

ALCATEL-LUCENT 1830 PHOTONIC SERVICE SWITCH-1 / ALCATEL-LUCENT 1830 PHOTONIC SERVICE SWITCH-4

RELEASE 5.0

The Alcatel-Lucent 1830 Photonic Service Switch (PSS)-1 and Alcatel-Lucent 1830 PSS-4 represent a new type of photonic switching access platform for metro Wavelength Division Multiplexing (WDM). Implementing Zero-Touch Photonics, they transform traditional WDM into a cost-effective, low footprint and fully flexible transport layer with complete visibility and control of individual wavelengths. This transformation simplifies broadband service delivery, speeds time-to-revenue generation and facilitates bandwidth expansion in optical transport network (OTN)-based metro access networks and provides highly secure, multiprotocol capable, low latency and resilient optical Data Center Connect (DCC) with a Key Management Tool (KMT). The 1830 PSS-1/PSS-4 are key members of the 1830 PSS portfolio serving applications that span access, metro/regional, and long-haul networks.

The Alcatel-Lucent 1830 PSS-4 has a two rack unit (RU) chassis with four slots available for service cards, the same cards supported by the Alcatel-Lucent 1830 PSS-16 and the Alcatel-Lucent PSS-32 (see Figure 1). The Alcatel-Lucent 1830 PSS-1 is a compact, one RU customer premises equipment (CPE), hardened for outdoor deployment and available in different fixed configurations.

APPLICATIONS

The Alcatel-Lucent 1830 PSS-1/PSS-4 supports the transport and delivery of multiple services in a variety of environments:

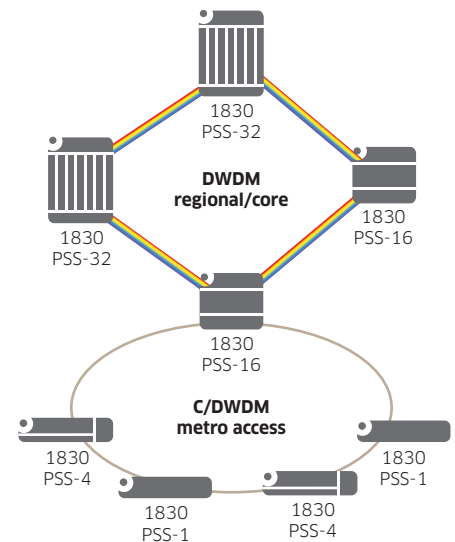
- Transport networks for service providers to aggregate Synchronous Digital Hierarchy/Synchronous Optical Network (SDH/SONET), IP/MPLS, mobile broadband (xDSL, passive optical network [PON]) traffic
- Metro network extension to the customer premises through cost-effective Coarse Wavelength Division Multiplexing/Dense Wavelength Division Multiplexing (CWDM/DWDM) technology up to 10G
- Campus networks for data center protection or data sharing for organizations such as universities, hospitals, banks and airports
- Multi-campus networks for cooperation among public and private companies and optimization of leased dark fiber

- Metropolitan or national research networks that can be combined with the Alcatel-Lucent 1830 PSS-16/PSS-32 to extend these networks to regional distances
- New encryption transponder for DCC, offers high security for sensitive data transport over both private and community clouds.

KEY BENEFITS

- Extension of the Alcatel-Lucent 1830 PSS product family to the customer premises
- Cost-effective, small footprint and low power consumption
- Deployment flexibility: Compact and temperature hardened for outdoor installation
- A variety of client interfaces with high port density to maximize wavelength efficiency
- Support for cost-effective multiplexing of any bit-rate services and transport over optical transport unit (OTU)-1/OTU-2
- Optical Data Unit (ODU)k switching capability
- Terminal, Fixed Optical Add/Drop Multiplexer (FOADM) or In-line Amplifier (ILA) applications
- Strong forward error correction (FEC) technology based on OTN to improve system performance and optical link budgets

