

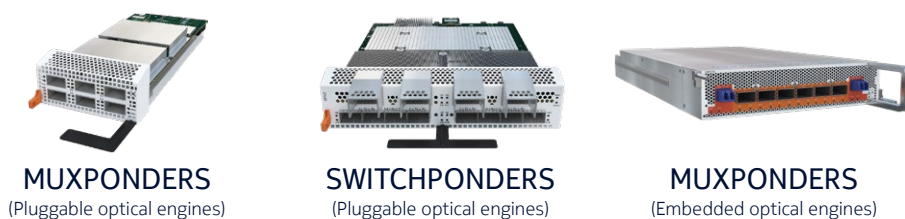
Nokia 1830 GX Compact Modular Platform – Muxponder Overview

Flexible Compact Modular Platform with Open APIs

With benefits of open optical networking such as more choice, faster innovation, and improved economics, optical network disaggregation is being embraced by a wide range of ICPs and service providers. At the same time, following the GX platform's market leadership, the devices used for this network disaggregation have evolved to compact modular form factors with slot-based architectures that provide the flexibility to mix optical layer and xponders on a common platform. The Nokia 1830 GX include transponders, muxponders, add/drop multiplexer (ADM), and switchponders with 200G, 400G, 600G, 800G, and 1.2T generation coherent technology that deliver substantial improvements in cost per bit, power efficiency, footprint, and fiber capacity.

Figure 1: GX platform Xponders

Nokia 1830 GX Compact Modular Xponders



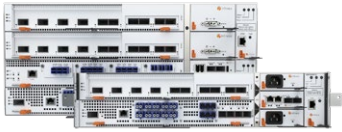
Benefits of GX Platform Muxponders

- **Leverage the latest** generation of coherent optical engines to significantly lower cost per bit, power consumption, and footprint while boosting reach and fiber capacity
- **Leverage** 400G and 800G generation ZR+ and XR coherent pluggables to reduce TCO
- **Transport** Ethernet, SONET/SDH, and Fiber Channel, Wavelength services cost efficient
- **Reduce TCO** with a single platform that supports transponder, switchponder, and open line system functionality
- **Optimize traffic** with distributed OTN switching for effective wavelength utilization and traffic switching
- **Secure** your transport network with protection options and wire speed encryption
- **Minimize** operational costs and speed service delivery with automation enabled by RESTCONF/NETCONF open APIs and gNMI/gRPC streaming telemetry.

Flexible Compact Modular Platform for Network Disaggregation

GX compact modular platforms, the GX G30c Series, GX G30 Series and GX G42 are compact modular systems that support 19", 21", and 23" installation environment. GX is built on the Converged OS – a microservices-based software architecture featuring simplified operations, standards-based open APIs, for easy integration, customization, and extensibility.

GX G30c Series



300-mm installation environment
OLS and transponders/switchponders

GX G30 Series



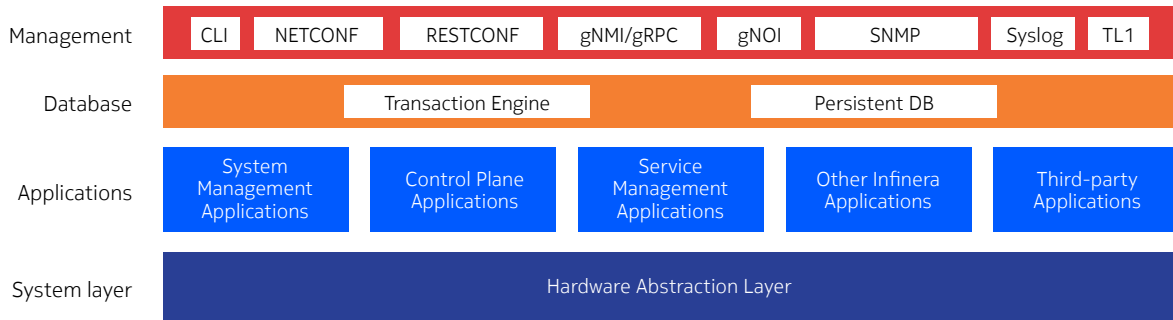
600-mm installation environment
OLS and transponders/switchponders

GX G42



600-mm installation environment
Transponders/muxponders

Figure 2: GX Converged OS overview



GX supports redundant field-replaceable AC or DC power supplies, fans, a controller, and a range of single-slot and double-slot hot-swappable sleds for transponder/muxponder applications (see Table 1), as well as industry-leading open line system solutions (see Nokia 1830 GX G30 Series Open Line System Overview Data Sheet).

