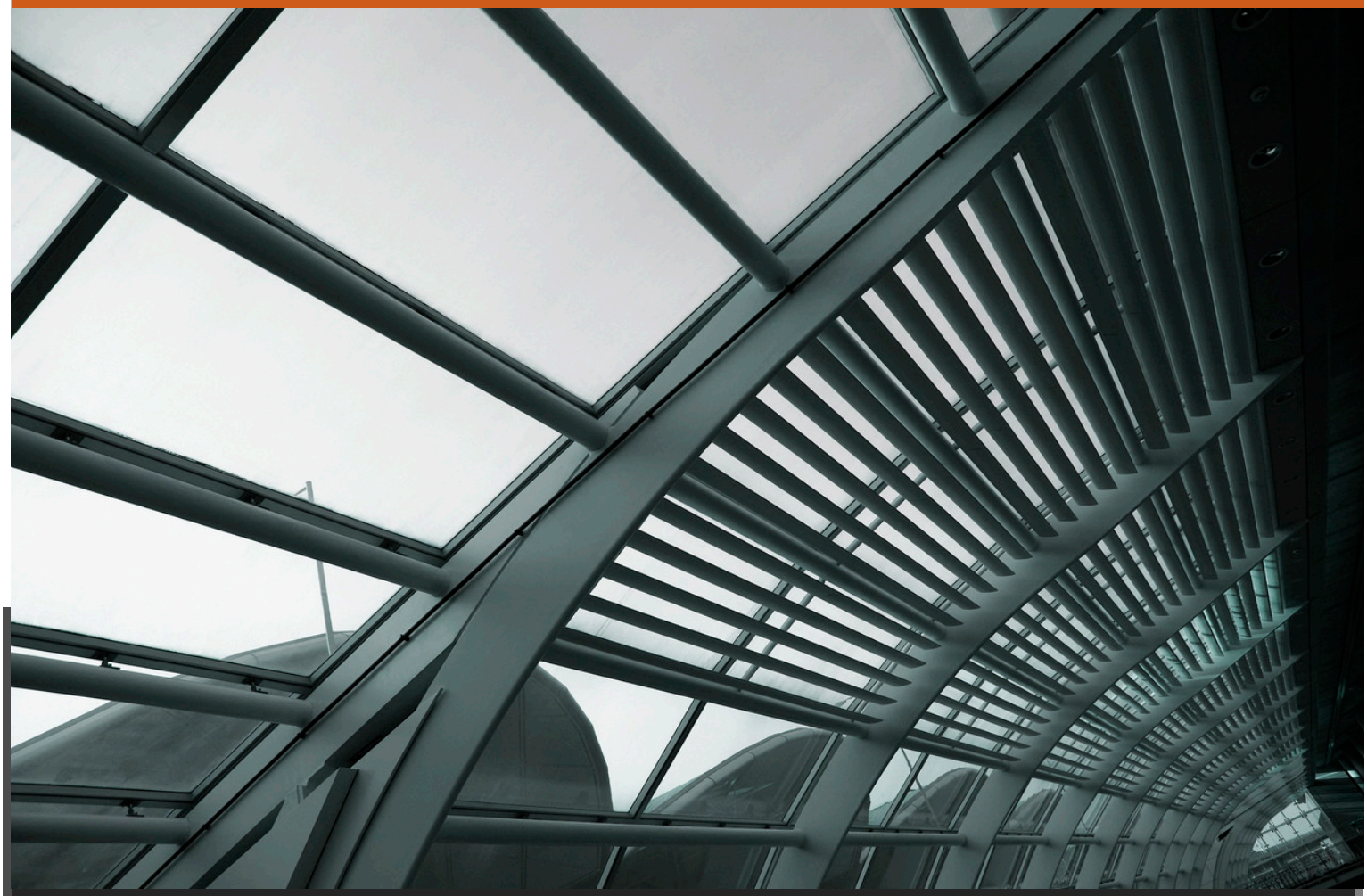

IBM Security
FIPS 140-2 Non-Proprietary Security Policy
Document Version: 1.4

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Revision	Description
September 2015, version 0.1	Initial Release
8/15/2016 version 0.9	Updated based on CMVP comments
8/24/2016 version 1.0	Updated based on CMVP comments
9/1/2016 version 1.1	Updated based on CMVP comments
10/28/2016 version 1.2	Added firmware version 5.3.3 throughout
12/13/2016 version 1.3	Updated Section 2.4.4
12/16/2016 version 1.4	Updated Section 2.4.4

Table Of Contents

1. Introduction

This is a non-proprietary FIPS 140-2 Security Policy for IBM Security Modular Extensible Security Architecture. Below are the details of the product certified:

Software Version #: 5.3.1 and 5.3.3
FIPS 140-2 Security Level: 1

1.1 Purpose

This document was prepared as Federal Information Processing Standard (FIPS) 140-2 validation process. The document describes how Modular Extensible Security Architecture meets the security requirements of FIPS 140-2. It also provides instructions to individuals and organizations on how to deploy the product in a secure FIPS-approved mode of operation. Target audience of this document is anyone who wishes to use or integrate this product into a solution that is meant to comply with FIPS 140-2 requirements.

