Cisco AS5400 Universal Gateway

THE CISCO AS5400 UNIVERSAL GATEWAY IS THE HIGHEST-DENSITY, CARRIER-CLASS ACCESS SERVER ON THE MARKET, OFFERING UNPARALLELED CAPACITY IN ONLY TWO RACK UNITS (2RUS). ITS HIGH DENSITY (UP TO 1 CT3 OR 14,112 PORTS IN A 7' RACK), LOW POWER CONSUMPTION (6.6A AT 48 VOLTS DC PER CT3), AND UNIVERSAL PORT READINESS MAKE IT IDEAL FOR MANY NETWORK DEPLOYMENT ARCHITECTURES, ESPECIALLY COLOCATION ENVIRONMENTS AND MEGA-POINTS OF PRESENCE (MEGA-POPS).

The Cisco AS5400 offers Signaling System 7 (SS7) media gateway interoperability and supports a wide range of Internet protocol (IP)-based value-added services such as wholesale dial, access Virtual Private Network (VPN), and mobile wireless solutions. As a carrier-class access server, the Cisco AS5400 has hot-swappable cards, an internal redundant power supply, and environmental monitoring. Its rich set of Cisco IOS® features enables Internet service providers (ISPs) and enterprise network managers to meet traditional dial-in needs, while supporting the migration to New World technologies.

By providing the industry's broadest family of access-server products, Cisco enables customers to pick the right starting point for a "pay-as-you-grow" rollout without compromising future capabilities. Complemented by the industry's highest-rated service and support, Cisco can also provide assistance with startup, maintenance, and marketing tasks, as well as advanced and custom solutions. (See figure 1.)

Figure 1 Cisco AS5400

Key Features

Capacity

The Cisco AS5400 supports E1, T1, and CT3 native interfaces. The Cisco AS5400 supports from 192 to 648 modem calls in T1 countries, or from 240 to 480 calls in E1 countries.

High Availability

The Cisco AS5400 is designed to meet the high-availability requirements found in carrier-class environments. Redundancy, hot sparing and environmental monitoring features allow the Cisco AS5400 to reach 99.9987-percent uptime.

Modem and voice digital signal processors (DSPs) are pooled and can be configured as hot spares. Because DSPs are allocated on a call-by-call basis, a DSP failure will not cause a DS0 or B channel to be left without a DSP to terminate the call. This prevents the occurrence of "holes" (unused channels) within a hunt. Having spare DSPs in the pool also allows DSP code to be updated without affecting active calls.

Hot-swap on all cards allows hardware maintenance to be performed on an active access server with little or no service interruption. During a hot-swap, any card may be removed, inserted, or replaced, and only the calls on the card being removed are affected. Similarly, the power supplies are load sharing and fully redundant with separate power feeds. In the unlikely event of a power supply failure, the second power supply can run the entire platform without interrupting existing calls.

Redundant AC or DC power supplies are provided with a mean time between failure (MTBF) of over 1,000,000 hours. Each power supply has redundant fans as well as internal protection features. Operational parameters are all monitored via internal sensors to the power supplies, and alarm status is provided to the system. Power-supply configuration adjusts automatically to system changes, allowing systems operations to continue without interruption.

Three redundant methods are included by default on the Cisco AS5400 that can be used to backhaul traffic from the server to the network. The first method uses the two Fast Ethernet ports. These can be configured to run different types of traffic on each link or use the Hot Standby Router Protocol (HSRP) in a redundant mode for increased reliability. The second method utilizes the two 8-MB serial ports. These ports support all of the Cisco serial routing protocols for flexibility in connecting to remote networks. The third method is achieved by using one or more of the T1/E1 trunks for backhaul instead of inbound calls. This can be done on either the T1/E1 cards or the CT3 card with part of the T3 provisioned for inbound and part for backhaul.

