Cisco ASA and ISA Firepower Threat Defense Cryptographic Modules

FIPS 140-2 Security Policy
Level 2 Validation

Version 1.1

November 11, 2020

1 Introduction

1.1 Purpose

This is a non-proprietary Cryptographic Module Security Policy for the Cisco ASA and ISA Firepower Threat Defense Cryptographic Modules. The firmware version running on each module is 6.4. This security policy describes how this module meets the security requirements of FIPS 140-2 Level 2 and how to run the module in a FIPS 140-2 mode of operation. This Security Policy may be freely distributed.

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 NIST website at https://csrc.nist.gov/projects/cryptographic-module-validation-program.

1.2 Module Validation Level

The following table lists the level of validation for each area in the FIPS PUB 140-2.

No.	Area Title	Level
1	Cryptographic Module Specification	2
2	Cryptographic Module Ports and Interfaces	2
3	Roles, Services, and Authentication	3
4	Finite State Model	2
5	Physical Security	2
6	Operational Environment	N/A
7	Cryptographic Key management	2
8	Electromagnetic Interface/Electromagnetic Compatibility	2
9	Self-Tests	2
10	Design Assurance	2
11	Mitigation of Other Attacks	N/A
	Overall module validation level	**2**

Table 1 Module Validation Level

1.3 References

This document deals only with the operations and capabilities of the module listed in section 1.1 above as it relates to the technical terms of a FIPS 140-2 cryptographic module security policy. More information is available from the following sources:

The Cisco Systems website contains information on the full line of Cisco Systems security. Please refer to the following websites:

http://www.cisco.com/c/en/us/products/index.html
http://www.cisco.com/c/en/us/td/docs/security/firepower/fxos/roadmap/fxos-roadmap.html

For answers to technical or sales related questions please refer to the contacts listed on the Cisco Systems website at www.cisco.com.

The NIST Validated Modules website (https://csrc.nist.gov/Projects/cryptographic-module-validation-program/validated-modules) contains contact information for answers to technical or sales-related questions for the module.

1.4 Terminology

In this document, the Firepower Threat Defense Cryptographic Module is referred to as FTD, Cryptographic Module or Module.

1.5 Document Organization

The Security Policy document is part of the FIPS 140-2 Submission Package. In addition to this document, the Submission Package contains:

Vendor Evidence document
Finite State Machine
Other supporting documentation as additional references

This document provides an overview of the Cisco ASA and ISA Firepower Threat Defense Cryptographic Modules identified in section 1.1 above and explains the secure layout, configuration and operation of the module. This introduction section is followed by Section 2, which details the general features and functionality of the module. Section 3 specifically addresses the required configuration for the FIPS-mode of operation.

With the exception of this Non-Proprietary Security Policy, the FIPS 140-2 Validation Submission Documentation is Cisco-proprietary and is releasable only under appropriate non-disclosure agreements. For access to these documents, please contact Cisco Systems.

2 Cisco ASA and ISA Firepower Threat Defense Cryptographic Modules

The module provides cryptographic services to a solution which offers the combination of the industry's most deployed stateful firewall with a comprehensive range of next-generation network security services, intrusion prevention system (IPS), content security, secure unified communications, TLSv1.2, SSHv2, IPSec/IKEv2, and Cryptographic Cipher Suite B.

The Firepower eXtensible Operating System (FX-OS), is a next-generation network and content security solution. The FX-OS is part of the Firepower Threat Defense (FTD) and provides an agile, open, built for scalability, consistent control, and simplified management. This makes it easy to configure platform settings and interfaces, provision devices, and monitor system status.

The module runs on the following Cisco ASA 5500/ISA 3000 platform models:

- ASA 5508-X
- ASA 5516-X
- ISA 3000-4C
- ISA 3000-2C2F

2.1 Cryptographic Module Physical Characteristics

The module is an integrated network security module, which is designed to integrate into the versatile units (ASA 5508-X, ASA 5516-X, ISA 3000-4C, and ISA 3000-2C2F).

2.2 Cryptographic Boundary

The module is a multiple-chip standalone cryptographic module. The cryptographic boundary is defined as the entire modules' chassis unit encompassing the "top," "front," "left," "right," "rear" and "bottom" surfaces of the case along with associated opacity shields.

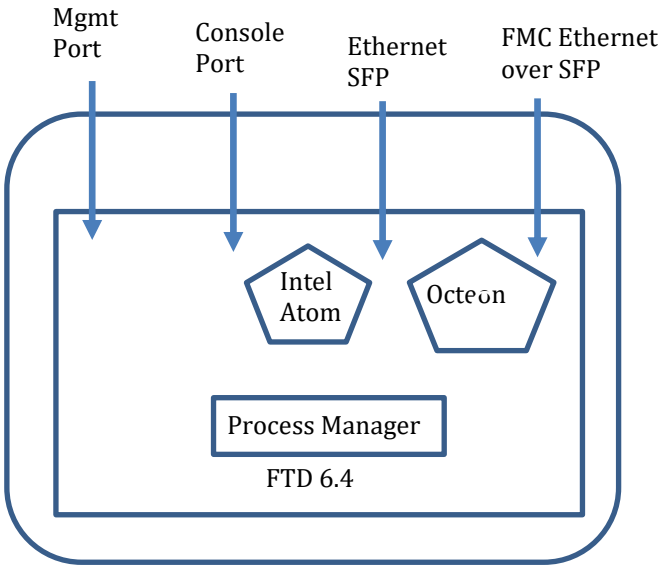

Diagram 1 Block Diagram

2.3 Module Interfaces

The module provides a number of physical and logical interfaces to the device, and the physical interfaces provided by the module are mapped to the following FIPS 140-2 defined logical interfaces: data input, data output, control input, status output, and power. The logical interfaces and their mapping are described in the following table:

FIPS 140-2 Logical Interface	ASA 5508-X, ASA 5516-X, ISA 3000-4C, ISA 3000-2C2F Physical Interface
Data Input Interface	Ethernet ports MGMT Port Console Port
Data Output Interface	Ethernet ports MGMT Port Console Port
Control Input Interface	Ethernet ports MGMT Port Console Port Reset Pin/Switch/Button
Status Output Interface	Ethernet ports MGMT Port LEDs Console Port
Power Interface	Power Plug
Unused Interface	USB Port (USB Type A port and mini-USB Type B Console port)

Table 2 Hardware/Physical Boundary Interfaces

2.4 Platform Overview

Figure 1 ASA 5508-X and ASA 5516-X Appliances Front Panel

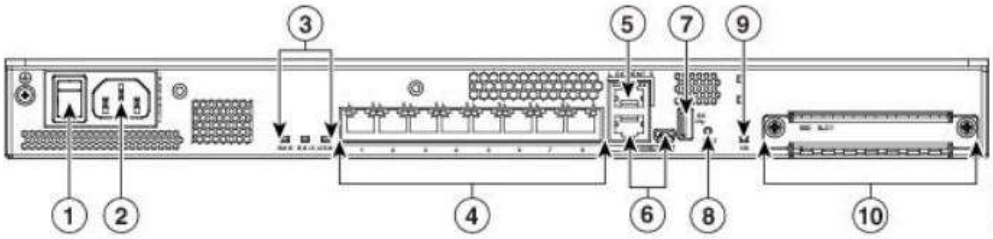

Figure 2 ASA 5508-X and ASA 5516-X Appliances Rear Panel

1	Power Switch	Standard power on/off switch
2	Power cord socket	Chassis power-supply socket
3	Status LEDS	LED status indicator
4	Network data ports	Eight gigabit ethernet RJ-45 network I/O interface. Each port includes pair of LED status.
5	Management port	A gigabit Ethernet interface restricted to network management access only

6	Console port	Serial ports, mini USB and standard RJ-45 are provided for management access. USB is not allowed in FIPS mode
7	USB port	Disallowed in FIPS mode
8	Reset button	Small recessed button that is pressed for longer than three seconds resets the unit.
9	SSD LED	Status light for installed solid-state drive.
10	SSD bay	Covered slot for SSD installation.

Table 3 ASA 5508-X and 5516-X rear panel description

Figure 3: ISA 3000-4C (Left) and ISA 3000-2C2F (Right) Appliance Front

1	Reset Pinhole Access	10	RJ45 10/100/100 BaseT Connectors 1&2
2	Console LED	11	On the ISA-3000-2C2F SKU, these are the SFP sockets. On the ISA-3000-4C SKU, these are RJ45 10/100/100 BaseT Connectors 3&4,
3	System LED	12	SD Card Slots
4	Console connector (RJ-45)	13	Alarm Connectors
5	Console connector (mini-USB)	14	Grounding Point
6	USB connectors	15	Alarm LEDs
7	Management Interface	16	DC Power LEDs
8	DC power connection A	17	Gig Ethernet LEDs
9	DC power connection B	18	Management LED

Table 4 ISA 3000-4C and ISA 3000-2C2F front panel description

Note: Item 11 in Figue 3 above is the only difference in between.

2.5 Roles and Services

The appliances can be accessed in one of the following ways:

- Console Port
- IPSec/IKEv2
- SSHv2
- HTTPS/TLSv1.2

Authentication is identity-based. As required by FIPS 140-2, there are two roles that operators may assume: Crypto Officer role and User role. The module, upon initial access to the module, authenticates both of these roles. The module also supports RADIUS and TACACS+ as another means of authentication, allowing the storage of usernames and passwords on an external server as opposed to using the module's internal database for storage.

The User and Crypto Officer passwords and all other shared secrets must each be at least eight (8) characters long, including at least one six (6) alphabetic characters, (1) integer number and one (1) special character in length (enforced procedurally). See the Secure Operation section for more information. Given these restrictions, the probability of randomly guessing the correct sequence is one (1) in 6,326,595,092,480 (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 52x52x52x52x52x52x32x10 = 6,326,595,092,480. Therefore, the associated probability of a successful random attempt is approximately 1 in 6,326,595,092,480, which is less than the 1 in 1,000,000 required by FIPS 140-2.

In addition, for multiple attempts to use the authentication mechanism during a one-minute period, under the optimal modern network condition, if an attacker would only get 60,000 guesses per minute. Therefore, the associated probability of a successful random attempt during a one-minute period is 60,000/ 6,326,595,092,480 = 1/105,443,251, which is less than 1 in 100,000 required by FIPS 140-2.

Additionally, when using RSA based authentication, RSA key pair has modulus size of 2048 bits, thus providing 112 bits of strength, which means an attacker would have a 1 in 2^{112} chance of randomly obtaining the key, which is much stronger than the one in a million chances required by FIPS 140-2. To exceed a one in 100,000 probability of a successful random key guess in one minute, an attacker would have to be capable of approximately $8.65x10^{31}$ ($2^{112}/60 = 8.65 \times 10^{31}$) attempts per second, which far exceeds the operational capabilities of the module to support.

