

Cisco Network Convergence System 1014 2.4T Transponder Line Card



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It's a 5G and web-scale era, and every second, a million minutes of video content crosses the network. The continuous expansion of Internet usage is driven by social networking, video streaming and downloads, business productivity, e-commerce, and gaming. To keep up with demand, hyperscalers, communication service providers, and enterprises need to rapidly scale their networks. Designing networks with scalability, operational efficiency, security and reliability in mind is essential. Cisco's 2.4Tbps multi-haul transponder along with CIM 8 (Coherent Interface Module 8) uses state-of-the-art silicon, silicon photonics and Opto-Electronic Multi-Chip Module (OE-MCM) package along with complete automation and real-time visibility to deliver best-in-class power and performance for metro, long-haul, and submarine applications while being simple to deploy and manage.

Product features and benefits

The all new NCS 2.4T transponder is supported in the NCS 1014 chassis, providing six QSFP-DD client ports for 100/400 and 800G protocols. The client ports map to two trunk ports operating any rate between 400G and 1.2T in 100G increments.

The trunk ports are CIM 8 (Coherent Interconnect Module 8) pluggables and are field replaceable without removing the line card. The CIM 8 is a next generation multi-haul optical transport product allowing the solution to be used for metro, terrestrial long-haul, or submarine applications:

- Continuous variable baud rate from 60Gbaud to 140+Gbaud.
- 2nd generation 3D shaping enabled transmission performance closer to Shannon limit.
- Best in class Soft Decision Forward Error Correction (SD-FEC) algorithms.
- Trunk line rate from 400G to 1.2T in 100G increments.



Figure 1.
Cisco NCS 1014 2.4T line card

The Cisco NCS 1014 2.4T transponder provides the following hardware benefits:

- Support of continuous variable baud rate and shaping to maximize spectral efficiency.
- One universal transponder that is performance optimized for metro, long-haul, and submarine applications.
- Support for >400,000 ps/nm of CD compensation, enable unregenerated 400GE subsea transmission > 18,000km.
- Transport of 100GE, OTU4, 400GE, and 800GE on the same platform through software provisioning.
- 2.4T DWDM provides unparalleled scale and density—with up to 76.8Tbps per fiber pair in C+L band.
- State-of-the-art AES-256 encryption at scale—9.6 Tbps of encrypted trunk capacity per 2RU.
- Nonlinear compensation for maximum performance and capacity on long haul and subsea transmission.
- DSP enabled real-time fiber sensing and monitoring applications.
- Availability in C-band and L-band with the same line card.
- Ability to introduce CIM8 pluggables as per the capacity demands.
- Dual card mode to split client across 4 trunk ports with 400GE/800GE clients.

The 2.4T DWDM line card is available in 2 variants. The first variant allows configuration of fixed client to trunk mapping between the two slices of a line card. The second variant allows optimized "Bundle mode" of operation in which client bandwidth of upto 200G can be split between the two slices of the line card over CIM8 pluggables. This allows optimization in the number of client interfaces required for maximum capacity.

Wavelength tunability

The line interface supports software-provisionable tunability across the entire C- and L-band from 191.25 to 196.10 THz and 184.48 to 191.56 THz, respectively, as enabled by separate CIM 8 modules. Grid-less tuning support allows for continuous tunability in increments of 0.1 GHz and the ability to create multicarrier super-channels over flex spectrum line systems.

Protocol transparency

The Cisco NCS 1014 2.4T transponder can transparently deliver 400GbE and 100GE/OTU4 clients over two trunks from 400G to 1.2T.

Encryption*

With increasing asks for data privacy and data protection across the globe, encryption of any data that leaves the data center facility is becoming an important requirement for cloud operators. The NCS 1014 2.4T line card provides AES256-based Layer-1 encryption for 100/400GE and OTU4. IKEv2 is used for authentication of the devices in an encryption session, and the protocol provides pre-shared keys, certificates, or 802.1X-based authentication options. The Elliptical Curve Diffie Hillman (ECDH) Key Exchange protocol runs over a GCC (Generic Communication Channel) between two NCS 1014 2.4T line cards.