Figure 1. Alcatel-Lucent 1830 PSS-1/PSS-4 for metro WDM



COMMON FEATURES

Optical-layer intelligence

- Ring, bus and point-to-point network topologies support
- Single fiber bidirectional line transmission (CWDM)

Scalability

- Pluggable client interfaces enable turning up interfaces based on traffic demand
- In-service network scalability without service disruption

Flexible protection options

- Diverse route protection
- E-SNCP within 50 ms

Integrated SLA support and monitoring

- Proactive service management for wavelength services
- G.709-compliant
- Flexible service level alarms

Carrier-class availability

- 99.999% availability
- CE, CSA, NEBS Level 1 and VCCI compliant
- Redundant power supply
- Temperature-hardened operation

Storage area networks (SAN)

- Brocade certification

Network management

- Full-featured operations, administration, maintenance and provisioning (OAM&P) functionality
- Alcatel-Lucent 1350 Optical Management System (OMS)
- Alcatel-Lucent 1340 Integrated Network Controller (INC)
- Alcatel-Lucent 1354 Photonic Manager (RM-PhM)
- Alcatel-Lucent 5620 Service Aware Manager (SAM)
- Interfaces: Web graphical user interface (GUI) and command-line interface (CLI)
- Transaction Language 1 (TL1)
- Simple Network Management Protocol (SNMP)
- Ethernet port for local access
- Integrated remote management through General Communication Channel (GCC) and Optical Supervisory Channel (OSC)
- Selectable rates for OSC: 100 Mb/s or 155 Mb/s
- Auto node discovery
- Alcatel-Lucent Advanced Engineering Planning Tool simplifies network design and system installation

1830 PSS-1 MODELS



1830 PSS-1 MSAH

- Client ports: 21 x E1 (75 ohm) plus 4 independent any-rate ports:
 - SDH: STM-1, STM-4 and STM-16
 - SONET: OC-3, OC-12 and OC-48
 - Fast Ethernet (FE), Gigabit Ethernet (GigE)
 - 1G Fiber Channel (FC), 2G FC and 4G FC
 - 1G Fiber Connectivity (FICON) and 2G FICON Express, ISC-3 peer mode
 - High-definition serial digital interface (HD-SDI)
 - Standard definition (SD)-SDI
 - DVB-ASI (270 Mb/s)
- Line ports: 2 x OTU-1/STM-1
- Up to 8 shelves stacked as one single network element; extension shelf support MD4H and MSAH mixed configuration
- Standard SDH/SONET mapping
 - E1, VC12, TUG2, TUG3, VC4, AU4
 - STM-16 and OC-48 to ODU1
 - Standard GigE to ODU0
 - Alternative proprietary mapping option for more efficient sub-ODU1 client grooming
- Support for provisional flexible multiplexing (1:2, 1:3 and 1:4) and transparent transport of any bit-rate services over OTU-1
- Up to 8 CWDM wavelengths
- Data communication network (DCN) access through LAN port



1830 PSS-1 AHP

- High-power, high-gain C-band optical amplifier with 20-dBm output and variable gain setting from 13 dB to 33 dB
- Auto power mode: Amplifier gain is adjusted automatically and dynamically
- Manual power mode
- Two stacked units serve as an ILA
- Stacked units can be managed by a single IP address
- OSC for remote management and auto node discovery
- Wavelength Tracker monitors and traces each wavelength



1830 PSS-1 GBEH

- Client ports: 12 x GigE (SFP)
- Line ports: 2 x 10GigE or 2 x OTU-2 (XFP)
- Integrated Layer 2 switching capability
- Supports full-rate and sub-rate Ethernet Virtual Private Line (EVPL) service with E-SNCP protection
- E-SNCP protection for intraboard traffic
- Committed Information Rate/Excess Information Rate (CIR/EIR) quality of service (QoS) control based on MEF 6.1
- Up to 8 CWDM wavelengths
- Support for sub-rate CIR Ethernet
- Synchronous Ethernet