2.6 User Services

A User enters the system by either Console port, SSHv2 or HTTPS/TLSv1.2. The User role can be authenticated via either Username/Password or RSA based authentication method. The module prompts the User for username and password. If the password is correct, the User is allowed entry to the module management functionality. The other means of accessing the console is via an IPSec/IKEv2 session. This session is authenticated either using a shared secret or RSA digital signature authentication mechanism. The services available to the User role accessing the CSPs, the type of access – read (r), write (w) and zeroized/delete (d) – and which role accesses the CSPs are listed below:

Services	Description	Keys and CSPs Access
Status Functions	View state of interfaces and protocols, version of the firmware currently running.	Operator password (r, w, d)
Terminal Functions	Adjust the terminal session (e.g., lock the terminal, adjust flow control).	Operator password (r, w, d)
Directory Services	Display directory of files kept in flash memory.	Operator password (r, w, d)
Self-Tests	Execute the FIPS 140 start-up tests on demand.	N/A
IPsec VPN	Negotiation and encrypted data transport via IPSec VPN.	Operator password, DRBG entropy input, DRBG seed, DRBG V, DRBG key, skeyid, skeyid_d, SKEYSEED, IKE session encrypt key, IKE session authentication key, ISAKMP preshared, IKE authentication private Key, IKE authentication public key, IPsec encryption key and IPsec authentication key (r, w, d)
SSHv2 Functions	Negotiation and encrypted data transport via SSHv2.	Operator password, DRBG entropy input, DRBG seed, DRBG V, DRBG key, SSHv2 private key, SSHv2 public key, SSHv2 session key and SSHv2 integrity key (r, w, d)
HTTPS Functions (TLSv1.2)	Negotiation and encrypted data transport via HTTPS/TLS(TLSv1.2).	Operator password, DRBG entropy input, DRBG seed, DRBG V, DRBG key, ECDSA private key, ECDSA public key, TLS RSA private key, TLS RSA public key, TLS pre-master secret, TLS master secret, TLS encryption keys and TLS integrity key (r, w, d)

Table 5 User Services

2.7 Crypto Officer Services

A Crypto Officer (CO) enters the system by accessing the Console port, SSH v2 or HTTPS/TLSv1.2. The CO role can be authenticated via either Username/Password or RSA based authentication method. The other means of accessing the console is via an IPSec/IKEv2 session. This session is authenticated either using a shared secret or RSA digital signature authentication mechanism. A Crypto Officer may assign permission to access the Crypto Officer role to additional accounts, thereby creating additional Crypto Officers.

The Crypto Officer role is responsible for the configuration of the module. The services available to the Crypto Officer role accessing the CSPs, the type of access – read (r), write (w) and zeroized/delete (d) – and which role accesses the CSPs are listed below:

Services and Access	Description	Keys and CSPs
Configure the Security	Define network interfaces and settings, create command aliases, set the protocols the router will support, enable interfaces and network services, set system date and time, and load authentication information.	DRBG entropy input, DRBG seed, DRBG V, DRBG key, Diffie-Hellman private key, Diffie-Hellman public key, Diffie-Hellman shared secret, EC Diffie-Hellman private key, EC Diffie-Hellman public key, EC Diffie-Hellman shared secret, SSHv2 private key, SSHv2 public key, SSHv2 session key, SSHv2 integrity key, ECDSA private key, ECDSA public key, TLS RSA private key, TLS RSA public key, TLS pre-master secret, TLS master secret, TLS encryption keys, TLS integrity key, ISAKMP preshared, SKEYSEED, IKE session encryption key, IKE session authentication key, IKE authentication private Key, IKE authentication public key, IPSec encryption key and IPSec authentication key (r, w, d)

Firmware Initialization	Conduct the firmware initialization.	N/A
Configure External Authentication Server	Configure RADIUS or TACACS+ authentication server • RADIUS: Remote Authentication Dial-In User Service. • TACACS+: Terminal Access Controller Access-Control System	RADIUS secret, TACACS+ secret (r, w, d)
Define Rules and Filters	Create packet Filters that are applied to User data streams on each interface. Each Filter consists of a set of Rules, which define a set of packets to permit or deny based on characteristics such as protocol ID, addresses, ports, TCP connection establishment, or packet direction.	Operator password, Enable password (r, w, d)
View Status Functions	View the router configuration, routing tables, active sessions health, temperature, memory status, voltage, packet statistics, review accounting logs, and view physical interface status.	Operator password, Enable password (r, w, d)
Configure Encryption/Bypass	Set up the configuration tables for IP tunneling. Set preshared keys and algorithms to be used for each IP range or allow plaintext packets to be set from specified IP address. Setup the rules for Bypass operation.	DRBG entropy input, DRBG seed, DRBG V, DRBG key, ISAKMP preshared, Operator password, Enable password, SKEYSEED, IKE session encrypt key, IKE session authentication key, IKE authentication private Key, IKE authentication public key, IPsec encryption key and IPsec authentication key (r, w, d)
TLS VPN (TLSv1.2)	Configure SSL VPN parameters, provide entry and output of CSPs.	DRBG entropy input, DRBG seed, DRBG V, DRBG key, ECDSA private key, ECDSA public key, TLS RSA private key, TLS RSA public key, TLS pre-master secret, TLS master secret, TLS encryption keys and TLS integrity key (r, w, d)
SSHv2 Function	Configure SSHv2 parameter, provide entry and output of CSPs.	DRBG entropy input, DRBG seed, DRBG V, DRBG key, SSHv2 private key, SSHv2 public key. SSHv2 session key and SSHv2 integrity key (r, w, d)
IPsec VPN Function	Configure IPsec VPN parameters, provide entry and output of CSPs.	DRBG entropy input, DRBG seed, DRBG V DRBG key, ISAKMP preshared, SKEYSEED, IKE session encrypt key, IKE session authentication key, IKE authentication private Key, IKE authentication public key, IPsec encryption key and IPsec authentication key (r, w, d)
Self-Tests	Execute the FIPS 140 start-up tests on demand	N/A
User services	The Crypto Officer has access to all User services.	Operator password (r, w, d)
Local Certificate Authority	Allows the module to be configured as a Root Certificate Authority and issue user certificates for SSL VPN use (AnyConnect and Clientless). The ASA can then be configured to require client certificates for authentication.	N/A
Zeroization	Zeroize cryptographic keys/CSPs by running the zeroization methods classified in table 7, Zeroization column.	All CSPs (d)

