Ixia

Vision ONE

Hardware Version: Vision ONE P/N 991-0114-01, Vision ONE AC Power Supply P/N 991-3023-01 (QTY: 2), Vision ONE Fan Assembly P/N 991-2020-02 (QTY: 2)

Firmware Version: 4.5.0.16

FIPS 140-2 Non-Proprietary Security Policy

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1. Introduction

1.1 Purpose

This is a non-proprietary Cryptographic Module Security Policy for the Vision ONE from Ixia. This Security Policy describes how the Vision ONE meets the security requirements of Federal Information Processing Standards (FIPS) Publication 140-2, which details the U.S.[1] and Canadian government requirements for cryptographic modules. More information about the FIPS 140-2 standard and validation program is available on the National Institute of Standards and Technology (NIST) and the Communications Security Establishment (CSE) Canada Cryptographic Module Validation Program (CMVP) website at http://csrc.nist.gov/groups/STM/cmvp.

This document also describes how to run the module in a secure FIPS-Approved mode of operation. This policy was prepared as part of the Level 2 FIPS 140-2 validation of the module. The Vision ONE is referred to in this document as Vision ONE, crypto module, or the module.

1.2 References

This document deals only with operations and capabilities of the module in the technical terms of a FIPS 140-2 cryptographic module security policy. More information is available on the module from the following sources:

- The Ixia website (www.ixiacom.com) contains information on the full line of products from Ixia.
- The CMVP website (http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/140val-all.htm) contains contact information for individuals responsible for answering technical or sales-related questions for the module.

1.3 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
- Finite State Model
- Submission Summary
- Other supporting documentation as additional references

This Security Policy and the other validation submission documentation were produced by Corsec Security, Inc. under contract to Ixia. With the exception of this Non-Proprietary Security Policy, the FIPS 140-2 Submission Package is proprietary to Ixia and is releasable only under appropriate non-disclosure agreements. For access to these documents, please contact Ixia.

[1] USA – United States of America

2. Vision ONE

2.1 Overview

Designed to sit between a customer's network and security tools, Vision ONE is a solution that controls the flow of network traffic to destination security devices and applications. The module uses a pool of high-speed data interfaces that are intended to forward different classes of traffic based on filters applied to each interface. These filters allow the module to aggregate, filter, replicate, optimize, and perform load balancing on network data. These features help eliminate SPAN[2] and TAP[3] shortages, increase network visibility, and improve the overall performance of security tools.

Ixia allows customers to designate physical ports as network ports, which allow ingress of network data to the Vision ONE system, and tool ports, which allow egress of network data to security devices and applications for processing. Dynamic filters, which provide rules for traffic entering or exiting the Vision ONE system, can be applied to either network ports or tool ports.

The Vision ONE (Figure 1) is a 1U[4] fixed-configuration platform that provides 48 1Gb/10Gb SFP+[5] and 4 QSFP+[6] data ports, and contains the Intel i7 3555LE processor. The Vision One performs deep packet inspection, packet processing, and load balancing services for network data.

Figure 1 – Vision ONE Chassis

The firmware is based on Linux Kernel version 3.5. The firmware provides access to two primary management interfaces, both of which provide the same functionality. Connections to these interfaces protected using TLSv1.2[7]. These include:

- Java Console – This interface provides a Java-based client that can be downloaded to a management workstation and used to manage the system.
- Web Console – This interface provides a web-based client that can be loaded in a web browser and used to manage the system.

In addition, the module provides a Web API[8] which can provide programmatic access to management services, as well as read-only SNMPv3 support which enables system settings to be viewed as well as for management

[2] SPAN – Switched Port Analyzer
[3] TAP – Test Access Point
[4] U – Unit (Rack space measurement)
[5] SFP – Small Form-Factor Pluggable
[6] QSFP – Quad Small Form-Factor Pluggable
[7] TLS – Transport Layer Security

traps to be sent to an SNMP manager. The Web API is protected via TLSv1.2 and the SNMPv3 interface is protected with AES and HMAC.

The module also provides remote syslog capabilities. Syslog traffic is protected with TLSv1.2.

Services offered via these interfaces are listed below in Table 4 and Table 5.

The Vision ONE is validated at the FIPS 140-2 Section levels shown in Table 1:

Table 1 – Security Level per FIPS 140-2 Section

Section	Section Title	Level
1	Cryptographic Module Specification	2
2	Cryptographic Module Ports and Interfaces	2
3	Roles, Services, and Authentication	2
4	Finite State Model	2
5	Physical Security	2
6	Operational Environment	N/A
7	Cryptographic Key Management	2
8	EMI/EMC[9]	2
9	Self-tests	2
10	Design Assurance	2
11	Mitigation of Other Attacks	N/A

2.2 Module Specification

The Vision ONE is a Hardware module with a multiple-chip standalone embodiment. The module has been validated against Level 2 requirements. The cryptographic boundary of the Vision ONE is defined by the hard metal casing making up the Vision ONE chassis.

The module implements the FIPS-Approved algorithms listed in Table 2 below.

[8] API – Application Programming Interface
[9] EMI/EMC – Electromagnetic Interference / Electromagnetic Compatibility

Table 2 – FIPS-Approved Algorithm Implementations

Algorithm	Certificate Number
AES ECB[10] encryption/decryption with 128-, 192-, and 256-bit keys	4089
AES CBC[11] encryption/decryption with 128- and 256-bit keys	4089
AES CFB128[12] encryption/decryption with 128-, 192-, and 256-bit keys	4089
AES CCM[13] encryption/decryption with 256 bit key	4089[14]
RSA Key Generation, Signature Generation, and Signature Verification with 2048-bit keys	2213
SHA[15]-1, SHA-256, SHA-512	3365
HMAC[16] with SHA-1, SHA-256, SHA-512	2669
SP[17]800-90A Hash DRBG[18]	1227
Section 4.2 TLS v1.2 KDF (SP 800-135) CVL[19]	904
Section 5.4 SNMP v3 KDF (SP 800-135) CVL	904
PBKDF[20] (SP 800-132 Option 1a with HMAC-SHA-512)	Vendor Affirmed
CKG[21]	Vendor Affirmed

The cryptographic module implements Key Derivation Functions (KDFs) listed in NIST SP 800-135 as part of the TLS secure networking protocol and SNMP protocol. No parts of these protocols, other than the KDF, have been tested by the CAVP.