1830 PSS-1 MD4H

- Dual muxponder boards, each supporting 4 client ports and 2 line ports
- Client ports: 4 independent any-rate ports
 - OC-3, OC-12 and OC-48
 - STM-1, STM-4 and STM-16
 - FE, GigE
 - 1G FC, 2G FC and 4G FC
 - 1G FICON and 2G FICON Express, ISC-3 peer mode
 - HD-SDI
 - SD-SDI
 - DVB-ASI (270 Mb/s)
- Line ports: 2 x OTU-1, 4.25 Gb/s
- Up to 8 shelves stacked as one single network element; extension shelf support MD4H and MSAH mixed configuration
- Mapping:
 - Standard STM-16 and OC-48 to ODU1
 - Standard GigE to ODU0
 - Alternative proprietary mapping option for more efficient sub-ODU1 client grooming
- Supports provisional flexible multiplexing (1:2, 1:3 and 1:4) and transparent transport of any bit-rate services over OTU-1
- Up to 8 CWDM wavelengths
- DCN access through LAN port
- EMC Certification for storage applications

1830 PSS-4 KEY FEATURES



1830 PSS-4

- 2 RU chassis, 4 full slot (full height)
- Support for field replaceable circuit packs
- 60G slot capacity
- Support for:
 - Standard mapping: GigE, AU3, AU4 and ODU0/1/flex
 - Alternative proprietary mapping option for more efficient sub-ODU1 client grooming
- Backplane add-drop multiplexer (ADM) and protection for adjacent service optical transponders (OTs)
- Temperature hardened for outdoor deployment
- Supports up to 8 CWDM or 32 DWDM wavelengths in ITU-T grid
- Support for single-fiber bidirectional line transmission (CWDM)
- Wavelength Tracker monitors and traces each wavelength
- Alien wavelength management
- Cascaded shelves managed as single element
- Synchronous Ethernet support
- Ethernet optical add-drop multiplexer (OAM) (CCM)
- ODUk switching and ODUk SNCP
- E-SNCP and Y-cable protection
- Supports AC and DC power supply mixed configuration
- Fan noise reducing by software enhancement on fan control
- Supports software download through CIT port
- Optical layer path tracing and power monitoring on a per-unique-wavelength service basis
- View of all wavelengths present on a selected fiber pair
- Integrated fault isolation and sectionalization at the optical layer
- Automated optical layer with dynamic power equalization
- Integrated fault correlation

Service cards

11QPEN4 – 11G Quad pluggable encrypted 4-client OT (R5.0)

- Full-slot card (full height)
- Supports all the 11QPA4 features plus the following additional features
- Client port: 4 x 10G (8G/10G FC, 10GigE LAN, OTU-2) (XFPs)
- Line port: 4 x 10G (OTU-2 line rate encrypted) (XFPs)
- AES256 block cipher with Counter Mode Encryption
- Low E2E latency (including encryption) < 15 microsecond
- Customer encryption algorithm as downloaded image
- Key Management Tool
 - Separation of “operation” and “crypto” functions
 - Key end-user management and control
 - Key generation
 - Automated or on-demand key rotation
 - Integration to centralized key management software
- 1+1 Client and line protection (Y-cable and OPS)
- Cascaded with 11DPM12/11DPE12 provides encrypted transmission for GigE, FC 100/200/400 services
- FIPS 140-2 Level 2 and CC certified (future release)
- Provides comprehensive security transport of sensitive data over both private and community clouds
- Applications:
 - Large enterprises/System Integrators (SI)
 - Network service providers (NSPs) or MSPs offering storage service to large customers
 - Community clouds
- **1DPP24M – STM-1 Dual pluggable, 21xE1/24xDS1 client OT**
- Half-slot card (half height)
- Client ports: 21 x E1/24 x DS1 (XFP)
- Line ports: 2 x STM-1/OC-3 (SFP)
- Supports SDH NE mode
- Terminal and facility loopback in client and line side
- Timing synchronization
 - Stratum 3 holdover capability
 - System timing derivable from STM-1 line signal or E1 clients; all E1s and STM-1 transmitters are locked to the system timing source
 - SSM generation and detection at STM-1 line port