The Cisco AS5400 chassis provides four high-capacity fans with front-to-back airflow that cool the chassis when fully loaded. Thermal sensors monitor the inlet and outlet temperatures and temperature rise across each card. If the operating temperature of the system exceeds its maximum, the thermal sensors initiate a shutdown of the dial feature cards (DFCs), starting with the modem cards and finishing with the trunk cards. The trunk cards are shut down last, so the system has a chance to recover before putting the trunks into alarm status at the central office. If the system continues to exceed its maximum operating temperature, the thermal sensors initiate a shutdown, preventing damage to the unit and protecting its surrounding environment from excess heat.

NEBS/ETSI Regulatory Compliance

The Cisco AS5400 complies with Network Equipment Building System (NEBS) Level 3 requirements, as defined by Telcordia SR-3580 and European requirements by the European Telecommunication Standards Institute (ETSI).

Rich Protocol Support

The Cisco AS5400 takes advantage of the full-feature richness and strong routing capabilities of Cisco IOS software. The Cisco AS5400 can be deployed in a variety of architectures, from multiprotocol corporate networks to service-provider IP networks. In addition, the Cisco AS5400 fully supports the specialized needs of AOL, MSN, and other content-oriented dialup services through Point-to-Point Protocol (PPP), Layer 2 Tunneling Protocol (L2TP) or "TCP-Clear" connections.

Manageability

The Cisco AS5400 has a wide range of console and Simple Network Management Protocol (SNMP) management tools designed to reduce operations costs. The console management features include a comprehensive set of debugging commands that can be enabled on a specific calling line identification (CLID) or automatic number identification (ANI), called number dialed-number identification string (DNIS), per user or per interface to immediately isolate only the relevant debugging output.

The SNMP management capability includes a rich call-tracking SNMP Management Information Base (MIB) that provides highly detailed records for active and historical calls, with a configurable call history buffer. Call records can also be obtained via syslog or Remote Access Dial-In User Service (RADIUS) as an alternative to polling via SNMP. Call records include modem connect rate, connect duration, disconnect codes, end-to-end delay, and line statistics. This information allows service providers (SPs) to debug problems for individual users. Wholesale dial SPs can use this performance management data to establish service-level agreements (SLAs) with their retail ISP customers.

Security Management

Cisco IOS software security features allow authorized users dial access while preventing access to intruders. These features include: multilevel password protection, user authentication such as Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP), access control lists (ACLs), IP address spoofing prevention and logging, and support of the industry-standard authentication, authorization and accounting (AAA) protocols, RADIUS, and Terminal Access Controller Access Control System (TACACS+).

SS7/C7 Integration

SPs around the world are deploying Cisco access servers with SS7 or Common Channel (C7) interfaces. With SS7, carriers realize immediate benefits of improved scaling, reduced network costs, and faster time to market. The Cisco SS7 solution, implemented through the Cisco SC2200 signaling controller, also guarantees investment protection in existing Cisco access servers while providing a smooth migration to IP packet telephony.

The Cisco SC2200 signaling controller provides signaling connectivity to the SS7 network and provides all the functions for signaling and SS7 network management. The access servers provide digital interoffice trunk interfaces for completion of the calls. Control traffic is logically separated from management and customer data, to provide greater security and reliability. Resource management, call control, and system health monitoring complement SS7 to facilitate network scalability. The SC2200 can be at a centralized location, or distributed.

In order to connect to the Public Switched Telephone Network (PSTN) as a network element, the Cisco solution supports two- and four-wire continuity check (COT), and milliwatt test calls at the access server. Time Division Multiplexing (TDM) hairpinning (Drop & Insert) plus network-side ISDN functionality provide a means of grooming incoming traffic and passing selected calls to external devices, such as private branch exchanges (PBXs), test sets, or voice-over-IP (VoIP) gateways.

