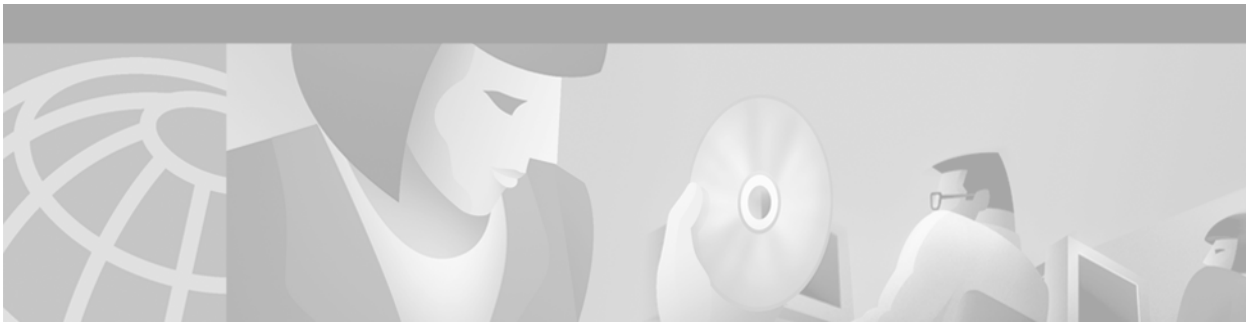

Cisco 7206 VXR Router with ISA Security Policy

Introduction

This nonproprietary Cryptographic Module Security Policy describes how the 7206 VXR NPE-400 routers meet the security requirements of Federal Information Processing Standards (FIPS) 140-1, and how they operate in a secure FIPS 140-1 mode. The policy was prepared as part of the Level 2 FIPS 140-1 certification of the 7206 VXR NPE-400 router.

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The FIPS 140-1 publication, "*Security Requirements for Cryptographic Modules*" details the U.S. Government requirements for cryptographic modules. More information about the FIPS 140-1 standard and validation program is available at the following National Institute of Standards and Technology (NIST) website:

http://csrc.nist.gov/cryptval/

This document contains the following sections:

- Introduction, page 1
- The 7206 VXR NPE-400 Router, page 2
- Secure Operation of the Cisco 7206 VXR NPE-400 Router, page 11
- Obtaining Documentation, page 13
- Obtaining Technical Assistance, page 14

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Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

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References

This document deals with operations and capabilities of the 7206 VXR NPE-400 router in the technical terms of a FIPS 140-1 cryptographic module security policy. For more information on Cisco 7206 VXR NPE-400 router and the entire 7200 series, check the following sources:

- The Cisco Systems website contains information on the full line of Cisco Systems products. Refer to the following website:

  www.cisco.com.
- The 7200 series product descriptions can be found at the following website:

  www.cisco.com/warp/public/cc/pd/rt/7200/
- For answers to technical or sales related questions, please refer to the contacts listed on the following website:

  www.cisco.com.

Terminology

In this document, the cryptographic module is referred to as the 7206 VXR router, the router, or the system.

Document Organization

The security policy document is part of the complete FIPS 140-1 Submission Package. In addition to this document, the complete submission package contains:

- Vendor evidence document
- Finite state machine
- Module software listing
- Other supporting documentation as additional references

This document provides an overview of the 7206 VXR NPE-400 router and explains the secure configuration and operation of the cryptographic module. It also explains the general features and functionality of the 7206 VXR NPE-400 routers and addresses the required configuration for the FIPS mode of operation.

Note This security policy and other certification submission documentation was produced by Corsec Security, Inc. under contract to Cisco Systems. With the exception of this nonproprietary security policy, the FIPS 140-1 Certification Submission documentation is Cisco-proprietary and can be released only under appropriate nondisclosure agreements. For access to these documents, please contact Cisco Systems.

The 7206 VXR NPE-400 Router

Cisco 7200 VXR routers are designed to support gigabit capabilities and to improve data, voice, and video integration in both service provider and enterprise environments. Cisco 7200 VXR routers support a high-speed network services engine (NSE) as well as the high-speed network processing engine, NPE-400, and all other available network processing engines.