- Fault monitoring
 - E1 interface: LOS, LOF, AIS, RAI
 - STM-1 interface: LOS, LOF, ExBER with fixed default threshold
- Performance monitoring
 - E1 per port: 15 min and 24 h near end CV/BBE, ES, SES, UAS
 - STM-1 port: 15 min and 24 h near end CV/BBE, ES, SES, UAS on RS
- E1 clients aggregation between adjacent cards (via backplane E1s from slave card aggregated to line L1 port of master card, point-to-point, no pass through from line to line within master card)
- Temperature hardened

4DPA2 – 4G Dual-port pluggable any-rate 2-client OT

- Half-slot card (half height)
- Client ports: 2 x OC-48/STM-16, 1GigE (SFP)
- Line ports: 2 x OC-48/STM-16, 1GigE (B&W, C/DWDM) (SFP)
- E-SNCP protection support for one client port
- Temperature range from -5°C to +55°C

MVAC – Multiple Variable Attenuator Card

- Half-slot card (half height)
- Unidirectional pack with 8 ports for adding and dropping alien wavelengths
- Conditions 8 alien wavelengths to pass through the TOADM system through
 - 8 x fast optical VOA
 - Wavelength Tracker encoders
- Supports unidirectional (single-strand) connections
- Adds alien wavelength passing through to the network for Wavelength Tracker encoding and monitoring
- Temperature range from -5°C to +55°C

11QPA4/11QPA4A – 11G Quad port tunable any-rate 4-client OT

- Full-slot card (full height)
- 4 independent multi-rate 10G channels
- Client ports
 - 4 x STM-64 and OC-192
 - 10GigE wide area network/local area network (WAN/LAN) PHY
 - OTU-2
 - 8G FC and 10G FC
- Line ports: 4 x OTU-2 with provisioning FEC (XFP)
- GCC0/GCC1/GCC2 support interworking with third-party WDM devices