Full Cisco IOS Support

The Cisco AS5400 has two software image options. The first is the IP Plus feature set, which is the full Cisco IOS enterprise feature set with all non-IP functions removed (for example, Internetwork Packet Exchange [IPX], AppleTalk, Systems Network Architecture [SNA], and so on). This image provides a complete palette of software functions to enable rapid deployment of feature-rich IP services using the Cisco AS5400, including key features such as full RADIUS support (standard Internet engineering Task Force [IETF] plus vendor-proprietary extensions not provided by Cisco), L2TP, Quality of Service (QoS), extended ACLs, AOL, and Prodigy support.

The second Cisco AS5400 image is the Enterprise Plus feature set, which includes support for all protocols (IP, IPX, AppleTalk, and so on) as well as the palette of software functions found in the IP Plus image.

VoIP Support

Voice will be supported in a future release of software.

Multivendor Back-Office Integration

The Cisco AS5400 supports RADIUS and TACACS+ protocols for back-office integration, control, and security. In addition to supporting the IETF-defined RADIUS attributes, Cisco IOS software supports many vendor-proprietary RADIUS attributes for both preauthentication and user authentication. This means that the Cisco AS5400 can be integrated into any multivendor remote-access network with no changes to the back-office systems.

Worldwide Certification

The Cisco AS5400 is homologated worldwide with all major T1 and E1 switch types. For ISDN Primary Rate Interface (PRI), the switch types and feature sets supported are listed in Table 1.

Table 1 Supported Switch Types and Features

Supported Switch Hardware	Supported Software	Supported Feature of Interest
5ESS (Lucent)	PRI custom and NI-2, Net5, NTT	NFAS with NI-2
4ESS (Lucent)	PRI custom	NFAS
DMS 100 (Nortel)	PRI custom	NFAS
DMS 250 (Nortel)	PRI custom	NFAS
GTD5 (GTE)	PRI custom and NI-2	NFAS with NI-2
AXE (Ericsson)	PRI custom and NI-2	NFAS with NI-2
EWSD (Siemens)	PRI custom and NI-2	NFAS with NI-2

Cisco IOS Software Enables Rich Services

AOL Support

The Cisco AS5400 offers 100-percent coverage for dedicated AOL dial installations, as well as other services that utilize the "TCP-Clear" or "autocommand Telnet" method of carrying dialup data. "DNS round robin" is also supported to allow load balancing of connections across multiple AOL hosts. The Cisco AS5400 also includes all the Layer 2 Tunneling Protocol (L2TP) features necessary to support AOL 6.0 clients and later.

Access VPN

Virtual Private Networks

The Cisco AS5400 is ideally suited to providing wholesale dial services to both large corporations and ISPs who do not want to support their own dial pools.

With support for VPNs in Cisco IOS software, SPs can take advantage of their existing infrastructures to deliver local dialup access for users of enterprise networks. By providing virtual dialup solutions, SPs can offer a full range of services closer to the remote user. Local calls can now be placed to gain access to the core infrastructures. Virtual dialup services not only attract more users of this service, but because calls are terminated locally, long-distance charges are eliminated and infrastructure costs are reduced.

VPN Provisioning and Accounting

Of importance to SPs in the VPN environment is the need to both provision and account for the number of connections that are allowed by VPN customers. The Cisco virtual private dialup network (VPDN) session counting software can keep track of the number of connections from the Cisco AS5400 to the user's home gateway. This software is provided in Cisco IOS software running on the Cisco AS5400 and in the Cisco access control server (ACS) to provide comprehensive accounting and billing information to ISPs about the virtual connections that their customers make.

Wholesale Dial

Many ISPs and content providers (or "portals") must provide dialup Internet access as part of their service package, and enterprise companies want to offer "private-label" Internet access to promote their brand. However, they do not have the experience, personnel, or time and money to build out a dialup access infrastructure, or they cannot build it fast enough—particularly when expanding into new regions. SPs can now take advantage of this opportunity through the Cisco wholesale dial solutions.