Cisco 7200 VXR routers accommodate a variety of network interface port adapters and an I/O controller. A Cisco 7200 VXR router equipped with an NPE-400 can support up to six high-speed port adapters and can also support higher-speed port adapter interfaces including Gigabit Ethernet and OC-12 ATM. Cisco 7200 VXR routers also contain bays for up to two AC-input or DC-input power supplies.

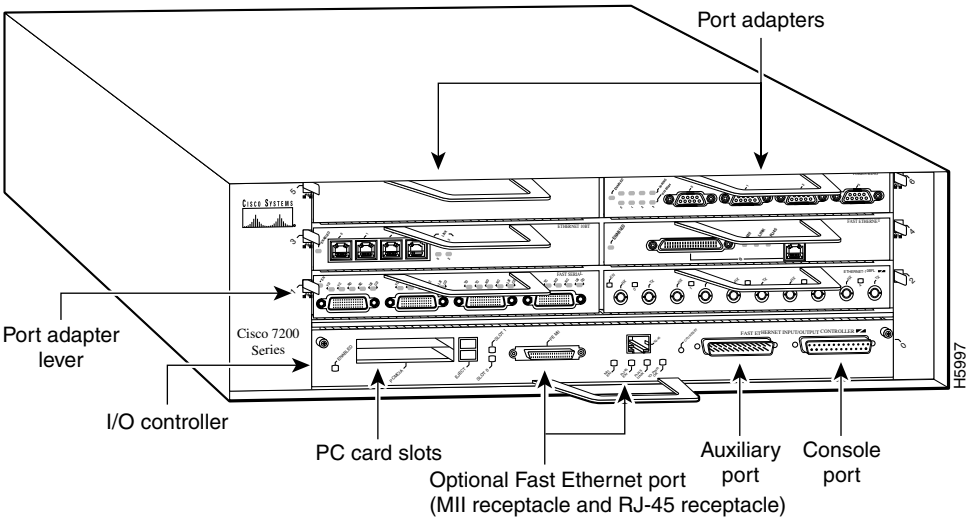
Cisco 7200 VXR routers support the following features:

- Online insertion and removal (OIR)—Add, replace, or remove port adapters without interrupting the system.
- Dual hot-swappable, load-sharing power supplies—Provide system power redundancy; if one power supply or power source fails, the other power supply maintains system power without interruption. Also, when one power supply is powered off and removed from the router, the second power supply immediately takes over the router power requirements without interrupting normal operation of the router.
- Environmental monitoring and reporting functions—Maintain normal system operation by resolving adverse environmental conditions prior to loss of operation.
- Downloadable software—Load new images into Flash memory remotely, without having to physically access the router.

The 7206 VXR NPE-400 Cryptographic Module

Cisco 7206 VXR routers support multiprotocol routing and bridging with a wide variety of protocols and port adapter combinations available for Cisco 7200 series routers. The metal casing that fully encloses the module establishes the cryptographic boundary for the router. All the functionality discussed in this document is provided by components within the casing. Cisco 7206 VXR routers have six slots for port adapters, one slot for an input/output (I/O) controller, and one slot for a network processing engine or network services engine.

Figure 1 The 7206 VXR NPE-400 Router



Cisco 7206 VXR NPE-400 uses an RM7000 microprocessor that operates at an internal clock speed of 350 MHz. The NPE-400 uses SDRAM for storing all packets received or sent from network interfaces. The SDRAM memory array in the system allows concurrent access by port adapters and the processor.

The NPE-400 has three levels of cache: a primary and a secondary cache that are internal to the microprocessor, and a tertiary 4-MB external cache that provides additional high-speed storage for data and instructions.

Cisco 7206 VXR routers come equipped with one 280W AC-input power supply. (A 280W DC-input power supply option is available.) A power supply filler plate is installed over the second power supply bay. A fully configured Cisco 7206 VXR router operates with only one installed power supply; however, a second, optional power supply of the same type provides hot-swappable, load-sharing, redundant power.

Module Interfaces

Input/Output Controller

The interfaces for the router are located on the front panel Input/Output (I/O) Controller, with the exception of the power switch and power plug. The module has two Fast Ethernet (10/100 RJ-45) connectors for data transfers in and out. The module also has two other RJ-45 connectors for a console terminal for local system access and an auxiliary port for remote system access or dial backup using a modem.

Figure 2 shows the front panel LEDs, which provide overall status of the router operation. The front panel displays whether or not the router is booted, if the redundant power is attached and operational, and overall activity/link status.

