

**Trusted Concepts
TrustedKeep
Encryption Module**
Version 1.8.3

**TrustedKeep Encryption Module
FIPS 140-2 Non-proprietary Security Policy**
Version 1.3

October 2017

Modification History

Version	Date	Description
Version 1.0	July 2017	Initial Release
Version 1.1	July 2017	Updates
Version 1.2	October 2017	Updates per CMVP comments
Version 1.3	November 2017	Updates per CMVP comments

References

Reference]	Full Specification Name
[FIPS 140-2]	Security Requirements for Cryptographic modules, May 25, 2001
[FIPS 180-4]	Secure Hash Standard
[FIPS 186-4]	Digital Signature Standard
[FIPS 197]	Advanced Encryption Standard
[FIPS 198-1]	The Keyed-Hash Message Authentication Code (HMAC)
[SP 800-38B]	Recommendation for Block Cipher Modes of Operation: The CMAC Mode for Authentication
[SP 800-38C]	Recommendation for Block Cipher Modes of Operation: The CCM Mode for Authentication and Confidentiality
[SP 800-38D]	Recommendation for Block Cipher Modes of Operation: Galois/Counter Mode (GCM) and GMAC
[SP 800-56A]	Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography
[SP 800-67R1]	Recommendation for the Triple Data Encryption Algorithm (TDEA) Block Cipher
[SP 800-89]	Recommendation for Obtaining Assurances for Digital Signature Applications
[SP 800-90A]	Recommendation for Random Number Generation Using Deterministic Random Bit Generators
[SP 800-131A]	Transitions: Recommendation for Transitioning the Use of Cryptographic Algorithms and Key Lengths
[SP 800-133]	Recommendation for Cryptographic Key Generation

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1 Introduction

This document is the non-proprietary security policy for the Trusted Keep TrustedKeep Encryption Module, hereafter referred to as the Module.

The Module is a software library providing a C-language application program interface (API) for use by other processes that require cryptographic functionality. The Module is classified by FIPS 140-2 as a software module, multi-chip standalone module embodiment. The physical cryptographic boundary is the general-purpose computer on which the module is installed. The logical cryptographic boundary of the Module is the *fipscanister* object module, a single object module file named *fipscanister.o*. The Module performs no communications other than with the calling application (the process that invokes the Module services).

The FIPS 140-2 security levels for the Module are as follows:

Security Requirement	Security Level
Cryptographic Module Specification	1
Cryptographic Module Ports and Interfaces	1
Roles, Services, and Authentication	2
Finite State Model	1
Physical Security	NA
Operational Environment	1
Cryptographic Key Management	1
EMI/EMC	1
Self-Tests	1
Design Assurance	1
Mitigation of Other Attacks	NA

Table 1-Security Level of Security Requirements

The Module's software version for this validation is 1.8.3.

