NitroGuard Intrusion Prevention System Version 8.0.0.20080605 and 8.2.0 Security Policy

FIPS 140-2 Level 2 Validation

Model Numbers

NS-IPS-620R-4C-B
NS-IPS-1220R-6C-B
NS-IPS-1220R-4C-2F-B
NS-IPS-620R-4C-BFS
NS-IPS-4245-R-4BTX
NS-IPS-4245-R-4BSX

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1 Introduction

This document is the Security Policy for NitroSecurity NitroGuard IPS cryptographic module. This Security Policy specifies the security rules under which this cryptographic module shall operate to meet the requirements of FIPS 140-2 Level 2. It describes how the module functions to meet the FIPS requirements, and the actions that operators must take to maintain the security of the module.

This Security Policy describes the features and design of the NitroGuard IPS cryptographic module using the terminology contained in the FIPS 140-2 specification. *FIPS 140-2, Security Requirements for Cryptographic Modules* specifies the security requirements that will be satisfied by a cryptographic module utilized within a security system protecting sensitive but unclassified information. The NIST Cryptographic Module Validation Program (CMVP) validates cryptographic modules to the FIPS 140-2 standard. The Cryptographic Algorithm Validation Program (CAVP) validates algorithms used by a FIPS validated module. Validated products are accepted by the Federal agencies of both the USA and Canada for the protection of sensitive or designated information.

The FIPS 140-2 standard, and information on the CMVP can be found at http://csrc.nist.gov/groups/STM/cmvp. Information on the CAVP can be found at http://csrc.nist.gov/groups/STM/cavp. More information describing the NitroGuard IPS can be found at http://www.NitroSecurity.com.

In this document, the NitroSecurity NitroGuard IPS is also referred to as “the IPS”, or “the module”.

This Security Policy contains only non-proprietary information. All other documentation submitted for FIPS 140-2 conformance testing and validation is “NitroSecurity - Proprietary” and is releasable only under appropriate non-disclosure agreements.

The NitroSecurity NitroGuard IPS cryptographic module meets the overall requirements applicable to Level 2 security for FIPS 140-2 as shown in Table 1.

Table 1. Cryptographic Module Security Requirements.

Security Requirements Section	*Level*
Cryptographic Module Specification	2
Cryptographic Module Ports and Interfaces	2
Roles and Services and Authentication	2
Finite State Machine Model	2
Physical Security	2
Operational Environment	N/A
Cryptographic Key Management	2
EMI/EMC	2
Self-Tests	2
Design Assurance	2
Mitigation of Other Attacks	N/A
Cryptographic Module Security Policy	2

Document Version History

Version	Date	Comments	Name
1.00	6/16/08	Initial Draft	Ward Rosenberry
1.01	6/19/08	Submission Draft	Ward Rosenberry
1.02	6/21/08	Submission Draft Update	Ward Rosenberry
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2.1	10/12/09	Converted for 8.0.0.20080605 and 8.2.0	Salo Fajer

1.1 Acronyms and Abbreviations

AES	Advanced Encryption Standard
CFB	Cipher Feedback
CMVP	Cryptographic Module Validation Program
CSE	Communications Security Establishment
CSP	Critical Security Parameter
DRNG	Deterministic Random Number Generator
DH	Diffie-Hellman Algorithm
DSA	Digital Signature Algorithm
ECB	Electronic Code Book
ECC	Elliptic Curve Cryptography
ECDSA	Elliptic Curve Digital Signature Algorithm
ECDH	Elliptic Curve Diffie-Hellman
EDC	Error Detection Code
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
FIPS	Federal Information Processing Standard
HMAC	Keyed-Hash Message Authentication Code
KAT	Known Answer Test
LAN	Local Area Network
LED	Light Emitting Diode
NDRNG	Non-Deterministic Random Number Generator
NIC	Network Interface Card
NIST	National Institute of Standards and Technology
PRNG	Pseudo Random Number Generator
PUB	Publication
RAM	Random Access Memory
ROM	Read Only Memory
RNG	Random Number Generator

RSA	Rivest Shamir Adleman public key cryptosystem
SHA-1	Secure Hash Algorithm
SHA-384	Secure Hash Algorithm
T-DES	Triple-DES (Data Encryption Standard)

2 NitroSecurity NitroGuard Intrusion Prevention System

2.1 Functional Overview

NitroSecurity provides highly scalable enterprise security solutions that provide intrusion prevention, network behavior analysis and security event management enabling enterprises to secure their networks with real-time threat mitigation. The NitroGuard Intrusion Prevention System (IPS) enables the collection of security events and network flow data by inspecting network traffic flowing into the device. The NitroGuard IPS is an integral component of a comprehensive security management solution with the ability to inspect, and modify or drop dangerous network traffic.