Figure 2 I/O Controller

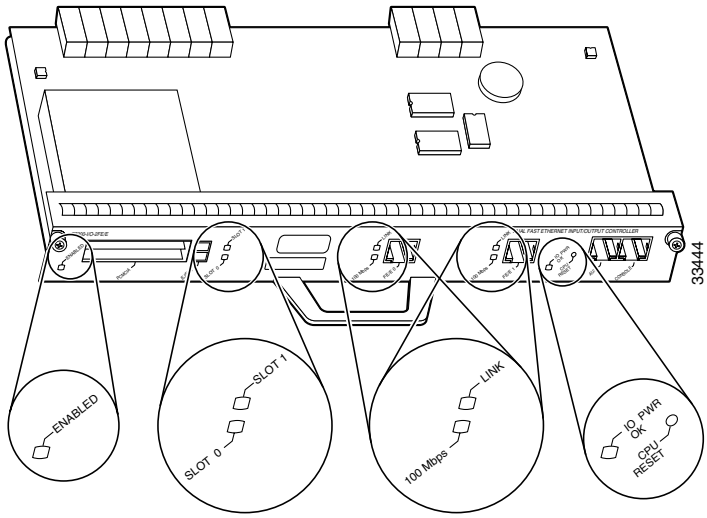


Table 1 provides detailed information conveyed by the LEDs on the front panel of the I/O Controller.

Table 1 Front Panel LEDs and Descriptions

LED	Indication	Description
Enabled	Green	Indicates that the network processing engine or network services engine and the I/O controller are enabled for operation by the system; however, it does not mean that the Fast Ethernet port on the I/O controller is functional or enabled. This LED goes on during a successful router boot and remains on during normal operation of the router.
IO POWER OK	Amber	Indicates that the I/O controller is on and receiving DC power from the router midplane. This LED comes on during a successful router boot and remains on during normal operation of the router.
	Off	Powered off or failed.
Slot 0 Slot 1	Green	These LEDs indicate which PC Card slot is in use by coming on when either slot is being accessed by the system. These LEDs remain off during normal operation of the router.
Link	Green	Indicates that the Ethernet RJ-45 receptacle has established a valid link with the network.
	Off	This LED remains off during normal operation of the router unless there is an incoming carrier signal
100 Mbps	Green	Indicates that the port is configured for 100-Mbps operation (speed 100), or if configured for autonegotiation (speed auto), the port has detected a valid link at 100 Mbps.
	Off	If the port is configured for 10-Mbps operation, or if it is configured for autonegotiation and the port has detected a valid link at 10 Mbps, the LED remains off.

All of these physical interfaces are separated into the logical interfaces from FIPS as described in Table 3.

Integrated Service Adapter

The ISA is a single-width service adapter. It provides high-performance, hardware-assisted tunneling and encryption services suitable for VPN applications. The ISA off-loads IPSec and MPPE processing from the main processor of the Cisco 7200 series router, thus freeing resources on the network processor engine.

The ISA has one enabled LED and two status LEDs. After system initialization, the enabled LED goes on to indicate that the ISA has been enabled for operation. If the initialization fails for any reason, the enabled LED does not go on.

Figure 3 shows the LEDs for the ISA Crypto Card with one enabled LED and two status LEDs.

Figure 3 LEDs for ISA Crypto Card

Refer to Table 2 for further description of the ISA LEDs

Table 2 ISA LEDs and Descriptions

LED	Indication	Description
ENABLED	Green	Indicates the ISA is powered up. After system initialization, the enabled LED goes on to indicate that power is received and that the ISA is enabled for operation. All the following conditions must be met before the enabled LED goes on: • The ISA is correctly connected to the backplane and receiving power. • The system bus recognizes the ISA. If either of these conditions is not met, or if the router initialization fails, the enabled LED does not go on.
BOOT	Amber	Indicates the ISA is booting. This amber LED remains on while the ISA is in the boot process or when a packet is being encrypted or decrypted.
	Pulse Amber	Indicates the ISA is operating. After successfully booting, the boot LED pulses in a "heartbeat" pattern to indicate that the ISA is operating. As crypto traffic increases, the nominal level of this LED increases in proportion to the traffic level.
ERROR	Amber	Indicates an error has occurred. This amber LED goes on to indicate that an error was found in either the encryption function or the compression function. It is normally off.