General Purpose Computer – Physical Boundary

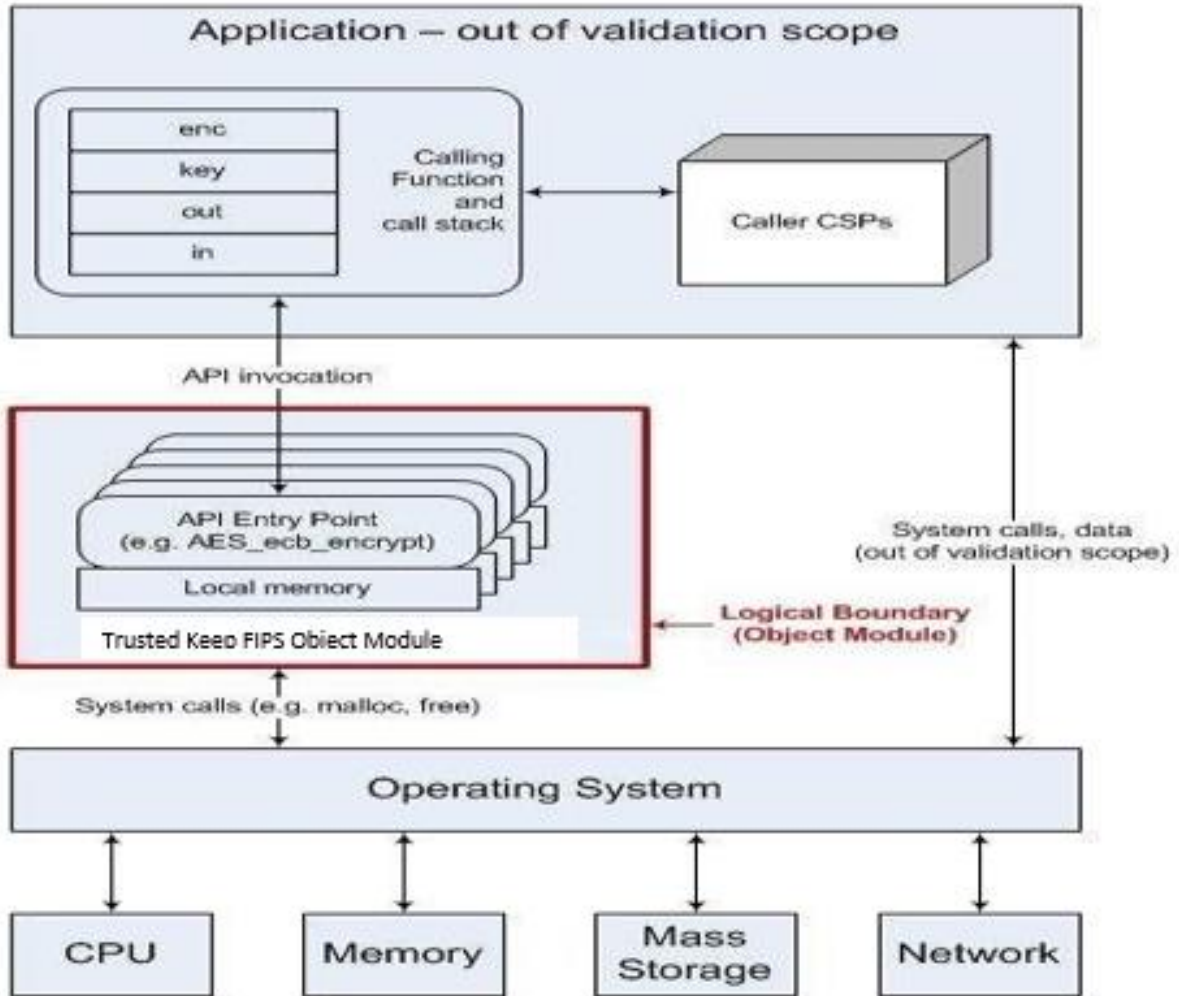


Figure 1-Module Block Diagram

2 Tested Configurations

Testing was performed on the module with and without PAA.

#	Hardware	Operating System	Processor
1	MacBook Pro	Centos 7	Intel Core i7 w/ PAA ¹
2	MacBook Pro	Centos 7	Intel Core i7 w/o PAA

Table 2-Tested Configuration(s)

See Appendix A for additional information on build method. See Appendix C for a list of the specific compilers used to generate the Module.

¹ AES-NI

3 Ports and Interfaces

The physical ports of the Module are the same as the system on which it is executing. The logical interface is a C-language application program interface (API).

Logical interface type	Description
Control input	API entry point and corresponding stack parameters
Data input	API entry point data input stack parameters
Status output	API entry point return values and status stack parameters
Data output	API entry point data output stack parameters

Table 3 – Logical interfaces

As a software module, control of the physical ports is outside module scope. However, when the module is performing self-tests, or is in an error state, all output on the logical data output interface is inhibited. The module is single-threaded and in error scenarios returns only an error value (no data output is returned).

4 Modes of Operation and Cryptographic Functionality

The Module supports a FIPS 140-2 Approved mode and Non-Approved mode of operation, which are implicitly transitioned by the service or algorithm being called. The operator calls the approved or allowed services and algorithms in order to run in a FIPS 140-2 approved mode of operation.