The NitroGuard IPS is unique due to its use of a highly customized Snort-based packet inspection subsystem, its IPS focused Snort-based packet inspection rules, and a patented ultra-high-performance aggregation and correlation engine that is integrated into each NitroGuard IPS. These sophisticated packet inspection, and data acquisition and management capabilities give NitroGuard IPS the power to inspect hundreds of thousands of packets per second, and manage thousands of events per second. The IPS can simultaneously inspect network traffic, drop and/or generate events based upon this inspection, and collect network flow data.

Figure 1 shows a high level functional view of the NitroGuard IPS, in inline-mode. Figure 2 shows a high level functional view of the NitroGuard IPS, in tap-mode. The IPS interacts with the NitroView Enterprise Security Manager (ESM), which aggregates and correlates event and network flow data collected from multiple sources including the NitroGuard IPS and the NitroView Receiver. The IPS encrypts the administration channel and data channels between the IPS and NitroView ESM.

Figure 1. Functional View of the NitroGuard IPS Cryptographic Module in Inline Mode.

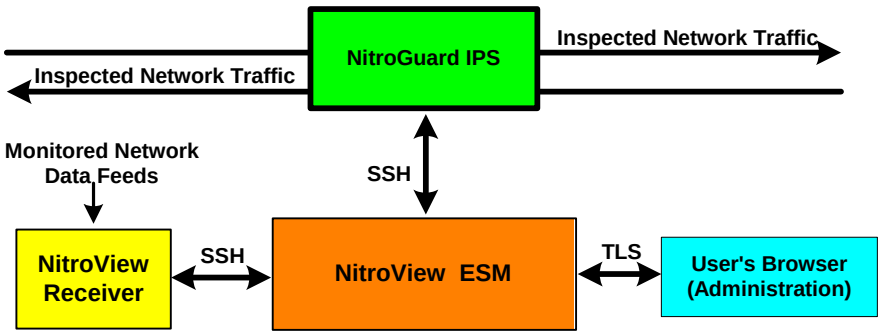
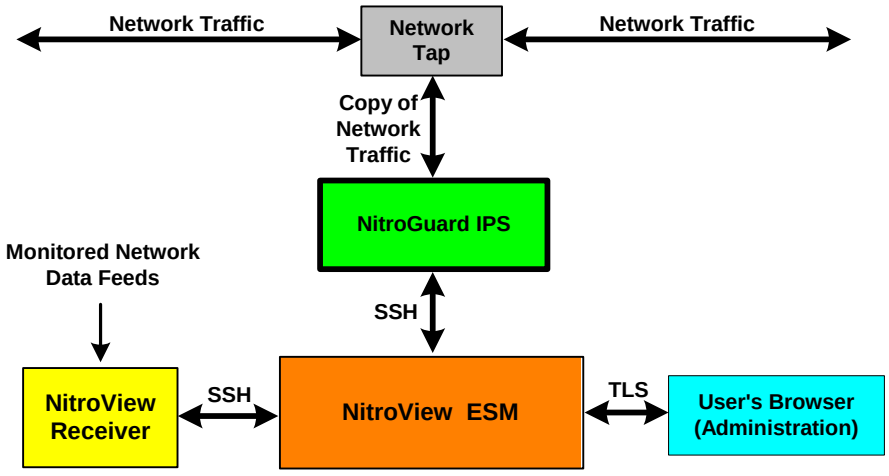


Figure 2. Functional View of the NitroGuard IPS Cryptographic Module in TAP Mode.



2.2 Module Description

The NitroGuard IPS is a multi-chip standalone cryptographic module consisting of production-grade components contained within an opaque hard production-grade enclosure (the outside case is steel). The removable cover is protected by tamper evident security seals in accordance with FIPS 140-2 Level 2. The cryptographic boundary is the metal enclosure of the device. The network interface cards do not contain any security-relevant functionality. They are within the cryptographic boundary but are excluded from the evaluation. The module has multiple (general purpose) processors for distributing the workload and improving overall processing efficiency. Use of the various processors is controlled by the operating system and not by IPS code which views these as a single processor. The module does not include any special purpose processors such as cryptographic accelerators. All of the module services implemented by module software are executed by the general purpose processors, and the memory devices that contain the executable code and data.

The module is available in three physical configurations that are functionally identical. All configurations run the same IPS code. The models differ only in the network interface they support. The interfaces support an administratively configured bypass capability that, when active, takes the module out of the data path (this is applicable to the inline configuration shown in Figure 1). In this state, no data passes through the module. This capability is therefore not a FIPS bypass mode. These interfaces are inside the cryptographic boundary but do not provide any cryptographic services.

The following set of module configurations all use a SuperMicro chassis with a SuperMicro X7DBU motherboard. These modules differ in processor strength, hard disk capacity, and number and type of network interfaces.

NS-IPS-620R-4C-B – This module contains four copper RJ45 network interfaces

NS-IPS-1220R-6C-B – This module has six copper network connectors on three 2-port NIC cards.

NS-IPS-1220R-4C-2F-B – This module has four copper network connectors (on two 2-port NIC cards) and two fiber interfaces (on a 2-port fiber NIC card).

