

Ruckus Networks Virtual SmartZone - Data Plane (vSZ-D) Version 5.2.1.3

FIPS 140-2 Level 1 Non-Proprietary Security Policy by CommScope Technologies LLC.

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1 Module Overview

Ruckus Networks Virtual SmartZone - Data Plane (vSZ-D)

The Ruckus virtual SmartZone – Data Plane (vSZ-D) is a virtualized WLAN solution to handle data plane traffic. Designed as a Network Functions Virtualization (NFV) application, vSZ-D can be easily deployed within an existing vSZ network, shown below in Figure 1, to provide secure and flexible user data plane management in either distributed or centralized configurations. This can address customer requirements to secure guest network Internet traffic, meet PCI compliance, and optimize VoIP quality by managing aggregates traffic through the secure tunnels. The vSZ-D is a software module, which is defined as a multi-chip standalone cryptographic module by FIPS 140-2.

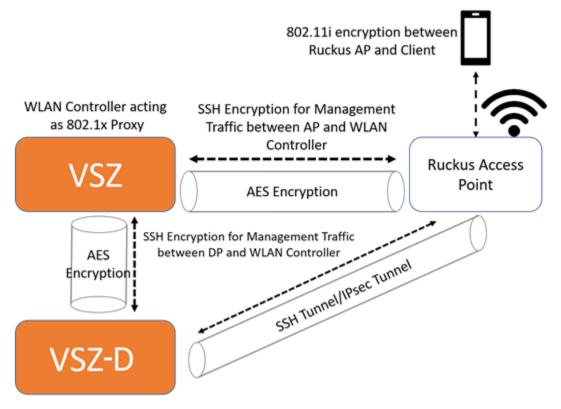


Figure 1: vSZ-D Network Functions Virtualization Diagram

FIPS 140-2 conformance testing was performed at Security Level 1. The following configurations were tested by the lab.

Table 1	: Confi	guration	tested	by t	he l	lab
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Module	Processors	Operating Systems	Tested Platform
	Intel XeonE5-2650 v2 with AES-NI; Intel Xeon E5-2650 v2 without AES-NI	CentOS 7.5 on VMware ESXi 6.5.0	Dell PowerEdge R620

The Cryptographic Module meets FIPS 140-2 Level 1 requirements.

Table 2: Module Security Level Statement

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

The module is defined as a multi-chip standalone software module, with the physical boundary being defined as the hard case enclosure around which everything runs. The logical cryptographic boundary is the vSZ-D cryptographic module, with the shared library file named /lib64/libcrypto.so.10. The module performs no communications other than with the calling application (the process that invokes the module services). The cryptographic boundary of the module is shown below.

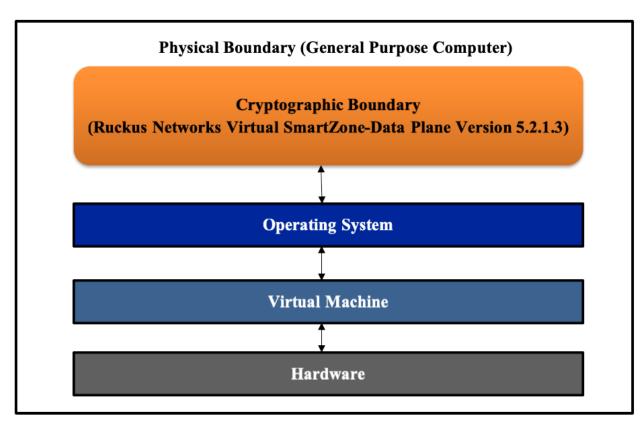


Figure 2: Block Diagram for Ruckus Networks Virtual SmartZone - Data Plane (vSZ-D)

2 Modes of Operation

The module is intended to always operate in the FIPS Approved mode. A provision is made to disable/enable FIPS mode via configuration (Login CLI -> enabled mode -> fips enable/disable). In addition to running the fips enable command, an operator must follow the procedural rules specified in Section 8 to remain in the Approved mode.

2.1 Approved and Allowed Cryptographic Algorithms

The following approved cryptographic algorithms are used in FIPS approved mode of operation. Note that in some cases, more algorithms/modes of operation have been tested than are utilized by the Module. Only implementations that are used are shown in the table below.