Table 6 Crypto Officer Services

2.8 Non-FIPS mode Services

The cryptographic module in addition to the above listed FIPS mode of operation can operate in a non-FIPS mode of operation. This is not a recommended operational mode but because the associated RFC's for the following protocols allow for non-approved algorithms and non-approved key sizes a non-approved mode of operation exist. So those services listed above with

their FIPS approved algorithms in addition to the following services with their non-approved algorithms and non-approved keys sizes are available to the User and the Crypto Officer. Prior to using any of the Non-Approved services in Section 2.8, the Crypto Officer must zeroize all CSPs which places the module into the non-FIPS mode of operation.

Services [1]	Non-Approved Algorithms
SSH	Hashing: MD5 MACing: HMAC-MD5 Symmetric: DES Asymmetric: 768-bit/1024-bit RSA (key transport), 1024-bit Diffie-Hellman
IPSec	Hashing: MD5 MACing: HMAC-SHA-1, MD5 Symmetric: DES, RC4 Asymmetric: 768-bit/1024-bit RSA (key transport), 1024-bit Diffie-Hellman
TLS	Symmetric: DES, RC4 Asymmetric: 768-bit/1024-bit RSA (key transport), 1024-bit Diffie-Hellman

Table 7 Non-approved algorithms in the Non-FIPS mode services

Neither the User nor the Crypto Officer are allowed to operate any of these services while in FIPS mode of operation.

All services available can be found at https://www.cisco.com/c/en/us/td/docs/security/firepower/640/fdm/fptd-fdm-config-guide-640/fptd-fdm-advanced.html. This site lists all configuration guides.

2.9 Unauthenticated Services

The services for someone without an authorized role are to view the status output from the module's LED pins and cycle power.

2.10 Operational Environment

The module is a hardware module. The Cisco operating system provides a proprietary and non-modifiable operating system. Thus, the requirements from FIPS 140-2 level 2, section 4.6.1, are not applicable to the module.

2.11 Cryptographic Key/CSP Management

The module administers both cryptographic keys and other critical security parameters such as passwords. All keys and CSPs are protected by the password-protection of the Crypto Officer role login and can be zeroized by the Crypto Officer. Zeroization consists of overwriting the memory that stored the key or refreshing the volatile memory. Keys are both manually and electronically distributed but entered electronically. Persistent keys with manual distribution are used for pre-shared keys whereas protocols such as IKEv2, TLSv1.2, and SSHv2 are used for electronic distribution. The entropy source used by the module falls into IG 7.14, Scenario #1a: A hardware module with an entropy-generating NDRNG inside the module's cryptographic boundary. The module provides at least 256 bits entropy to instantiate the DRBG.

[1] These approved services become non-approved when using any non-approved algorithms or non-approved key or curve sizes. When using approved algorithms and key sizes these services are approved.

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
DRBG entropy input	SP800-90A CTR_DRBG (AES-256)	384-bits	This is the entropy input for SP 800-90A CTR_DRBG, used to construct seed.	DRAM (plaintext)	Power cycle the device
DRBG Seed	SP800-90A CTR_DRBG (AES-256)	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.	DRAM (plaintext)	Power cycle the device
DRBG V	SP800-90A CTR_DRBG (AES-256)	128-bits	The DRBG V is one of the critical values of the internal state upon which the security of this DRBG mechanism depends. Generated first during DRBG instantiation and then subsequently updated using the DRBG update function.	DRAM (plaintext)	Power cycle the device
DRBG key	SP800-90A CTR_DRBG (AES-256)	256-bits	Internal critical value used as part of SP 800-90A CTR_DRBG. Established per SP 800-90A CTR_DRBG.	DRAM (plaintext)	Power cycle the device
Diffie-Hellman Shared Secret	DH	2048 - 4096 bits	The shared secret used in Diffie-Hellman (DH) exchange (as part of SSH, IKE/IPSec, and TLS). Established per the Diffie-Hellman key agreement.	DRAM (plaintext)	Power cycle the device
Diffie-Hellman private key	DH	224-384 bits	The private key used in Diffie-Hellman (DH) exchange (as part of SSH, IKE/IPSec, and TLS). This key is generated by calling SP800-90A DRBG.	DRAM (plaintext)	Power cycle the device
Diffie-Hellman public key	DH	2048 - 4096 bits	The public key used in Diffie-Hellman (DH) exchange (as part of SSH, IKE/IPSec, and TLS). This key is derived per the Diffie-Hellman key agreement. Note that the public key is a cryptographic key, but not considered a CSP.	DRAM (plaintext)	Power cycle the device
EC Diffie-Hellman shared Secret	ECDH	P-256, P-384, P-521 Curves	The shared secret used in Elliptic Curve Diffie-Hellman (ECDH) exchange. Established per the Elliptic Curve Diffie-Hellman (ECDH) protocol.	DRAM (plaintext)	Power cycle the device
EC Diffie-Hellman private key	ECDH	P-256, P-384, P-521 Curves	Used in establishing the session key for an IPSec session. The private key used in Elliptic Curve Diffie-Hellman (ECDH) exchange. This key is established per the EC Diffie-Hellman key agreement.	DRAM (plaintext)	Power cycle the device
EC Diffie-Hellman public key	ECDH	P-256, P-384, P-521 Curves	Used in establishing the session key for an IPSec session. The public key used in Elliptic Curve Diffie-Hellman (ECDH) exchange. This key is established per the EC Diffie-Hellman key agreement. Note that the public key is a cryptographic key, but not considered a CSP.	DRAM (plaintext)	Power cycle the device