The password for the SP 800-132 is 12 bytes in length concatenated with a 16 byte string. The upper bound for the probability of having guessed the password at random is 1/(26*26*10*32)^12. The salt is 64 bytes in length and the iteration count is 1024. The output size is 256 bits. Keys derived using PBKDF may only be used in storage applications.

The module implements the following non-Approved security functions. These algorithms and protocols are allowed for use in a FIPS-Approved mode of operation:

- RSA (key transport; key establishment methodology provides 112 bits of encryption strength)
- The Non-Deterministic Random Number Generator (NDRNG) is used to seed the approved SP 800-90A Hash DRBG. This seeding source provides a minimum number of bits of entropy of 7.9 out of 8 bits.

[10] ECB – Electronic Codebook
[11] CBC – Cipher Block Chaining
[12] CFB – Cipher Feedback
[13] CCM – Counter with CBC-MAC
[14] Please note that key sizes 128 and 192 listed on certificate #4089 are not accessible.
[15] SHA – Secure Hash Algorithm
[16] HMAC – (keyed-) Hashed Message Authentication Code
[17] SP – Special Publication
[18] DBRG – Deterministic Random Bit Generator
[19] CVL – Component Validation List
[20] PBKDF – Password Based Key Derivation Function
[21] CKG – Cryptographic Key Generation

2.3 Module Interfaces

The Vision ONE cryptographic module physical ports can be categorized according to the following logical interfaces defined by FIPS 140-2:

- Data Input Interface
- Data Output Interface
- Control Input Interface
- Status Output Interface

Physical interfaces for the Vision ONE are described in Table 3:

Table 3 – Vision ONE FIPS 140-2 Logical Interface Mappings

Physical Port	Quantity	FIPS 140-2 Interface
Management Ethernet Port	1	• Control Input • Status Output • Data Input • Data Output
Management Ethernet Port LEDs	2	• Status Output
Craft Port (RJ45)	1	• N/A (Disabled in FIPS-Approved mode)
Micro USB Craft Port	1	• N/A (Disabled in FIPS-Approved mode)
SFP+ Ports	48	• N/A
QSFP+ Ports	4	• N/A
System Status LEDs	4	• Status Output
IEEE[22] Port (Precision Time Protocol Port)	1	• N/A
Power Button	1	• Control Input
Alarm Reset Button (Below Power Button)	1	• N/A
Alarm Connector	1	• N/A
Power Interfaces	2	• Power

[22] IEEE – Institute of Electrical and Electronics Engineers

Figure 2 – Vision ONE Interfaces - Front

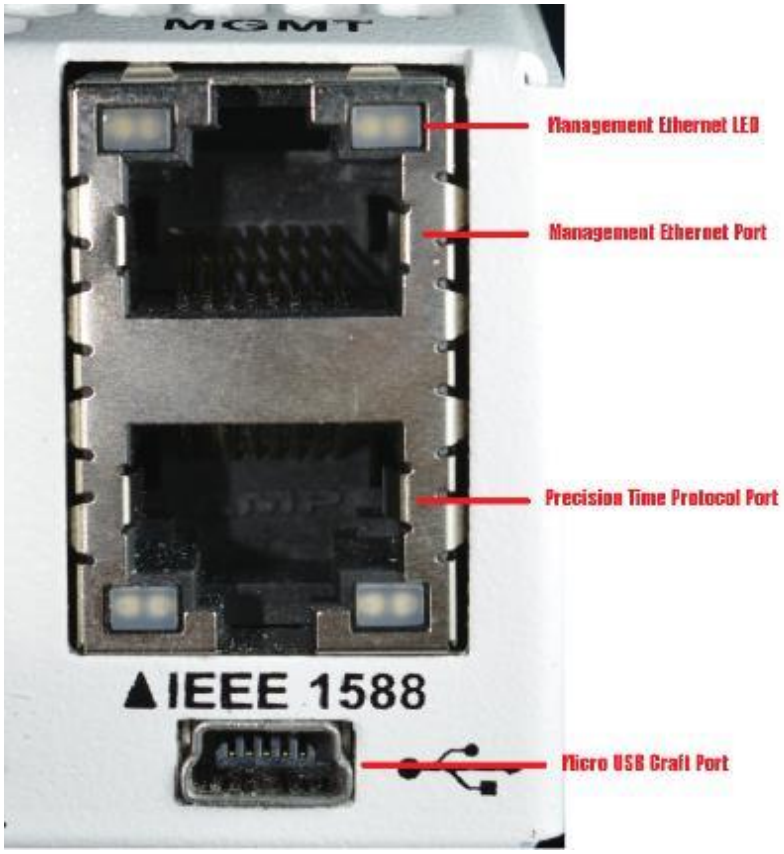

Figure 3 – Vision ONE Management, PTP, and Micro USB Craft Port

Figure 4 – Vision ONE Interfaces - Rear

2.4 Roles, Services, and Authentication

There are three roles that operators may assume: a Crypto Officer (CO), User, and SNMP User. The Crypto Officer (which corresponds to the module's "System Administrator" account) is responsible for installing, configuring, and monitoring the module. Users (which correspond to any account that is not a "System Administrator") are responsible for monitoring the module, configuring ports and filters, and managing group membership. The CO and User roles access the module remotely over a secure session provided by TLSv1.2. SNMP Users access read-only configuration information, which is protected with AES and HMAC.

The module supports multiple concurrent operators. No restrictions are set on the number of operators that may access the module at once. Access to module functionality is determined by the role of the account the operator is using to access the module.

The module implements role-based authentication. Crypto Officer and User accounts each have a unique username and password assigned to them. Role selection is accomplished explicitly by successfully authenticating to the Crypto Officer or User role using valid credentials that are associated with the desired role's account. SNMP User accounts have a privacy password in addition to an authentication password. Role assumption as the SNMP User is accomplished by successfully authenticating with the privacy and authentication password associated with the SNMP user.

Keys and CSPs listed in the tables indicate the type of access required according to the following notation:

- R – Read: The CSP is read.
- W – Write: The CSP is established, generated, modified, or zeroized.
- X – Execute: The CSP is used within an Approved or Allowed security function or authentication mechanism.
- None – No access is provided to the CSP or no CSP is applicable.