- Operation mode: Add/Drop, Cross Reg, Drop_Continue (10GigE signal), add only (10GigE signal)
 - Protection: E-SNCP and Y-cable
 - Drop and continue for 10GigE service
 - Each channel independently supports unidirectional and bidirectional operation mode
 - Temperature hardened (11QPA4A)
 - Temperature range from -5°C to +55°C (11QPA4)
- 11DPE12 - Dual pluggable 12 x GigE OT**
- Full-slot card (full height)
 - 12 x GigE/FE (SFP) client ports
 - 2 x 10GigE or 2 x OTU2 (XFP) line ports
 - GCCO/GCC1/GCC2 support interworking with third-party WDM devices
 - Statistic Layer 2 multiplexing
 - Support for full-rate and sub-rate EVPL service with E-SNCP protection
 - Supports CIR/EIR provision range with 500 Mb/s step for the 10GigE line port (Q-in-Q)
 - E-SNCP protection for both intraboard and interboard traffic
 - E-SNCP via backplane cross connection and protection
 - Up to 32 flows E-SNCP based on APS_PCC (Q-in-Q)
 - Y-cable protection
 - CIR/EIR QoS control based on MEF 6.1
 - Ethernet OAM: Y.1731/802.1ag FM/PM
 - Cross-connection (ADM) between two mate 11DPE12 via backplane
 - Temperature hardened
- 11DPE12E - Dual pluggable 12 x GigE enhanced OT**
- Supported all of the 11DPE12 features and additional new features are as below:
 - Full-slot card (full height)
 - 12 x GigE/FE (SFP) client ports
 - 2 x 10GigE or 2 x OTU2 (XFP) line ports
 - GCCO/GCC1/GCC2 support interworking with third-party WDM devices
 - Up to 100 E-Line services per 10G line port (Q-in-Q)
 - Supports rate provision (CIR/PIR) in flexible increments up to full-port rates
 - 5 Mb/s steps from 10 Mb/s to 100 Mb/s
 - 50 Mb/s steps from 100 Mb/s to 1 Gb/s
 - 10G native LAN for interworking with 10G router (both line ports need to be 10GigE)
 - Q-in-Q tagging
 - Native 10GigE line support with FEC ASIC
 - Flexible SVLAN ID 2 to 4094
 - Cross-connection between two mate 11DPE12Es via backplane
- VLAN protection based on CCM/LOSPROP – 50 ms switching and protection < 32 flows
 - SVLAN Pop-pushing (10GigE line used as CIF)
 - OTN overhead alarm and PM; far-end PM; analog PM enhanced; pre/post-FEC BER monitoring
 - Full-rate and sub-rate EVPL: Q-in-Q
 - FEC type: RS FEC, EFEC, EFEC2 (Alcatel-Lucent)
 - Terminal or OADM/blade application
 - VLAN based CIR/EIR QoS (MEF 6.1)
 - Protection: E-SNCP in Q-in-Q and Y-cable; E-SNCP protection for two mate 11DPE12E
 - Single-fiber CWDM bidirectional line transmission (4 services per line)
 - Temperature hardened
- 4DPA4 - 4G Dual-port pluggable any-rate 4-client OT**
- Half-slot card (half height)
 - Client ports
 - 4 independent any-rate ports
 - OC-3, OC-12 and OC-48
 - STM-1, STM-4 and STM-16
 - FE, GigE
 - 1G, 2G and 4G FC
 - 1G and 2G FICON
 - HD-SDI
 - SD-SDI
 - DVB-ASI (270 Mb/s)
 - Line ports: 2 x OTU-1
 - Mapping
 - Standard STM-16/OC-48 to ODU1
 - Standard GigE to ODU0
 - Alternative proprietary mapping option for more efficient sub-ODU1 client grooming
 - Support for provisioning flexible multiplexing (1:2, 1:3 and 1:4) and transparent transport of any bit-rate services over OTU-1
 - Temperature hardened
- 11DPM12 - Dual-port pluggable multi-rate mux 12-client OT**
- Full-slot card (full height)
 - Client ports: 12 x any-rate ports
 - OC-3, OC-12 and OC-48
 - STM-1, STM-4 and STM-16
 - FE, GigE
 - 1G FC, 2G FC and 4G FC
 - 1G FICON and 2G FICON
 - OTU-1
 - HD-SDI
 - SD-SDI
 - 3G-SDI
- Line ports: 2 x OTU-2
 - GCCO/GCC1/GCC2 support interworking with third-party WDM devices
 - Support for both standard mapping (ODU0/1/flex) and proprietary sub-ODU1 mapping for clients
 - Code-transparent transport for GigE and clock-transparent for GigE, STM-1 and STM-4
 - 40G embedded ODUk matrix: Client/line/mate interconnection
 - Client and line side protection (E-SNCP); E-SNCP on drop and continue
 - ODUk SNCP
 - Y-cable protection for OC-3/12/48, STM-1/4/16, GigE
 - Proprietary mapping for STM-1/OC-3 and STM-4/OC-12
 - Proprietary cascading
 - ADM on a blade implementation
 - Flexible grooming
 - Add/drop of services around the ring created with 12 x any muxponder cards
 - Drop and continue support for GigE and HD-SDI, SD-SDI
 - Interworks with 4DPA4 muxponder for:
 - STM-1, STM-4 and STM-16
 - OC-3, OC-12 and OC-48
 - GigE
 - 1G FC and 2G FC
 - HD-SDI
 - E-FEC with more than 9.2 dB OSNR gain
 - Pluggable Wavelength Tracker encoder and slow eVOA for automatic power adjustment
 - Facility and terminal loopbacks
 - Digital performance monitoring
 - SDH/SONET
 - ODU and OTU path and section
 - 8B CV and 10B CV
 - GigE statistics
 - FEC-based PM for OTN client and line
 - Temperature hardened
- Optical amplifier cards**
- AHPHG**
- C-band amplifier in a full-slot card
 - Output power: 20 dBm
 - Input power: -30 dBm to +7 dBm
 - Variable gain from 13 dB to 29 dB
- A2325A**
- C-band amplifier in a full-slot card
 - Output power: 23 dBm
 - Input power: -33 dBm to +7.5 dBm
 - Variable gain from 16 dB to 32 dB