Function	Algorithm	Options	Certificate #
Random Number Generation; Symmetric key Generation	[SP 800-90] DRBG Prediction resistance supported for all variations	Hash DRBG HMAC DRBG, no reseed CTR DRBG (AES), no derivation function	#1563
Encryption, Decryption and CMAC	[SP 800-67]	3-Key TDES ECB, TCBC, TCFB, TOFB; CMAC generate and verify	#2466
	[FIPS 197] AES [SP 800-38B] CMAC [SP 800-38C] CCM [SP 800-38D] GCM	128/ 192/256 ECB, CBC, OFB, CFB 1, CFB 8, CFB 128, CTR, CCM; GCM; CMAC generate and verify	#4637
	[SP 800-38E] XTS	128/256	
Message Digests	[FIPS 180-4]	SHA-1, SHA-2 (224, 256, 384, 512)	#3801
Keyed Hash	[FIPS 198] HMAC	SHA-1, SHA-2 (224, 256, 384, 512)	#3070
Digital Signature and Asymmetric Key Generation	[FIPS 186-2] RSA	SigVer9.31 (2048/3072/4096 with SHA-1, 256, 384, 512)	#2532
		SigVerPKCS1.5 (2048/3072/4096 with SHA-1, 224, 256, 384, 512)	
		SigVerPSS (2048/3072/4096 with SHA-1, 224, 256, 384, 512)	
	[FIPS 186-4] RSA	SigGenPSS (2048/3072 with SHA-224, 256, 384, 512)	#2532
		SigGenPKCS1.5 (2048/3072 with SHA-224, 256, 384, 512)	
		SigGen9.31 (2048/3072 with SHA-256, 384, 512) Note: SHA-1 affirmed for use with protocols only	
		SigVerPSS (1024/2048/3072 with SHA-1, 224, 256, 384, 512) Note: SHA-1 affirmed for use with protocols only	
		SigVerPKCS1.5 (1024/2048/3072 with SHA-1, 224, 256, 384, 512) Note: SHA-1 affirmed for use with protocols only	
		SigVer9.31 (1024/2048/3072 with SHA-1, 256, 384,512)	
		Key Generation (Random e) PGM (Probable Prime Condition), (2048/3072)	
[FIPS 186-4] DSA	PQGen (2048, 224 with SHA-224, 256, 384, 512; 2048, 256 with SHA-256, 384, 512; 3072,256 with SHA-256, 384, 512)	#1227	
	Key Pair Gen (2048,224; 2048,256; 3072,256)		
	Sig Gen (2048,224 with SHA-1, 224, 256, 384, 512; 2048,256 with SHA-1, 224, 256, 384, 512; 3072,256 with SHA-1, 224, 256, 384, 512) note: SHA-1 affirmed for use with protocols only		