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
SKEYSEED	Keying material	160 bits	Keying material known only to IKE peers. It was derived via key derivation function defined in SP800-135 KDF (IKEv2) and it will be used for deriving IKE session authentication key.	DRAM (plaintext)	Power cycle the device
IKE session encrypt key	Triple-DES/AES	Triple-DES 192 bits or 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 (IKEv2).	DRAM (plaintext)	Power cycle the device
IKE session authentication key	HMAC-SHA-256/384/512	256-512 bits	The IKE session (IKE Phase I) authentication key. This key is derived via key derivation function defined in SP800-135 KDF (IKEv2).	DRAM (plaintext)	Power cycle the device
ISAKMP preshared	Pre-shared secret	Variable 8 plus characters	The secret used to derive IKE skeyid when using preshared secret authentication. This CSP is entered by the Crypto Officer.	NVRAM (plaintext)	Overwrite with new secret
IKE authentication private Key	RSA/ECDSA	RSA (2048 bits) or ECDSA (Curves: P-256/P-384/512)	RSA/ECDSA private key used in IKE authentication. This key is generated by calling SP800-90A DRBG.	NVRAM (plaintext)	Zeroized by RSA/ECDSA keypair deletion command
IKE authentication public key	RSA/ECDSA	RSA (2048 bits) or ECDSA (Curves: P-256/P-384/512)	RSA/ECDSA public key used in IKE authentication. The key is derived in compliance with FIPS 186-4 RSA/ECDSA key pair generation method in the module. Note that the public key is a cryptographic key, but not considered a CSP.	NVRAM (plaintext)	Zeroized by RSA/ECDSA keypair deletion command
IPsec encryption key	Triple-DES, AES or AES-GCM	Triple-DES 192 bits or AES 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 (IKEv2).	DRAM (plaintext)	Power cycle the device
IPsec authentication key	HMAC-SHA-1/256/384/512	160-512 bits	The IPsec (IKE Phase II) authentication key. This key is derived via a key derivation function defined in SP800-135 KDF (IKEv2).	DRAM (plaintext)	Power cycle the device
Operator password	Password	8 plus characters	The password of the User role. This CSP is entered by the User.	NVRAM (plaintext)	Erase password
Enable password	Password	8 plus characters	The password of the CO role. This CSP is entered by the Crypto Officer.	NVRAM (plaintext)	Erase password
RADIUS secret	Shared Secret	16 characters	The RADIUS shared secret. Used for RADIUS Client/Server authentication. This CSP is entered by the Crypto Officer.	NVRAM (plaintext)	Erase secret
TACACS+ secret	Shared Secret	16 characters	The TACACS+ shared secret. Used for TACACS+ Client/Server authentication. This CSP is entered by the Crypto Officer.	NVRAM (plaintext)	Erase secret
SSHv2 private key	RSA	2048 bits modulus	The SSHv2 private key used in SSHv2 connection. This key is generated by calling SP 800-90A DRBG.	NVRAM (plaintext)	Zeroized by RSA keypair deletion command

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
SSHv2 public key	RSA	2048 bits modulus	The SSHv2 public key used in SSHv2 connection. This key is derived in compliance with FIPS 186-4 RSA key pair generation method in the module. Note that the public key is a cryptographic key, but not considered a CSP.	NVRAM (plaintext)	Zeroized by RSA keypair deletion command
SSHv2 session key	Triple-DES/AES	192 bits Triple-DES or 128/192/256 bits AES	This is the SSHv2 session key. It is used to encrypt all SSHv2 data traffics traversing between the SSHv2 Client and SSHv2 Server. This key is derived via key derivation function defined in SP800-135 KDF (SSH).	DRAM (plaintext)	Power cycle the device
SSHv2 integrity key	HMAC-SHA-1	160 bits	Used for SSH connections integrity to assure the traffic integrity. This key is derived via key derivation function defined in SP800-135 KDF (SSH).	DRAM (plaintext)	Automatically when SSH session is terminated
ECDSA private key	ECDSA	Curves: P-256,384,521	Key pair generation, signature generation/Verification. This key is generated by calling SP 800-90A DRBG.	DRAM (plaintext)	Zeroized by ECDSA keypair deletion command
ECDSA public key	ECDSA	Curves: P-256,384,521	Key pair generation, signature generation/Verification. This key is derived in compliance with FIPS 186-4 ECDSA key pair generation method in the module. Note that the public key is a cryptographic key, but not considered a CSP.	DRAM (plaintext)	Zeroized by ECDSA keypair deletion command
TLS RSA private keys	RSA	2048 bits	Identity certificates for the security appliance itself and also used in IPSec, TLS, and SSH negotiations. This key was generated by calling FIPS approved DRBG.	NVRAM (plaintext)	Zeroized by RSA keypair deletion command
TLS RSA public keys	RSA	2048 bits	Identity certificates for the security appliance itself and also used in TLS negotiations. This key is derived in compliance with FIPS 186-4 RSA key pair generation method in the module. Note that the public key is a cryptographic key, but not considered a CSP.	NVRAM (plaintext)	Zeroized by RSA keypair deletion command
TLS pre-master secret	keying material	At least eight characters	Keying material used to derive TLS master key during the TLS session establishment. This key entered into the module in cipher text form, encrypted by RSA public key.	DRAM (plaintext)	Automatically when TLS session is terminated.
TLS master secret	keying material	48 Bytes	Keying material used to derive other HTTPS/TLS keys. This key was derived from TLS pre-master secret during the TLS session establishment.	DRAM (plaintext)	Automatically when TLS session is terminated
TLS Encryption keys	Triple-DES, AES or AES-GCM	Triple-DES 192 bits or AES 128/192/256 bits	Used in HTTPS/TLS connections. Generated using TLS protocol. This key is derived via key derivation function defined in SP800-135 KDF (TLSv2).	DRAM (plaintext)	Automatically when TLS session is terminated