AHPLG

- C-band amplifier in a full-slot card
- Output power: 20 dBm
- Input power: -24 dBm to +7 dBm
- Variable gain from 16 dB to 24 dB

AM2125A

- Output power: +21 dBm
- 25 dB gain with mid-stage access

AM2125B

- Output power: +21 dBm
- 25 dB gain without mid-stage access

AM2318A

- Low variable gain amplifier with no dispersion compensation module (DCM) access

TECHNICAL SPECIFICATIONS 1830 PSS-1

Small Form Factor Pluggable (SFP) support

- FE: 100BASE-LX10, BX40U/D, 100BASE-TX
- GigE: 1000BASE-SX/LX/ZX/T, BX20U/D, BX40U/D
- OC-3/STM-1: SS-1.1/SL-1.1/SL-1.2
- OC-12/STM-4: SS-4.1, SL-4.1
- OC-48/STM-16: SS-16.1A, multi-rate 2.7 Gb/s; SI-16.1, SL-16.1, SL-16.2
- 1G/2G FC/FICON, 4G FC: 4 FCSN-I and 4 FCLC-L
- CWDM 2G5 MR PIN: SS-16.2C
- CWDM 2G5 MR APD: SL-16.2C
- OTU-1: SL-16.1, SL-16.2D
- 4.55G CWDM: 4 FC-OC
- 4.55G DWDM: 4 FC-OD
- CWDM 2G5 MR PIN: SS-16.2C
- CWDM 2G5 MR APD: SL-16.2C
- eVOA SFP FAST: fVOA
- OSC SFP ultra-long haul (ULH): SUL-1.20
- OSC SFP eULH: SEU-1.20

10 Gb/s Form Factor Pluggable (XFP) support

- 10GigE XI-64.1 and XS-64.2b
- 10GigE ZR: 10GB-ZR
- 10G CWDM PIN: XS-64.2C
- CWDM any-rate up to 11G APD: XL-64.2C
- DWDM any-rate up to 11G: XL-64.2D
- Temperature hardened CWDM XFP (70 km)

Physical dimensions

- 1 RU
 - Height: 43.5 mm (1.71 in.)
 - Width: 443.9 mm (17.48 in.)
 - Depth: 278.5 mm (10.94 in.) without cover; 288 mm (11.34 in.) with cover
- Wall-mount and rack-mount kits: 19 in. EIA, 19 in. and 21 in. ETSI, 23 in. WECCO

Operating environment

- Power supply: -48 V DC or 110/220 V AC
- Maximum power dissipation
 - AHP: 100 W
 - GBEH: 101 W
 - MD4H: 110 W
 - MSAH: 100 W
- Typical power dissipation
 - AHP: 75 W
 - GBEH: 86 W
 - MD4H: 90 W
 - MSAH: 83 W
- Operating temperature
 - GBEH: -40°C to +65°C (-40°F to +149°F)
 - MD4H/MSAH: -25°C to +65°C (-13°F to +149°F)
 - AHP: -5°C to +40°C (23°F to 104°F); for short-term operation -5°C to +50°C (23°F to 122°F)
- Humidity:
 - CO environment
 - 85% long term
 - 95% short term
 - ETSI
 - 95% long term
 - Hardened environment
 - 100% long term