1.2 Document Organization

The Security Policy document is one document in a 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 Security Policy and the other validation submission documentation were produced by Acumen Security under contract to IBM Security. With the exception of this Non-Proprietary Security Policy, the FIPS 140-2 Submission Package is proprietary to IBM and is releasable only under appropriate non-disclosure agreements.

1.3 Notices

This document may be freely reproduced and distributed in its entirety without modification.

1.4 Acronyms

The following table defines acronyms found in this document:

Acronym	Term
AES	Advanced Encryption Standard
CBC	Cipher Block Chaining
CSEC	Communications Security Establishment Canada
CSP	Critical Security Parameter
DRBG	Deterministic Random Bit Generator
DTR	Derived Testing Requirement
ECDSA	Elliptic Curve Digital Signature Algorithm
FIPS	Federal Information Processing Standard
GPC	General Purpose Computer
GPOS	General Purpose Operating System
GUI	Graphical User Interface

Acronym	Term
HMAC	Hashed Message Authentication Code
IBM	International Business Machines
ISS	Internet Security Systems
KAT	Known Answer Test
NDRNG	Non-Deterministic Random Number Generator
NIM	Network Interface Module
NIST	National Institute of Standards and Technology
RSA	Rivest Shamir Adelman
SHA	Secure Hashing Algorithm
SSH	Secure Shell
TLS	Transport Layer Security
Triple-DES	Triple Data Encryption Standard

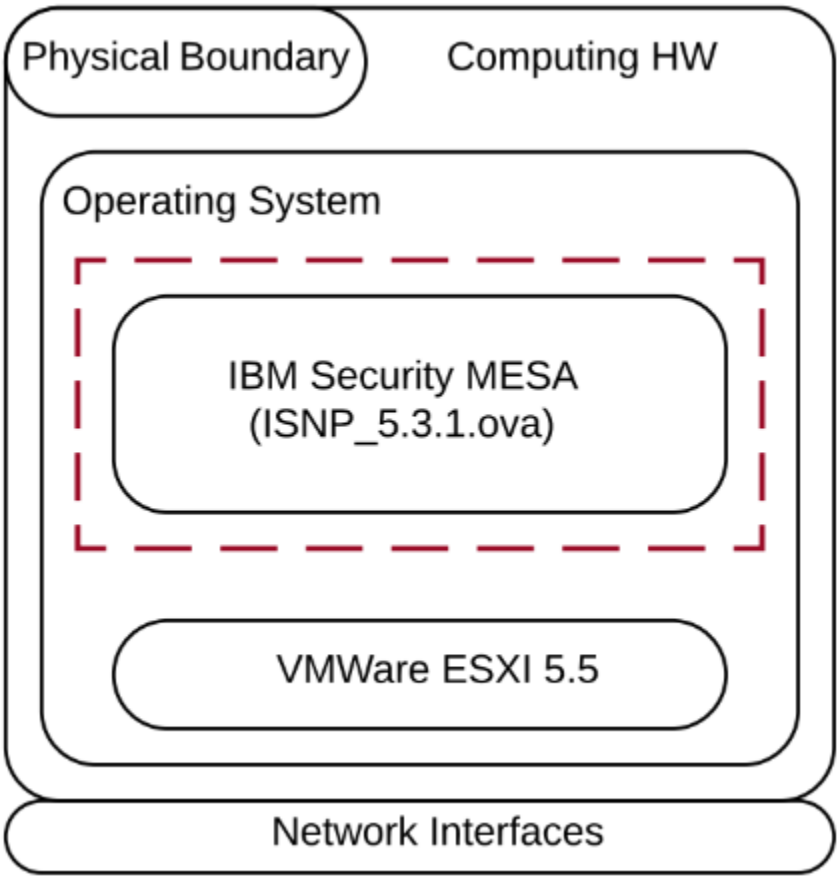
Table 1 – Acronyms and Terms

2. IBM SECURITY MODULAR EXTENSIBLE SECURITY ARCHITECTURE

2.1 Product Overview

This module provides the FIPS validated cryptographic services for applications requiring cryptography. The services provided by the module, includes Symmetric and Asymmetric Cryptography as well as some support for TLS, SSH, SNMP protocols. The Modular Extensible Security Architecture supports various IBM Security platforms, such as, the IBM Security GX Security Appliances and the IBM Security XGS Security Appliances.

2.2 Cryptographic Module Characteristics



The module's block diagram is shown above. The red dashed line area denotes the logical cryptographic boundary of the module which is defined as the virtual machine image. The virtual image which is supported by VMware ESXi, includes the following file,

- ISNP_5.3.1.ova
- ISNP_5.3.3.ova

While the outer black solid line denotes the physical cryptographic boundary of the module which is the enclosure of the system on which the module is executed.