The Cisco wholesale dial outsourcing solution delivers "virtual port" capability across any number of Cisco remote-access servers. Coupled with sophisticated port policy management that guarantees port availability to wholesale customers, Cisco enables carriers and ISPs to offer unique service offerings that drive incremental revenue while holding down operations costs.

Service-Level Management

The Cisco AS5400 supports Cisco Resource Pool Management (RPM). This enables SPs to offer guaranteed dial port availability across shared dial infrastructure, thereby allowing SPs to guarantee service levels to their customers. In addition, RPM offers the ability to ensure "fairness" across multiple customers for the same shared dial ports when there is no service-level guarantee, and it also enables the Cisco AS5400 to support a form of ISDN tariff arbitrage known as "data over voice bearer service" (DOVBS).

Resource pooling can be configured on a per-AS5400 or per-network basis. In the former case, customer profiles stored on the Cisco AS5400 determine how resources are allocated to each of the wholesale dial service provider's customers. Each customer is identified based on a list of dialed numbers (DNIS). When network-wide service levels are required, external Cisco Resource Pool Management Server (RPMS) software running on a Sun Solaris server holds the customer profiles and keeps track of port utilization across multiple Cisco AS5x00s. The Cisco AS5400 queries the RPMS when a new call is presented, and the RPMS makes its determination of whether the call should be accepted based on network utilization and the profiles for each customer.

DOVBS is used in areas where ISDN data calls are charged at a higher rate (or tariff) than ISDN voice calls. The ISDN customer provided equipment (CPE) device (terminal adapter or router) must support DOVBS operation—the majority of popular ISDN devices available today support DOVBS. The ISDN CPE device is programmed to signal all

ISDN data calls as voice calls, so that these calls will be billed at the lower voice rate. RPM on the Cisco AS5400 is used to configure a customer profile for DOVBS calls based on the called number (DNIS). This profile configures the Cisco AS5400 to treat all calls received on that number as ISDN data calls, even if they are signaled as voice calls by the PSTN network.

Table 2 Features and Benefits of Cisco AS5400

Feature	Benefit
• High Density – Up to 648 modem ports in a single system	• High density creates a single administrative domain • Growth potential protects investment without incurring large initial costs
• High-speed processor with Level 3 caching	• Enables the Cisco AS5400 to easily sustain 648 concurrent modem sessions at line speed
• Scalable chassis with Multichassis Multilink PPP capable of carrying increased density and higher-speed traffic	• Allows customers to start small and stack additional servers as required, while still being able to bond B channel across one telco hunt group
• Hot-swap • Three redundant backhaul methods • Redundant power supplies and power feeds • Redundant modems • Thermal management and redundant fans	• Improves network and service availability, reducing time and money lost because of outages • Ensures system availability of 99.9987-percent
• Wide-Area Network (WAN) optimization, including: – Compression – Routing filters – Snapshot routing • Dial-on Data Routing (DDR)	• Helps customers to reduce WAN costs, the single largest cost of internetwork operation
• Application-Specific support, including: – AOL traffic – MSN traffic – Compuserve traffic – Prodigy traffic	• Provides functionality necessary to carry special types of traffic for wholesale dial applications
• Extensive console commands • Call tracker MIB and console extensions • Conditional debug features • Syslog functions	• Reduces problem detection and resolution time • Reliable collection of statistics improves network planning, reducing operating costs
• Security management, including: – RADIUS – Access lists – TACACS+ – Antihacking/spoofing features – Violation logging	• Provides comprehensive security throughout customer's core network infrastructure
• Integrated CSUs, router, and modems accommodate ISDN PRI T1/E1 trunks as well as Channelized T1/E1 trunks	• Terminates asynchronous modem and digital ISDN calls with one phone number and allows a simple, cost-efficient migration path from today's analog dialup environment to the fast-growing ISDN digital services
• Full Cisco IOS support	• Differentiates dial services • Provides the widest array of networking and routing protocol support in the industry for large-scale deployment • Offers full range of call-termination protocols • End-to-end Cisco IOS software simplifies operations, reduces training costs, and improves reliability