2.4.1 Crypto Officer Role

The Crypto Officer role has the ability to install, configure, and monitor all parts of the module. Descriptions of the services available to the Crypto Officer role are provided in Table 4 below.

Table 4 – Crypto Officer Services

Service	Description	CSP and Type of Access
Authenticate to the module	Supply authentication credentials to access the control interface	Crypto Officer Password – RX
Configure system and statistics	View system information and configurations that affect the whole system, and view or reset statistics	None
View system status	View the operational status of the system.	None
Configure ports	Configure port settings for network port filtering, dynamic filtering, load balancing, and tool port filtering	None
Configure filters and filter templates	Configure individual filters and filter templates	None
Configure monitors	Configure monitors to generate SNMP traps or syslog messages when specified events occur	None

Service	Description	CSP and Type of Access
Configure load-balancing	Configure load-balancing for the system.	None
Configure resources	Configure resources for packet capture.	None
Manage groups	Configure and manage groups and group owners	None
Manage users	Create, edit, and delete operator accounts and modify permissions	Crypto Officer Password – W User Password – W
Change password	Change the password for the Crypto Officer account or any other operator account	Crypto Officer Password – W
Manage logs	Configure and manage local and remote logs and logging capabilities	None
Power down	Shut down the module and zeroize all session keys in volatile memory	All CSPs stored in RAM[23] – W
Restart	Reboot the module, zeroize all session keys in volatile memory, and execute power-on self-tests on demand	All CSPs stored in RAM – W
Upgrade firmware	Apply a new firmware update to the module	Firmware load test key – RX
Factory reset	Restore module to factory defaults	All CSPs stored in Flash – W
Establish management TLS session	Use the Java Console or Web Console to establish a management session using TLS and perform any of the available services	Web RSA public key – RX Web RSA private key – RX TLS server session key – WX TLS server HMAC key – WX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Decrypt management data	Decrypt incoming data sent to the management interfaces	TLS server session key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Encrypt management data	Encrypt outgoing data sent from the management interfaces	TLS server session key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Produce SHA digest	Create a digest using the SHA-1 and SHA-256 algorithms for use with TLS	None
Produce HMAC digest	Create a keyed hash using the HMAC-SHA-1 and HMAC-SHA-256 algorithms for use with TLS	TLS server HMAC key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Generate web RSA key pair	Generate RSA key pair for use with web TLS sessions	Key store HMAC key – WX Key store AES key – WX Web RSA public key – W Web RSA private key – W SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX

[23] RAM – Random Access Memory

Service	Description	CSP and Type of Access
Generate web certificate signing request	Generate certificate signing request for use with web TLS sessions	Key store HMAC key – RX Key store AES key – RX Web RSA private key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Import web TLS certificate	Import a certificate file to replace the Web TLS certificate currently in use by the module	Key store HMAC key – RX Key store AES key – RX Web RSA public key – W
Configure syslog parameters	Configure settings that affect the syslog functionality	None
Generate syslog RSA key pair	Generate RSA key pair for use with web TLS sessions	Key store HMAC key – WX Key store AES key – WX Syslog RSA public key – W Syslog RSA private key – W SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Generate syslog certificate signing request	Generate certificate signing request for signing with a third-party certificate authority	Key store HMAC key – RX Key store AES key – RX Syslog RSA private key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Import syslog TLS certificate	Import a certificate file to replace the Syslog TLS certificate currently in use by the module	Key store HMAC key – RX Key store AES key – RX Syslog RSA public key – W
Establish syslog TLS session	Establish a TLS session with the syslog server	Syslog RSA public key – RX Syslog RSA private key – RX TLS client session key – RWX TLS client HMAC key – RWX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Configure SNMP parameters	Configure settings that affect the SNMP functionality	None
Configure SNMPv3 encryption	Update the encryption keys used for SNMPv3 connections	SNMPv3 privacy password – W SNMPv3 authentication password – W
Export log file	Export a copy of the logs in encrypted format	Log encryption key – RWX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX

2.4.2 User Role

The User role has the ability to monitor the module and manage ports and filters. Users can also manage group membership. Descriptions of the services available to the User role are provided in Table 5 below.

Table 5 – User Services

Service	Description	CSP and Type of Access
Authenticate to the module	Supply authentication credentials to access the control interface	User Password – RX
View system and statistics	View system information and statistics	None
View system status	View that operational status of the system.	None
Configure ports	Configure port settings for network port filtering, dynamic filtering, load balancing, and tool port filtering	None
Configure filters and filter templates	Configure individual filters and filter templates	None
View monitors	View monitors that generate SNMP traps or syslog messages when specified events occur	None
Manage groups	Configure and manage groups	None
Change password	Change the current operator's account password	User Password – W
Establish management TLS session	Establish web session using TLS and perform any of the available services	Web RSA public key – RX Web RSA private key – RX TLS server session key – WX TLS server HMAC key – WX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Decrypt management data	Decrypt incoming data sent to the management interfaces	TLS server session key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Encrypt management data	Encrypt outgoing data sent from the management interfaces	TLS server session key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Produce SHA digest	Create a digest using the SHA-1 and SHA-256 algorithms for use with TLS	None
Produce HMAC digest	Create a keyed hash using the HMAC-SHA-1 and HMAC-SHA-256 algorithms for use with TLS	TLS server HMAC key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX

2.4.3 SNMP User

The SNMP User role has the ability to monitor the module and manage SNMP traps for ports and filters. Descriptions of the services available to the SNMP User role are provided in Table 6 below.

Table 6 – SNMP User Services

Service	Description	CSP and Type of Access
Read network settings	Read the network settings for the given interface	None
Read statistics	Read statistics for the given type	None
Read history	Read the historical data of the given type	None
Read filters	Read the filters defined for the module	None
Establish SNMPv3 session	Establish an SNMPv3 session to view system settings	SNMPv3 authentication password – RX SNMPv3 privacy password – RX SNMPv3 encryption key – WX SNMPv3 HMAC key – WX
Produce HMAC digest	Create a keyed hash using the HMAC-SHA-1 and HMAC-SHA-256 algorithms for use with TLS and SNMP	SNMPv3 HMAC key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Decrypt SNMP data	Decrypt incoming data sent to the SNMP interface	SNMPv3 encryption key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX
Encrypt SNMP data	Encrypt outgoing data sent from the SNMP interface	SNMPv3 encryption key – RX SP 800-90A DRBG Output – RX SP 800-90A Hash DRBG values V and C – RX

2.4.4 Additional Services

The module provides a limited number of services for which the operator is not required to assume an authorized role. Table 7 lists the services for which the operator is not required to assume an authorized role. None of the services listed in the table modify, disclose, or substitute cryptographic keys and CSPs, or otherwise affect the security of the module.