Table 3: Approved Cryptographic Functions

CAVP Cert	Algorithm	Standard	Model/Method	Use
Ruckus Virt	ual SmartZone -	– Data Plan (vSZ-D) Crypto – OpenSSL/OpenSSH /	Algorithm Implementation
C2085	AES	FIPS 197, SP 800-38A, SP 800-38D	CBC, CFB128, CTR, GCM (128, 192, 256 bits)	Data Encryption/Decryption
Vendor affirmed	CKG	SP 800-133rev2	N/A	Key Generation
C2085	CVL	SP 800-135 KDF	SSHv2 TLSv1.2 IKEv2	Key Derivation
A2458	KAS-FFC-SSC	SP800-56Arev3	dhEphem ffdhe2048, ffdhe3072, MODP- 2048, MODP-3072	Key establishment methodology provides 112 or 128 bits of encryption strength
A2458	KAS-ECC-SSC	SP800-56Arev3	ephemeralUnified P-256, P-384, P-521	Key establishment methodology provides between 128 and 256 bits of encryption strength
A2458	KAS (FFC) KAS (ECC)		ffdhe2048, ffdhe3072, MODP- 2048, MODP-3072;	Key Agreement Scheme per SP 800-56Arev3 with key derivation per SP 800-135rev1
C2085	DRBG	SP 800-90A	CTR_DRBG (AES-256)	Deterministic Random Bit Generation
C2085	ECDSA	FIPS 186-4	Key Generation: - Curves: P-256/384/521 SigGen/SigVer: - Curves: P-256/384/521 with SHA-256/384/512	Key Generation, Digital Signature Generation and Verification

CAVP Cert	Algorithm	Standard	Model/Method	Use
C2085	НМАС	FIPS 198-1	HMAC-SHA1 HMAC-SHA256 HMAC-SHA384 HMAC-SHA512	Message Authentication
C2085	KTS	SP 800-38F	AES (128, 192, 256 bits) with HMAC SHA-1/256/384/512	Key Transport
C2085	KTS	SP 800-38F	AES-GCM (128, 256 bits)	Key Transport
C2085	RSA	FIPS 186-2 FIPS 186-4 Note: only FIPS 186-2 RSA 4096 bits was used in FIPS mode	- I	Key Generation, Digital Signature Generation and Verification
A2458	Safe Primes	SP800-56Arev3	fdhe2048, ffdhe3072, MODP-	KAS-FFC-SSC Domain Parameters Generation with SafePrimes groups
C2085	SHS	FIPS 180-4	SHA1 SHA-256 SHA-384 SHA-512	Message Digest

Notes:

- There are some algorithm modes that were tested but not used 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 RFCs 4252, 4253 and RFC 5647 for SSHv2. 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 is also compatible with SSHv2 and provides support for the acceptable GCM cipher suites from Section 7.1 of RFC 5647. The IV consist of a 4-byte fixed field and an 8-byte invocation counter. If the invocation counter reaches

its maximum value $2^64 - 1$, the next AES GCM encryption is performed with the invocation counter set to 0. No more than $2^64 - 1$ AES GCM encryptions may be performed in the same session. The SSH session is reset for both the client/server after one GB of data (2^23 block encryptions) or one hour whichever comes first. When a session is terminated for any reason, a new key and a new initial IV are derived.

- 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 is the unmodified output from SP800-90A DRBG.

2.2 Non-FIPS Approved but Allowed Cryptographic Algorithms

The following non-FIPS approved but allowed cryptographic algorithms are used in FIPS approved mode of operation.

Table 4: Non-FIPS Approved but Allowed Cryptographic Algorithms

Algorithm	Caveat	Use
NDRNG		Used to seed the SP 800-90A DRBG.