*Future software release

Management

The Cisco NCS 1014 2.4T line card supports all management feature as mentioned in the NCS 1014 system data sheet.

Performance monitoring and management

The Cisco NCS 1014 2.4T line card supports performance monitoring of optical parameters on the client and DWDM line interface including laser bias current, transmit, and receive optical power. Ethernet RMON statistics for the client ports and OTN error counters for the trunk are also available. Calculation and accumulation of the performance-monitoring data are supported in 30sec, 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, pre-FEC Bit Error Rate, and received Optical Signal-to-Noise Ratio (OSNR), are also included in the set of performance-monitoring parameters. These parameters can greatly simplify troubleshooting operations. Additionally, NCS 1014 2.4T Transponder supports PRBS patterns of 31, 23, 15, and 7, which allows users to perform data integrity checks between trunk links without enabling actual client traffic.

OpenConfig protocols for management GNMI and operations GNOI are also supported for efficient manageability and programmability. GNOI based operational commands for system reboot, file transfers, certificate authentication, loopbacks, LLDP and BERT are supported. The Cisco NCS 1014 2.4T line card provides a set of native YANG models as well as the ability to map into any industry-standard or customer-defined YANG data models. For monitoring, the card provides a streaming telemetry feature that relies on a push mechanism to disseminate user-selected PM and status information at user-specified frequencies at granular 10-second intervals. This improves monitoring speed and scale compared to traditional pull-based mechanisms such as SNMP. The telemetry infrastructure also allows for events such as alarms, and port-state changes to be notified.

Protection options

Using a PSM and a Y-cable, the NCS 1014 2.4T Transponder offers client protection. Line-side protection is also accessible via a PSM module.

Table 1. Client and Trunk PM parameters

Port	PM Parameters
Client	<ul style="list-style-type: none">• LBC, OPT, OPR, FREQ_OFF
Trunk	<ul style="list-style-type: none">• LBC, OPT, OPR, CD, DGD, SOPMD, OSNR, PDL, PCR, RX_SIG, FREQ_OFF, PREFEC BER, POSTFEC BER, Q,Q Margin, SOP.

Please refer to Table 6 for detailed performance monitoring parameters. The NCS 1014 2.4T line card provides a set of port and system LEDs for a quick visual check of the operational status. The various LEDs are described in detail in Table 7.

Feature summary

The following table summarizes the features of the NCS 1014.

Table 2. Feature summary

Feature	Description
Software compatibility	<ul style="list-style-type: none">• IOS® XR 7.11.1 for Fixed variant• IOS® XR 24.1.1 for Cross connect mode/ Bundle mode variant
Port density	<ul style="list-style-type: none">• 6 QSFP-DD client-side ports per card• 2 DWDM line/trunk ports per card
OTN feature summary	<ul style="list-style-type: none">• Alarm reporting for Loss of Signal (LOS), Loss of Frame (LOF), Loss of Multiframe (LOM), Alarm Indication Signal (AIS), Backward Defect Indicator (BDI)• OTUk, ODUk, OPUk Performance Monitoring• Threshold Crossing Alerts (TCAs)• Local (internal) and line (network) loopbacks• Trunk Trace Identifier, Generic Communication Channel• L1 AES-256 encryption
Optical feature summary	<ul style="list-style-type: none">• Flex-grid (0.1-GHz) tunability• Nyquist shaping• DSP compensated linear and nonlinear link impairments• Performance Monitoring and Threshold Crossing Alerts (TCAs)• Tx and Rx power monitoring
Ethernet feature summary	<ul style="list-style-type: none">• Alarms and Performance Monitoring• Squelch and Local Fault Propagation• LLDP Snooping• Performance Monitoring and Threshold Crossing Alerts (TCAs)• Local (internal) and line (network) loopbacks
Network management	<ul style="list-style-type: none">• iPXE and Zero-Touch Provisioning (ZTP)• IOS XR CLI• SNMP• Streaming Telemetry including event-driven telemetry.• NETCONF, RESTCONF, GNMI, GNOI, gRPC with YANG data models
Physical dimensions (NCS 1014)	<ul style="list-style-type: none">• 1.59" tall x 7.55" wide x 10.90" deep• Weight: 3.2Kg
Power	<ul style="list-style-type: none">• Typical: 271W
MTBF for line card and 2xCIM 8 pluggables	<ul style="list-style-type: none">• 5,67,040 hours