Table 7 – Additional Services

Service	Description	CSP and Type of Access
Perform on-demand self-tests	Perform power-on self-tests on demand	None
View firmware version	Show the module's current firmware version, including build number	None
Download Java Console	Download a copy of the Java Console file to the client workstation	None
Receive/transmit network traffic	Send network data through the module	None

2.4.5 Authentication

The module implements explicit role-based authentication. The CO and Users each have a unique username and password assigned to their accounts. When logging in, the operator will pass the username and password of the account to the module via a TLS tunnel protected with AES encryption. In the case of SNMP, operators must supply an authentication and a privacy password. Operators assume the roles associated with the credentials that were submitted during the authentication process and the interface accessed. In order for an operator to

change roles, they must log out of any active sessions and re-authenticate. The results of previous authentications are cleared when the module is powered off.

Passwords that are generated after the module has been configured to operate in the FIPS-Approved mode of operation are 15 characters minimum and must include at least one upper- and lower-case letter, number, and special character. The probability for guessing a 15 character password in the worst case is 1 in 1,230,428,359,612,438,187,500,000,000. The probability of guessing the password within one minute is 1:2,460,856,719,224,876,375.

SNMPv3 privacy and authentication passwords set by the CO should adhere to the complexity requirements for CO and User roles. In this case, the probability is far lower given both the privacy and authentication passwords must both be guessed in order to successfully establish a SNMPv3 session.

2.5 Physical Security

The Ixia Vision ONE is a hardware module with a multi-chip standalone embodiment that consists of production-grade materials that use standard passivation techniques. The Vision ONE chassis is a hard metal enclosure that is physically contiguous and opaque within the visible spectrum. Tamper-evident seals are applied to the removable components to provide physical evidence in the event of an unauthorized attempt to open the enclosure or remove any components[24]. The tamper-evident seals must be inspected periodically for signs of tampering. The placement of the tamper-evident seals can be found in the Secure Operation section of this document.

If any evidence of tampering is observed on the module enclosure or tamper-evident seals, the module shall be considered to be in a non-compliant state. Upon such discovery, the CO shall immediately zeroize all keys and CSPs and contact Ixia Customer Support for further instruction.

2.6 Operational Environment

The Vision ONE cryptographic hardware module's operational environment is non-modifiable and is comprised of the NVOS[25] v4.5.0.16 firmware running on the Vision ONE appliance.

[24] For more information on the placement of tamper-evident seals, please refer to Section 3.5.1.1. For more information on performing a physical inspection to detect tamper evidence, please refer to Section 3.3.
[25] NVOS – Network Visibility Operating System

2.7 Cryptographic Key Management

The module supports the CSPs listed below in Table 8 below.

Table 8 – List of Cryptographic Keys, Cryptographic Key Components, and CSPs

CSP	CSP Type	Generation / Input	Output	Storage	Zeroization	Use
Web RSA public key	RSA 2048-bit public key	• Generated internally using the approved SP 800-90A DRBG; or • Imported by CO as part of a certificate file over TLS	Exported by CO as part of a certificate signing request file over TLS	Stored on non-volatile Flash in AES encrypted key store	• Zeroized when existing key is replaced with a new key; or • Zeroized by "Factory reset" operation.	Used by the management interfaces for TLS authentication
Web RSA private key	RSA 2048-bit private key	Generated internally using the approved SP 800-90A DRBG	Never exits the module	Stored on non-volatile Flash in AES encrypted key store	• Zeroized when existing key is replaced with a new key; or • Zeroized by "Factory reset" operation.	Used by the management interfaces for TLS authentication
TLS server session key	AES 128- or 256-bit key	Imported from client using RSA key transport	Never exits the module	Stored in RAM in plaintext	• Zeroized by session termination; or • Zeroized by power cycling the module	Used for encrypting and decrypting inbound and outbound traffic during the TLS session
TLS server HMAC key	HMAC SHA-1 key or HMAC SHA-256 key	Generated internally using the approved SP 800-90A DRBG	Never exits the module	Stored in RAM in plaintext	• Zeroized by session termination; or • Zeroized by power cycling the module	Used in TLS v1.2 sessions

CSP	CSP Type	Generation / Input	Output	Storage	Zeroization	Use
Syslog RSA public key	RSA 2048-bit public key	• Generated internally using the approved SP 800-90A DRBG; or • Imported by CO as part of a certificate file over TLS	Exported by CO as part of a certificate signing request file over TLS	Stored on non-volatile Flash in AES encrypted key store	• Zeroized when existing key is replaced with a new key; or • Zeroized by "Factory reset" operation.	Used by the syslog client for TLS authentication
Syslog RSA private key	RSA 2048-bit private key	• Generated internally using the approved SP 800-90A DRBG	Never exits the module	Stored on non-volatile Flash in AES encrypted key store	• Zeroized when existing key is replaced with a new key; or • Zeroized by "Factory reset" operation.	Used by the syslog client for TLS authentication
TLS client session key	AES 128- or 256-bit key	Generated internally using the approved SP 800-90A DRBG	Exported to syslog server using RSA key transport	Stored in RAM in plaintext	• Zeroized by session termination; or • Zeroized by power cycling the module	Used for encrypting and decrypting inbound and outbound traffic during the Syslog TLS session
TLS client HMAC key	HMAC SHA-1 key or HMAC SHA-256 key	Generated internally using the approved SP 800-90A DRBG	Never exits the module	Stored in RAM in plaintext	• Zeroized by session termination; or • Zeroized by power cycling the module	Used in TLS v1.2 sessions
SNMPv3 encryption key	AES 128-, AES 192-, or AES 256-bit key	Generated internally using the approved SP 800-90A DRBG	Never exits the module	Stored in RAM in plaintext	• Zeroized by session termination; or • Zeroized by power cycling the module	Used for encrypting and decrypting inbound and outbound traffic during SNMPv3 sessions