2.3 Non-FIPS Approved Cryptographic Algorithms

Table 5: Algorithms/Services Available in the Non-Approved Mode

Table 517 illger in indicate in the real representation					
Algorithm	Use				
chacha20-poly1305@openssh.com, umac-64@openssh.com, hmac-sha1-etm@openssh.com, umac-64-etm@openssh.com, umac-128-etm@openssh.com, hmac-sha2-256-etm@openssh.com, hmac-sha2-512-etm@openssh.com, hmac-ripemd160-etm@openssh.com, umac-64@openssh.com, umac-128@openssh.com, hmac-ripemd160, DSA, ED25519	OpenSSH				
MD5, DES,	OpenSSL				
TDES					

Note

- In addition to the FIPS mode of operation, the cryptographic module can also be operated in a non-FIPS mode of operation. Table 5 lists the non-approved/non-allowed the algorithms and services are available to both the User role and CO role in the module. Prior to using any of the Non-Approved services with the associated non-approved/non-allowed algorithms listed in Table 5 above, the Crypto Officer must zeroize all CSPs, which would put the module into the non-FIPS mode of operation.
- Neither the User nor the Crypto Officer are allowed to operate any of these services listed in table 5 above while in FIPS mode of operation.

- To put the module back into the FIPS mode from the non-FIPS mode, the CO must zeroize all Keys/CSPs used in non-FIPS mode, and then strictly follow up the steps in section 8 of this document to put the module into the FIPS mode.
- In addition, all available services supported by the module can be found at RUCKUS FIPS and Common Criteria Configuration Guide for SmartZone and AP, 5.2.1.3, Published on 2021-04-14 with the documentation Part Number 800-72735-001 RevA https://support.ruckuswireless.com/documents/3509.

3 Ports and Interfaces

The following table describes logical interfaces of the module.

Table 6: FIPS 140-2 Logical Interfaces

Logical Interface	Description
Data Input	Input parameters that are supplied to the API commands
Data Output	Output parameters that are returned by the API commands
Control Input	API commands
Status Output	Return status provided by API commands

4 Roles, Services and Authentication

The module supports role-based authentication mechanism. Each role is authenticated by the module upon initial access to the module. There are three roles supported by the module: Crypto Officer role, User role and AP (Access Point) role. The Crypto Officer installs and administers the module. The Users and APs use the cryptographic services provided by the module.

The User role or Crypto Officer role password as well as all other shared secrets must each be at least eight (8) characters long, including at least one alphabet, one numeric character, one special character (note: The special character `cannot be used in the password and the special characters combination '\$(' cannot be used in the password). Given these restrictions, we have $52 \times 10 \times 31 \times 93 \wedge 5 = 112,144,965,131,160$ password combinations. If the '\$(' combination was chosen in the password, then it would have $1 \times 52 \times 10 \times 93^4 = 38,898,704,520$ combinations, resulting the final correct password combinations are 112,144,965,131,160 - 38,898,704,520 = 112,106,066,426,640. Thus, the probability of a successful random attempt is approximately is one (1) in 112,106,066,426,640, which is less than the 1 in 1,000,000 required by FIPS 140-2. This calculation is based on the assumption that the typical standard American QWERTY computer keyboard has 10×10^{-2} Integer digits, 10×10^{-2} alphabetic characters, and 10×10^{-2} alphabetic characters, and 10×10^{-2} alphabetic characters providing 10×10^{-2} characters to choose from in total.

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 60,000/112,106,066,426,640 = 1/1,868,434,440, which is less than 1 in 100,000 required by FIPS 140-2.

Additionally, when using RSA based authentication (AP Role), RSA key pair has modulus size of 3072 bits, thus providing 128 bits of strength, which means an attacker would have a 1 in 2^128 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 2.04×10^40 ($2^128 = 2.04 \times 10^40$) attempts per second, which far exceeds the operational capabilities of the module to support.

Table 7 lists the complete services and the associated types of access to the Keys/CSPs access supported by each role.

Table 7: Approved Mode Roles and Services

Service	Corresponding	Types of Access to Cryptographic Keys and CSPs
	Roles	R – Read or Execute
		W – Write or Create
		Z – Zeroize
Reboot/Self-test	Crypto Officer	All (not including instances in NVRAM): Z
	User	
Zeroization	Crypto Officer	All: Z
Software update	Crypto Officer	Software update key: R
Show status	Crypto Officer	N/A
	User	
	AP	
Login	Crypto Officer	Password: R
	User	SSHv2 Keys: R, W
		DRBG related Keys: R, W
SSHv2 Functions	Crypto Officer	Password: R, W
	User	SSHv2 Keys: R, W
	AP	DRBG related Keys: R, W
Configuration	Crypto Officer	Password: R, W
		SSHv2 Keys: R, W
		TLSv1.2 Keys: R, W
		DRBG related Keys: R, W
TLSv1.2 Functions	Crypto Officer	TLSv1.2 Keys: R, W
	User	DRBG related Keys: R, W
	AP	·
IPsec/IKEv2 Functions	AP	IPSec/IKEv2 Keys: R, W
		DRBG related Keys: R, W
FIPS mode enable/disable	Crypto Officer	ALL: Z

For the services and algorithms supported by the module while in non-approved mode of operation, please refer to section 2.3 in this document for more information.