Pluggable Optics Supported at FCS

Module type	PID
400G-FR4	<ul style="list-style-type: none">• QDD-400G-FR4-S
400G-AOC	<ul style="list-style-type: none">• QDD-400G-AOCxM
400G-DR4	<ul style="list-style-type: none">• QDD-400G-DR4-S
4X100G-LR-S	<ul style="list-style-type: none">• QDD-4X100G-LR-S

Regulatory compliance

Table 3 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 that are not listed below.

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
<ul style="list-style-type: none">• EMC (Emissions)	<ul style="list-style-type: none">• FCC 47CFR15, Class A• AS/NZS CISPR 32, Class A• CISPR 32, Class A• CISPR 22, Class A• EN55032, Class A• ICES-003, Class A• VCCI, Class A• KN 32, Class A• KN61000-3-2• KN61000-3-3• CNS-13438, Class A
<ul style="list-style-type: none">• EMC (Immunity)	<ul style="list-style-type: none">• IEC/EN61000-4-2 Electrostatic Discharge Immunity• IEC/EN61000-4-3 Radiated Immunity• IEC/EN61000-4-4 EFT-B Immunity

ANSI system	ETSI system
	<ul style="list-style-type: none"> • IEC/EN61000-4-5 Surge AC Port • IEC/EN61000-4-6 Immunity to Conducted Disturbances • IEC/EN61000-4-11 Voltage Dips, Short Interruptions, and Voltage Variations • KN 35
<ul style="list-style-type: none"> • EMC (ETSI/EN) 	<ul style="list-style-type: none"> • EN 300 386 Telecommunications Network Equipment (EMC) • EN55032 Electromagnetic Compatibility of Multimedia Equipment-Emission Requirements • EN55022 Information Technology Equipment (Emissions) • EN55035 Electromagnetic Compatibility of Multimedia Equipment-Immunity Requirements • EN55024 Information Technology Equipment (Immunity) • EN61000-6-1/EN61000-6-2 Generic Immunity Standard • EN61000-3-2 Power Line Harmonics • EN61000-3-3 Voltage Changes, Fluctuations, and Flicker
Safety	
<ul style="list-style-type: none"> • CSA C22.2 #60950-1 – Edition 7, March 2007 • BS/IEC/EN 62368-1 • CAN 22.2 No. 62368-1 • UL 62368-1 	<ul style="list-style-type: none"> • IEC 60950-1 Information technology equipment Safety Part 1: General requirements – Edition 2, 2005 + Amendment 1 2009 + Amendment 2 2013 • EN 60950-1: Edition 2 (2006) Information technology equipment – Safety – Part 1: General requirements + A11:2009 + A1:2010 + A12:2011 + A2:2013 • CE Low Voltage Directive (LVD): 2014/35/EC • A/NZS 62368.1
Laser	
<ul style="list-style-type: none"> • 21CFR1040 (2008/04) (Accession Letter and CDRH Report) Guidance for Industry and FDA Staff (Laser Notice No. 56), May 2019 	<ul style="list-style-type: none"> • IEC 60825-1: 2014-05 Ed. 3.0 Safety of laser products Part 1: Equipment classification, requirements and users guide • IEC60825-2 Ed.3.2 (2010) Safety of laser products Part 2: Safety of optical fiber communication systems
Optical	
<ul style="list-style-type: none"> • ITU-T G.691 	<ul style="list-style-type: none"> • 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) 	

Table 4 provides the DWDM specifications and details receive-side optical performances, Table 5 lists performance-monitoring parameters, Table 6 provides card specifications, and Table 7 gives ordering information.