All of these physical interfaces are separated into the logical interfaces from FIPS as described in Table 3.

Table 3 FIPS 140-1 Logical Interfaces

Router Physical Interface	FIPS 140-1 Logical Interface
10/100BASE-TX LAN Port Port Adapter Interface Service Module Interface Console Port Auxiliary Port* PCMCIA Slot*	Data Input Interface
10/100BASE-TX LAN Port Port Adapter Interface Service Module Interface Console Port Auxiliary Port* PCMCIA Slot*	Data Output Interface
Power Switch Console Port Auxiliary Port*	Control Input Interface
10/100BASE-TX LAN Port LEDs Pwr LED Sys Rdy LED Console Port Auxiliary Port*	Status Output Interface
Power Plug	Power Interface

* Disabled in FIPS mode. See the "Secure Operation of the Cisco 7206 VXR NPE-400 Router"section in this document for more information.

In addition to the built-in interfaces, the router also has additional port adapters that can optionally be placed in an available slot. These port adapters have many embodiments, including multiple Ethernet, token ring, and modem cards to handle frame relay, ATM, and ISDN connections.

Roles and Services

There are two main roles in the router (as required by FIPS 140-1) that operators can assume: crypto officer or administrator role and user role. The administrator of the router assumes the crypto officer role in order to configure and maintain the router using crypto officer services, while the users exercise only the basic user services.

Cryptographic Officer Services

During initial configuration of the router, a cryptographic officer (crypto officer) password (the "enable" password) is defined and all management services are available from this role. The crypto officer connects to the router through the console port through the terminal program. A crypto officer can assign permission to access the crypto officer role to additional accounts, thereby creating additional crypto officers.

At the highest level, crypto officer services include the following:

- Configure the router: define network interfaces and settings, create command aliases, set the protocols the router will support, enable interfaces and network services, set system date and time, and load authentication information.
- Define rules and filters: create packet filters that are applied to user data streams on each interface. Each filter consists of a set of rules, which define a set of packets to permit or deny based on characteristics such as protocol ID, addresses, ports, TCP connection establishment, or packet direction.
- Status functions: view the router configuration, routing tables, and active sessions; view SNMP MIB II statistics, health, temperature, memory status, voltage, and packet statistics; review accounting logs, and view physical interface status.
- Manage the router: log off users, shut down or reload the router, manually back up router configurations, view complete configurations, manager user rights, and restore router configurations.
- Set encryption/bypass: set up the configuration tables for IP tunneling. Set keys and algorithms to be used for each IP range or allow plaintext packets to be set from specified IP addresses.
- Change port adapters: insert and remove adapters in port adapter slots as described in the "Initial Setup" section on page 11 in this document.

User Services

A user enters the system by accessing the console port with a terminal program. The IOS prompts the user for their password. If it matches the plaintext password stored in IOS memory, the user is allowed entry to the IOS executive program. At the highest level, user services include the following:

- ·Status Functions: view state of interfaces, state of layer 2 protocols, version of IOS currently running
- Network Functions: connect to other network devices through outgoing telnet or PPP, and initiate diagnostic network services (for example, ping or mtrace)
- Terminal Functions: adjust the terminal session (that is, lock the terminal and adjust flow control)
- ·Directory Services: display directory of files kept in flash memory

Physical Security

The router is entirely encased by a thick steel chassis. The front of the router provides 4 port adapter slots, on-board LAN connectors, PC Card slots, and Console/Auxiliary connectors. The power cable connection, a power switch, and the access to the Network Processing Engine are at the rear of the router.