Unauthenticated Services

The module also supports the unauthenticated services, including the view to the status output from the module's LED and power cycling.

5 Operational Environment

The operating system is restricted to a single operator mode of operation wherein concurrent operators are explicitly excluded.

This software cryptographic module is implemented in client/server architecture and is intended to be used on both the client and the server. It will be used to provide cryptographic functions to the client and server applications. Since this module is implemented in a server environment, the server application is the user of the cryptographic module. The server application makes the calls to the cryptographic module. Therefore, the server application is the single user of the module, even when the server application is serving multiple clients. Please refer to Table 1 above for the tested platform information.

6 Cryptographic Keys and CSPs

The entropy source (NDRNG) within the module provides at least 256 bits of entropy to seed SP800-90a DRBG for use in key generation. The table below describes cryptographic keys and CSPs used by the module.

Table 8: Cryptographic Keys and CSPs

Name	CSP Type	Size	Description/Usage	Storage	Zeroization
DRBG Entropy	SP800-90A	384 bits	This is the entropy for SP 800	DRAM	Power cycle
Input	CTR_DRBG		90A CTR_DRBG, used to	(plaintext)	the device
	(AES-256)		construct the seed.		
DRBG Seed	SP800-90A	384 bits	Input to the DRBG that	DRAM	Power cycle
	CTR_DRBG		determines the internal state of	(plaintext)	the device
	(AES-256)		the DRBG. Generated using		
			DRBG derivation function that		
			includes the entropy input from		
			the entropy source.		
DRBG V	SP800-90A	128 bits	The DRBG V is one of the	DRAM	Power cycle
	CTR_DRBG		critical values of the internal	(plaintext)	the device
	(AES-256)		state upon which the security		
			of this DRBG mechanism		
			depends. Generated first		
			during DRBG instantiation and		
			then subsequently updated		
			using the DRBG update		
			function.		
DRBG Key	SP800-90A	256 bits	Internal critical value used as	DRAM	Power cycle
	CTR_DRBG		part of SP 800-90A CTR_DRBG.	(plaintext)	the device
	(AES-256)		Established per SP 800-90A		
			CTR_DRBG.		
User Password	Password	At least eight	Password used to authenticate	NVRAM	Procedurally
		characters	the User (at least eight (8)	(cyphertext)	erase the
			characters).		password
Crypto Officer	Password	At least eight	Password used to authenticate	NVRAM	Procedurally
Password		characters	the Crypto Officer (at least	(cyphertext)	erase the
			eight (8) characters)		password