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
TLS Integrity Key	HMAC-SHA256/384	256-384 bits	Used for TLS integrity to assure the traffic integrity. This key is derived via key derivation function defined in SP800-135 KDF (TLSv2)	DRAM (plaintext)	Automatically when TLS session is terminated

Table 8 Cryptographic Keys and CSPs

2.12 Cryptographic Algorithms

The module implements a variety of approved and non-approved algorithms.

2.11.1 Approved Cryptographic Algorithms

The module supports the following FIPS 140-2 approved algorithm implementations:

Algorithm		
	Cisco Security Crypto (Firmware on each module)	Cavium Octeon III (Only on ASA5508-X and 5516-X)
AES (128/192/256 CBC, GCM)	4905	3301
Triple-DES (CBC, 3-key)	2559	1881
SHS (SHA-1/256/384/512)	4012	2737
HMAC (SHA-1/256/384/512)	3272	2095
RSA (KeyGen, SigGen and SigVer; PKCS1_V1_5; 2048bits with SHA-256/384/512)	2678	
ECDSA (PKG, SigGen and SigVer; P-256, P-384, P-521)	1254	
CTR_DRBG (AES-256)	1735	819
CVL Component (IKEv2, TLSv1.2, SSHv2)	1521	
CKG (vendor affirmed)		

Table 9 Approved Cryptographic Algorithms and Associated Certificate Number

Notes:

- There are some algorithm modes that were tested but not implemented by the module. Only the algorithms, modes, and key sizes that are implemented by the module are shown in this table.
- The module's AES-GCM implementation conforms to IG A.5 scenario #1 following RFC 5288 for TLS and RFC 7296 for IPSec/IKEv2. The module is compatible with TLSv1.2 and provides support for the acceptable GCM cipher suites from SP 800-52 Rev1, Section 3.3.1. The operations of one of the two parties involved in the TLS key establishment scheme were performed entirely within the cryptographic boundary of the module being validated. The counter portion of the IV is set by the module within its cryptographic boundary. When the IV exhausts the maximum number of possible values for a given session key, the first party, client or server, to encounter this condition will trigger a handshake to establish a new encryption key. In case the module's power is lost and then restored, a new key for use with the AES GCM encryption/decryption shall be established. The module uses RFC 7296 compliant IKEv2 to establish the shared secret SKEYSEED from which the AES GCM encryption keys are derived. The operations of one of the two parties involved in the IKE key establishment scheme shall be performed entirely within the cryptographic boundary of the module being validated. When the IV exhausts the maximum number of possible values for a given session key, the first party, client or server, to encounter this condition will trigger a handshake to establish a new encryption

key. In case the module's power is lost and then restored, a new key for use with the AES GCM encryption/decryption shall be established.

- Each of TLS, SSH and IPSec protocols governs the generation of the respective Triple-DES keys. Refer to RFC 5246 (TLS), RFC 4253 (SSH) and RFC 6071 (IPSec) for details relevant to the generation of the individual Triple-DES encryption keys. The user is responsible for ensuring the module limits the number of encryptions with the same key to 2^{20}.
- No parts of the SSH, TLS and IPSec protocols, other than the KDFs, have been tested by the CAVP and CMVP.
- In accordance with FIPS 140-2 IG D.12, the cryptographic module performs Cryptographic Key Generation as per scenario 1 of section 5 in SP800-133. The resulting generated seed used in the asymmetric key generation are the unmodified output from SP800-90A DRBG.

2.11.2 Non-FIPS Approved Algorithms Allowed in FIPS Mode

The module supports the following non-FIPS approved algorithms which are permitted for use in the FIPS approved mode:

- Diffie-Hellman (CVL Cert. #1521, key agreement; key establishment methodology provides between 112 and 150 bits of encryption strength)
- EC Diffie-Hellman (CVL Cert. #1521, key agreement; key establishment methodology provides between 128 and 256 bits of encryption strength)
- RSA (key wrapping; key establishment methodology provides 112 bits of encryption strength)
- NDRNG (entropy source)

2.11.3 Non-Approved Cryptographic Algorithms

The module supports the following non-approved cryptographic algorithms that shall not be used in FIPS mode of operation:

- Diffie-Hellman (key agreement; key establishment methodology less than 112 bits of encryption strength; non-compliant)
- RSA (key wrapping; key establishment methodology less than 112 bits of encryption strength; non-compliant)
- DES
- HMAC-MD5
- MD5
- RC4
- HMAC-SHA1 is not allowed with key size under 112-bits

2.13 Self-Tests

The module includes an array of self-tests that are run during startup and periodically during operations to prevent any secure data from being released and to ensure all components are functioning correctly. The FIPS power-on self-tests are run regardless of the FIPS mode setting.