NS-IPS-620R-4C-BFS – This module is the same appliance as the NS-IPS-620-4C-B. It has the exact same hardware configurations and runs the exact same software. There is NO operational difference between the two (**NS**-IPS-620R-4C-BFS / NS-IPS-620-4C-B) the 'FS' was added to the part number to designate an optional redundant cold spare. The description of the 'FS' at the end of the part number is 'Fail Safe'.

NS-IPS-4245-R-4BTX – This module contains 4 copper interfaces with built in bypass capability.

NS-IPS-4245-R-4BSX – This module contains 4 fiber (multimode) interfaces with built in bypass capability. The bypass functionally on the NIC is relevant to the physical network connectivity only.

The module has a limited operational environment and does not have a FIPS bypass mode or a maintenance mode.

The NitroGuard IPS meets applicable Federal Communication Commission (FCC) Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) requirements as defined in Subpart B of FCC Part 15, for Class B devices.

The module uses algorithms from OpenSSL that is built, installed, protected and initialized as specified in the *OpenSSL FIPS 140-2 Security Policy* Version 1.1.2, dated January 29, 2008. Appendix B of the OpenSSL Security Policy specifies the complete set of source files of this module. There are no additions, deletions or alterations of this set as used during module build. All source files, including the specified OpenSSL distribution tar file, are verified as specified in Appendix B of the OpenSSL Security Policy. Installation, protection, and initialization must be completed as specified in Appendix C of the OpenSSL Security Policy. That information is provided to consumers of the IPS cryptographic module. Any deviation from specified verification, protection, installation and initialization procedures will result in a non FIPS 140-2 compliant module.

Once the software is installed there are no modifications allowed to the OpenSSL or OpenSSH software components. NitroSecurity Linux kernel version 2.6.18.5 is unlikely to be modified.

2.3 Module Ports and Interfaces

The cryptographic module has numerous physical ports and four logical FIPS 140-2 interfaces. The physical ports and logical interfaces are described in Table 2.

Where distinct logical interfaces share the same physical port, communication protocols (such as TCP/IP, and 802.3) and the IPS application rules of operation logically separate and isolate these interfaces from one another.

Table 2. Physical Ports and Logical FIPS 140-2 Interfaces.

Physical Port	*Description*
Front Panel	
Power On Switch	Power input
Power Off Switch	Power input
Arrow Keys	Control input for the front panel LCD
LCD Display	Status output
Rear Panel	
Management Port 1	Onboard network interface connector (RJ45) for control input, status output, and data output. This port may connect to a managing NitroSecurity Enterprise Security Manager over an SSH tunnel. This port connects to systems on the trusted side of the network.
Management Port 2	Onboard network interface connector (RJ45) with the same functionality as Management Port 1. The IPS may use this as an alternate management port. This port connects to systems on the trusted side of the network.
Untrusted Port (1–*n)*	An Ethernet data interface that may be an RJ45 copper interface (10/100/1000 megabit) or LC multimode fiber interface. As a data input interface it receives raw network data for the purpose of packet inspection and traffic analysis. As a data output interface (only when the module is in inline mode) it transmits inspected and possibly sanitized data. The number of untrusted ports depends on the IPS model. Other untrusted ports may be used to analyze network data on separate network segments. An untrusted port connects to systems on the untrusted side of the network (the network side facing a firewall or the internet).
Trusted Port (1–*n*)	An Ethernet interface that may be an RJ45 copper interface (10/100/1000 megabit) or LC multimode fiber interface. As a data input interface it receives raw network data for the purpose of packet inspection and traffic analysis. As a data output interface (only when the module is in inline mode) it transmits inspected and possibly sanitized data The number of trusted ports depends on the IPS model. Other trusted ports may be used to analyze network data on separate network segments. A trusted port connects to systems on the trusted side of the network (the internal network).
VGA Monitor Port	15-pin D-connector for status output.
Serial Port	Not used.
Mouse Port	PS2 Control input from mouse.
Keyboard Port	PS2 Control input from keyboard.
USB 0	Not used.

Physical Port	Description
USB 1	Not used.
Power Input 1	This is not a FIPS 140-2 logical interface. Power (110 / 220 VAC) enters the module via the power input connectors.
Power Input 1 LED	Green indicates power is available to the module via this power connector. Yellow indicates power is not available at this power connector. Unlit indicates no power is connected to this power connector.
Power Input 2	This is not a FIPS 140-2 logical interface. Power (110 / 220 VAC) enters the module via the power input connectors.
Power Input 2 LED	Green indicates power is available to the module via this power connector. Yellow indicates power is not available at this power connector. Unlit indicates no power is connected to this power connector.

The FIPS 140-2 logical interfaces correspond to physical ports as described in Table 3.

Table 3. FIPS 140-2 Logical Interfaces.