Function	Algorithm	Options	Certificate #
		SigVer (2048/3072 with SHA-1, 224, 256, 384, 512) PQGVe (1024, 160 with SHA-1, 224, 256, 384, 512; 2048, 224 with SHA-224, 256, 384, 512; 2048, 256 with SHA-256, 384, 512; 3072,256 with SHA-256, 384, 512)	
	[FIPS 186-4] ECDSA	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) SigGen: CURVES(P-224: (SHA-1, 224, 256, 384, 512) P-256: (SHA-1, 224, 256, 384, 512) P-384: (SHA-1, 224, 256, 384, 512) P-521: (SHA-1, 224, 256, 384, 512) K-233: (SHA-1, 224, 256, 384, 512) K-283: (SHA-1, 224, 256, 384, 512) K-409: (SHA-1, 224, 256, 384, 512) K-571: (SHA-1, 224, 256, 384, 512) B-233: (SHA-1, 224, 256, 384, 512) B-283: (SHA-1, 224, 256, 384, 512) B-409: (SHA-1, 224, 256, 384, 512) B-571: (SHA-1, 224, 256, 384, 512)) SIG(gen) with SHA-1 affirmed for use with protocols only. SigVer: CURVES(P-192: (SHA-1, 224, 256, 384, 512) P-224: (SHA-1, 224, 256, 384, 512) P-256: (SHA-1, 224, 256, 384, 512) P-384: (SHA-1, 224, 256, 384, 512) P-521: (SHA-1, 224, 256, 384, 512) K-163: (SHA-1, 224, 256, 384, 512) K-233: (SHA-1, 224, 256, 384, 512) K-283: (SHA-1, 224, 256, 384, 512) K-409: (SHA-1, 224, 256, 384, 512) K-571: (SHA-1, 224, 256, 384, 512) B-163: (SHA-1, 224, 256, 384, 512) B-233: (SHA-1, 224, 256, 384, 512) B-283: (SHA-1, 224, 256, 384, 512) B-409: (SHA-1, 224, 256, 384, 512) B-571: (SHA-1, 224, 256, 384, 512))	#1142
ECC CDH	[SP 800-56A] (§5.7.1.2)	All NIST defined B, K and P curves except sizes 163 and 192	CVL #1295

Table 4a – FIPS Approved Cryptographic Functions

- The Module supports only NIST defined curves for use with ECDSA and ECC CDH.
- The vendor affirms generated seeds for private keys are generated per SP 800-133 (unmodified output from a DRBG)
- Per SP800-67 rev2, the user is responsible for ensuring the module’s limit to 2^32 encryptions with the same Triple-DES key while being used in SSH and/or TLS protocols.

Category	Algorithm	Description
Key Agreement	EC DH	Non-compliant (untested) DH scheme using elliptic curve, supporting all NIST defined B, K and P curves. Key agreement is a service provided for calling process use, but is not used to establish keys into the Module.
Key Encryption, Decryption	RSA	The RSA algorithm may be used by the calling application for encryption or decryption of keys. No claim is made for SP 800-56B compliance, and no CSPs are

		established into or exported out of the module using these services
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Table 4b – Non-FIPS Approved But Allowed Cryptographic Functions

The module supports the following non-FIPS 140-2 approved but allowed algorithms:

- RSA (key wrapping; key establishment methodology provides between 112 and 270 bits of encryption strength; non-compliant less than 112 bits of encryption strength)
- EC Diffie-Hellman (key agreement; key establishment methodology provides between 112 and 256 bits of encryption strength; non-compliant less than 112 bits of encryption strength)

The Module implements the following services which are Non-Approved per the SP 800-131A transition:

Function	Algorithm	Options
Digital Signature and Asymmetric Key Generation	[FIPS 186-2] RSA	GenKey9.31, SigGen9.31, SigGenPKCS1.5, SigGenPSS (2048/3072/4096 with SHA-1)
	[FIPS 186-2] DSA	PQG Gen, Key Pair Gen, Sig Gen (2048/3072 with SHA-1)
	[FIPS 186-4] DSA	PQG Gen, Key Pair Gen, Sig Gen (2048/3072 with SHA-1)
	[FIPS 186-2] ECDSA	PKG: CURVES(P-192 K-163 B-163) SIG(gen): 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)
	[FIPS 186-4] ECDSA	PKG: CURVES(P-192 K-163 B-163) SigGen: CURVES(P-192: (SHA-1, 224, 256, 384, 512) P-224:(SHA-1) P-256:(SHA-1) P-384: (SHA-1) P-521:(SHA-1) K-163: (SHA-1, 224, 256, 384, 512) K-233:(SHA-1) K-283:(SHA-1) K-409:(SHA-1) K-571:(SHA-1) B-163: (SHA-1, 224, 256, 384, 512) B-233:(SHA-1) B-283: (SHA-1) B-409:(SHA-1) B-571:(SHA-1))
ECC CDH (CVL)	[SP 800-56A] (§5.7.1.2)	All NISTB, K and P curves sizes 163 and 192

Table 4c – Non-Approved Cryptographic Functions

These algorithms shall not be used when operating in the FIPS Approved mode of operation.