Self-tests performed

- POSTs – Cisco Security Crypto (Firmware on each module)
    - AES CBC Encrypt/Decrypt KATs
    - AES GCM KATs
    - DRBG KAT (Note: DRBG Health Tests as specified in SP800-90A Section 11.3 are performed)
    - ECDSA (sign and verify) Power On Self-Test
    - Firmware Integrity Test (SHA-512)
    - HMAC (SHA-1/256/384/512) Known Answer Tests
    - SHA-1/256/384/512 KATs
    - Triple-DES CBC Encrypt/Decrypt KATs
- POSTs - On-board Hardware (only on ASA 5508-X and 5516-X)
    - AES CBC Encrypt/Decrypt KATs
    - DRBG KAT (Note: DRBG Health Tests as specified in SP800-90A Section 11.3 are performed)
    - HMAC (SHA-1/256/384/512) Known Answer Tests
    - SHA-1/256/384/512 KATs
    - Triple-DES CBC Encrypt/Decrypt KATs
- Conditional Tests - Cisco Security Crypto (Firmware on each module)
    - RSA PWCT
    - ECDSA PWCT
    - Conditional Bypass test
    - CRNGT for SP800-90A DRBG
    - CRNGT for NDRNG
- Conditional Tests - On-board Hardware (only on ASA 5508-X and 5516-X)
    - CRNGT for SP800-90A DRBG
    - CRNGT for NDRNG

Note: DRBGs will not be available should the NDRNG become unavailable. This will in turn make the associated security service/CSP outlined above in Table 8 non-available.

The module performs all power-on self-tests automatically when the power is applied. All power-on self-tests must be passed before a User/Crypto Officer can perform services. The power-on self-tests are performed after the cryptographic systems are initialized but prior to the initialization of the LAN's interfaces; this prevents the security appliances from passing any data during a power-on self-test failure. In the unlikely event that a power-on self-test fails, an error message is displayed on the console followed by a security appliance reboot.

2.14 Physical Security

The FIPS 140-2 level 2 physical security requirements for the modules are met by the use of opacity shields covering the front panels of modules to provide the required opacity and tamper evident seals to provide the required tamper evidence.

2.14.1 Opacity Shield Security

The following table shows the tamper labels and opacity shields that shall be installed on the modules to operate in a FIPS approved mode of operation. The CO is responsible for using, securing and having control at all times of any unused tamper evident labels. Actions to be taken when any evidence of tampering should be addressed within site security program.

ASA Models	Number Tamper labels	Tamper Evident Labels	Number Opacity Shields	Opacity Shields
ASA 5508-X	5	AIR-AP-FIPSKIT=	1	ASA5508-FIPS-KIT=
ASA 5516-X	5	AIR-AP-FIPSKIT=	1	ASA5516-FIPS-KIT=
ISA 3000-4C and ISA 3000-2C2F	4	AIR-AP-FIPSKIT=	0	None

Table 10 Tamper Labels and Opacity Shield Quantities

ASA 5508-X and ASA 5516-X Opacity Shield

To install an opacity shield on the ASA 5508-X or ASA 5516-X rear, follow these steps:
Step 1: Power off the ASA.

Step 2: Remove the two screws.

Step 3: Place the shield over the vent areas and insert the screws.

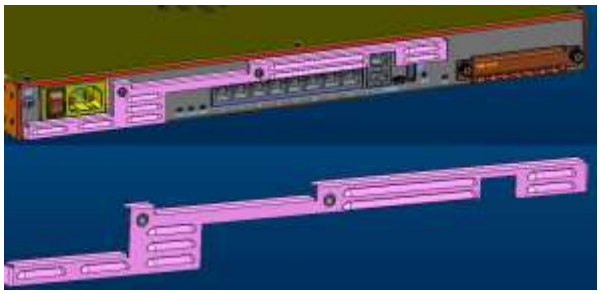

Figure 4 ASA 5508-X and ASA 5516-X Opacity Shield Placement

2.14.2 Tamper Evidence Labels (TELs)

The tamper evident seals (hereinafter referred to as tamper evident labels (TEL)) shall be installed on the security devices containing the module prior to operating in FIPS mode. TELs shall be applied as depicted in the figures below. Any unused TELs must be securely stored, accounted for, and maintained by the CO in a protected location.

Should the CO have to remove, change or replace TELs (tamper-evidence labels) for any reason, the CO must examine the location from which the TEL was removed and ensure that no residual debris is still remaining on the chassis or card. If residual debris remains, the CO must remove the debris using a damp cloth.

Any deviation of the TELs placement such as tearing, misconfiguration, removal, change, replacement or any other change in the TELs from its original configuration as depicted below by unauthorized operators shall mean the module is no longer in FIPS mode of operation. Returning the system back to FIPS mode of operation requires the replacement of the TEL as depicted below

and any additional requirement per the site security policy which are out of scope of this Security Policy.

The Crypto Officer shall inspect the seals for evidence of tamper as determined by their deployment policies (every 30 days is recommended). If the seals show evidence of tamper, the Crypto Officer shall assume that the modules have been compromised and contact Cisco accordingly.

To seal the system, apply tamper-evidence labels as depicted in the figures below.

