

Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK Client Interface

Simplify the integration and transport of 100 Gigabit Ethernet and Optical Transport Unit 4 (OTU-4) interfaces and services into enterprise and service provider optical networks with the Cisco® NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK™ Client Interface. The Cisco Network Convergence System 2000 Series (NCS 2000 Series) supports a wide variety of service line cards to efficiently aggregate and transport nearly any client signal over a metro, regional, or long haul DWDM infrastructure and offers full compatibility with the Cisco ONS 15454 MSTP.

Continuing Cisco's innovation in 100 Gigabit technology, Cisco nLight™ silicon now extends to the client-facing interface through the Cisco CPAK pluggable transceiver. The extremely compact dimensions and low power consumption of Cisco CPAK can support a single-slot 100 Gigabit Ethernet coherent DWDM line card with a standards-based 100GBASE-LR4 client interface, resulting in a superb system density of one 100 Gigabit Ethernet transponder per rack unit (Figure 1).

Figure 1. Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK Client Interface



Feature Overview

With advanced modulation schemes, the ability to transmit 100-Gbps wavelengths on existing or new DWDM systems improves return on investment (ROI) by increasing the overall capacity per fiber pair without affecting the unregenerated transmission distance supported by the system. Scaling from 10 to 40 Gbps and now 100 Gbps increases by a factor of 10 the bandwidth that can be transported over existing fiber networks. The 100 Gigabit Ethernet CP-DQPSK modulation supports 9.6-Tbps capacity transmission over ultra-long-haul (ULH) networks of up to 4500 km of unregenerated optical spans. The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface provides the following features:

- Transport of 100-Gbps wavelengths over fully uncompensated networks, up to 4500 km of unregenerated optical spans
- Transport at 100 Gbps over very-low-quality fiber with very high Polarization Mode Dispersion (PMD)
- Support for up to ninety-six 100-Gbps wavelengths (50-GHz channel spacing) with very high tolerance to filtering penalties
- Improved system density of 100-Gbps transponders with a 100GBASE-LR4 client interface

- Support for different configurations (transponder, muxponder, or regenerator) through software provisioning only

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface is a plug-in module for the NCS 2000 Series, providing a cost-effective architecture for delivering 100-Gbps services. The card also features a pluggable client interface that can provide transponder capabilities, mapping the client signal to a single DWDM line interface. The client port supports the Cisco CPAK pluggable transceiver. The Cisco CPAK pluggable is available in two variants providing IEEE-compliant 100GBASE-SR10 and 100GBASE-LR4 optical interfaces. Interworking with CXP and CFP 100 Gigabit Ethernet transceivers is supported. Please refer to the [Cisco CPAK 100GBASE Modules Data Sheet](#) for additional information.

Figure 2. Cisco CPAK 100GBASE-LR4 Module (left) 100GBASE-SR10 Module (right)



The card features a software-configurable baud rate between 27.952 and 31.241 Gbaud depending on Forward Error Correction (FEC) selection, as well as a G.709v3 OTU-4 wrapped, ITU-compliant, 50-GHz spaced optical interface using LC connectors. The DWDM output line interface is tunable to 96 wavelengths across the full optical C-band. When operated within the outlined specifications, the trunk card can operate with a post-FEC bit error rate (BER) of better than 10E-15.

The trunk card provides many carrier-class features and advanced capabilities necessary to deliver 100-Gbps services, including protocol transparency, wavelength tunability, flexible protection mechanisms, flow-through timing, and management and performance-monitoring capabilities.

Enhanced Forward Error Correction Capability

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card can support FEC mechanisms on trunk and client interfaces. The trunk port supports three software-configurable FEC coding options, which cannot be disabled:

- Generic FEC (GFEC) is a Standard G.975 Reed-Solomon algorithm with 7-percent overhead (OH).
- Ultra FEC (UFEC) is a standard G.975.1 (Subclause I.7) with 20-percent overhead. This FEC scheme uses two orthogonally concatenated BCH Enhanced FEC (EFEC) codes. The constructed code is decoded iteratively to rebuild the original frame.
- High-Gain FEC (HG-FEC) has 7 percent overhead, providing better performance than standard G.975.1 7-percent-overhead FEC. Because of the reduced overhead and lower bit rate, HG-FEC is suitable for applications where 100-Gbps wavelengths are passing through a large number of ROADMs with limited pass-band performance.