Name	CSP Type	Size	Description/Usage	Storage	Zeroization
Software Upgrade	RSA (FIPS 186-2)	4096 bits	RSA public key used to verify	NVRAM	Zeroized by
Verification Key			the signature for Software	(plaintext)	erasing the
			Update/Load Test. The key was		software
			pre-installed on the system for		image
			signature verification. Note		
			that the public key is a		
			cryptographic key, but not		
			considered as CSP.		
Software Integrity	RSA (FIPS 186-2)	4096 bits	RSA public key used to verify	NVRAM	Zeroized by
Test Key			the signature for Software	(plaintext)	erasing the
			Integrity Test. The key was pre-		software
			installed on the system for		image
			signature verification. Note		
			that the public key is a		
			cryptographic key, but not		
			considered as CSP.		
TLSv1.2 Protocol K	eys and CSPs			ı	1
TLS DH/ECDH	KAS-FFC/ECC-	256 bits/P-384	DH or ECDH private key used to	DRAM	Automatically
Private Key	SSC (DH/ECDH)	curve	establish the TLSv1.2 DH/ECDH	(plaintext)	when TLS
,	[SP800-		shared secret. This key was	(1)	session is
	56Arev3]		generated by calling FIPS		terminated.
			approved DRBG.		
TLS DH/ECDH	KAS-FFC/ECC-	3072 bits/P-384	DH or ECDH public key used in	DRAM	Automatically
Public Key	SSC (DH/ECDH)	curve	TLSv1.2 handshakes. Note that	(plaintext)	when TLS
•	[SP800-		the public key is a	"	session is
	56Arev3]		cryptographic key, but not		terminated.
			considered a CSP		
TLS DH/ECDH	KAS-FFC/ECC-	3072 bits	The shared secret used in	DRAM	Automatically
Shared Secret	SSC (DH/ECDH)		TLSv1.2 DH/ECDH exchange.	(plaintext)	when TLS
	[SP800-		This key was derived per the	"	session is
	56Arev3]		DH/ECDH key agreement		terminated
			scheme.		
TLS RSA Private Key	RSA (FIPS 186-4)	3072 bits	RSA private key, used to sign	NVRAM	Zeroization by
,	,		the authentication certificate	(plaintext)	RSA Keypair
			during the TLSv1.2 handshakes.	(1)	delete
			This key was generated by		command
			calling FIPS approved DRBG		
TLS RSA Public Key	RSA (FIPS 186-4)	3072 bits	RSA public key, used for	NVRAM	Zeroization by
,	,		authentication during the	(plaintext)	RSA Keypair
			TLSv1.2 handshakes. This key is	(1)	delete
			derived in compliance with FIPS		command
			186-4 RSA key pair generation		
			method in the module. Note		
			that the public key is a		
			cryptographic key, but not		
			considered a CSP.		
TLS Pre-Master	keying material	At least eight	Keying material used in TLSv1.2	DRAM	Automatically
Secret	-, 8	characters	handshakes. This key was used	(plaintext)	when TLS
		2	to derive TLSv1.2 Master	(5.0	session is
					terminated.
			Secret.		

Name	CSP Type	Size	Description/Usage	Storage	Zeroization
TLS Master Secret	keying material	48 bytes	Keying material, used to derive	DRAM	Automatically
			TLS Encryption Key and TLS	(plaintext)	when TLS
			Authentication Key. The master		session is
			secret was derived from TLS		terminated.
			pre-master secret during the		
			TLS session establishment.		
TLS Encryption Key	AES-CBC or AES-	AES 128/256 bits	This key is used to	DRAM	Automatically
,, ,	GCM		encrypt/decrypt the data	(plaintext)	when TLS
			throughout the TLSv1.2 session.	, ,	session is
			This key was derived via key		terminated.
			derivation function defined in		
			SP800-135 KDF (TLSv1.2).		
TLS Authentication	HMAC-SHA256	256 bits	This key is used to protect the	DRAM	Automatically
Key	HMAC-SHA384	384 bits	data integrity throughout the	(plaintext)	when TLS
•			TLSv1.2 session. This key is		session is
			derived via key derivation		terminated.
			function defined in SP800-135		
			KDF (TLSv1.2).		
SSHv2 protocol Ke	evs/CSPs	l	,		_
SSHv2 DH/ECDH	KAS-FFC/ECC-	224 bits/P-256, P-	DH/ECDH private key, used to	DRAM	Automatically
		384 and P-521			·
Private Key	SSC (DH/ECDH)		derive SSHv2 DH/ECDH Shared	(plaintext)	when SSH
	[SP800-	curves	Secret during the SSHv2		session is
	56Arev3]		handshakes. This key was		terminated.
			generated by calling FIPS		
			approved DRBG.		
SSHv2 DH/ECDH	KAS-FFC/ECC-	2048 bits/P-256,	DH/ECDH public key, used in	DRAM	Automatically
Public Key	SSC (DH/ECDH)	P-384 and P-521	SSHv2 DH/ECDH exchange. This	(plaintext)	when SSH
	[SP800-	curves	key is established per the		session is
	56Arev3]		DH/ECDH key agreement. Note		terminated.
			that the public key is a		
			cryptographic key, but not		
			considered a CSP.		
SSHv2 DH/ECDH	KAS-FFC/ECC-	2048 bits/P-256,	The shared secret used in	DRAM	Power cycle
Shared Secret	SSC (DH/ECDH)	P-384, P521	SSHv2 DH/ECDH exchange. This	(plaintext)	the device.
	[SP800-	curves	key was derived per the		
	56Arev3]		DH/ECDH key agreement		
			scheme.		
SSHv2 RSA/ECDSA	RSA/ECDSA	3072 bits/P-384	RSA or ECDSA private key, used	NVRAM	Zeroization by
Private Key		curve	to sign the authentication	(plaintext)	RSA Keypair
			certificate during the SSHv2		delete
			handshakes. The key was		command
			generated by calling SP800-90A		
			DRBG.		
SSHv2 RSA/ECDSA	RSA/ECDSA	3072 bits/P-384	RSA or ECDSA public key, used	NVRAM	Zeroization by
Public Key		curve	for authentication during the	(plaintext)	RSA Keypair
- 1			SSHv2 handshake. This key is		delete
			derived in compliance with FIPS		command
			186-4 RSA/ECDSA key pair		
			generation method in the		
			module. Note that the public		
			module. Note that the public		