Per IG 9.10, the Module implements a default entry point and automatically runs the FIPS self-tests upon startup.

4.1 Critical Security Parameters and Public Keys

All CSPs used by the Module are described in this section. All access to these CSPs by Module services are described in Section 4. The CSP names are generic, corresponding to API parameter data structures.

CSP Name	Description
RSA SGK	RSA (2048 to 16384 bits) signature generation key
RSA KDK	RSA (2048 to 16384 bits) key decryption (private key transport) key
DSA SGK	[FIPS 186-4] DSA (2048/3072) signature generation key
ECDSA SGK	ECDSA (All NIST defined B, K, and P curves except sizes 163 and 192) signature generation key
EC DH Private	EC DH (All NIST defined B, K, and P curves except sizes 163 and 192) private key agreement key.
AES EDK	AES (128/192/256) encrypt / decrypt key
AES CMAC	AES (128/192/256) CMAC generate / verify key
AES GCM	AES (128/192/256) encrypt / decrypt / generate / verify key
AES XTS	AES (256/512) XTS encrypt / decrypt key ²

²This may only be used for storage of data.

TDES EDK	TDES (3-Key) encrypt / decrypt key
TDES CMAC	TDES (3-Key) CMAC generate / verify key
HMAC Key	Keyed hash key (160/224/256/384/512)
Hash_DRBG CSPs	V (440/888 bits) and C (440/888 bits), entropy input (length dependent on security strength)
HMAC_DRBG CSPs	V (160/224/256/384/512 bits) and Key (160/224/256/384/512 bits), entropy input (length dependent on security strength)
CTR_DRBG CSPs	V (128 bits) and Key (AES 128/192/256), entropy input (length dependent on security strength)
CO-AD-Digest	Pre-calculated HMAC-SHA-1 digest used for Crypto Officer role authentication
User-AD-Digest	Pre-calculated HMAC-SHA-1 digest used for User role authentication

Table 4.1a – Critical Security Parameters

Authentication data is loaded into the module during the module build process, performed by an authorized operator (Crypto Officer), and otherwise cannot be accessed.

The module does not output intermediate key generation values.

CSP Name	Description
RSA SVK	RSA (2048 to 16384 bits) signature verification public key
RSA KEK	RSA (2048 to 16384 bits) key encryption (public key transport) key
DSA SVK	[FIPS 186-4] DSA (2048/3072) signature verification key
ECDSA SVK	ECDSA (All NIST defined B, K and P curves) signature verification key
EC DH Public	EC DH (All NIST defined B, K and P curves) public key agreement key.

Table 4.1b – Public Keys

For all CSPs and Public Keys:

Storage: RAM, associated to entities by memory location. The Module stores DRBG state values for the lifetime of the DRBG instance. The module uses CSPs passed in by the calling application on the stack. The Module does not store any CSP persistently (beyond the lifetime of an API call), with the exception of DRBG state values used for the Modules' default key generation service.

Generation: The Module implements SP 800-90 compliant DRBG services for creation of symmetric keys, and for generation of DSA, elliptic curve, and RSA keys as shown in Table 4a. The calling application is responsible for storage of generated keys returned by the module.

Entry: All CSPs enter the Module's logical boundary in plaintext as API parameters, associated by memory location. However, none cross the physical boundary.

Output: The Module does not output CSPs, other than as explicit results of key generation services. However, none cross the physical boundary.

Destruction: Zeroization of sensitive data is performed automatically by API function calls for temporarily stored CSPs. In addition, the module provides functions to explicitly destroy CSPs related to random number generation services. The calling application is responsible for parameters passed in and out of the module.