Cisco AS5400 Architecture

The Cisco AS5400 provides all the system components that SPs have come to expect from carrier-class products as well as all the routing, WAN, and QoS features that are the hallmark of Cisco routing products. The main CPU in the Cisco AS5400 is the QED RM7000. This is the same high-performance processor used in the Cisco 7206 VXR series router platforms. A Cisco dial feature card (DFC) contains DSPs, trunk interfaces, or any other functionality required on an access server. The Cisco AS5400 architecture uses distributed processing between the DFCs and the motherboard to optimize the processing path for unparalleled performance.

Egress Interfaces

The Cisco AS5400 provides three redundant WAN backhaul methods for moving packets out to the network:

- Two Fast Ethernet (FE) ports
- Two 8-MB serial ports
- Multiple T1, E1, or CT3 DS1 trunks

Ingress Interfaces

The Cisco AS5400 accepts and consolidates all types of remote traffic, including dial-in analog, digital ISDN, and wireless Global System for Mobile Communication (GSM) V.110 calls. The Cisco AS5400 currently supports two ingress types:

- Channelized T3 termination
- Eight-port CT1/CE1/PRI termination

Cisco AS5400 CT3 Termination Card

Cisco provides the CT3 card for high-density PSTN connectivity. This card provides a maximum of 672 channels via a single CT3 connection. This card is valuable to any customer who wishes to reduce the amount of cables required to deliver 672 channels and take advantage of lower tariffs associated with purchasing a single CT3 circuit versus 28 individual T1 circuits. The CT3 card provides a standards-based M13 multiplexer in conjunction with resources to terminate up to 28 T1s.

Configuration of any T1 interface contained within the CT3 interface can be provisioned independently of other CT1 interfaces included within the same CT3 facility. Users can configure the CT3 card to carry ISDN PRI trunks (each connected to a different switch type), and a variety of North American robbed-bit signaling (RBS) types such as "loop-start" and "ground-start," all on the same Cisco AS5400 platform. Configuring the CT3 interface and accompanying PRI/T1 trunks can be performed using the standard Cisco IOS Command-Line Interface (CLI).

The CT3 card can be used for both ingress and egress at the same time. An example configuration would be to use 22 T1 circuits for inbound traffic and 6 T1s for outbound backhaul. This would allow the Cisco AS5400 to provide a large density of modems in a remote Point of Presence (POP) environment, with only a power cable and a CT3 line running to the server.

Following is a brief description of the CT3 interface type and PRI/T1 trunk types supported:

- T3 (44.736 Mbps) links default to binary 3 zero substitution (B3ZS) line encoding and C-bit framing. Physical connection to a T3 circuit is provided on two standard 75-ohm, unbalanced, female BNC connectors.
- T1/PRI (1.544 Mbps) links are supported as described in the following section on the 8-Port E1/T1 card. E&M, loop-start, and ground-start links are all supported.
- Universal access (analog modem or digital calls) is supported when an individual 1.544-Mbps interface contained within the CT3 circuit is configured for ISDN PRI signaling. PRI signaling is available on all 1.544-Mbps trunks. Up to a maximum of 248 individual B channels total may be terminated per CT3 card.
- Nonintrusive monitoring of individual T1/PRI signals is available at the front of the CT3 card via standard 100-ohm bantam jacks.

Figure 2 CT3 Termination Card

Cisco AS5400 Eight-Port T1/E1 Termination Card

When provisioned for Channelized E1 trunks, the card provides physical termination for up to eight E1 R2, PRI, or inter-machine trunks (IMTs). When provisioned as a Channelized T1 trunk card, it provides physical termination for up to 8 T1 channel-associated signaling (CAS), PRI, or IMT trunks, and includes channel service units (CSUs) that connect directly to the telco network. Nonintrusive monitoring of individual T1/E1 signals is available at the front of the T1/E1 termination card via standard 100-ohm bantam jacks.