Regulatory and standards compliance

- Telcordia NEBS Level 1, GR63 and GR1089
- FCC Part 15 Class A
- UL Certification: UL 1950 and UL 60950
- CE mark: EN 300 386
- IEC safety: IEC 60950 and IEC 60825-1/2
- CSA-22.2 - No. 25-M90
- ETSI ETS 300 019
 - Storage: Hazard Level 1.2
 - Transportation: Hazard Level 2.2
 - Operational: Hazard Level 3.2
- ETSI EN 300 019
 - Storage: Class 1.2
 - Transportation: Class T2.3 and Class 3.2

- ETSI EMC
 - EN 300 386 v1.3.2
 - ETSI ES 201 468 v1.2.1
 - EMC directive 89/336 LV
- ETS 300 753
- ANSI T1.308
- RoHS-5
- GR-383-CORE

TECHNICAL SPECIFICATIONS 1830 PSS-4

Maximum number of client interfaces per chassis

- Supported SFPs and XFPs are same as for 1830 PSS-1
- Additional SFPs/XFPs supported in PSS-4:
 - 10BASE-SR DDM 850 nm XFP (B&W)
 - 100BASE-T (electrical SFP)
 - 100BASE-X (optical SFP)
 - CWDM 70 km XFP (temperature hardened)
- Client interfaces
 - E1: 42
 - FE: 24
 - GigE: 24
 - OC-3/STM-1: 24
 - OC-12/STM-4: 24
 - OC-48/STM-16: 16
 - OC-192/STM-64: 8
 - 1G FC/FICON: 24
 - 2G FC/FICON: 16
 - 4G FC: 8
 - 8G FC: 8
 - 10G FC: 8
 - 10G GigE LAN/WAN PHY: 8
 - HD-SDI: 16
 - SD-SDI: 24
 - 3G-SDI: 8
 - OTU-1: 8
 - OTU-2: 8
- Line interfaces
 - STM-16: 8
 - STM-1: 2
 - GigE: 8
 - 10GigE: 4
 - OTU-1: 8
 - OTU-2: 8

Physical dimensions

- 2 RU
 - Height: 88 mm (3.46 in.)
 - Width: 440 mm (17.32 in.)
 - Depth: 289.75 mm (11.41 in.)
 - Weight: 3.318 kg (4.366 kg with complete shelf kit)
- Wall-mount and rack-mount kits: 19 in. EIA, 19 in. and 21 in. ETSI, 23 in. WECCO

Operating environment

- Power supply:
 - -48 V DC or +24 V DC
 - 110/220 V AC
 - Mixed AC and DC power supply configuration
- Maximum power dissipation: 328 W
- Typical power dissipation: 230 W
- Operating temperature: -40°C to +65°C (-40°F to +149°F)
- Humidity:
 - CO environment
 - 85% long term
 - 95% short term
 - ETSI
 - 95% long term
 - Hardened environment
 - 100% long term

Regulatory and standards compliance

- Telcordia GR-3108-CORE Class 2
- Telcordia NEBS Level 1, GR-63-CORE and GR-1089-CORE
- FCC Part 15 Class A
- UL Certification: UL 1950 and UL 60950
- CE mark: EN 300 386
- IEC safety: IEC 60950 and IEC 60825-1/2
- CSA-22.2 - No. 25-M90
- ETSI ETS 300 019
 - Storage: Hazard Level 1.2
 - Transportation: Hazard Level 2.2
 - Operational: Hazard Level 3.2
- ETSI EN 300 019
 - Storage: Class 1.2
 - Transportation: Class T2.3 and Class 3.2
- ETSI EMC
 - EN 300 386 v1.3.2
 - ES 201 468 v1.2.1
 - EMC directive 89/336 LV
- ETS 300 753
- ANSI T1.308
- RoHS-5
- GR-383-CORE
- VCCI