Name	CSP Type	Size	Description/Usage	Storage	Zeroization
			key is a cryptographic key, but		
			not considered a CSP.		
SSHv2 Session Key	AES-CTR or AES-	CTR mode:	This key is used to	DRAM	Automatically
	GCM	128/256 bits	encrypt/decrypt the data	(plaintext)	when SSH
		GCM mode:	throughout the SSHv2 session.		session is
		256-bits	This key is derived from key		terminated.
			derivation function defined in		
			SP800-135 KDF (SSHv2).		
SSHv2	HMAC-SHA1	160 bits	This key is used to protect the	DRAM	Automatically
Authentication Key	HMAC-SHA256	256 bits	data integrity throughout the	(plaintext)	when SSH
	HMAC-SHA512	512 bits	TLSv1.2 session. This key is		session is
			derived from key derivation		terminated.
			function defined in SP800-135		
			KDF (SSHv2).		
IPsec/IKEv2 Keys	and CSPs			•	
IKEv2 ECDH Private	KAS-ECC-SSC	P-384 curve	ECDH private key, used to sign	DRAM	Automatically
Key	(ECDH)		the authentication certificate	(plaintext)	when IPsec
-,	[SP800-		signature verification Used	(1)	session is
	56Arev3]		during the IKEv2 handshakes.		terminated.
	,		This key was generated by		
			calling FIPS approved DRBG.		
IKEv2 ECDH Public	KAS-ECC-SSC	P-384 curve	ECDH public key, used in IKEv2	DRAM	Automatically
Key	(ECDH)		EC Diffie-Hellman (DH)	(plaintext)	when IPsec
,	(=====,		exchange. This key is	(()	session is
			established per the ECDH key		terminated.
			agreement. Note that the		
			public key is a cryptographic		
			key, but not considered a CSP		
IKEv2 ECDH Shared	KAS-ECC-SSC	P-384 curve	The shared secret used to in	DRAM	Power cycle
Secret	(ECDH)		IKEv2 ECDH exchange. This key	(plaintext)	the device.
			was derived per the ECDH key	"	
			agreement scheme.		
IKEv2 RSA Private	RSA	3072 bits	RSA private key used for	NVRAM	Zeroization by
Key			authentication during the IKEv2	(plaintext)	RSA Keypair
,			protocol handshake. This key	(()	delete
			was generated by calling FIPS		command
			approved DRBG.		
IKEv2 RSA Public	RSA	3072 bits	RSA public key used for	NVRAM	Zeroization by
Key		001 = 0.00	authentication during the IKEv2	(plaintext)	RSA Keypair
,			protocol handshake. The key is	(pranteexte)	delete
			derived in compliance with FIPS		command
			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.		
SKEYSEED	Keying material	160 bits	Keying material used to derive	DRAM	Automatically
			the IKEv2 session key. It was		when IPsec/IKE
			derived via key derivation	(plaintext)	session is
			function defined in SP800-135		terminated
			KDF (IKEv2).		Commuted