CSP	CSP Type	Generation / Input	Output	Storage	Zeroization	Use
SNMPv3 HMAC key	HMAC SHA-1 key or HMAC SHA-256 key	Generated internally using the approved SP 800-90A DRBG	Never exits the module	Stored in RAM in plaintext	• Zeroized by session termination; or • Zeroized by power cycling the module	Used for SNMPv3 authentication
SNMPv3 privacy password	Passphrase	Input manually by the CO via the Java Console or Web Console	Never exits the module	Stored on non-volatile Flash in RSA 2048-encrypted format	• Zeroized when existing password is replaced with a new password; or • Zeroized by "Factory reset" operation.	Used to derive the SNMPv3 encryption key
SNMPv3 authentication password	Passphrase	Input manually by the CO via the Java Console or Web Console	Never exits the module	Stored on non-volatile Flash in RSA 2048-encrypted format	• Zeroized when existing password is replaced with a new password; or • Zeroized by "Factory reset" operation.	Used to authenticate the SNMPv3 endpoint
Firmware load test key	RSA 2048-bit public key	Hard coded into the module	Never exits the module	Stored in the module's firmware image	Never zeroized	Used by the module during firmware updates to verify the firmware image
Log encryption key	AES 256-bit key	Generated internally using the approved SP 800-90A DRBG	Never exits the module	Stored in RAM in plaintext	• Zeroized by session termination; or • Zeroized by power cycling the module	Used during encryption of log files

CSP	CSP Type	Generation / Input	Output	Storage	Zeroization	Use
SP 800-90A Hash DRBG values V and C	Random seed bits	Generated internally using a hardware RNG	Never exits the module	Stored in RAM in plaintext	• Zeroized by reseed function; or • Zeroized by uninstantiate function; or • Zeroized by power cycling the module	Used for seeding the SP 800-90A DRBG during instantiation or reseed
SP 800-90A DRBG Output	Output from the Hash-DRBG	Generated using the Hash-DRBG	Never exits the module	Stored in RAM in plaintext	• Zeroized by the uninstantiate function	Used for generating cryptographic keys for approved functions. The resulting symmetric key or generated seed is an unmodified output from the DRBG.
Crypto Officer Password	Authentication password	Entered by the Crypto Officer	Never exits the module	Stored on non-volatile Flash using SHA-1	• Zeroized by “Factory reset” operation	Used to authenticate the Crypto Officer
User Password	Authentication password	Entered by the User	Never exits the module	Stored on non-volatile Flash using SHA-1	• Zeroized by “Factory reset” operation	Used to authenticate the User
Key store HMAC key	HMAC-SHA-512 key	Generated internally using PBKDF input parameters	Never exits the module	Stored in RAM in plaintext	• Zeroized by power cycling the module; or • Zeroized at the completion of the key derivation function	Used for deriving the key store AES key

CSP	CSP Type	Generation / Input	Output	Storage	Zeroization	Use
Key store AES key	AES-CCM 256-bit key	Generated internally using PBKDF	Never exits the module	Stored in RAM in plaintext	• Zeroized by power cycling the module; or • Zeroized at the completion of the encryption function	Used for encryption for storage of Web and Syslog RSA private/public keys

2.8 EMI / EMC

The module was tested and found conformant to the EMI/EMC requirements specified by 47 Code of Federal Regulations, Part 15, Subpart B, Unintentional Radiators, Digital Devices, Class A (business use).

2.9 Self-Tests

The module performs power-up self-tests automatically after power is applied and no further intervention is required from the operator. Conditional tests are performed when the conditions require. Data output and cryptographic operations are inhibited until the module has successfully passed all the power-up self-tests. If any of the self-tests fail (with the exception of the firmware load test), an error message indicating the failure is written to the system log, the module enters a critical error state, and the System LED is illuminated red. In this state, cryptographic operations are halted and the module inhibits all data output from the module. The only action that can be taken in this state is to power cycle the module to trigger the execution of the power-up self-tests. The error condition is considered to have been cleared if the module successfully passes all of the subsequent power-up-self-tests. If the module continues to fail subsequent power-up self-tests, the module is considered to be malfunctioning or compromised and the module should be sent to Ixia for repair or replacement.

2.9.1 Power-Up Self-Tests

The Vision ONE performs the following self-tests at power-up:

- Firmware integrity check with an Error Detection Code (CRC[26]-32)
- Known Answer Tests (KATs)
    - AES-ECB encrypt KAT
    - AES-ECB decrypt KAT
    - AES-CCM encrypt KAT
    - AES-CCM decrypt KAT
    - RSA signature generation KAT
    - RSA signature verification KAT
    - SHA-1 KAT
    - SHA-256 KAT
    - SHA-512 KAT
    - HMAC (with SHA-1) KAT
    - HMAC (with SHA-256) KAT
    - HMAC (with SHA-512) KAT
    - Hash DRBG KAT
- SP 800-90A Health Checks:
    - Instantiate
    - Generate
    - Reseed

[26] CRC – Cyclic Redundancy Check

2.9.2 Conditional Self-Tests

The Vision ONE performs the following conditional self-tests:

- Firmware load test with 2048-bit RSA Private key
- Pairwise Consistency Test (PCT) for RSA key pair generation
- Continuous RNG[27] test on DRBG
- Continuous RNG test on NDRNG
- SP 800-90A Health Checks:
    - Reseed

2.10 Mitigation of Other Attacks

This section is not applicable. The module does not claim to mitigate any attacks beyond the FIPS 140-2 Level 2 requirements for this validation.

[27] RNG – Random Number Generator

3. Secure Operation

The Vision ONE meets Level 2 requirements for FIPS 140-2. The sections below describe how to place and keep the module in the FIPS-approved mode of operation.

Except where otherwise stated below, the CO should follow the guidance as described in the *Ixia Vision ONE Installation Guide, NVOS 4.5, August 2016* and *Ixia Vision ONE User Guide, NVOS 4.5, August 2016*.

3.1 Management

When configured according to the Crypto Officer guidance in this Security Policy, the module only runs in a FIPS-Approved mode of operation. The Crypto Officer shall configure the module via the Web Console or Java Console as prescribed in this Security Policy.