2.3 Validation Level Detail

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

FIPS 140-2 Section Title	Validation Level
Cryptographic Module Specification	1
Cryptographic Module Ports and Interfaces	1
Roles, Services, and Authentication	1
Finite State Model	1
Physical Security	N/A
Operational Environment	1
Cryptographic Key Management	1
Electromagnetic Interference / Electromagnetic Compatibility	1
Self-Tests	1
Design Assurance	1
Mitigation of Other Attacks	N/A
Overall Validation Level	**1**

Table 2 – Validation Level by DTR Section

The “Mitigation of Other Attacks” section is not relevant as the module does not implement any countermeasures towards special attacks.

2.4 Cryptographic Algorithms

2.4.1 Approved Algorithms and Implementation Certificates

The module’s cryptographic algorithm implementations have received the following certificate numbers from the Cryptographic Algorithm Validation Program:

Algorithm	CAVP Certificate	Use
RSA (FIPS186-2) **ALG[ANSIX9.31]:** **Signature Verification:** Key Size: 1024, 1536, 2048, 3072, 4096 bits Hash: SHA-1, SHA-256, SHA-384 , SHA-512 **ALG[RSASSA-PKCS1_V1_5]:** **Signature Verification:** Key Size: 1024, 1536, 2048, 3072, 4096 bits Hash: SHA-1, SHA-224, SHA-256, SHA-384 , SHA-512 **RSA (FIPS186-4)** **Key Generation:** Key Size: 2048, 3072 bits **ALG[ANSIX9.31]** **Signature Verification:** Key Size: 1024, 2048, 3072 bits Hash: SHA-1, SHA-256, SHA-384 , SHA-512	OpenSSL - #1841	Sign / verify operations Digital Certificates

Algorithm	CAVP Certificate	Use
ALG[RSASSA-PKCS1_V1_5] **Signature Generation:** Key Size: 2048, 3072 bits Hash: SHA-224, SHA-256, SHA-384 , SHA-512 **Signature Verification:** Key Size: 1024, 2048, 3072 bits Hash: SHA-224, SHA-256, SHA-384 , SHA-512		
RSA (FIPS186-2) **ALG[RSASSA-PKCS1_V1_5]:** **Signature Verification:** Key Size: 1024, 1536, 2048, 3072 bits Hash: SHA-1, SHA-224, SHA-256, SHA-384 , SHA-512 **RSA (FIPS186-4)** **Key Generation:** Key Size: 2048, 3072 bits **ALG[RSASSA-PKCS1_V1_5]** **Signature Generation:** Key Size: 2048, 3072 bits Hash: SHA-224, SHA-256, SHA-384 , SHA-512 **Signature Verification:** Key Size: 1024, 2048 bits Hash: SHA-1, SHA-224, SHA-256, SHA-384 , SHA-512	GSKIT – #1840	
ECDSA **FIPS186-4:** **PKG**: CURVES: P-224, P-256, P-384, P-521, K-233, K-283, K-409, K-571, B-233, B-283, B-409, B-571 **PKV:** CURVES: ALL-P ALL-K ALL-B **Signature Generation:** CURVES: P-224, P-256, P-384, P-521, K-233, K-283, K-409, K-571, B-233, B-283, B-409, B-571 Hash: SHA-1, SHA-224, SHA-256, SHA-384 , SHA-512 **Signature Verification:** CURVES: P-192, P-224, P-256, P-384, P-521, K-163, K-233, K-283, K-409, K-571, B-163, B-233, B-283, B-409, B-571 Hash: SHA-1, SHA-224, SHA-256, SHA-384 , SHA-512	OpenSSL - #727	
ECDSA	GSKIT – #726	

Algorithm	CAVP Certificate	Use
FIPS186-4: **PKG**: CURVES: P-224, P-256, P-384, P-521, K-233, K-283, K-409, K-571, B-233, B-283, B-409, B-571 **PKV:** CURVES: ALL-P ALL-K ALL-B **Signature Generation:** CURVES: P-224, P-256, P-384, P-521, K-233, K-283, K-409, K-571, B-233, B-283, B-409, B-571 Hash: SHA-224, SHA-256, SHA-384 , SHA-512 **Signature Verification:** CURVES: P-192, P-224, P-256, P-384, P-521, K-163, K-233, K-283, K-409, K-571, B-163, B-233, B-283, B-409, B-571 Hash: SHA-1, SHA-224, SHA-256, SHA-384 , SHA-512		
SHS **SHA-1** (BYTE-only) **SHA-224** (BYTE-only) **SHA-256** (BYTE-only) **SHA-384** (BYTE-only) **SHA-512** (BYTE-only)	OpenSSL - #2941	Message digest in TLS sessions Module integrity via SHA-1
SHS **SHA-1** (BYTE-only) **SHA-224** (BYTE-only) **SHA-256** (BYTE-only) **SHA-384** (BYTE-only) **SHA-512** (BYTE-only)	GSKIT – #2940	
HMAC **HMAC-SHA1** (Key Sizes Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA224** (Key Size Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA256** (Key Size Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA384** (Key Size Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA512** (Key Size Ranges Tested: KS<BS KS=BS KS>BS)	OpenSSL - #2279	Message verification
HMAC **HMAC-SHA1** (Key Sizes Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA224** (Key Size Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA256** (Key Size Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA384** (Key Size Ranges Tested: KS<BS KS=BS KS>BS) **HMAC-SHA512** (Key Size Ranges Tested: KS<BS KS=BS KS>BS)	GSKIT – #2278	
AES **ECB, CBC, CFB1, CFB8, CFB128, OFB, CTR,** (e/d) Key Size: 128 , 192 , 256	OpenSSL - #3579	Data encryption / decryption

