technology, *FIPS 140-2 Annex C: Approved Random Number Generators*, available at URL: http://csrc.nist.gov/groups/STM/cmvp/index.html.

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National Institute of Standards and Technology, *Data Encryption Standard (DES)*, Federal Information Processing Standards Publication 46-3, available at URL: http://csrc.nist.gov/groups/STM/cmvp/index.html.

National Institute of Standards and Technology, *DES Modes of Operation*, Federal Information Processing Standards Publication 81, available at URL: http://csrc.nist.gov/groups/STM/cmvp/index.html.

National Institute of Standards and Technology, *Digital Signature Standard (DSS)*, Federal Information Processing Standards Publication 186-2, available at URL: http://csrc.nist.gov/groups/STM/cmvp/index.html.

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