Table 1: GX Xponder sleds

		GX G31/G32							GX G34c	GX G42		
		UTM2	CHM1R	SPN2	CHMQ6	CHMS8	CHM2TX	CHM7X	SPN2C	UCM4	CHM6	CHM7
Line	Wavelengths	100G/200G	100G-400G	100G-400G	200G-800G	200G-800G	100G-500G	200G - 1.2T	100G-400G	-	100G-800G	200G-1200G
	Interfaces	2 x CFP2-DCO	2 x CFP2-DCO	4 x QSFP-DD	6 x QSFP56-DD	8 x OSFP	2 x integrated	2 x integrate	4 x QSFP-DD	4 x QSFP28	2 x integrated	2 x integrated
	I/F Line capacity max	0.2 Tb/s	0.8 Tb/s	0.6 Tb/s	2.4 Tb/s	3.2 Tb/s	1.0 Tb/s	2.4 Tb/s	0.6 Tb/s	-	1.6 Tb/s	2.4 Tb/s
Clients	800GE	-	-	-	yes	yes	-	yes	-	-	-	yes
	400GE	-	yes	yes	yes	yes	yes	yes	yes	-	yes	yes
	100GE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	10GE	yes	-	yes	-	-	-	-	yes	yes	-	-
	1GE	yes	-	-	-	-	-	-	-	-	-	-
	OTU4	yes	yes	yes	future	future	yes	yes	yes	yes	yes	yes
	OTU2	yes	-	yes	-	-	-	-	yes	yes	-	-
	OC192/STM64	yes	-	-	-	-	-	-	-	yes	-	-
	OC48/STM16	yes	-	-	-	-	-	-	-	-	-	-
	32G FC	-	-	yes	-	-	-	-	yes	-	-	-
Other	16G FC	yes	-	yes	-	-	-	-	yes	HW ready	-	-
	1G/4G FC	yes	-	-	-	-	-	-	-	-	-	-
	Encryption	-	yes	HW ready			HW ready	HW ready	HW ready	HW ready	yes	HW ready
	MSA compliant	-	optional	optional	optional	optional	-	-	optional	-	-	-
	ADM	yes	-	yes	HW ready	HW ready	-	HW ready	yes	HW ready	yes	HW ready
	OTN Switching	-	-	yes	-	-	-	-	yes	-	-	-
	Client splitting	-	-	-	yes	yes		yes	-	-	yes	yes
	Protection	SNCP	-	SNCP	HW ready	HW ready	-	HW ready	SNCP	HW ready	SNCP, y-cable, OPSM	HW ready

CHM7: 1.2T Generation Coherent Muxponder

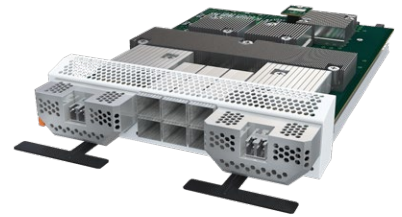
The CHM7 leverages our seventh-generation Infinite Capacity Engine (ICE7) which includes a state-of-the-art 5-nm CMOS process node digital ASIC/DSP, advanced optical front end, and high-performance packaging. ICE7 technology enables each CHM7 to deliver two independent wavelengths with data rates of up to 1.2 Tb/s each, and baud rates of up to 140+ Gbaud each and is supported in GX G42 chassis. CHM7 is compatible with 4.8 THz extended C-band and supports an additional 27% (1.3 THz) of C-band spectrum through the 6.1 THz Super C-band, offering an alternative to full C+L. CHM7 comes also in the Super L-Band version the CHM7L and with Super C+L band can deliver more than 100Gb/s over a fiber pair.



Each CHM7 can be deployed as an Ethernet transponder, OTN transponder, Ethernet muxponder, OTN muxponder, on-card regenerator, or ADM adding and dropping clients on a ring that leverages its two line interfaces. With a total of 2.4 Tb/s of line capacity per CHM7, a single 3RU G42 can deliver 9.6 Tb/s of line interface capacity. CHM7 supports 800 GbE, 400 GbE, 100 GbE, and OTU4 clients. Bandwidth virtualization and client splitting can enable a client service over the two line interfaces. CHM7 offers a straightforward upgrade for operators using GX G42 with ICE6-enabled CHM6 sleds, allowing ICE7 sleds to be deployed in available slots. CHM7 supports deployment in terrestrial and subsea network applications.