Private and secret keys as well as seeds and entropy input are provided to the Module by the calling application, and are destroyed when released by the appropriate API function calls. Keys residing in internally allocated data structures (during the lifetime of an API call) can only be accessed using the Module defined API. The operating system protects memory and process space from unauthorized access. Only the calling application that creates or imports keys can use or export such keys. All API functions are executed by the invoking calling application in a non-overlapping sequence such that no two API functions will execute concurrently. An authorized application as user (Crypto-Officer and User) has access to all key data generated during the operation of the Module.

Because the amount of entropy loaded by the application is dependent on the "num" parameter used by the calling application, the minimum number of bits of entropy is considered equal to the "num" parameter selection of the calling application. The calling application must call the RAND_add() with the "num" parameter of at least 32-bytes (256-bits)."

In the event Module power is lost and restored the calling application must ensure that any AES-GCM keys used for encryption or decryption are re-distributed.

Module users (the calling applications) shall use entropy sources that meet the security strength required for the random number generation mechanism as shown in [SP 800-90] Table 2 (Hash_DRBG, HMAC_DRBG), Table 3 (CTR_DRBG). This entropy is supplied by means of callback functions. Those functions must return an error if

the minimum entropy strength cannot be met.

5 Roles, Authentication and Services

The Module implements the required User and Crypto Officer roles and requires authentication for those roles. Only one role may be active at a time and the Module does not allow concurrent operators. The User or Crypto Officer role is assumed by passing the appropriate password to the *FIPS_module_mode_set()* function. The password values may be specified at build time and must have a minimum length of 16 characters. Any attempt to authenticate with an invalid password will result in an immediate and permanent failure condition rendering the Module unable to enter the FIPS mode of operation, even with subsequent use of a correct password.

Authentication data is loaded into the Module during the Module build process, performed by the Crypto Officer, and otherwise cannot be accessed.

Since minimum password length is 16 characters, the probability of a random successful authentication attempt in one try is a maximum of $1/256^{16}$, or less than $1/10^{38}$. The Module permanently disables further authentication attempts after a single failure, so this probability is independent of time.

Both roles have access to all of the services provided by the Module.

- User Role (User): Loading the Module and calling any of the API functions.
- Crypto Officer Role (CO): Installation of the Module on the host computer system and calling of any API functions.

All services implemented by the Module are listed below, along with a description of service CSP access.

Service	Role	Description
Initialize	User, CO	Module initialization. CO-AD-Digest, User-AD-Digest
Self-test	User, CO	Perform self tests (<i>FIPS_selftest</i>). Does not access CSPs.
Show status	User, CO	Functions that provide module status information: <ul style="list-style-type: none"> • Version (as unsigned long or const char *) • FIPS Mode (Boolean) Does not access CSPs.
Zeroize	User, CO	Functions that destroy CSPs: <ul style="list-style-type: none"> • <i>fips_drbg_uninstantiate</i>: for a given DRBG context, overwrites DRBG CSPs (Hash_DRBG CSPs, HMAC_DRBG CSPs, CTR_DRBG CSPs.) All other services automatically overwrite CSPs stored in allocated memory. Stack cleanup is the responsibility of the calling application.
Random number generation	User, CO	Used for random number and symmetric key generation. <ul style="list-style-type: none"> • Seed or reseed a DRBG instance • Determine security strength of a DRBG instance • Obtain random data Uses and updates Hash_DRBG CSPs, HMAC_DRBG CSPs, CTR_DRBG CSPs.
Asymmetric key generation	User, CO	Used to generate DSA, ECDSA and RSA keys: RSA SGK, RSA SVK; DSA SGK, DSA SVK; ECDSA SGK, ECDSA SVK There is one supported entropy strength for each mechanism and algorithm type, the maximum specified in SP800-90
Symmetric encrypt/decrypt	User, CO	Used to encrypt or decrypt data. Executes using AES EDK, TDES EDK, AES GCM, AES XTS (passed in by the calling process).
Symmetric digest	User, CO	Used to generate or verify data integrity with CMAC. Executes using AES CMAC, TDES CMAC (passed in by the calling process).
Message digest	User, CO	Used to generate a SHA-1 or SHA-2 message digest.