The client port supports the standard G.975 Reed-Solomon FEC algorithm, which can be activated or disabled through software configuration.

Advanced Modulation Scheme

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with Cisco CPAK Client Interface features an advanced modulation scheme to provide optical performance significantly better than industry-standard 10-Gbps equivalent interfaces. Cisco selected a CP-DQPSK modulation format to optimize 100-Gbps transmission in terms of optical signal-to-noise ratio (OSNR), CD, and PMD robustness.

Trunk-Card Versions

Two versions of the Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with Cisco CPAK client interface are offered to support different application requirements:

- An extended-performance version offering full performance targeting ULH applications where the network is optimized for CP-DQPSK transmission (no 10-Gbps channels or dispersion compensation units [DCUs])
- A metro edge performance version with differential mode only (CP-DQPSK), cost-optimized for metropolitan application and 10-Gbps installed networks

Protocol Transparency

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card can transparently deliver 100-Gbps point-to-point services cost-effectively for the Cisco NCS 2000 platform. Table 1 shows transponder client configurations and mapping.

Table 1. Transponder Client Configurations and Mapping

Client		Mapping	Trunk		
Format	Rate (Gbps)		Format	Rate with 7% GFEC or HG-FEC OH (Gbps)	Rate with 20% UFEC OH (Gbps)
100GE LAN-PHY	103.125	Bit transparent through standard G.709v3 mapping	OTU-4	111.809	124.964
OTU-4	111.809	Transparent G.709 standard			

Wavelength Tunability

The trunk card supports software-provisionable tunability across the full C-band, covering 96 channels on the 50-GHz grid. Tunability provides flexibility and reconfigurability of services transported on ROADM-based networks, and also allows ordering and inventory of a single part for deployment and sparing.

Flexible Protection Mechanism Support

The trunk card supports multiple protection mechanisms commonly used in optical transport networks. Table 2 outlines the available protection options and the associated service-level agreements (SLAs) that can be provided.

Table 2. Protection Formats

Protection Type	Capabilities
Unprotected	There is no client terminal interface, transponder card, or DWDM line protection. The client signal is transported over a single unprotected transponder card or optical path.
1 + 1	Protection is provided for the client terminal interface, transponder card, and DWDM line through client Automatic Protection Switching (APS) or Linear Multiplex Section Protection (LMSP) signaling transported transparently over the transponder card or optical path. Protection is provided through client line or path through transparent signal transport through a transponder circuit.
Optical Channel (OCH)-trail	Protection is provided for DWDM signals through external optical switch units: Protection Switch Module (PSM).
Y-cable	Protection is provided for transponder equipment without protection for the client terminal equipment interface. A single client interface is split to two transponder cards using a Y-cable module.

Flow-Through Timing

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface allows timing to flow through from a client to the line optical interface. The received timing from the client interface is used to time the line transmitter interface. This flow-through timing allows you to place multiple trunk cards in the same shelf, which may be independently timed, independent of the network element timing.

Management

The Cisco NCS 2000 Series provides comprehensive management capabilities to support OAM&P capabilities through the integrated Cisco Transport Controller craft Interface with support from the Cisco Prime™ Optical element management system. The trunk card features provisionable digital wrapper (G.709) functions, providing per-wavelength performance-management capabilities, especially for services transported transparently across the network. The generic communication channel (GCC) of the digital wrapper provides a separate communications channel on a per-wavelength basis to be used by the platform when transparent signals are transported. GCC allows the Cisco NCS 2000 Series to extend its advanced network autodiscovery capabilities to DWDM-based services. The integrated Cisco Transport Controller craft manager and Cisco Prime Optical provide OAM&P functions for the system.

Far-End-Laser-Off Behavior

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface can provision the far-end-laser-off behavior when SONET/SDH payloads are present. You can use Cisco Transport Controller to configure how the remote client interface will behave following a fault condition. You also can configure the remote client to Squelch or to send an Alarm Indication Signal (AIS). For 100 Gigabit Ethernet signals, the default behavior is Squelching.

Performance Monitoring

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface supports both transparent and non-transparent signal transport performance monitoring. The digital wrapper channel is monitored according to G.709 Optical Transport Network (OTN) and G.8021 standards. Performance monitoring of optical parameters on the client and DWDM line interface includes Loss of Signal (LOS), laser bias current, and transmit and receive optical power. Calculation and accumulation of the performance-monitoring data are supported in 15-minute and 24-hour intervals as per G.7710.