Algorithm	CAVP Certificate	Use
CCM (implemented but not used) **CMAC (implemented but not used)** (Generation/Verification) (128, 192, 256 bits) Key Size: 128 , 192 , 256 Message Length: Min: 0 Max: 2^16 Tag Length: Min: 0 Max: 16 **GCM** (e/d) Key Size: 128 , 192 , 256 bits Tag Length: 128 IV Generated internally using Section 8.2.2		
AES **ECB, CBC, CFB1, CFB8, CFB128, OFB, CTR**(e/d) Key Size: 128 , 192 , 256 Message Length: **CCM (implemented but not used)** **CMAC (implemented but not used)** (Generation/Verification) (128, 192, 256 bits) Key Size: 128 , 192 , 256 Message Length: Min: 0 Max: 2^16 Tag Length: Min: 0 Max: 16 **GCM** (e/d) Key Size: 128 , 192 , 256 bits Tag Length: 128 IV Generated internally using Section 8.2.2	GSKIT – #3578	
Triple-DES **TECB, TCBC, TCFB64, TOFB** (e/d) Keying Option 1 **CMAC (implemented but not used)** (Generation/Verification) Key Size: 3 key Message Length: Min: 0 Max: 2^16 Tag Length: Min: 2 Max: 8	OpenSSL - #1992	
Triple-DES **TECB, TCBC, TCFB64, TOFB** (e/d) Keying Option 1 **CMAC (implemented but not used)** (Generation/Verification) Key Size: 3 key Message Length: Min: 0 Max: 2^16 Tag Length: Min: 0 Max: 8	GSKIT – #1991	
DRBG **Hash_Based DRBG**:	OpenSSL - #919	Deterministic Random Bit Generation

Algorithm	CAVP Certificate	Use
Prediction Resistance: Enabled/Not Enabled Hash: SHA-1 , SHA-224 , SHA-256 , SHA-384 , SHA-512 **HMAC_Based DRBG**: Prediction Resistance: Enabled/Not Enabled Hash: SHA-1 , SHA-224 , SHA-256 , SHA-384 , SHA-512 **CTR_DRBG**: Prediction Resistance: Enabled/Not Enabled BlockCipher_Use_df: (AES-128 , AES-192 , AES-256) BlockCipher_No_df: (AES-128 , AES-192 , AES-256)		
DRBG **Hash_Based DRBG**: Prediction Resistance: Enabled/Not Enabled Hash: SHA-1 , SHA-224 , SHA-256 , SHA-384 , SHA-512 **HMAC_Based DRBG**: Prediction Resistance: Enabled/Not Enabled Hash: SHA-1 , SHA-224 , SHA-256 , SHA-384 , SHA-512 **CTR_DRBG**: Prediction Resistance: Enabled/Not Enabled BlockCipher_Use_df: (AES-128 , AES-192 , AES-256) BlockCipher_No_df: (AES-128 , AES-192 , AES-256)	GSKIT – #918	
CVL Elliptic Curve Diffie-Hellman CURVES: P: 224, P-256, P-384, P-521	GSKIT – #748	Cofactor Diffie-Hellman Primitive

Table 3 – Algorithm Certificates

2.4.2 Non-Approved But Allowed Algorithms

The Module supports the following key establishment schemes and non-approved but allowed algorithms:

- Diffie-Hellman (key agreement; key establishment methodology provides 112 (2048-bit keys) or 128 (3072-bit keys) bits of encryption strength)
- EC Diffie-Hellman (key agreement; key establishment methodology provides between 112 and 256 bits of encryption strength)
- MD5 for use in TLS only
- NDRNG
    - The minimum number of bits of entropy requested per each GET function is 256 bits.

- RSA Key Wrapping Encrypt / Decrypt (2048, 3072 bits) Allowed to be used in FIPS mode (key wrapping; key establishment methodology provides 112 or 128 bits of encryption strength)

2.4.3 Cryptographic Module Specification

For FIPS 140-2 purposes, the Module is classified as a multi-chip standalone module. The Module's physical cryptographic boundary is the enclosure of the computer system on which it is executing.