Logical Interface	Description
Data input	Data input consists of: • Network data entering the module data interfaces for the purpose of being analyzed.
Data output	Data output consists of: • Network data exiting the module after it has been analyzed (for the inline configuration) on trusted and untrusted ports. • Analytical data exiting the module via the SSH tunnel on Management Port 1 (or Management port 2) to the ESM for storage and further analysis. • Operational information output by the system in response to changes in module conditions. This data exits via the SSH tunnel on Management Port 1.
Control input	Control input consists of: • Commands from crypto officers entering the module from an ESM in encrypted format via Management Port 1 (or Management port 2) over an SSH connection. • Plaintext commands from a master crypto officer entering the module via the keyboard and mouse ports (the console) and the arrow keys on the front of the system.
Status output	The status output consists of • FIPS operational status returned from status requests by crypto officers. FIPS operational status is output in encrypted format on the SSH connection. The IPS device properties dialog displays the result of the most recent FIPS self-test. • FIPS error status output automatically in plaintext format to the LCD and on HTTP port 4242 (management ports 1 and 2). Module LEDs may also indicate status such as network traffic or the status of power supplied to the module.

3 Security Functions

The NitroGuard IPS cryptographic module implements the security functions described in Table 4.

Table 4. Module Security Functions.

Security Function	*Purpose or Use*	*Certificate*
Approved Security Functions		
AES (FIPS PUB 197) CBC(e/d; 128)	SSH encryption and decryption.	668
Triple-DES (FIPS PUB 46.3) (CBC)	Support for ANSI X9.31 PRNG	613
SHA-1 (FIPS PUB 180-2) (BYTE-only)	SSH signature generation and verification, data integrity	701
HMAC-SHA1	Data integrity and data authentication within SSH	352 (HMAC), 701 (SHS)
RNG (ANSI X9.31 PRNG, Appendix A.2.4)	Key generation	387
RSA (FIPS PUB 186-2) ALG[RSASSA-PKCS1_V1_5]; SIG(gen); SIG(ver); 2048, SHS: SHA-1 (key transport methodology provides a minimum of 112 bits of encryption strength)	SSH key transport, signature verification	310
Allowed Security Functions		
Diffie Hellman (2048 bit key agreement and key establishment methodology). While not approved, it may be used in FIPS mode.	Key agreement within SSH	N/A

4 FIPS Approved Mode of Operation

The Master Crypto Officer must select FIPS mode during initial configuration. Once in FIPS mode the module performs only FIPS-approved cryptographic algorithms and security functions. When the module is registered with an ESM that is in FIPS mode, the [IPS] module permanently enters FIPS mode. The module can not register with a NitroView ESM (server) that is not in FIPS mode. The IPS will only communicate with a FIPS approved mode ESM.

In the FIPS approved mode, crypto officers may configure the module for operation within the IT environment and they may make administrative changes. Users may access the module's data encryption and decryption services by using the IPS services via an ESM. The FIPS-validated NitroGuard IPS allows loading software updates in the field, but this operation must not be used as this operation invalidates the module's FIPS evaluated configuration.

The module supports a non-FIPS mode of operation. If during initial configuration the Master Crypto Officer does not enable FIPS mode, the module will not be in FIPS mode and can only communicate with a non-FIPS mode ESM. Non-FIPS mode communication between the IPS and ESM exists and is proprietary.

4.1 Set-Up and Initialization Procedures

The NitroSecurity *NitroGuard IPS Operator Guidance* provides the following steps to set up and initialize the module into FIPS approved mode:

1. The NitroView ESM (to be used for IPS management operations) must be configured and operating. The ESM must be a FIPS validated system configured to operate in FIPS approved mode.
2. Check the IPS packaging and the module, including the two tamper evident seals for signs of tampering. If tampering is detected, contact NitroSecurity Support for further instructions. Place the third tamper-evident seal so it covers the USB ports. This seal can be found in the package of accessories included in the shipping container.
3. Power up the module. While the module boots up, confirm the NitroSecurity software version displayed on the LCD is 8.0.0.20080605 and 8.2.0. If the version number is different, the module is not the FIPS validated version. Contact NitroSecurity Support for further instructions.
4. After the module boots up, configure the network interface by following the instructions in the *NitroSecurity Installation and Setup Guide* section "Configuring the Network Interface on the IPS".
5. Complete the setup by using the ESM to add the device to the ESM and register the device to operate with the ESM. Follow the instructions in the *NitroSecurity Installation and Setup Guide* section "Keying the Device". Note that this action puts the IPS in FIPS mode.
6. To verify FIPS mode use the NitroView ESM GUI. The bottom 'status' bar indicates that the module is in FIPS mode (shows version / date and "FIPS Enabled"). Using the GUI, select a single device go to device properties, click the FIPS button – runs the FIPS self test and outputs the FIPS status
    a. Additionally, the master crypto officer is able to see the FIPS status when they authenticate to cryptographic module's console. The FIPS status can be observed when the crypto officer selects the command line option number 3 to determine whether the cryptographic module is in a FIPS approved mode of operation.

5 Identification and Authentication

The module supports two crypto officer roles and a user role. See Section 7 "Roles and Services" for more information about these roles.