Physical system parameters measured at the wavelength level, such as mean polarization mode dispersion, accumulated chromatic dispersion, and received optical signal-to-noise ratio (SNR) are also included in the set of performance-monitoring parameters. These parameters can greatly simplify troubleshooting operations and enhance the set of data that you can collect directly from the equipment.

The trunk card incorporates faceplate-mounted LEDs to provide a quick visual check of the operational status of the card. An orange circle is printed on the faceplate, indicating the shelf slot in which you can install the card.

A specific configuration of the client supports an IP-over-DWDM (IPoDWDM) proactive protection trigger over the Cisco CPAK interface, for support of pre-FEC fast re-route (FRR) on Cisco routers and switches using grey interfaces.

Regeneration

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface supports OTU-4 regeneration capabilities. You can configure two cards to work in back-to-back mode connecting through the backplane in the same shelf, and perform the OTN Optical-Electrical-Optical (OEO) regeneration of the frame.

Both 100 Gigabit Ethernet and OTU-4 clients are supported. Regeneration capability uses the OTU-4 backplane interconnection supported by the Cisco Network Convergence System 2006 or Cisco Network Convergence System 2002 chassis; OTU-4 overhead is terminated, allowing ODU-4 traffic to transparently pass through. GCC0 is properly terminated, while GCC1 and GCC2 are passed through. No Cisco CPAK client is required, because communication between the two cards acting as a regeneration group is supported through the chassis backplane.

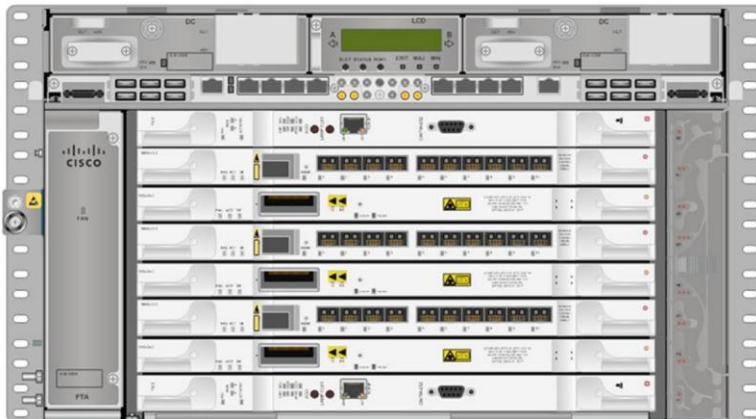
You can use an IPoDWDM configuration in the regeneration configuration to support proactive protection messaging between IPoDWDM router interfaces. If failure occurs on one side, ODUk Alarm Indication Signal (ODUk-AIS) is generated and propagated on the other side, while an OTUk Backwards Defect Indicator (OTUk-BDI) is sent back on the same side as defined by the ITU G.709 standard.

10-Port 10-Gbps Line Card Configuration

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface can be coupled with the Cisco ONS 15454 10-Port 10-Gbps Line Card to support 10-port 10-Gbps muxponder capability. You can connect the Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with Cisco CPAK client interface through the Cisco Network Convergence System (NCS) 2006 or NCS 2002 backplane (no client Cisco CPAK required) with the Cisco ONS 15454 10-Port 10-Gbps Line Card to provide OTN multiplexing of 10 ports of 10-Gbps data streams into a single 100-Gbps DWDM OTU-4 wavelength (Figure 4).

Supported client signals are any combination of 10 Gigabit Ethernet LAN-PHY, 10 Gigabit Ethernet WAN-PHY, OC-192, STM-64, 10-Gbps, and 8-Gbps Fibre Channel (FICON) or OTU-2 data rates. Please refer to the [Cisco ONS 15454 10-Port 10-Gbps Line Card data sheet](#) for additional information.

Figure 3. Three 10-Port 10-Gbps Muxponder Applications in a Cisco NCS 2006 Chassis



2-Port CFP 40-Gbps Muxponder Application

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface can be coupled with the Cisco ONS 15454 2-Port CFP Line Card to support two ports of 40-Gbps muxponder capability in a CFP configuration. You can connect the trunk card through the Cisco NCS 2006 backplane with the 2-port CFP line card to provide OTN multiplexing of the two ports of 40-Gbps data streams into a single 100-Gbps DWDM OTU-4 wavelength.