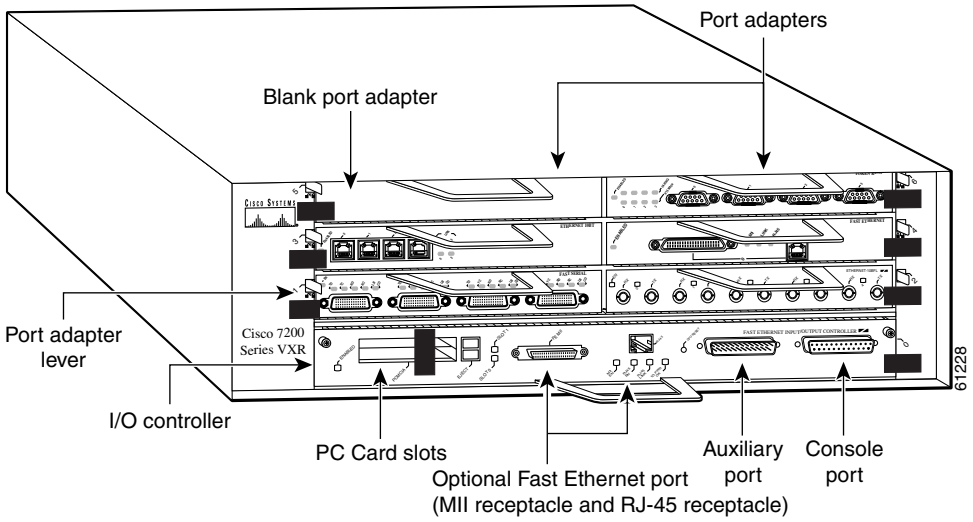
Once the router has been configured to meet FIPS 140-1 Level 2 requirements, the router cannot be accessed without signs of tampering. To seal the system, apply serialized tamper-evidence labels as follows:

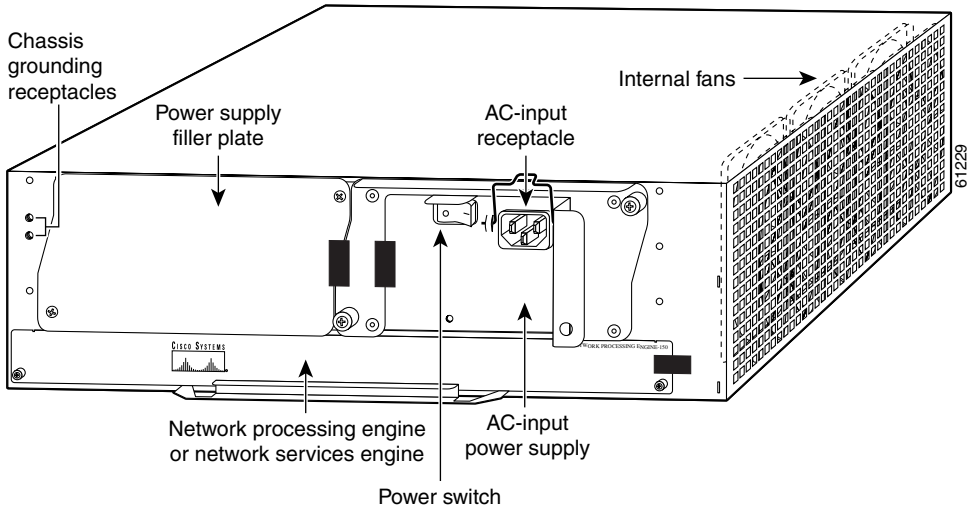
- Clean the cover of any grease, dirt, or oil before applying the tamper evidence labels. Alcohol-based cleaning pads are recommended for this purpose. The ambient air must be above 10C, otherwise the labels may not properly cure.
- The tamper evidence label should be placed so that the one half of the label covers the enclosure and the other half covers the 7206 VXR NPE-400 Input/Output Controller.
- The tamper evidence label should be placed over the Flash PC Card slots on the Input/Output Controller.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the port adapter slot 1.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the port adapter slot 2.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the port adapter slot 3.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the port adapter slot 4.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the port adapter slot 5.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the port adapter slot 6.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the network processing engine.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the power supply plate.
- The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the redundant power supply plate.

The labels completely cure within five minutes.

Figure 4 shows the tamper evidence label placements.

Figure 4 Tamper Evidence Label Placement





The tamper evidence seals are produced from a special thin gauge vinyl with self-adhesive backing. Any attempt to remove port adapters or service modules will damage the tamper evidence seals or the painted surface and metal of the module cover. Since the tamper evidence labels have nonrepeated serial numbers, the labels can be inspected for damage and compared against the applied serial numbers to verify that the module has not been tampered with. Tamper evidence labels can also be inspected for signs of tampering, which include the following: curled corners, bubbling, crinkling, rips, tears, and slices. The word “Opened” can appear if the label was peeled back.