The software was validated on the following platforms:

- IBM X3550 M2 Server with an Intel Xeon E5530 (2x) w/ RHEL 6.3 Linux on VMware ESXi 5.5

2.4.4 Excluded Components

Excluded components including the following:

- Monitoring Ports
    - The excluded monitoring ports accept and pass data traffic that is analyzed by the internal IDS analysis engine. The traffic is not security relevant and does not interact with the cryptographic processing of the appliance. However, the IDS analysis engine uses TLS/SSL cipher suites for outbound/inbound SSL inspection/detection. Furthermore, the IDS analysis engine may use non-approved algorithms and cipher suites to analyzing data packets on the protected network. TLS flows using non-approved/approved algorithms and cipher suites should be considered clear text and non-security relevant.

2.4.5 FIPS Mode

The module can only be enabled for FIPS mode at the time of initial configuration. Additionally, if the module enters an error state (e.g., a known answer test fails), the module must be restarted.

2.5 Module Interfaces

The physical ports of the Module are the same as the system on which it is executing. The VMware ESXi hypervisor provides virtualized ports and interfaces for the module. Interaction of with the virtual ports created by the hypervisor occurs through the host system's Ethernet port. Management, data, and status traffic must all flow through the Ethernet port. Direct interaction with the module via the host system is not possible.

The module provides logical interfaces to the system, and is 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:

Interface	Description
Data Input	Virtual Network Interfaces Plaintext and/or ciphertext data

Interface	Description
Data Output	Virtual Network Interfaces Plaintext and/or ciphertext data
Control Input	Virtual Network Interfaces Configuration or Administrative data entered into the module
Status Output	Virtual Network Interfaces status provided or displayed via the user interfaces

Table 4 – Interface Descriptions

2.6 Roles, Services, and Authentication

The Module assumes two roles: User role and Crypto Officer role, which are identified along with their allowed services below. The User and Crypto Officer roles are implicitly assumed by the entity accessing services implemented by the Module.

2.6.1 Operator Services and Descriptions

The services available to the User and Crypto Officer roles in the module are as follows:

Service	Description	Service Input / Output	Key/CSP Access	Roles
Configure	Initializes the module for FIPS mode of operation	Configuration Parameters / Module configured	None	Crypto Officer
Self-Test	Performs self tests on critical functions of module	Initiate self-tests / Self tests run	None	Crypto Officer User
Decrypt	Decrypts a block of data	Initiate decryption / data decrypted	15, 16, 37, 38, 40, 41, 42	Crypto Officer User
Encrypt	Encrypts a block of data	Initiate encryption/ data encrypted	15, 16, 37, 38, 40, 41, 42	Crypto Officer User
Hash	Verifies the hash of a block of data	Initiate hash/ hash value	17, 39, 43	Crypto Officer User
Random Bit Generation	Generates Random Bits	Initiate Bit Generation/Random Bits	18, 19, 20, 21, 22, 46, 47, 48, 49, 50	Crypto Officer User
Signature Generation	Generates Digital Signature	Initiate Generation/Signature	1, 2, 3, 4, 23, 24, 25, 26	Crypto Officer User
Signature Verification	Verifies Digital Signature	Initiate verification/pass or fail	1, 2, 3, 4, 23, 24, 25, 26	
Establish Session	Provides a protected session for establishment of encryption keys with peers	Initiate session establishment / session established	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 23, 24, 25, 26, 27 28, 29, 30, 31, 32, 33, 34, 35, 36, 44, 45	Crypto Officer User
Zeroize CSPs	Clear CSPs from memory	Terminate Session / CSPs cleared	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50	Crypto Officer User

Service	Description	Service Input / Output	Key/CSP Access	Roles
	Clear CSPs from disk	Reimage module / CSPs cleared and module restored to factory settings	1, 2, 3, 4, 23, 24, 25, 26	Crypto Officer
Show Status	Shows status of the module	Show status commands / Module status	None	Crypto Officer User

Table 5 – Operator Services and Descriptions

2.6.2 Operator Authentication

At security level 1, authentication is not required. The role is implicitly assumed on entry.

2.6.3 Mechanism and Strength of Authentication

At security level 1, authentication is not required.

2.7 Physical Security

The module is a software module. Physical security is not required.

2.8 Operational Environment

This Module operates in a modifiable operational environment per the FIPS 140-2 definition. The module was validated in the following environment: RHEL 6.3 Linux on VMware ESXi 5.5 with an Intel Xeon E5530 (2x) processor.

2.8.1 Operational Environment Policy

The operating system is restricted to a single operator mode of operation (i.e., concurrent operators are explicitly excluded).

The application that makes calls to the cryptographic Module is the single user of the cryptographic Module, even when the application is serving multiple clients.