Service	Role	Description
		Does not access CSPs.
Keyed Hash	User, CO	Used to generate or verify data integrity with HMAC. Executes using HMAC Key (passed in by the calling process).
Key transport	User, CO	Used to encrypt or decrypt a key value on behalf of the calling process (does not establish keys into the module). Executes using RSA KDK, RSA KEK (passed in by the calling process).
Key agreement	User, CO	Used to perform key agreement primitives on behalf of the calling process (does not establish keys into the module). Executes using EC DH Private, EC DH Public (passed in by the calling process).
Digital signature	User, CO	Used to generate or verify RSA, DSA or ECDSA digital signatures. Executes using RSA SGK, RSA SVK; DSA SGK, DSA SVK; ECDSA SGK, ECDSA SVK (passed in by the calling process).
Utility	User, CO	Miscellaneous helper functions. Does not access CSPs.

Table 5 – Services and CSP Access

6 Self-test

The Module performs the self-tests listed below on invocation of Initialize or Self-test.

Algorithm	Type	Test Attributes
Software integrity	KAT	HMAC-SHA1
HMAC	KAT	One KAT per SHA1, SHA224, SHA256, SHA384 and SHA512 Per IG 9.3, this testing covers SHA POST requirements.
AES	KAT	Separate encrypt and decrypt, ECB mode, 128 bit key length
AES CCM	KAT	Separate encrypt and decrypt, 192 key length
AES GCM	KAT	Separate encrypt and decrypt, 256 key length
XTS-AES	KAT	128, 256 bit key sizes to support either the 256-bit key size (for XTS-AES-128) or the 512-bit key size (for XTS-AES-256)
AES CMAC	KAT	Sign and verify CBC mode, 128, 192, 256 key lengths
TDES	KAT	Separate encrypt and decrypt, ECB mode, 3-Key
TDES CMAC	KAT	CMAC generate and verify, CBC mode, 3-Key
RSA	KAT	Sign and verify using 2048 bit key, SHA-256, PKCS#1
DSA	PCT	Sign and verify using 2048 bit key, SHA-384
DRBG	KAT	CTR_DRBG: AES, 256 bit with and without derivation function HASH_DRBG: SHA256 HMAC_DRBG: SHA256
ECDSA	PCT	Keygen, sign, verify using P-224, K-233 and SHA512. The K-233 self-test is not performed for operational environments that support prime curve only (see Table 2).
ECC CDH	KAT	Shared secret calculation per SP 800-56A §5.7.1.2, IG 9.6

Table 6a - Power On Self Tests (KAT = Known answer test; PCT = Pairwise consistency test)

The Module is installed using one of the set of instructions in Appendix A, as appropriate for the target system. The HMAC-SHA-1 of the Module distribution file as tested by the CMT Laboratory and listed in Appendix A is verified during installation of the Module file as described in Appendix A.

The `FIPS_mode_set()` function performs all power-up self-tests listed above with no operator intervention required, returning a “1” if all power-up self-tests succeed, and a “0” otherwise. This function is run as part of every module initialization. If any component of the power-up self-test fails an internal flag is set to prevent subsequent invocation of any cryptographic function calls.

The power-up self-tests may also be performed on-demand by calling `FIPS_selftest()`, which returns a “1” for success and “0” for failure. Interpretation of this return code is the responsibility of the calling application.

The Module also implements the following conditional tests:

Algorithm	Test
DRBG	Tested as required by [SP800-90] Section 11
DRBG	FIPS 140-2 continuous test for stuck fault
DSA	Pairwise consistency test on each generation of a key pair
ECDSA	Pairwise consistency test on each generation of a key pair
RSA	Pairwise consistency test on each generation of a key pair

Table 6b - Conditional Tests

In the event of a DRBG self-test failure the calling application must unstantiate and reinstantiate the DRBG per the requirements of [SP 800-90A]; this is not something the Module can do itself.

Pairwise consistency tests are performed for both possible modes of use, e.g. Sign/Verify and Encrypt/Decrypt.