The Cisco AS5400 configured with two eight-port interface cards can terminate 16 T1 or E1 trunks. Any of the interface ports on these trunk cards can be configured independently of any other interface. Therefore, users can configure a variety of North American T1 trunks, European E1 trunks, and ISDN PRI trunks (each connected to a different switch type), all within the same Cisco AS5400 platform. The standard Cisco IOS CLI can be used to configure each trunk.

The following is a brief description of the trunk types supported.

- North American RBS is supported on T1 trunks, including a variety of North American RBS protocol, framing, and encoding types on these trunks.
- CAS is supported for E1 trunks, with R2 signaling.
- IMT is supported when used with an SS7 signaling controller.
- Many countries require an E1 R2 variant. Per-country defaults are provided for supervisory and inter-register signaling.
- Universal access (analog modem or digital calls) is supported when an interface is configured for ISDN PRI signaling. PRI signaling is available for both T1 and E1 trunks.
- Nonintrusive monitoring of individual T1/PRI signals is available at the front of the CT3 card via standard 100-ohm bantam jacks.

Switch types supported and their features are listed in Table 1.

Figure 3 Cisco AS5400 Eight-Port T1/E1 Termination Card

Cisco AS5400 108-Port Modem Card

Cisco AS5400 108-port modem card is a full-featured DSP-based card that supports either 108 modem or GSM calls. Modem management features are available for troubleshooting, including modem status, real-time call-in-progress statistics, modem activity log, hard/soft busy out, and modem firmware upgrade. Additional information can be obtained through the console, SNMP, or RADIUS accounting via the call tracker feature.

Figure 4 Cisco AS5400 108-Port Modem Card

Table 3 Cisco AS5400 System Data

Feature	Benefit
Processor Type	• 250-MHz RM7000 RISC processor
Demonstrated Speed	• 50,000 packet-per-second fast switching
Memory	• 256-512-MB SDRAM • 64-128-MB Shared I/O • 8-16-MB Boot Flash • 32-64-MB System Flash • 2-MB Level 3 Cache
Maximum Supported Calls	• 648 modem calls or 248 ISDN calls (CT3) • 480 modem or ISDN calls (E1) • 384 modem or ISDN calls (T1)
DFC Slots	• Seven slots
DFC Trunk Cards	• CT3 DFC • Eight T1/E1/PRI DFC
DFC DSP Card	• 108-modem DFC
Egress Ports	• Two 10/100-MB Ethernet ports • Two 8-MB serial ports • T1, E1, or CT3 DS1 trunks
Modem Protocols Supported	• V.90 standard supporting rates of 56000 to 28000 in 1333-bps increments • Fax out (transmission) Group 3, standards EIA 2388 Class 2 and EIA 592 Class 2.0, at modulations V.33, V.17, V.29, V.27ter, and V.21 • K56Flex at 56000 to 32000 in 2000-bps increments • ITU-T V.34 Annex 12 at 33600 and 31200 bps • ITU-T V.34 at 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400 bps • V.32bis 14400, 12000, 9600, 7200, 4800; V.32 9600, 4800; V.22bis 2400, 1200; V.21 300; Bell 103, 300; V.22 1200; V.23 1200/75 • ITU-T V.42 (including MNP 2-4 and LAPM) error correction • ITU-T V.42bis (1K nodes) and MNP 5 data compression • Async mode PPP
ISDN Protocols Supported	• Sync mode PPP • V.120 • V.110 at rates up to 38400 bps • Network-side ISDN • User-side ISDN
Wireless Protocols Supported	• V.110 • MNP10EC
Console and Auxiliary Ports	• Asynchronous serial (RJ-45)
Power-Supply Options	• Dual redundant internal AC power supply • Dual redundant internal DC power supply