2.9 Cryptographic Key Management

The table below provides a complete list of Critical Security Parameters used within the module:

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
GSKIT Implementation							
Asymmetric Cryptography							
1	RSA Private Key	Private key for sign / verify operations and key establishment[1] for XGS TLS connections	Internal generation at installation by DRBG	**Storage**: On disk in plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: None	Establish Session	Crypto Officer R W D User R
2	RSA Public Key	Public key for sign / verify operations and key establishment[2] for XGS TLS connections Encryption/Decryption of the Premaster Secret for entry/output	Internal generation at installation by DRBG	**Storage**: On disk in plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: plaintext during TLS negotiation	Establish Session	Crypto Officer R W D User R
3	ECDSA Private Key	Private Key for sign / verify operations and key establishment for	Internal Generation	**Storage**: On disk in plaintext **Type:** Static	**Agreement**: N/A **Entry**: N/A	Establish Session	Crypto Officer R W D

[1] Key establishment methodology provides 112 or 128-bits of encryption strength
[2] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
		SiteProtector TLS connections.		**Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Output**: None		User R
4	ECDSA Public Key	Public Key for sign / verify operations and key establishment for SiteProtector TLS connections.	Internal Generation	**Storage**: On disk in plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: plaintext during TLS negotiation.	Establish Session	Crypto Officer R W D User R
TLS							
5	Master Secret (48 Bytes)	Used for computing the Session Key	Internal generation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
6	Premaster Secret (48 Bytes)	Premaster Secret Message	Internal generation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: Input during TLS negotiation **Output**: Output to server encrypted by Public Key	Establish Session	Crypto Officer None User None
7	ECDHE Private Key		Internal generation	**Storage**: RAM plaintext **Type:** Static	**Agreement**: N/A **Entry**: N/A	Establish Session	Crypto Officer R W D

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
		Private asymmetric key for key establishment[3] for XGS TLS connections.		**Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Output**: Key handle from request is output only to the SiteProtector application		User R
8	ECDHE Public Key	Public asymmetric key for key establishment[4] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
9	ECDH Private Key	Private asymmetric key for key establishment[5] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
10	ECDH Public Key		Internal generation	**Storage**: RAM plaintext **Type:** Static	**Agreement**: N/A **Entry**: N/A	Establish Session	Crypto Officer R W D

[3] Key establishment methodology provides between 112 and 256 bits of encryption strength
[4] Key establishment methodology provides between 112 and 256 bits of encryption strength
[5] Key establishment methodology provides between 112 and 256 bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
		Public asymmetric key for key establishment[6] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output		**Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Output**: Key handle from request is output only to the SiteProtector application		User R
11	DH Private Key	Private asymmetric key for key establishment[7] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
12	DH Public Key	Public asymmetric key for key establishment[8] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R

[6] Key establishment methodology provides between 112 and 256 bits of encryption strength
[7] Key establishment methodology provides 112 or 128-bits of encryption strength
[8] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
13	DHE Private Key	Private asymmetric key for key establishment[9] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
14	DHE Public Key	Public asymmetric key for key establishment[10] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
15	GSKIT TLS AES Session Key	AES 128, 192, 256 encryption & decryption of management traffic	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: Via secure TLS tunnel **Entry**: N/A **Output**: N/A	Decrypt Encrypt	Crypto Officer R W D User R W D

[9] Key establishment methodology provides 112 or 128-bits of encryption strength
[10] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
16	GSKIT TLS Triple-DES Session Key	Triple-DES 192 encryption & decryption of management traffic	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: Via secure TLS tunnel **Entry**: N/A **Output**: N/A	Decrypt Encrypt	Crypto Officer R W D User R W D
17	GSKIT TLS HMAC key	HMAC-SHA-1, HMAC-SHA-224, HMAC-SHA-256, HMAC-SHA-384, HMAC-SHA-512 for message verification	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: None	Establish Session	Crypto Officer R W D User R W D
DRBG							
18	DRBG Seed Key	256-bit value to seed the FIPS-approved DRBG	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
19	Entropy Input String	Input value for entropy calculation	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
20	Hash_DRBG mechanism	V and C values	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
21	HMAC_DRBG mechanism	V and Key values	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
22	CTR_DRBG mechanism	V and Key values	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
OpenSSL Implementation							
Asymmetric Cryptography							
23	RSA Private Key	Private key for sign / verify operations and key establishment[11] for XGS TLS connections	Internal generation at installation by DRBG	**Storage**: On disk in plaintext **Type:** Static	**Agreement**: N/A **Entry**: N/A **Output**: None	Establish Session	Crypto Officer R W D

[11] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
				Association: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.			User R
24	RSA Public Key	Public key for sign / verify operations and key establishment[12] for XGS TLS connections Encryption/Decryption of the Premaster Secret for entry/output	Internal generation at installation by DRBG	**Storage**: On disk in plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: plaintext during TLS negotiation	Establish Session	Crypto Officer R W D User R
25	ECDSA Private Key	Private Key for sign / verify operations and key establishment for SiteProtector TLS connections.	Internal Generation	**Storage**: On disk in plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: None	Establish Session	Crypto Officer R W D User R
26	ECDSA Public Key	Public Key for sign / verify operations and key establishment for SiteProtector TLS connections.	Internal Generation	**Storage**: On disk in plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: plaintext during TLS negotiation.	Establish Session	Crypto Officer R W D User R

[12] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
TLS							
27	Premaster Secret (48 Bytes)	Premaster Secret Message	Internal generation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: Input during TLS negotiation **Output**: Output to server encrypted by Public Key	Establish Session	Crypto Officer None User None
28	Master Secret (48 Bytes)	Used for computing the Session Key	Internal generation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
29	ECDHE Private Key	Private asymmetric key for key establishment[13] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static	**Agreement**: N/A **Entry**: N/A	Establish Session	Crypto Officer R W D