7 Operational Environment

The tested operating systems segregate user processes into separate process spaces. Each process space is logically separated from all other processes by the operating system software and hardware. The Module functions entirely within the process space of the calling application, and implicitly satisfies the FIPS 140-2 requirement for a single user mode of operation.

8 Mitigation of other Attacks

The module is not designed to mitigate against attacks which are outside of the scope of FIPS 140-2.

Appendix A Installation and Usage Guidance

The build and target systems may be the same type of system or even the same device, or may be different systems – the Module supports cross-compilation environments.

Each of these command sets are relative to the top of the directory containing the uncompressed and expanded contents of the distribution files *trustedkeep-encryption-module-1.8.3.tgz*. The command sets are:

```
./config  
make  
make install
```

Installation instructions

1. Download and copy the distribution file to the build system.
2. Verify the SHA-512 digest of the distribution file; see Appendix B. An independently acquired FIPS 140-2 validated implementation of SHA-512 must be used for this digest verification. Note that this verification can be performed on any convenient system and not necessarily on the specific build or target system.
3. Unpack the distribution

```
Gunzip -c trustedkeep-encryption-module-1.8.3.tgz
```
4. Execute one of the installation command set as shown above. No other command sets shall be used.
5. The resulting *fipsanister.o* file is now available for use.

Note that failure to use one of the specified commands sets exactly as shown will result in a module that cannot be considered compliant with FIPS 140-2.

Linking the Runtime Executable Application

Note that applications interfacing with the TrustedKeep Encryption Module are outside of the cryptographic boundary. When linking the application with the TrustedKeep Encryption Module two steps are necessary:

1. The HMAC-SHA1 digest of the TrustedKeep Encryption Module file must be calculated and verified against the installed digest to ensure the integrity of the TrustedKeep Encryption Module.
2. A HMAC-SHA1 digest of the TrustedKeep Encryption Module must be generated and embedded in the TrustedKeep Encryption Module for use at runtime initialization.

The `fips_standalone_sha1` command can be used to perform the verification of the TrustedKeep Encryption Module and to generate the new HMAC-SHA1 digest for the runtime executable application. Failure to embed the digest in the executable object will prevent initialization of FIPS mode.

AES-GCM IV Construction/Usage

In case the module's power is lost and then restored, the key used for the AES GCM encryption or decryption shall be redistributed. The AES GCM IV generation is in compliance with the [RFC5288] and shall only be used

for the TLS protocol version 1.2 to be compliant with [FIPS140-2_IG] IG A.5, provision 1 (“TLS protocol IV generation”); thus, the module is compliant with [SP800-52].

Appendix B Controlled Distribution File Fingerprint

The *Trusted Concepts TrustedKeep Encryption Module v1.8.3* consists of the Trusted Keep TrustedKeep Encryption Module (the *fipscanister.o* or *fipscanister.lib* contiguous unit of binary object code) generated from the specific source files.

The source files are in the specific special trustedkeep-encryption-module-1.8.3.tgz with SHA-512 digest of

9dcece5db9a73b9bcb0c254103f8fccf99601d1b86d397cc005b2129cec9caff3f3faed6b78bb00d298457a8c53d4b4
b585029f540acc54de6ef811e22c0b995

The distribution is obtained by directly contacting Trusted Concepts, LLC.

The set of files specified in this tar file constitutes the complete set of source files of this module.

There shall be no additions, deletions, or alterations of this set as used during module build. The OpenSSL distribution tar file (and patch file if used) shall be verified using the above SHA-256 digest.

Appendix C

Compilers

This appendix lists the specific compilers used to generate the Module for the respective Operational Environments. Note this list does not imply that use of the Module is restricted to only the listed compiler versions, only that the use of other versions has not been confirmed to produce a correct result.

#	Operational Environment	Compiler
1	CentOS 7 with Intel Core i7 w/ PAA	gcc 4.8.5
2	CentOS 7 with Intel Core i7 w/o PAA	gcc 4.8.5

Table 7 - Compilers