3.2 Monitoring Status

The CO shall be responsible for regularly monitoring the module's status to verify that it continues to operate in the FIPS-Approved mode of operation. When configured according to the Crypto Officer's guidance, the module only operates in the FIPS-Approved mode.

A CO logged in via the Web Console or Java Console can view the operational status on the System screen. If a cryptographic error is encountered, the system will display an error message via the web start page, the regular management interface will not be accessible, and the System LED will be illuminated red.

3.3 Physical Inspection

The CO is required to periodically inspect the module for evidence of tampering at intervals specified per end-user policy. The CO must visually inspect the tamper-evident seals for tears, rips, dissolved adhesive, and other signs of tampering. If evidence of tampering is found during periodic inspection, the module shall be considered to be in a non-compliant state. Upon such discovery, the CO shall immediately zeroize all keys and CSPs and contact Ixia Customer Support for further instruction.

3.4 Zeroization

All of the module's stored keys and CSPs are capable of being zeroized. The module stores the keys listed in Table 8 in either the RAM or non-volatile Flash. Zeroization of ephemeral keys and CSPs in RAM are zeroized during session termination or power cycling. Zeroization of keys and CSPs stored in Flash can be accomplished by:

1. Logging into the Java Console
2. Clicking on the **File** menu
3. Clicking on the **Factory Reset** command
4. Clicking **OK** to verify that the system should return to default settings

Once invoked, the effect of the Factory Reset command is immediate and does not allow sufficient time to compromise any stored plaintext CSPs. After zeroization, the module will need to be reinitialized to return to an operational state.

3.5 CO and User Guidance

The CO shall be in charge of receiving, installing, initializing, and maintaining the Vision ONE module. COs or Users must not reveal their password to anyone. The CO shall power cycle the module if the module has encountered a critical error and becomes non-operational. If power cycling module does not correct the error condition, the module is considered to be compromised or malfunctioned, and should be sent back to Ixia for repair or replacement.

The following sections provide important instructions and guidance to the CO for secure installation and configuration of the Vision ONE.

3.5.1 Initial Setup

Upon receiving the Vision ONE hardware, the CO shall check that the system is not damaged and that all required parts and instructions are included. The CO shall refer to the *Ixia Vision ONE Installation Guide NVOS 4.5* for initial setup instructions.

After the CO has finished setting up the module, the management interfaces can be accessed to continue initializing the module in the FIPS-Approved mode of operation, outlined in the sections below.

For additional information, refer to *Ixia Vision ONE User Guide, NVOS 4.5, August 2016*, chapter entitled "Configure Government Security Settings".

3.5.1.1 Placement of Tamper-Evident Seals

The Vision ONE uses tamper-evident seals to protect against unauthorized access to the internal components of the chassis through removable covers. These seals are shipped as part of the FIPS Kit. If one of the seals shows evidence of tampering, it is possible the module has been compromised. It is up to the CO to ensure proper placement of the tamper-evident seals using the following steps:

- Apply at room temperature – the adhesive will not form a solid bond if applied at temperatures below 50° F.
- The surface must be dry and free of dirt, oil, and grease, including finger oils. Alcohol pads or a 99% isopropyl alcohol solution can be used to clean the surface. The surface should be dried with a clean cloth before application of the labels.
- Once the seal is placed, the CO shall rub a thumb over it to ensure complete adhesion.
- Wait 72 hours to ensure a complete adhesive bond. This will ensure that all tamper-evident features of the seals can be activated.

The four (4) tamper-evident seals shall be installed for the module to operate in a FIPS-Approved mode of operation as depicted in Figure 5 below.

Figure 5 – Tamper-Evident Label Placement

The tamper-evident seals must be inspected periodically by the CO for tamper evidence. If the CO finds evidence of tampering, then the module must be considered to have been compromised and the CO must contact Ixia to return the module for replacement or repair. The CO shall maintain control of any unused or additional tamper-evident seals after installation of the seals is complete; additional seals are not available for re-order. The module must be under the direct control and observation of the CO when any changes to the module such as reconfigurations where the tamper evident seals are removed or installed to ensure the security of the module is maintained during such changes and the module is returned to a FIPS Approved state.

3.5.2 Configure the FIPS-Approved Mode

The Vision ONE is shipped and initially operates with FIPS settings not configured. The following instructions shall be followed to ensure the module operates in a FIPS-Approved mode of operation.

3.5.2.1 Turning On FIPS Cryptography

The CO shall enable FIPS cryptography. This ensures that the system will use only FIPS-Approved cryptographic algorithms and key sizes. FIPS cryptography can be enabled using either the Java Console or Web Console to perform the following steps:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Click on the **Disabled** setting for **FIPS Encryption**
4. In the **Enable FIPS Encryption** window, enter your password and then click **Enable FIPS Encryption**
5. Click **OK** in the confirmation prompt
6. The system will reboot
7. FIPS Encryption will now be reported as **Enabled**

3.5.2.2 Configure Strong Passwords for Password-Based Authentication

The CO shall configure strong passwords for operator authentication. Enabling strong passwords ensures that the module enforces the use of passwords that are a minimum of 15 characters in length and contain at least one number, one upper-case letter, one lower-case letter or special character. The strong passwords feature is enabled and configured by using either the Java Console or Web Console to perform the following steps:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Under **Remote Services,** click on the text that appears next to **Authentication**
4. In the **Set Authentication Mode** window, configure **Local**[28] authentication and ensure that **Enable password policies** and **Enable DoD Security Policies** are enabled
5. Set the **Minimum password length** greater than or equal to 15
6. Configure the **Lock users after** value to between 35 and 365 days
7. Click **OK** in the **Set Authentication Mode** window
8. Click **OK** again at the confirmation prompt
9. Click **OK** again at the information prompt
10. The operator will be forced to login again and then change the account password so that it conforms to the now enabled DoD password policy
11. Authentication will now be reported as **Local**

3.5.2.3 Enable TLS/HTTPS

The CO shall enable TLS/HTTPS. Enabling TLS/HTTPS ensures that management sessions using either the Java Console or Web Console are encrypted. TLS/HTTPS is enabled by using either the Java Console or Web Console to perform the following steps:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Under **General,** click on **Disabled** next to **TLS/HTTPS**
4. In the **TLS/HTTPS Configuration** window, enable the **Enable console encryption** option
5. Click **OK** in the **TLS/HTTPS Configuration** window
6. Click **OK** again at the confirmation prompt
7. Click **OK** again at the information prompt
8. The system will reboot
9. TLS/HTTPS will now be reported as **Enabled**