Name	CSP Type	Size	Description/Usage	Storage	Zeroization
IKEv2 Encryption	AES-CBC	128/192/256 bits	This key is used to	DRAM	Automatically
Key			encrypt/decrypt the data	(plaintext)	when IPsec
			throughout the IKEv2 session.		session is
			This key was derived by key		terminated.
			derivation function defined in		
			SP800-135 KDF (IKEv2).		
IKEv2	HMAC-SHA256	256 bits	This key is used to protect the	DRAM	Automatically
Authentication Key	HMAC-SHA384	384 bits	data integrity of data	(plaintext)	when IPsec
	HMAC-SHA512	512 bits	throughout the IKEv2 session.		session is
			This key is derived by key		terminated.
			derivation function defined in		
			SP800-135 KDF (IKEv2).		
IPsec Encryption	AES-CBC	128/192/256 bits	This key is used to	DRAM	Automatically
Key			encrypt/decrypt the data	(plaintext)	when IPsec
			throughout the IPsec session.		session is
			This key is derived by key		terminated.
			derivation function defined in		
			SP800-135 KDF (IKEv2).		
IPsec	HMAC-SHA256	256 bits	This key is used to protect the	DRAM	Automatically
Authentication Key	HMAC-SHA384	384 bits	data integrity of data	(plaintext)	when IPsec
	HMAC-SHA512	512 bits	throughout the IPsec session.		session is
			This key is derived by key		terminated.
			derivation function defined in		
			SP800-135 KDF (IKEv2).		

7 Self-tests

The module performs the power-up and conditional self-tests listed below in Table 9 and Table 10. Running power up self-tests does not involve action from the operator. Successful power-up self-tests are shown in the console output. Upon failure of a power-up or conditional self-test, the module halts its operation in a quarantine resulting from the module entering the Failure Mode error state. The following tables describe each self-test implemented by the module.

Table 9: Power-Up Self-Tests

Algorithm	Test	
Virtual SmartZone – Data Plan (vSZ-D) Crypto - OpenSSL/OpenSSH		
AES	AES-CBC KATs (encryption/decryption)	
AES-GCM	AES-GCM KATs (encryption/decryption)	
SHS	SHA-1/256/512 KATs	
НМАС	HMAC-SHA-1/224/256/384/512 KATs	
SP800-90A DRBG	AES-256 CTR DRBG KAT (DRBG health tests per SP 800-90A Section 11.3)	
RSA (FIPS 186-4)	RSA KATs (separate KAT for signing; separate KAT for verification)	
KAS-FFC-SSC	KAS-FFC-SSC Primitive "Z" computation KAT	
KAS-ECC-SSC	KAS-ECC-SSC Primitive "Z" computation KAT	
ECDSA	ECDSA Pairwise Consistency Test (Sign and Verify)	
Software Integrity Test	FIPS 186-2 RSA 4096 bits with SHA-384 for signature verification	
SP800-135rev1 SSH-KDF	KAT for SSHv2 KDF	

SP800-135rev1 TLS-KDF	KAT for TLSv1.2 KDF
SP800-135rev1 IKE-KDF	KAT for IKEv2 KDF
SP800-135rev1 SNMP-KDF	KAT for SNMPv3 KDF

Table 10: Conditional Self-Tests

Algorithm	Test
SP800-90A DRBG	Continuous Random Number Generator test
NDRNG	Continuous Random Number Generator test
RSA	Pairwise Consistency Test
ECDSA	Pairwise Consistency Test
Software Load Test	FIPS 186-2 RSA 4096 bits with SHA-384 for signature verification.

8 Procedural Rules

The module meets all the Level 1 requirements for FIPS 140-2. The module is shipped only to authorized operators by the vendor. 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. The module was validated with software version 5.2.1.3 in FIPS-approved mode of operation.

The following procedural rules must be maintained by the operator in order to remain in the Approved mode.

- An operator shall zeroize all keys/CSPs when switching between the Approved and non-Approved mode (or vice versa).
- Approved key sizes are used by default, however the operator is capable of loading their own TLS
 certificates containing non-Approved RSA key lengths. Only Approved RSA key lengths specified
 in Table 3 shall be used.
- An operator shall not attempt to access the module's BIOS. In particular, an operator shall not change the port configurations specified in Section 3 of this Security Policy.
- The module does not enforce a limit on the number of authentication attempts without first being configured to do so. The User and Cryptographic Officer shall have an authentication try limit configured between the range of 1-100.
- An operator shall not authorize access to the Diagnostics service while in the Approved mode.
- The module's validation to FIPS 140-2 is no longer valid once a non-validated software version is loaded. Any software not identified in this Security Policy does not constitute the Module defined by this Security Policy or covered by this validation.