Multiple (two) concurrent role-based sessions (crypto officer and master crypto officer) are allowed. The module's "system administrator", always has the master crypto officer role, and is the only user that can initialize the device using the module front panel arrow keys and zeroize the device using the device console port. Use of the LCD and front panel controls is unauthenticated. The operator using these controls to initialize the module is assumed to be the master crypto officer. Use of the console port is authenticated by entry of a username and password.

Once initialization is completed, crypto officers access the module over the SSH channel. All commands on the SSH channel are considered valid crypto officer commands.

Separation of crypto officer roles from the master crypto officer role is not necessary before or during initialization as no crypto officer roles are defined. Once crypto officer roles are defined, separation of crypto officer roles from the master crypto officer role is achieved by physical separation of the command and control channels. All crypto officer operations enter the module via the SSH tunnel. Master crypto officer operations enter via the console interface.

Separation of unauthenticated (user) roles is maintained by relying on the protocols and related port assignments to handle user data appropriately as user data enters the module only on Untrusted Port 1 and 2 which are physically separate ports from those used for control and status data (Management port 1 or 2).

The module does not display any authentication data entered into the console. Access to the authorized roles is restricted as explained in Table 5:

Table 5. Roles and Required Identification and Authentication.

Role	*Type of Authentication*	*Authentication Data*
Master Crypto Officer	Role-based	Master Crypto Officer Role-based A master crypto officer authenticates by entering a username and a password at the console. Start-up and other operations using the LCD and front panel arrow controls are unauthenticated.
Crypto Officer	Role-based	A crypto officer authenticates by establishing a valid SSH connection with the IPS.
User	Role-based	Users are unauthenticated.

The strength of the operator authentication, per the above roles, is as follows in Table 6:

Table 6. Strength of Authentication.

Authentication Mechanism	*Strength of Mechanism*
Password	The master crypto officer authenticates using a minimum 8 ASCII-character (Decimal values between 33 and 126, inclusive) password that must include all of the following: one upper case character (A-Z), one digit (0-9), and one special character (printable characters excluding space and alphanumerics, 32 choices). This yields a minimum of 61.1E+12, over 61 trillion, possible combinations; thus, the possibility of correctly guessing a password is less than 1 in 1,000,000. This password is set using the management interface on the management ESM. The possibility of randomly guessing a password in 60 seconds is less than 1 in 100,000. The system allows no more than 6,000 login attempts per minute. Combine this fact with a one in 61 trillion possibility of guessing a password to compute only a 1 in 10.2E+9, over 10 billion, possibility of guessing a password in one minute.
Public key authentication	The IPS supports public key based authentication with RSA 2048-bit keys. A 2048-bit RSA key has at least 112-bits of equivalent strength. The probability of a successful random attempt is 1/2^112, which is less than 1/1,000,000. The possibility of randomly guessing a key in 60 seconds is less than 1 in 100,000. The system allows no more than 6,000 login attempts per minute. Combine this fact with a one in 61 trillion possibility of guessing a password to compute only a 1 in 10.2E+9, over 10 billion, possibility of guessing a password in one minute.

When the cryptographic module is powered off and subsequently powered on, the results of previous authentications (the authentication states of sessions) are cleared from memory. When the module is powered up again, operators must re-authenticate to the module, entering the correct user name and password.

6 Cryptographic Keys and CSPs

The following table identifies the cryptographic keys and critical security parameters (CSPs) used within the module. Cryptographic keys and CSPs are never output from the module in plaintext. An Approved key generation method is used to generate keys that are generated on the module. Cryptographic keys in the section of the table labeled Other Cryptographic Keys are not considered CSPs as they are public keys.

Table 7. Cryptographic Keys and CSPs.

Data Item	*Description*
IPS SSH Private Key	This RSA 2048-bit private key corresponds to the IPS SSH Public Key described below in Other Cryptographic Keys. This private key is used for the transfer of key material in the SSH protocol. This key is generated by the FIPS validated RNG (certificate #387) during manufacturing and can never be regenerated again. This key is stored in unencrypted format on an unencrypted disk partition. This key is zeroized according to DoD 5220.22-M when returning the module to the manufacturer for repair or replacement.
SSH AES Encryption Keys	AES 128-bit ephemeral symmetric key used for encrypting and decrypting SSH sessions with ESM devices. This key is produced using DH key agreement. The key is deleted from memory after use.
Diffie-Hellman Keys	Ephemeral Diffie-Hellman public and private parameters used for key agreement to provide SSH AES Encryption Keys. These key parameters are deleted from memory after use.
HMAC Key	The ephemeral HMAC key is used within the SSH protocol for data authentication purposes. It is generated as specified in the SSH protocol specification [1] (using OpenSSH). This key is deleted from memory after use.
Master Crypto Officer Password	A minimum 8-character password used by the master crypto officers to authenticate to the console interface. A default 8 character password exists on the device but a new password (minimum 8 characters) is set using the ESM.. An obfuscated, non human-readable, version of the password is stored in the file system. The limited operating environment does not provide access to operating system services to access the obfuscated password data.
Seed Key	Triple Des 168 bit seed key used to initialize the ANSI X9.31 Pseudo RNG which is used to generate other cryptographic keys.
RNG Seed	OpenSSL uses /dev/random as a source of random numbers. The linux kernel initializes this pseudo device at system startup. /dev/random guarantees a high degree of entropy and blocks until it has the proper level of entropy. The FIPS-validated version of OpenSSL performs continual tests on the random numbers it uses.
Other Cryptographic Keys	
IPS SSH Public Key	This RSA 2048-bit public key corresponds to the IPS SSH Private Key described above. This key is generated by the FIPS validated RNG (certificate #387) during manufacturing and can never be regenerated again. The key is stored in unencrypted format on an unencrypted disk partition. The public key is maintained in a self signed certificate. This key is zeroized according to DoD 5220.22-M when returning the module to the manufacturer for repair or replacement.