[13] Key establishment methodology provides between 112 and 256 bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
				Association: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Output**: Key handle from request is output only to the SiteProtector application		User R
30	ECDHE Public Key	Public asymmetric key for key establishment[14] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
31	ECDH Private Key	Private asymmetric key for key establishment[15] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
32	ECDH Public Key	Public asymmetric key for key establishment[16] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static	**Agreement**: N/A **Entry**: N/A	Establish Session	Crypto Officer R W D

[14] Key establishment methodology provides between 112 and 256 bits of encryption strength
[15] Key establishment methodology provides between 112 and 256 bits of encryption strength
[16] Key establishment methodology provides between 112 and 256 bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
		Encryption/Decryption of the Premaster Secret for entry/output		**Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Output**: Key handle from request is output only to the SiteProtector application		User R
33	DH Private Key	Private asymmetric key for key establishment[17] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
34	DH Public Key	Public asymmetric key for key establishment[18] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
35	DHE Private Key	Private asymmetric key for key establishment[19] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static	**Agreement**: N/A **Entry**: N/A	Establish Session	Crypto Officer R W D

[17] Key establishment methodology provides 112 or 128-bits of encryption strength
[18] Key establishment methodology provides 112 or 128-bits of encryption strength
[19] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
				Association: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Output**: Key handle from request is output only to the SiteProtector application		User R
36	DHE Public Key	Public asymmetric key for key establishment[20] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
37	OpenSSL TLS AES Session Key	AES 128, 192, 256 encryption & decryption of management traffic	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: Via secure TLS tunnel **Entry**: N/A **Output**: N/A	Decrypt Encrypt	Crypto Officer R W D User R W D
38	OpenSSL TLS Triple-DES Session Key	Triple-DES 192 encryption & decryption of management traffic	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: Via secure TLS tunnel **Entry**: N/A **Output**: N/A	Decrypt Encrypt	Crypto Officer R W D User R W D

[20] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
39	OpenSSL TLS HMAC key	HMAC-SHA-1, HMAC-SHA-224, HMAC-SHA-256, HMAC-SHA-384, HMAC-SHA-512 for message verification	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: None	Establish Session	Crypto Officer R W D
SNMP							
40	SNMP AES Key	AES CBC 256-bit key for encryption / decryption of SNMP traffic	Internal generation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Encrypt	Crypto Officer R W D User R W D
SSH							
41	SSH AES Session Key	AES 128, 192, 256 encryption & decryption of management traffic	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: Via secure SSH tunnel **Entry**: N/A **Output**: N/A	Decrypt Encrypt	Crypto Officer R W D User R W D
42	SSH Triple-DES Session Key	Triple-DES 192 encryption & decryption of management traffic	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: Via secure SSH tunnel **Entry**: N/A **Output**: N/A	Decrypt Encrypt	Crypto Officer R W D User R W D

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
43	SSH HMAC key	HMAC-SHA-1, HMAC-SHA-224, HMAC-SHA-256, HMAC-SHA-384, HMAC-SHA-512 for message verification	Internal generation at installation by DRBG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: None	Establish Session	Crypto Officer R W D User R W D
44	DH Private Key	Private asymmetric key for key establishment[21] for XGS TLS connections.	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
45	DH Public Key	Public asymmetric key for key establishment[22] for XGS TLS connections. Encryption/Decryption of the Premaster Secret for entry/output	Internal generation	**Storage**: RAM plaintext **Type:** Static **Association**: The system is the one and only owner. Relationship is maintained by the operating system via X509 certificates.	**Agreement**: N/A **Entry**: N/A **Output**: Key handle from request is output only to the SiteProtector application	Establish Session	Crypto Officer R W D User R
DRBG							

[21] Key establishment methodology provides 112 or 128-bits of encryption strength
[22] Key establishment methodology provides 112 or 128-bits of encryption strength

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
46	DRBG Seed Key	256-bit value to seed the FIPS-approved DRBG	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None
47	Entropy Input String	Input value for entropy calculation	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
48	Hash_DRBG mechanism	V and C values	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
49	HMAC_DRBG mechanism	V and Key values	Generated internally by non-Approved RNG	**Storage**: RAM plaintext **Type:** Ephemeral **Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Agreement**: N/A **Entry**: N/A **Output**: N/A	Establish Session	Crypto Officer None User None
50	CTR_DRBG mechanism	V and Key values	Generated internally by	**Storage**: RAM plaintext **Type:** Ephemeral	**Agreement**: N/A **Entry**: N/A	Establish Session	Crypto Officer None

#	Key/CSP Name	Description / Use	Generation	Storage	Establishment / Export	Interface	Privileges
			non-Approved RNG	**Association**: The system is the one and only owner. Relationship is maintained by the operating system via protected memory.	**Output**: N/A		User None

R = Read W = Write D = Delete

Table 6 - Key/CSP Management Details

The TLS, SSH, and SNMP protocols have not been reviewed or tested by the CAVP and CMVP. Please see NIST document SP800-131A for guidance regarding the use of non FIPS-approved algorithms.