3.5.2.4 Change the TLS/HTTPS Certificate

The CO shall replace the default TLS/HTTPS certificate. The TLS/HTTPS certificate is replaced by using either the Java Console or Web Console to perform the following steps:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Under **General,** click on **Enabled** next to **TLS/HTTPS**
4. In the **TLS/HTTPS Configuration** window, click **Generate CSR…**
5. Complete the fields in the **Certificate Signing Request** window
6. Click **Update** in the **Certificate Signing Request** window
7. Click **OK** at the information prompt
8. Click **Generate CSR…** in the **Certificate Signing Request** window
9. Click **OK** at the confirmation prompt
10. In the **Save** window, select a save location for the certificate file and then click **OK**
11. Click **OK** at the confirmation prompt
12. Click **Close** in the **Certificate Signing Request** window

[28] References to local authentication throughout this document should be considered as: an authentication method that uses locally stored operator accounts (as opposed to RADIUS accounts) and is used to authenticate operators accessing the Java Console and Web Console interfaces.

13. Supply the certificate signing request to a trusted certification authority and request a TLS server certificate to be generated; for more information, refer to *Ixia Vision ONE User Guide, NVOS 4.5, August 2016*, chapter entitled "Uploading Custom TLS/HTTPS Certificates"
14. Once the certificate has been signed, click **Upload** in the **TLS/HTTPS Configuration** window
15. In the **Browse** window, browse to and select the newly created server certificate file and click **Open**
16. Click **OK** in the **TLS/HTTPS Configuration** window
17. The default TLS/HTTPS certificate has been replaced

3.5.2.5 Disable the Craft Port

The CO shall disable the Craft Port. The craft port is disabled by using either the Java Console or Web Console to perform the following steps:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Under **General,** click **Enabled** next to **Serial port access**
4. Click **OK** at the confirmation prompt
5. Serial port access will now be reported as **Disabled**

3.5.2.6 Disable Tcl

The CO shall disable Tcl. Tcl is disabled by using either the Java Console or Web Console to perform the following steps:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Under **General,** click **Enabled** next to **Tcl**
4. Click **OK** at the confirmation prompt
5. Tcl will now be reported as **Disabled**

3.5.2.7 Configuring SNMP (Optional)

If SNMP is used then the following instructions shall be implemented, otherwise SNMP shall remain disabled. SNMP, if used, is configured by using the Web Console to perform the following steps:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Click the text next to **SNMP**
4. In the **Set SNMP Configuration** window, make sure **Enable SNMP Requests** is checked
5. Under **Access Control (Community String or Local User[29])** click **Add**
6. In the **Add SNMP Access Control** window, configure the SNMP version to be **V3**
7. Type the username for the SNMP user in the **SNMP user name** field
8. Configure the **Security level** to **Authentication and privacy required**
9. Under **Authentication** make sure **Protocol** is set to **HMAC_SHA_96**[30]
10. Under **Authentication** make sure the **Password** and **Confirm Password** fields are set to the desired SNMP login password (See note below)
11. Under **Privacy** make sure the **Protocol** field is set to one of:
12. AES128
13. AES192

[29] Local User refers to a locally stored operator account.

[30] While the GUI indicates the Authentication Protocol as HMAC_SHA_96, the underlying algorithm is actually SHA-1.

14. AES256
15. Under **Privacy** make sure the **Password** and **Confirm Password** fields are set to the desired SNMP privacy secret (See note below)
16. Click **OK** in the **Add SNMP Access Control** window
17. Click **OK** in the **Set SNMP Configuration** window

***NOTE:** The SNMP configuration does not automatically enforce password complexity requirements. The CO shall take care to make sure that SNMP passwords match the following complexity requirements:

- Password must be at least 15 characters in length
- Password must contain at least one upper-case letter
- Password must contain at least one lower-case letter
- Password must contain at least one number
- Password must contain at least one special character

3.5.2.8 Configuring Syslog Encryption and Installing a Certificate (Optional)

If using a Syslog server to obtain syslogs from the module then the following instructions shall be implemented, otherwise Syslog shall remain disabled. If using Syslog, then the following steps shall be executed using the Java Console or Web Console:

1. Navigate to the **System** tab
2. Click on the **Settings** tab
3. Under **Remote Services**, click the text next to **Syslog** to open the Syslog configuration dialog
4. Click **Add** and enter the DNS Name or IPv4 Address of the external Syslog server
5. Check **Enable TLS Encryption**
6. Click **OK**
7. Click **OK**
8. Click **Generate CSR**
9. Configure all of the appropriate information and click **Update**
10. Click **OK** at the information prompt
11. Click **Generate CSR**
12. Click **OK**
13. In the **Save** window, choose a save location for the certificate request file and click **OK**
14. Click **Close**
15. Supply the certificate signing request to a trusted certification authority and request a TLS client certificate to be generated; for more information, refer to *Ixia Vision ONE User Guide, NVOS 4.5, August 2016*, chapter entitled “Add a Syslog Server”
16. Click **Upload** under **Client Certificate**
17. In the **Choose TLS Certificate File,** select the TLS client certificate generated in the previous step
18. Click **OK**
19. Request the trusted root certificate from your certificate authority
20. Under **Server Trusted Root,** click **Upload**
21. In the **Choose TLS certificate** window, select the trusted root certificate and click **OK**
22. Click **OK**

Once all of the above steps have been completed the module is now operating in the FIPS-approved mode of operation.

3.5.2.9 ATIP SSL/TLS Decryption

ATIP SSL/TLS decryption is disabled by default and shall remain disabled.

Once all of the above steps have been completed the module is now operating in the FIPS-approved mode of operation.