Figure 5 ASA 5508-X Front View

Figure 6 ASA 5508-X Right Side TEL Location

Figure 7 ASA 5508-X Left Side TEL Location

Figure 8 ASA 5508-X Rear TEL Location

Figure 1 ASA 5508-X Top TEL Location

Figure 10 ASA 5508-X Bottom TEL Location

Figure 11 ASA 5516-X Front View

Figure 12 ASA 5516-X Right Side TEL Location

Figure 13 ASA 5516-X Left Side TEL Location

Figure 14 ASA 5516-X Rear TEL Location

Figure 15 ASA 5516-X Top TEL Location

Figure 16 ASA 5516-X Bottom TEL Location

Figure 17 ISA 3000 (both 3000-4C and 3000-2C2F) Front TEL Location

Figure 18 ISA 3000 (both 3000-4C and 3000-2C2F) Right Side View

Figure 19 ISA 3000 (both 3000-4C and 3000-2C2F) Left Side View

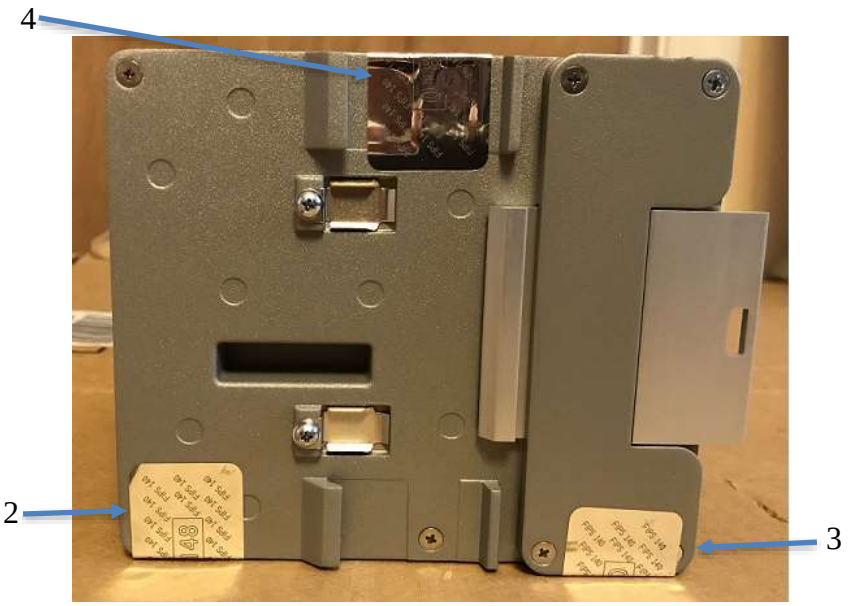

Figure 20 ISA 3000 (both 3000-4C and 3000-2C2F) Rear TEL Location

Figure 21 ISA 3000 (both 3000-4C and 3000-2C2F) Top TEL Location

Figure 22 ISA 3000 (both 3000-4C and 3000-2C2F) Bottom TEL Location

Appling Tamper Evidence Labels

Step 1**:** Turn off and unplug the system before cleaning the chassis and applying labels.

Step 2: Clean the chassis of any grease, dirt, or oil before applying the tamper evident labels. Alcohol-based cleaning pads are recommended for this purpose.

Step 3: Apply a label to cover the security appliance as shown in figures above.

The tamper evident seals are produced from a special thin gauge vinyl with self-adhesive backing. Any attempt to open the device will damage the tamper evident seals or the material of the security appliance cover. Because the tamper evident seals have non-repeated serial numbers, they may be inspected for damage and compared against the applied serial numbers to verify that the security appliance has not been tampered with. Tamper evident seals can also be inspected for signs of tampering, which include the following: curled corners, rips, and slices. The tamper evidence shall appear if the label was peeled back.

3 Secure Operation

The module meets all the Level 2 requirements for FIPS 140-2. The module is shipped only to authorized operators by the vendor, and the module is shipped in Cisco boxes with Cisco adhesive, so if tampered with the recipient will notice. Follow the instructions provided below to place the module in FIPS-approved mode. Operating this module without maintaining the following settings prevents the module from being placed into FIPS approved mode of operation.

3.1 Crypto Officer Guidance - System Initialization

The module was validated with FTD version 6.4. This is the only allowable image for FIPS-approved mode of operation.

The Crypto Officer must configure and enforce the following initialization steps:

1. The Crypto Officer must install opacity shields as described in Section 2.14 of this document.

2. The Crypto Officer must apply tamper evidence labels as described in Section 2.14 of this document.

3. Power on the systems. Then when prompted, enter the default username "admin" and the password "Admin123". After that, the CO needs to replace the default password with a new password.

4. Configure the management IP and answer all the prompt questions. After this is done you have set up the configure file. It will ask if you want to manage it locally. This will mean you are managing it through FDM (Firepower Device Manager) for local or FMC (Firepower Management Center).
   Note: ASA/ISA with FTD can be managed by FMC or FDM.

5. Install Triple-DES/AES licenses to require the security appliances to use Triple-DES and AES.

6. Enable "FIPS Mode" to allow the module to internally enforce FIPS-compliant behavior.

7. If using a RADIUS/TACACS+ server for authentication, please configure an IPSec/TLS tunnel to secure traffic between the module and the RADIUS/TACACS+ server. The RADIUS/TACACS+ shared secret must be at least 8 characters long.

8. Configure the module such that any remote connections via Telnet are secured through IPSec.

9. Configure the module such that only FIPS-approved algorithms are used for IPSec tunnels.

10. Configure the module such that error messages can only be viewed by Crypto Officer.

11. Disable the TFTP server.

12. Disable HTTP for performing system management in FIPS mode of operation. HTTPS with TLS should always be used for Web-based management. The CO shall only use FIPS approved/Allowed cryptographic algorithms listed above for TLS configuration.

13. Ensure that installed digital certificates are signed using FIPS approved algorithms.

14. Reboot the module.