Alternatively, when configured as 100GBASE-SR-10, the Cisco CPAK client interface can multiplex two 40GBASE-SR4 signals directly on the trunk card, without the need for the CFP line card.

Supported client signals are any mix and combination of 40 Gigabit Ethernet LAN-PHY or OTU-3 data rates. Please refer to the [Cisco ONS 15454 2-Port CFP Line Card data sheet](#) for additional information.

Cisco 100-Gbps LR4 Transponder Application

The Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface provides a very efficient single-slot solution using the Cisco CPAK LR4 pluggable transceiver as the 100GBASE-LR4 interface. Supported client signals are 100 Gigabit Ethernet LAN-PHY or OTU-4 data rates.

Regulatory Compliance

Table 4 lists regulatory compliance information for the trunk card. Note that all compliance documentation may not be completed at the time of product release. Please check with your Cisco sales representative for countries other than Canada, the United States, and the European Union.

Table 3. Regulatory Compliance

ANSI System	ETSI System
Countries and Regions Supported	
<ul style="list-style-type: none"> • Canada • United States • Korea • Japan • European Union 	<ul style="list-style-type: none"> • European Union • Africa • CSI • Australia • New Zealand • China • Korea • India • Saudi Arabia • South America
EMC (Class A)	
<ul style="list-style-type: none"> • ICES-003, 2004 • GR-1089-CORE Issue 4, NEBS EMC and Safety, June 2006 • FCC 47CFR15, 2007 	<ul style="list-style-type: none"> • ETSI EN 300 386 V1.4.1 (2008-04) Telecommunication network equipment EMC requirements (Note: EMC-1) • CISPR22:2008 and EN55022:2006/A1:2007 Information Technology Equipment (Emissions) (EMC-2) • CISPR24: 1997/A1:2001/A2:2002 and EN55024:1998/A1:2001/A2:2003: Information Technology Equipment - Immunity characteristics - Limits and Methods of Measurement (test levels)
Safety	
<ul style="list-style-type: none"> • CSA C22.2 #60950-1 - Edition 7, March 2007 • UL 60950-1 - Edition 2, March 2007 • GR-1089-CORE Issue 4, NEBS EMC and Safety, June 2006 	<ul style="list-style-type: none"> • UL 60950-1 - Edition 2, March 2007 • IEC 60950-1 Information technology equipment Safety Part 1: General requirements - Edition 2, 2005 and National Differences as per CB Bulletin 112A • IEC/EN 60950-1 (2006/10) with Amendment 11:2004 to EN 60950-1:2001, 1st Edition and National Differences as per CB Bulletin 112A • EN 60950-1, Edition 2 (2006) Information technology equipment - Safety - Part 1: General requirements • CE Safety Directive: 2006/95/EC
Laser	
<ul style="list-style-type: none"> • UL 60950-1 - Edition 2, March 2007 • IEC 60825-1: 2001 Ed.1.2 (incl. am1+am2) Safety of laser products Part 1: Equipment classification, requirements and users guide • IEC60825-2 Ed.3 (2004) Safety of laser products Part 2: Safety of optical fiber communication systems + A1:2006 	<ul style="list-style-type: none"> • IEC 60825-1: 2001 Ed.1.2 (incl. am1+am2) Safety of laser products Part 1: Equipment classification, requirements and users guide • IEC60825-2 Ed.3 (2004) Safety of laser products Part 2: Safety of optical fibre communication systems + A1:2006 • 21CFR1040 (2008/04) (Accession Letter and CDRH Report) Automatic Laser Shutdown and restart (ALS) according to ITU-T G.664 (03/06). Guidance for Industry and FDA Staff (Laser Notice No. 50), June 2007 • Laser Products: Conformance with IEC 60825-1 and IEC 60601-2-22; Guidance for Industry and FDA Staff (Laser Notice No. 50), June 2007
Environmental	
<ul style="list-style-type: none"> • GR-63-CORE Issue 3, Network Equipment Building Standards (NEBS) Physical Protection, March 2006 	<ul style="list-style-type: none"> • ETS 300-019-2-1 V2.1.2 (Storage, Class 1.1) • ETS 300-019-2-2 V2.1.2 (1999-09): Transportation, Class 2.3 • ETS 300-019-2-3 V2.2.2 (2003-04):Operational, Class 3.1E
Optical	
<ul style="list-style-type: none"> • GR-253-CORE - Issue 04 • ITU-T G.691 	<ul style="list-style-type: none"> • ITU-T G.709 • ITU-T G.975
Quality	
<ul style="list-style-type: none"> • TR-NWT-000332, Issue 4, Method 1 calculation for 20-year mean time between failure (MTBF) 	
Miscellaneous	
<ul style="list-style-type: none"> • GR-1089-CORE Issue 4, NEBS EMC and Safety (June 2006) (Note: NEBS-1) • GR-63-CORE Issue 3, NEBS Physical Protection (March 2006) (Note: NEBS-2) • ATT-TP-76200: 2008 • ANSI T1.315-2001 • GR-499: 2004 Transport Systems Generic Requirements (TSGR): Common Requirements 	