Note The Cisco 7206 router supports the following FIPS-approved algorithms: DES, 3DES, and SHA-1. These algorithms received certification numbers 74, 17, and 26 respectively.

Cryptographic Key Management

The router securely administers both cryptographic keys and other critical security parameters such as passwords. The tamper evidence seals provide physical protection for all keys. Keys are also password protected and can be zeroized by the crypto officer. Keys are exchanged manually and entered electronically via manual key exchange or Internet Key Exchange (IKE).

Self-Tests

In order to prevent any secure data from being released, it is important to test the cryptographic components of a security module to insure all components are functioning correctly. The router includes an array of self-tests that are run during startup and periodically during operations. The self-test run at power-up includes a cryptographic known answer test (KAT) on the FIPS-approved cryptographic algorithms (DES, 3DES), on the message digest (SHA-1), and on the Diffie-Hellman algorithm. Also performed at startup are software integrity test using an EDC, and a set of Statistical Random Number Generator (RNG) tests. The following tests are also run periodically or conditionally: a bypass mode test performed conditionally prior to executing IPSec, a software load test for upgrades, and the continuous random number generator test. If any of these self-tests fail, the router transitions into an error state. Within the error state, all secure data transmission is halted and the router outputs status information indicating the failure.

Secure Operation of the Cisco 7206 VXR NPE-400 Router

Cisco 7206 VXR NPE-400 router meets all the Level 2 requirements for FIPS 140-1. Follow the setting instructions provided below to place the module in FIPS mode. Operating this router without maintaining the following settings will remove the module from the FIPS approved mode of operation.

Initial Setup

- The crypto officer must apply tamper evidence labels as described in the "Physical Security" section of this document. The crypto officer must securely store tamper evidence labels before use, and any tamper evidence labels not used should also be stored securely.
- Only a crypto officer can add and remove port adapters. When removing the tamper evidence label, the crypto officer should remove the entire label from the router and clean the cover of any grease, dirt, or oil with an alcohol-based cleaning pad. The crypto officer must reapply tamper evidence labels on the router as described in the "Physical Security" section in this document.

System Initialization and Configuration

- The crypto officer must perform the initial configuration. The IOS version shipped with the router, version 12.1(9)E, is the only allowable image. No other image can be loaded.
- The value of the boot field must be 0x0101 (the factory default). This setting disables the break from the console to the ROM monitor and automatically boots the IOS image. From the **configure terminal** command line, the crypto officer enters the following syntax:

  config-register 0x0101

- The crypto officer must create the "enable" password for the crypto officer role. The password must be at least 8 characters and is entered when the crypto officer first engages the **enable** command. The crypto officer enters the following syntax at the "#" prompt:

  enable secret [*PASSWORD*]

- The crypto officer must always assign passwords (of at least 8 characters) to users. Identification and authentication of the console port is required for users. From the **configure terminal** command line, the crypto officer enters the following syntax:

  line con 0

  password [*PASSWORD*]

  login local

- The crypto officer shall only assign users to a privilege level 1 (the default).
- The crypto officer shall not assign a command to any privilege level other than its default.
- The PCMCIA Flash memory card slot is not configured in FIPS mode. Its use is restricted via tamper evidence labels. See the "Physical Security" section for more details.

Non FIPS-Approved Algorithms

- The following algorithms are not FIPS approved and should be disabled:
  - RSA for encryption
  - MD-5 for signing
  - AH-SHA-HMAC
  - ESP-SHA-HMAC
  - HMAC SHA-1

Protocols

- The following network services affect the security data items and must not be configured: NTP, TACACS+, RADIUS, Kerberos.
- SNMP v3 over a secure IPSec tunnel can be employed for authenticated, secure SNMP Gets and Sets. Since SNMP v2C uses community strings for authentication, only gets are allowed under SNMP v2C.

Remote Access

- Auxiliary terminal services must be disabled, except for the console. The following configuration disables login services on the auxiliary console line.

  line aux 0

  no exec

- Telnet access to the module is only allowed via a secure IPSec tunnel between the remote system and the module. The crypto officer must configure the module so that any remote connections via telnet are secured through IPSec.

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at the following sites:

- http://www.cisco.com
- http://www-china.cisco.com
- http://www-europe.cisco.com

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The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

Contacting TAC by Telephone

If you have a priority level 1 (P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

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