2.10 Self-Tests

The modules include 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. In the event of any self-test failure, the modules will output an error dialog and will shut down. When a module is in an error state, no keys or CSPs will be output and the module will not perform cryptographic functions. The module does not support a bypass function.

The following sections discuss the modules' self-tests in more detail.

2.10.1 Power-On Self-Tests

The module uses a default entry point built into the software to ensure that power-on self-tests are run upon every initialization of each module and do not require operator intervention to run. If any of the tests fail, the module will not initialize. The module will enter an error state and no services can be accessed by the users. Each module implements the following power-on self-tests:

- Module integrity check (HMAC-SHA1)
- OpenSSL Implementation
  - RSA KAT (Signature Generation)
  - RSA KAT (Signature Verification)
  - ECDSA pairwise consistency (Signature Generation)
  - ECDSA pairwise consistency (Signature Verification)
  - AES KAT (Encryption)
  - AES KAT (Decryption)
  - Triple-DES KAT (Encryption)
  - Triple-DES KAT (Decryption)
  - SHA-1, SHA-224, SHA-256, SHA-384, SHA-512 KAT
  - HMAC: SHA-1, SHA-224, SHA-256, SHA-384, SHA-512 KAT
  - DRBG SP 800-90A KAT
- GSKIT Implementation
  - RSA KAT (Signature Generation)
  - RSA KAT (Signature Verification)
  - ECDSA pairwise consistency (Signature Generation)
  - ECDSA pairwise consistency (Signature Verification)
  - AES KAT (Encryption)
  - AES KAT (Decryption)
  - Triple-DES KAT (Encryption)

- Triple-DES KAT (Decryption)
- SHA-1, SHA-224, SHA-256, SHA-384, SHA-512 KAT
- HMAC: SHA-1, SHA-224, SHA-256, SHA-384, SHA-512 KAT
- DRBG SP 800-90A KAT

Each module performs all power-on self-tests automatically when the module is initialized. All power-on self-tests must be passed before a User/Crypto Officer can perform services. The Power-on self-tests can be run on demand by rebooting the module in FIPS approved Mode of Operation.

2.10.2 Conditional Self-Tests

Conditional self-tests are tests that run continuously during operation of each module. If any of these tests fail, the module will enter an error state. The module can be re-initialized to clear the error and resume FIPS mode of operation. No services can be accessed by the operators. Each module performs the following conditional self-tests:

- OpenSSL Implementation
  - Pairwise consistency test for RSA (Signature Generation)
  - Pairwise consistency test for RSA (Signature Verification)
  - Pairwise consistency test for ECDSA implementation (Signature Generation)
  - Pairwise consistency test for ECDSA implementation (Signature Verification)
  - FIPS-Approved DRBG CRNGT
  - NDRNG CRNGT

- GSKIT Implementation
  - Pairwise consistency test for RSA (Signature Generation)
  - Pairwise consistency test for RSA (Signature Verification)
  - Pairwise consistency test for ECDSA implementation (Signature Generation)
  - Pairwise consistency test for ECDSA implementation (Signature Verification)
  - FIPS-Approved DRBG CRNGT
  - NDRNG CRNGT

The module implements the following health conditional tests on the FIPS-approved DRBG:

- OpenSSL Implementation
  - SP 800-90A Health Tests
    - Instantiate Test
    - Generate Test
    - Reseed Test
    - Uninstantiate Test

- GSKIT Implementation
  - SP 800-90A Health Tests
    - Instantiate Test
    - Generate Test
    - Reseed Test
    - Uninstantiate Test

2.11 Mitigation of Other Attacks

The module does not mitigate other attacks.

3. Guidance and Secure Operation

This section describes how to configure the modules for FIPS-approved mode of operation. Operating a module without maintaining the following settings will remove the module from the FIPS-approved mode of operation.

3.1 Crypto Officer Guidance

3.1.1 Enabling FIPS Mode

When first powering on the module, the operator will be guided through a configuration wizard. In the CLI, the following will appear:

```
Enable FIPS mode
```

To initialize the module for FIPS mode, the Crypto Officer must select Y at this prompt then 1 to enable FIPS mode.

Note: The module can only be enabled for FIPS mode at the time of initial configuration. If the module enters an error state (e.g., a known answer test fails), the module must be powered off and reimaged to FIPS mode of operation.

3.2 User Guidance

The User role is defined by a management session over a TLS tunnel. As such, no additional guidance is required to maintain FIPS mode of operation.

3.3 General Guidance

The Crypto Officer must configure and enforce the following initialization procedures in order to operate in FIPS approved mode of operation:

- Verify that the software version of the module is Version 5.3.1 or Version 5.3.3. No other version can be loaded or used in FIPS mode of operation.
- Only FIPS approved or allowed algorithms and key sizes may be used. Please refer to section 2.3 for more information.