Table 4. DWDM specifications

Parameter	CIM8-C-K9/ CIM8-CE-K9	CIM8-LE-K9
Baud rate	60 to 142 Gbaud/s	60 to 142 Gbaud/s
Nominal wavelengths (Tnom)	Fully tunable between 1528.77 to 1566.72 nm (C-band)	Fully tunable between 1565 to 1625 nm (L-band)
Optical transmitter		
Type	QPSK Equivalent 16-QAM Equivalent 32-QAM Equivalent 64-QAM Equivalent	QPSK Equivalent 16-QAM Equivalent 32-QAM Equivalent 64-QAM Equivalent
Output power	+3 to - 10 dBm in 0.01 - dBm increments	+3 to - 10 dBm in 0.01 - dBm increments
Optical receiver		
Frequency range	C: 191.25 to 196.10 THz (1528.77 to 1566.72 nm)	L: 184.48 to 191.56 THz (1565 to 1625 nm)
Input power range	-2 to - 12dBm	0 to - 12dBm
PMD tolerance	Up to 130-ps DGD	Up to 130-ps DGD
Chromatic dispersion tolerance	>±350,000 ps/nm	>±350,000 ps/nm

Table 5. Trunk performance-monitoring parameters

Area	Parameter name	Description
OTUk monitoring (Near-end, far-end, OTUk-SM, ODUk-PM)	BBE	Number of background block errors
	BBER	Background block error ratio
	ES	Number of errored seconds
	ESR	Errored seconds ratio
	SES	Number of severely errored seconds
	SESR	Severely errored seconds ratio
	UAS	Number of unavailable seconds
	FC	Number of failure counts
FEC	Bit errors	Number of corrected bit errors
	Uncorrectable words	Number of uncorrectable words
	Q	Q-factor
	Q-Margin	Q-factor margin
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 6. NCS 1014 2.4T line card specifications

Management	
Attention LED	Blue
Client and DWDM port LEDs <ul style="list-style-type: none">No alarmsMinor alarmsCritical and major alarms	Green Amber Red
Storage temperature	-40° C to 85° C (-40° F to 185° F)
Operating temperature <ul style="list-style-type: none">Normal	0° C to 40° C (32° F to 104° F)
Relative humidity <ul style="list-style-type: none">NormalShort-term¹	5% to 85%, noncondensing 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).	

Table 7. Ordering information

Part Number	Description
NCS1K14-2.4T-K9=	Network Convergence System 1014 2.4T Line Card
NCS1K14-2.4T-L-K9=	Network Convergence System 1014 2.4T Line Card Licensed
NCS1K14-2.4T-X-K9=	NCS 1014 2.4T Line Card Cross Connect Mode
NCS1K14-2.4TXL-K9=	NCS 1014 2.4T licensed card-Cross Connect Mode
CIM8-C-K9=	Coherent Interface Module 8 C-Band
CIM8-CE-K9=	Coherent Interface Module 8 enhanced C-Band
CIM8-LE-K9	Coherent Interface Module 8 enhanced L-Band

Cisco environmental sustainability

Information about Cisco’s environmental sustainability policies and initiatives for our products, solutions, operations, and extended operations or supply chain is provided in the “Environment Sustainability” section of Cisco’s [Corporate Social Responsibility](#) (CSR) Report.

Reference links to information about key environmental sustainability topics (mentioned in the “Environment Sustainability” section of the CSR Report) are provided in the following table:

Sustainability topic	Reference
Information on product material content laws and regulations	Materials
Information on electronic waste laws and regulations, including products, batteries, and packaging	WEEE compliance

Cisco makes the packaging data available for informational purposes only. It may not reflect the most current legal developments, and Cisco does not represent, warrant, or guarantee that it is complete, accurate, or up to date. This information is subject to change without notice.

Warranty

The following is the warranty:

- Hardware warranty duration: 5 years
- Software warranty duration: 1 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.

Your formal warranty statement appears in the Cisco Information Packet that accompanies your Cisco product.

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

www.cisco.com/go/warranty.

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Document history

New or revised topic	Described in	Date
Revised datasheet to include 2.4T cross connect version and CIM8 Enhanced modules	Description , specification and product ordering sections	April 09, 2024

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