[1] http://www.ietf.org/rfc/rfc4252.txt

Data Item	Description
Default ESM SSH Public Key	RSA 2048-bit public key used for the initial identification of a managing ESM and transfer of key material in the SSH protocol. The key is generated off the module and is stored in unencrypted form in the file system on an unencrypted disk partition (in the authorized keys table) for initial authentication of ESM devices. This key is zeroized according to DoD 5220.22-M when returning the module to the manufacturer for repair or replacement.
Active ESM SSH Public Key	RSA 2048-bit public key used for the identification of a managing ESM and transfer of key material in the SSH protocol. The key is generated off the module and is stored in unencrypted form in the file system on an unencrypted disk partition (in the authorized keys table). This key is zeroized according to DoD 5220.22-M when returning the module to the manufacturer for repair or replacement.
Integrity Public Key	RSA 2048-bit public key used to verify the digital signature of stored hash values used for the software/firmware integrity test. The public key is in a self signed certificate stored in unencrypted form in the filesystem. This key is zeroized according to DoD 5220.22-M when returning the module to the manufacturer for repair or replacement.

7 Roles and Services

The module supports a master crypto officer role, a crypto officer role and user roles. The module has a single system administrator role that is designated as the master crypto officer role and that role has the user name ”root”. The master crypto officer role may initialize the module using the LCD and front panel controls, may zeroize the module using the console port, and perform other operations unique to the role. Crypto officers access the device over the SSH channel, give commands to use the IPS device features, and perform key management operations.

Users passively access the device by sending network data to its normal destination. The IPS receives the data in either inline mode or in tap mode using the Trusted Port or Untrusted Port (1 and/or 2) network interfaces.

The module supports services that are available to module operators in the various roles. All of the services are described in detail in the module’s user documentation. Table 8 shows the services available to the various roles.

Table 8. Roles and Services

Service	Master Crypto Officer	Crypto Officer	User
Initialize the IPS.	●		
Rekey the IPS	●	●	
Start, stop, reboot, and control flow collection services	●	●	
Access the system via the console (keyboard and monitor ports) for zeroization operations.	●		
Import device keys	●	●	

Service	Master Crypto Officer	Crypto Officer	User
Read Status via SSH (Show Status)	●	●	
Read Status via the Console (Show Status)	●		
Read Status via HTTP (port 4242)	●	●	
Send user data to the IPS			●
Manage the device (use device IPS services)	●	●	
Run the FIPS self test (reboot and on demand)	●	●	
Change password on console port	●		
Zeroize the system for repair or replacement purposes (uninstallation). 'Shreds' key material using the Linux command per DoD 5220.22-M.	●		

Importing Device keys is available as part of the (device) registration process. Each / any IPS or Receiver must register with an ESM before communications can begin between the devices. This registration is performed by exchanging 'key' information. A unique key is assigned to a device for the purpose of identifying a 'valid' device to be registered. Once an IPS is added, it is very important to key the device. Keying the device enables
the ESM to communicate with the IPS and ensures added security by ignoring all outside sources of communication.
Note: A key exported from a non-FIPS device cannot be imported to a device operating in
FIPS mode, nor can a key exported from a FIPS device be imported to a non-FIPS device. If you attempt to perform this action when you are adding a device to the system, the "The file is invalid" error will appear.

This term 'Key' in this manner is not related to encryption keys and refers to device registration keys

NitroSecurity uses the Linux 'shred' command as the actual 'process' to securely erase disk data following the guidelines under the authority of DoD Directive 5220.22-M for the protection of classified information. NitroSecurity also recommends its customers become familiar with the NIST Special Publication 800-88 (Guidelines for Media Sanitation) to devise an appropriate erasure policy specific to their environment.

The Linux 'shred' command is designed primarily to securely delete files on the system. Using 'shred' overwrites all addressable hard drive locations with a character, its complement, and then a random character, followed by verification. The procedure is completed a number of times and prevents data from being recovered by commercially available processes.

8 Access Control

Table 9 shows services that use or affect cryptographic keys or CSPs. For each service, the key or CSP is indicated along with the type of access.