3.5.3 Determining the FIPS-Approved Mode

The CO can verify that the module is operating in the FIPS-Approved mode of operation by performing the following checks:

1. The tamper evident labels have been applied and show no signs of tamper evidence. See Section 3.5.1.1 for seal placement and inspection instructions.
2. Password-based authentication is enabled and DoD password policy is enabled. Use the Web Console or Java console to navigate to **System** and then **Settings**. Open the configuration settings for Authentication and ensure that it is set to **Local.** In addition, ensure that **Enable password** policies and **Enable DoD Security** Policies are checked, and that the **Minimum password length** has been set to 15. For more information, see Section 3.5.2.2.
3. Using the Web Console or Java Console, authenticate to the module navigate to **System** and then **Settings.** On the Settings page, ensure the following:
    a) FIPS encryption is **Enabled**
    b) TLS/HTTPS is **Enabled**
    c) Serial port access is **Disabled**
    d) Tcl is **Disabled**
    e) Syslog is either **Not Set,** or an IP address or DNS name is present
    f) SNMP is either **Enabled** or **Disabled**
4. Verify SNMP Settings – this is only required if SNMP is enabled in the previous step. If SNMP is enabled, using the Web Console or Java Console, navigate to **System** and then **Settings.** On the **Settings** page, click on **Enabled** which appears next to SNMP which will open the **Set SNMP Configuration (Community String or Local User) Pane.** The summary for each entry should report the following:
    a) Version: **V3**
    b) Security Level: **Authentication and privacy required**
    c) Auth Protocol: **HMAC_SHA_96**
    d) Priv Protocol: **AES-128** or **AES-192** or **AES-256**
    e) For more information, see instructions in Section 3.5.2.7 above
5. Verify Syslog Settings – this is only required if Syslog is enabled in Step 4. If syslog is enabled, using the Web Console or Java Console, navigate to **System** and then **Settings.** On the **Settings** page, click the link next to **Syslog.** Perform the following:
    a) Select the syslog server from the list of servers, and click **Modify**
    b) Verify that **Enable TLS encryption** is set for the syslog server
    c) Click **Cancel**
    d) Verify that the Subject and Issued by fields are correct for both the **Server Trusted Root Certificate** and the **Client Certificate**
    e) Select the syslog server again and click **Test**
    f) For more information, see instructions in Section 3.5.2.8 Above
6. Verify that ATIP SSL/TLS Decryption is not configured. Using the Java Console, perform the following:
    a) Click on **Diagram.**

b) In the **Resources** view, right click on the ATIP box and select **Launch ATIP.**
c) Click on the **NF** button (top right corner) and then click on **SSL.**
d) Ensure that **Enable Passive SSL Decryption** is unchecked.

Once the module has been configured to be in the FIPS-Approved mode, the CO shall ensure that it remains in the FIPS-Approved mode until it is ready to be decommissioned. At this time, the module can be factory reset to revert to a non-FIPS-Approved mode. The factory reset command can be entered from the Java Console by going to **File → Factory Reset** with any CO account.

3.5.4 Non-Approved Services

The services in Table 9 are non-Approved and therefore shall not be used in an Approved mode of operation. Installing and configuring the module per Section 3 of this SP will ensure that the non-Approved services will not be used.

In addition, the "ATIP SSL Decryption" feature only becomes available in a non-Approved mode of operation; thus it does not map to any of the services in section 2.4 above.

Table 9 – Non-Approved Services

Service	Algorithm	Use
Encrypt SNMP data (Table 6) Decrypt SNMP data (Table 6)	DES	SNMPv3
Produce HMAC digest (Table 6)	HMAC-MD5	SNMPv3
Hash function to support "Produce HMAC digest" service (Table 6)	MD5	SNMPv3
Encryption/Decryption	AES-CBC, AES-GCM (all key sizes)	ATIP SSL Decryption
Encryption/Decryption	TDES-CBC (all key sizes)	ATIP SSL Decryption
Encryption/Decryption	RC4 (all key sizes)	ATIP SSL Decryption
Message Authentication	HMAC-SHA-1, HMAC-SHA-256, HMAC-SHA-384	ATIP SSL Decryption
Key Agreement	ECDH (all key sizes)	ATIP SSL Decryption
Digital Signature Generation/Verification	ECDSA (all key sizes)	ATIP SSL Decryption
Digital Signature Generation/Verification Key Transport	RSA (all key sizes)	ATIP SSL Decryption
Hashing	MD5	ATIP SSL Decryption
Hashing	SHA-1, SHA-256, SHA-384	ATIP SSL Decryption

When the module is installed and configured as per Section 3 of this SP, the following non-Approved services are disabled and no longer available for use.

Table 10 – Non-Approved Algorithm Implementations

Service	Algorithms
Key Generation Key Transport Digital Signature Generation/Verification	RSA with key size less than 2048 bits

4. Acronyms

Table 11 provides definitions for the acronyms used in this document.

Table 11 – Acronyms

Acronym	Definition
AES	Advanced Encryption System
AFM	Advanced Feature Module
API	Application Programming Interface
CBC	Cipher Block Chaining
CCM	Counter with CBC-MAC
CFB	Cipher Feedback
CKG	Cryptographic Key Generation
CMVP	Cryptographic Module Validation Program
CO	Cryptographic Officer
CRC	Cyclic Redundancy Check
CSE	Communications Security Establishment
CSP	Critical Security Parameter
CTR	Counter
DH	Diffie-Hellman
DRBG	Deterministic Random Bit Generator
EAP-TTLS	Extensible Authentication Protocol – Tunneled Transport Layer Security
EC	Elliptic Curve
ECB	Electronic Codebook
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
FIPS	Federal Information Processing Standard
HMAC	(keyed-) Hash Message Authentication Code
IEEE	Institute of Electrical and Electronics Engineers
KAT	Known Answer Test
KDF	Key Derivation Function
LCD	Liquid Crystal Display
NDRNG	Non-Deterministic Random Number Generator
NIST	National Institute of Standards and Technology
NVOS	Network Visibility Operating System
OS	Operating System

Acronym	Definition
PBKDF	Password Based Key Derivation Function
PCM	Packet Capture Module
PCT	Pairwise Consistency Test
PKCS	Public Key Cryptography Standard
QSFP	Quad Small Form-Factor Pluggable
RAM	Random Access Memory
RNG	Random Number Generator
RSA	Rivest Shamir and Adleman
SFP	Small Form-Factor Pluggable
SHA	Secure Hash Algorithm
SNMP	Simple Network Management Protocol
SP	Special Publication
SPAN	Switch Port Analyzer
TACACS	Terminal Access Controller Access Control System
TAP	Test Access Point
TLS	Transport Layer Security
U	Unit (Rack space measurement)
USB	Universal Serial Bus

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