8.1 Module Initialization

The Crypto Officer shall follow the steps below to configure and initialize the module.

• Establish a command Line Interface (CLI) connection between the module and the CO management PC.

- Integrity Check: Before deployment, the image's checksum should be checked and compared with the one announced on Ruckus website¹
- Deployment: Deploy the Virtual SmartZone Data Plan (vSZ-D) image on a hypervisor by following up the steps specified in section "vSZ-D FIPS Installation with FIPS Image" of RUCKUS FIPS and Common Criteria Configuration Guide for SmartZone and AP, 5.2.1.3, Published on 2021-04-14 with the documentation Part Number 800-72735-001 RevA https://support.ruckuswireless.com/documents/3509
- Controller Configuration with FIPS Image:
 - o Power on the module and access the CLI via its virtual console port from hypervisor.
 - At the login prompt, login with the administrator username and password. And then, issue 'enable' (en) command with the privileged mode password to promote the authorization.
 - o If the system is first time boot up, issue 'setup' command and follow the virtual console's instructions to configure the system fundamental parameters, such as the network and its controller (vSZ). Note that its FIPS mode will be changed if the FIPS mode differs from the mode on the controller. In this case, the system will reboot when FIPS mode is being changed. In addition, the login passwords will be synchronized from its controller.
 - o At the command prompt enter 'fips?' to display the list of available FIPS commands.
 - Enter 'fips status' to verify whether FIPS mode is enabled or disabled. If the FIPS mode is enabled, user should be able to observe "FIPS compliance is Enable" from the console.
 On the other hand, if the FIPS mode is disabled, "FIPS compliance is Disable" will be shown on the console.
 - Enter 'fips showlog' to display the results of self-tests and verify all are passing.
 - o Follow steps in Section 8, above, while operating the module.

In addition, for more module's configuration related information, please refer to RUCKUS FIPS and Common Criteria Configuration Guide for SmartZone and AP, 5.2.1.3, Published on 2021-04-14 with the documentation Part Number 800-72735-001 RevA https://support.ruckuswireless.com/documents/3509

9 References

Table 11: References

Reference	Specification
[ANS X9.31]	Digital Signatures Using Reversible Public Key Cryptography for the Financial Services
	Industry (rDSA)
[FIPS 140-2]	Security Requirements for Cryptographic modules, May 25, 2001
[FIPS 180-4]	Secure Hash Standard (SHS)
[FIPS 186-2/4]	Digital Signature Standard
[FIPS 197]	Advanced Encryption Standard
[FIPS 198-1]	The Keyed-Hash Message Authentication Code (HMAC)
[FIPS 202]	SHA-3 Standard: Permutation-Based Hash and Extendable-Output Functions
[PKCS#1 v2.1]	RSA Cryptography Standard
[PKCS#5]	Password-Based Cryptography Standard
[PKCS#12]	Personal Information Exchange Syntax Standard
[SP 800-38A]	Recommendation for Block Cipher Modes of Operation: Three Variants of Ciphertext
	Stealing for CBC Mode

¹ https://support.ruckuswireless.com/software?format=coveo#q=virtual%20smartzone%205.2.1.3&layout=table

[SP 800-38B]	Recommendation for Block Cipher Modes of Operation: The CMAC Mode for	
[51 000 300]	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 800-38F]	Recommendation for Block Cipher Modes of Operation: Methods for Key Wrapping	
[SP 800-56A]	Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm	
	Cryptography	
[SP 800-56B]	Recommendation for Pair-Wise Key Establishment Schemes Using Integer Factorization	
	Cryptography	
[SP 800-56C]	Recommendation for Key Derivation through Extraction-then-Expansion	
[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 800-108]	Recommendation for Key Derivation Using Pseudorandom Functions	
[SP 800-132]	Recommendation for Password-Based Key Derivation	
[SP 800-135]	Recommendation for Existing Application –Specific Key Derivation Functions	