R - The item is read or referenced by the service.
W - The item is written or updated by the service.

E - The item is executed by the service. (The item is used as part of a cryptographic service.)
D - The item is deleted by the service.
Z - The item is zeroized using DoD 5220.22-M zeroization.

Table 9. Access Control

Key or CSP	*Service*	*Access Control*
Default ESM SSH Public Key	Initialize IPS	R,E
	Zeroize the system	Z
Active ESM SSH Public Key	Key IPS (during initialization)	W, E
	Open SSH connection (using ESM instrumentation)	R, E
	Zeroize the system	Z
IPS SSH Key Pair	Rekey Receiver (during initialization)	W, E
	Open (accept) SSH connection from an ESM	R, E,D
	Import Key	W
	Zeroize the system	Z
SSH AES Encryption Key	Open SSH connection (using ESM instrumentation)	W, E
	SSH rekey after each hour of operation	D, W
	Close SSH connection (using ESM instrumentation)	D
	Shutdown or Reboot	D
HMAC Key	Open SSH connection (using ESM instrumentation)	W, E
	SSH rekey after each hour of operation.	D, W
	Close SSH connection (using ESM instrumentation)	D
	Shutdown or Reboot	D
Integrity Public Key	Start the system	E
	Zeroize the system	Z
Crypto Officer Password	Change password	W, D
	Authenticate to Console Interface	R
	Zeroize	Z
RNG Seed Key	Any RNG function	W,R,E,D

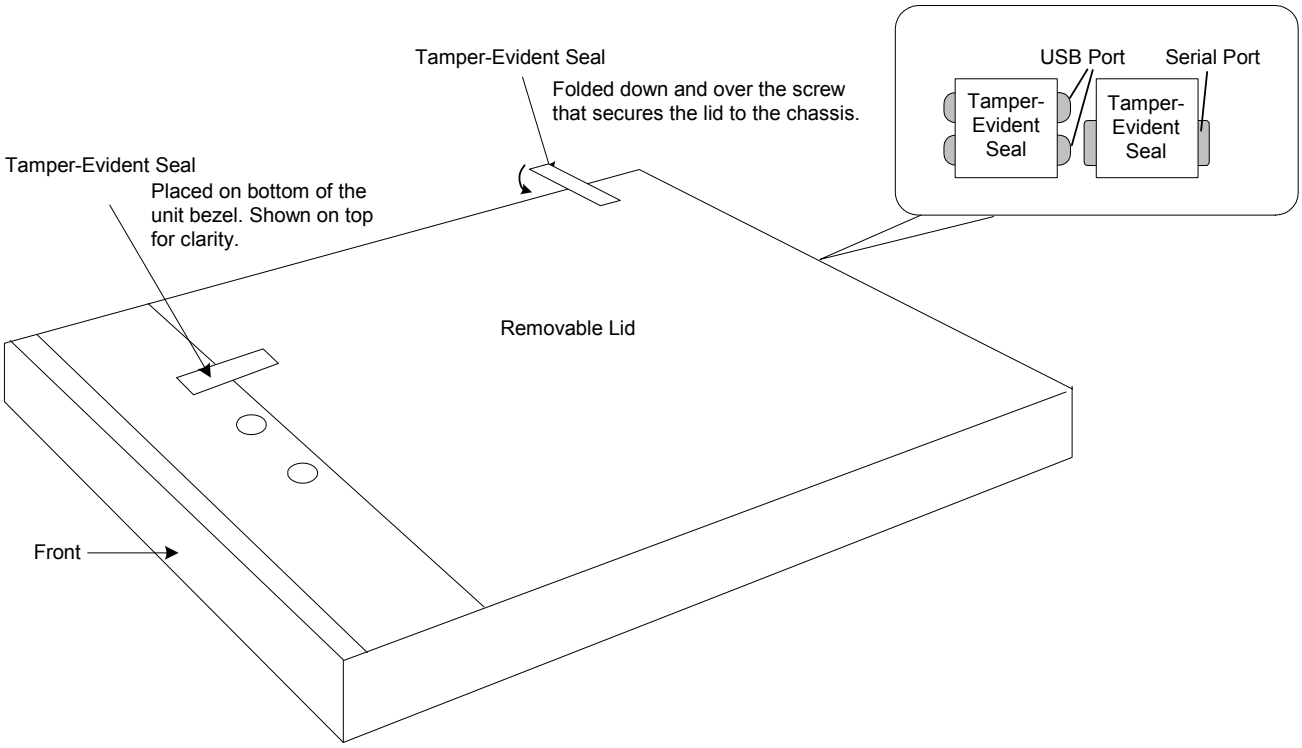
9 Physical Security

The physical security of the cryptographic module meets FIPS 140-2 level 2 requirements. The cryptographic module consists of production-grade components that include standard passivation techniques (a sealing coat applied over the module's circuitry to protect against environmental or other physical damage). The module meets commercial-grade specifications for power, temperature, reliability, shock and vibration.