Other Specifications

Table 5 lists system requirements for the Cisco NCS 2000 100-Gbps Coherent DWDM Trunk Card with CPAK client interface. Table 6 provides the DWDM specifications. Table 7 details receive-side optical performances. Table 8 lists performance monitoring parameters. Table 9 provides card specifications, and Table 10 gives ordering information.

Table 4. System Requirements

Component	Cisco NCS 2006 or ONS 15454 M6	Cisco NCS 2002 or ONS 15454 M2
Processor	15454-M-TNCE, 15454-M-TSCE, 15454-M-TSC, 15454-M-TNC	15454-M-TNCE, 15454-M-TSCE, 15454-M-TSC, 15454-M-TNC
Shelf Assembly	NCS2006-SA, 15454-M6-SA	NCS2002-SA, 15454-M2-SA
Shelf Door	NCS2006-DDR, 15454-M6-DDR	NCS2002-DDR, 15454-M2-DDR
Fan Tray	15454-M6-FTA2, NCS2006-FTA	15454-M2-FTA2, NCS2002-FTA
Power Supply	NCS2006-DC40, NCS2006-DC, NCS2006-DC20 (limited card quantity), NCS2006-AC, 15454-M6-AC2, 15454-M6-AC (limited card quantity)	NCS2002-DC, NCS2002-DC-E, NCS2002-AC, 15454-M2-DC, 15454-M2-DC-E, 15454-M2-AC
System Software	Release 10.0 or later	Release 10.0 or later
Slot Compatibility	2 through 7	2 through 3

Table 5. DWDM Specifications

Parameter	Value
Bit rate	27.952 Gbaud \pm 20 ppm (OTU4 with GFEC or HG-FEC 7% OH) 31.241 Gbaud \pm 20 ppm (OTU4 with UFEC 20% OH)
Automatic laser shutdown and restart	ITU-T G.664 (06/99)
Nominal wavelengths (λ_{Tnom})	Full-tunable between 1528.77 and 1566.72 nm (C-Band - 50 GHz)
Connector type (TX/RX)	LC, duplex (shuttered)
Optical Transmitter	
Type	CP-DQPSK modulation format
Output power (PTmin)	-2 to +0.5 dBm (metro edge performance) -1 to +1.5 dBm (extended performance)
Required optical return loss, minimum (ORLmin)	27 dB
Laser safety class	1
Optical Receiver	
Chromatic dispersion tolerance (DLRmax)	+/- 70,000 ps/nm
Overload	0 dBm
Receiver reflectance (maximum)	30 dB
Input wavelength bandwidth (λ_{c_rx})	Between 1528.77 and 1566.72 nm (C-Band - 50 GHz)

Table 6. DWDM Receive-Side Optical Performances

CD Tolerance	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	DGD	OSNR (0.5 nm RWB)
Extended Performance						
0 ps/nm	UFEC (20% OH)	<1x10E (-2)	<10E (-15)	0 to -14 dBm (-20 dBm with 0.5 dB of OSNR penalty)	-	7.5 dB
0 ps/nm					180 ps	8.0 dB
+/- 70,000 ps/nm					180 ps	9.0 dB