Table 4 Cisco AS5400 Environmental Data

Feature	Benefit	
NEBS Certification	Telcordia SR-3580	Level 3 certification based on usage and critical nature of equipment
ETSI Certification	• ETS 300386-2 • ETS 300 019 (series)	• EMC in public telecommunications centers • Mechanical/environmental requirements
Normal Operating Conditions		• 0 to 40 C • 200- to 10,000-ft. elevation
Safety Certifications	• UL 1950, third edition • CSA 950, third edition • EN 60950, with amendments 1, 2, and 3 • IEC 950 • AS/NZS 3260 • TS 001	
Electromagnetic Emissions Certifications	• EN 55022B • NZ/AS3548B • VCCI II • FCC A	
Immunity Certifications	• 1000-4-2 (electrostatic discharge) • 1000-4-3 (radiated emissions) • 1000-4-4 (electrical fast transients) • 1000-4-5 (surge) • 000-4-6 (conducted emissions)	Level 3 standalone
Environmental Specifications	• Heat dissipation	• 683–870 Btu/hr
	• AC power cable supplied, dual cables for redundant version	• 12 American wire gauge (AWG), 15 amp IEC standard cable
	• DC	• 12 AWG, 2 pairs (black and red)
	• Storage temperature	• 25.8 to 185 F (-40 to 85 C)
	• Operating temperature (air inlet to power unit)	• 20 to 50 C airfbw front to back
	• Acoustics	• 60 dBA typical; sound pressure level at 1m
	• Humidity (noncondensing)	• 5 to 95 percent
	• Altitude	• 200 to 10,000 ft.
	• Reliability (at 40 C, 200 VAC, 1600W)	• 7500 FITS per TR-EOP-000332 • 1.5 x 105 hours MTBF per RIN

Table 5 Cisco AS5400 Mechanical Data

Dial Shelf	• Dimensions (H x W x D) • Weight	• 3.4 x 17.5 x 18.25 in. • 32 lb (12 kg)

Table 6 Cisco AS5400 Input AC and DC Power Supply Specifications

Input Description	Input Specifications
Typical Input Power Requirement	• 175-320 watts, both AC and DC units
Input Voltage (DC unit)	• -48 volts nominal, 72 volts maximum
Typical Input Current (DC unit)	• 3.6-6.6 amps[1, 2]
Input Voltage (AC unit)	• 100 to 240 VAC
Typical Input Current (AC unit)	• 2.0- 3.0 amps[2]
Input Frequency (AC unit)	• 50 to 60 Hertz • CISPR Class B, EN55022 Class B, with 6 dB
Power Factor (AC unit)	• 0.850 at 50 percent of full load; 0.90 at full load
Electromagnetic Compatibility (EMC) Conducted Standalone	• CISPR Class B, EN55022 Class B, with 6 dB of margin, standalone
EMC (conducted and radiated, in power shelf)	• When used in conjunction with PS3000A2-211, meets CISPR Class B with 6 dB margin

1. Power is shown with the normal set points inputs of 120VAC, -48 UDC. These are typical values.
2. Redundant power supplies will automatically configure input voltages on both AC and DC versions. Output load will be auto configured to share between redundant output modules; no user action is required. All power inputs are given as maximum load power. The maximum power is shown as a function of one redundant power supply in nonfunction mode, so that the system power can be maintained with one redundant unit.

Table 7 Cisco AS5400 Output AC and DC Power Supply Specifications

Output Description (AC and DC units)	Output Specifications
Power Output (4)	• 3.3 volts, 5.0 volts, + and –12 volts
Power Output (watts)	• 300 watts maximum system load (DC load)[1]
Output Current Limit (peak)	• 350 watts at load, any combination of above voltages and current; units have internal protection
Efficiency (AC and DC units)	• 67-75 percent load[2]

1. Maximum DC load for system cards, DC power will not exceed 300 units.
2. 67-percent at half load.

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