The module has two tamper-evident seals. One is placed at the rear between the top cover and rear of the chassis. The other seal is placed between the chassis and the bezel (on the bottom). The top cover is removed by sliding it back and then lifting it off. This action breaks both seals, leaving evidence of tampering. The crypto officer guidance directs the crypto officer to periodically inspect the module for signs of tampering such as dents or scratches on the module enclosure or damage to the tamper evident seals. If tampering is detected, the crypto officer is instructed to perform a zeroize command and then to contact NitroSecurity Technical support for further assistance.

Figure 7 shows how the tamper evident seals are placed over the front and rear seams between the module's removable lid and the module chassis. A crypto officer applies a third tamper evident seal (provided with the module) over the USB connectors and a fourth seal over the serial port to prevent their use without leaving evidence of tampering. These seals must be inspected in accordance with the organization security policy.

Figure 7. Tamper Evident Seals.



10 Self Tests

The module performs both power-on self test (POST) and conditional self tests to verify the integrity and correct operational functioning of the cryptographic module. If the system fails a self test, it reports status indicating that a failure has occurred and transitions to an error state, blocking all data input and data output via their respective interfaces.

While the module is performing any power on self test or conditional test, software rules within the executable image prevent the module from entering a state where data output via the data output interface is possible.

Anyone with physical or logical access to the module can run the POST on demand by power cycling the module or entering a Reboot command.

Table 10 summarizes the system self tests and conditional tests.

Table 10. Self Tests.

Self Test	*Description*
Mandatory power-up tests performed at power-up and on demand:	
Cryptographic Algorithm Known Answer Tests	Each cryptographic algorithm (AES, Triple-DES, SHA-1, and RNG) performed by the module, is tested using a “known answer” test to verify the correct operation of the algorithm.
Software Integrity Test	The module verifies the RSA 2048 bit digital signatures on SHA-1 hashes of the NitroSecurity Software (Version 8.0.0.20080605 and 8.2.0) to confirm their integrity.
Critical Functions tests performed at power-up:	
None	No security-relevant critical functions tests are performed.
Conditional tests performed, as needed, during operation:	
Pairwise Consistency Tests	The module performs pairwise consistency tests whenever RSA asymmetric keys are generated.
Continuous RNG	16 bits continuous testing is performed during each use of the approved RNG. This test is a “stuck at” test to check the RNG output data for failure to a constant value.

Any self test success or failure messages are output to error log files.

Known answer tests for encryption/decryption or hashing, function by encrypting or hashing a string for which the calculated output is known and stored within the cryptographic module. An encryption or hashing test passes when the freshly calculated output matches the expected (stored) value. A test fails when the calculated outmatch does not match the expected value. For decryption, the test then decrypts the ciphertext encrypted string. A decryption test passes when the freshly calculated output matches the plaintext value. A decryption test fails when the calculated output does not match the plaintext value.

Known answer tests for Random Number Generators function by seeding the RNG with known values and checking that the output matches the pre-calculated value stored within the cryptographic module. The test passes when the freshly generated output matches the pre-calculated value. A test fails when the generated output does not match the pre-calculated value.

Pairwise consistency tests for RSA keys (these keys are used for key transport) use the public key to encrypt a plaintext value. The resulting ciphertext value is compared to the original plaintext value. If the two values are

equal, then the test fails. If the two values differ, the private key is used to decrypt the ciphertext and the resulting value is compared to the original plaintext value. If the two values are not equal, the test fails.

11 Mitigation of Attacks

The cryptographic module is not designed to mitigate specific attacks such as differential power analysis or timing attacks.

12 References

National Institute of Standards and Technology, *FIPS PUB 140-2: Security Requirements for Cryptographic Modules*, available at URL: http://www.nist.gov/cmvp.

National Institute of Standards and Technology, *FIPS 140-2 Annex A: Approved Security Functions*, available at URL: http://www.nist.gov/cmvp.

National Institute of Standards and Technology, *FIPS 140-2 Annex B: Approved Protection Profiles*, available at URL: http://www.nist.gov/cmvp.

National Institute of Standards and Technology, *FIPS 140-2 Annex C: Approved Random Number Generators*, available at URL: http://www.nist.gov/cmvp.

National Institute of Standards and Technology, *FIPS 140-2 Annex D: Approved Key Establishment Techniques*, available at URL: http://www.nist.gov/cmvp.

National Institute of Standards and Technology and Communications Security Establishment, *Derived Test Requirements (DTR) for FIPS PUB 140-2, Security Requirements for Cryptographic Modules*, available at URL: http://www.nist.gov/cmvp.

National Institute of Standards and Technology, *Data Encryption Standard (DES)*, Federal Information Processing Standards Publication 46-3, available at URL: http://www.nist.gov/cmvp.

National Institute of Standards and Technology, *DES Modes of Operation*, Federal Information Processing Standards Publication 81, available at URL: http://www.nist.gov/cmvp.

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Intel S5000PAL server board, available at URL;
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