CD Tolerance	FEC Type	Pre-FEC BER	Post-FEC BER	Input Power Sensitivity	DGD	OSNR (0.5 nm RWB)
0 ps/nm	HG-FEC (7% OH)	<4.0x10E (-3)	<10E (-15)	0 to -14 dBm (-20 dBm with 0.5 dB of OSNR penalty)	-	8.0 dB
0 ps/nm					180 ps	8.5 dB
+/- 70,000 ps/nm					180 ps	9.5 dB
0 ps/nm	GFEC (7% OH)	<1.0x10E (-5)	<10E (-15)	0 to -14 dBm (-20 dBm with 0.5 dB of OSNR penalty)	-	14.5 dB
+/- 20,000 ps/nm					100 ps/nm	15.5 dB
Metro Edge Performance						
0 ps/nm	HG-FEC 7% OH	<4.0x10E (-3)	<10E (-15)	0 to -14 dBm -20 dBm with 0.5 dB of OSNR penalty	-	11.0 dB
+/- 5,000 ps/nm					30 ps	11.5 dB

Table 7. Performance Monitoring Parameters

Area	Parameter Name		Description
OTN	OTUk SM	ODUk PM	
	BBE-SM	BBE-PM	Number of background block errors
	BBER-SM	BBER-PM	Background block error ratio
	ES-SM	ES-PM	Number of errored seconds
	ESR-SM	ESR-PM	Errored seconds ratio
	SES-SM	SES-PM	Number of severely errored seconds
	SESR-SM	SESR-PM	Severely errored seconds ratio
	UAS-SM	UAS-PM	Number of unavailable seconds
	FC-SM	FC-PM	Number of failure counts
FEC	Bit errors		Number of corrected bit errors
	Uncorrectable words		Number of uncorrectable words
Trunk optical performance monitoring	OPT		Transmitter optical power
	LBC		Transmitter laser bias current
	OPR		Receiver optical power
	RCD		Residual chromatic dispersion
	PMD		Mean polarization mode dispersion
	OSNR		Optical signal-to-noise ratio, calculated with 0.5 nm RBW
	SOPMD		Second Order PMD (SOPMD Estimation)
	SOPCR		Polarization Change Rate Estimation
	PDL		Polarization Dependent Loss (PDL) Estimation

Table 8. Card Specifications

Management	
Card LEDs	
Failure (FAIL)	Red
Active/standby (ACT/STBY)	Green/yellow
Signal fail (SF)	Yellow
Client port LEDs (per port)	
Active input signal	Green
DWDM port LEDs	
Active input signal	Green
Output wavelength	Green

Management	
Power (including pluggable)	
Standby	45W (25C and -48V)
Typical	130W (25C and -48VDC)
Maximum	150W (55C and -38VDC)
Physical	
Dimensions	Occupies 1 slot
Weight	4 lb (1.8 kg)
Reliability and availability	
Mean time between failures (MTBF)	116,052 hrs
Latency (end to end)	
G.709 - GFEC	4 microseconds
G.709 - HG-FEC 7%	20 microseconds
G.709 - UFEC 20%	39 microseconds
Storage temperature	-40°C to 70°C (-40°F to 158°F)
Operating temperature	
Normal	0°C to 40°C (32°F to 104°F)
Short-term ¹	-5°C to 55°C (23°F to 131°F)
Relative humidity	
Normal	5% to 85%, noncondensing
Short-term ¹	5% to 90% but not to exceed 0.024 kg water/kg of dry air
¹ Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year (a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period). The values shown are valid for M6 or M2 chassis.	

Table 9. Ordering Information

Part Number	Description
NCS2K-100G-CK-C=	100G CPAK Multi Rate Line Card - CP-DQPSK - C Band
NCS2K-100ME-CKC =	100G CPAK Multi Rate Line Card - CP-DQPSK - Metro - C Band
L-NCS2K-100G-FFU	NCS2K/MSTP License 100G LC - Full Feature Upgrade (e-delivery)
L-NCS2K-100G-10G	NCS2K/MSTP License 100G MXP - 1x 10G MR Port (e-delivery)
CPAK-100G-LR4=	100GBASE-LR4 CPAK Module for SMF
CPAK-100G-SR10=	100GBASE-SR10 CPAK Module for MMF

Warranty

The following warranty terms apply to the Cisco NCS 2000 as well as services you may use during the warranty period. Your formal warranty statement appears in the Cisco Information Packet that accompanies your Cisco product.

- Hardware warranty duration: Five years
- Software warranty duration: One year
- Hardware replacement, repair, or refund procedure: Cisco or our service center will use commercially reasonable efforts to ship a replacement part for delivery within 15 working days after receipt of the defective product at Cisco's site. Actual delivery times of replacement products may vary depending on customer location

Product warranty terms and other information applicable to Cisco products are available at:

<http://www.cisco.com/go/warranty>.

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