CHM7X: 1.2T Generation Coherent Muxponder

The CHM7X leverages our seventh-generation Infinite Capacity Engine (ICE7) which includes a state-of-the-art 5-nm CMOS process node digital ASIC/DSP, advanced optical front end, and high-performance packaging. ICE7X technology enables each CHM7X to deliver two independent wavelengths with data rates of up to 1.2 Tb/s each, and baud rates of up to 140+ Gbaud each and is supported in GX G31 and G32 chassis. CHM7X is compatible with 4.8 THz extended C-band and supports an additional 27% (1.3 THz) of C-band spectrum through the 6.1 THz Super C-band, offering an alternative to full C+L. Each CHM7X can be deployed as an Ethernet transponder, OTN transponder, Ethernet muxponder, OTN muxponder, on-card regenerator, or ADM adding and dropping clients on a ring that leverages its two line interfaces. With a total of 2.4 Tb/s of line capacity per CHM7X, a single 1RU G31 can deliver 4.8 Tb/s of line interface capacity. CHM7X supports 800 GbE, 400 GbE, 100 GbE, and OTU4 clients. Bandwidth virtualization and client splitting can enable a client service over the two line interfaces. CHM7X offers a straightforward upgrade for operators using GX G31/G32, enabling ICE7 technology to be deployed in available slots. CHM7X supports deployment in terrestrial and subsea network applications.



CHM6: 800G Generation Coherent Muxponder

CHM6 coherent channel module leverages ICE6, the sixth generation of our vertically integrated optical engines, and combines 2 x 800 Gb/s wavelengths with 16 client ports into a single module providing up to 1.6T of line capacity and up to 1.6T of client capacity. The CHM6 is designed to be operated over Nokia or third-party line systems, and with the flexibility to tune its baud rate from 31 to 100+ Gbaud with 400+ supported line modes, CHM6 can be deployed in both fixed-grid and flexible-grid networks.



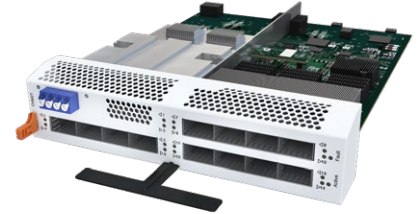
Each of its two carriers can be arbitrarily tuned with 0.05 GHz granularity to any frequency within the extended C-band or the extended L-band to support more than 80 Tb/s of capacity over a single fiber pair. The CHM6 utilizes methods such as second-generation Nyquist subcarriers, long-codeword probabilistic

constellation shaping (LC-PCS), dynamic bandwidth allocation (DBA), high-gain soft decision-forward error correction (SD-FEC), and SD-FEC gain sharing to maximize capacity-reach and spectral efficiency/fiber capacity in any network scenario. CHM6 supports deployment in terrestrial and subsea network applications. The CHM6 supports flexible transport of 100 GbE, 400 GbE, and OTU4 clients and is deployed within the Nokia 1830 GX G42 platform with power consumption profile of around 0.2 W/Gb. In addition, 10 GbE, OTU2, OTU2e, and OC192/STM64 services can be supported utilizing the GX G42's UCM4 sled.

CHM2TX: 600G Generation Coherent Muxponder

CHM2TX sled leverages 16-nm DSP and high-performance indium phosphide modulators to deliver two wavelengths each ranging from 100 Gb/s to 500 Gb/s in 50 Gb/s increments. It supports a tuneable baud rate from 28 to 72 Gbaud and PM-QPSK/8QAM/16QAM/32QAM/64QAM modulation. Advanced modulation features include hybrid modulation, which provides the ability to mix different QAM symbols in the time domain; geometric shaping, which optimizes the location of the constellation points; and set-partitioned PM-QPSK and PM-16QAM, which provide higher-performance alternatives to PM-BPSK and PM-8QAM respectively. These features have enabled the CHM2TX to demonstrate excellent performance, resulting in average cost savings of around 33% relative to 400G generation coherent. They also enable the CHM2TX to maximize fiber capacity and spectral efficiency with PM-64QAM, while PM-32QAM and hybrid modulation enable increased fiber capacity over a wide range of distances.

The dual-slot CHM2TX provides up to 12 x 100G client ports, three of which can be used for 400 GbE. LLDP and RMON are supported for 100 GbE. It can provide coherent transport of up to 38.4 Tb/s on a single fiber pair, with typical power consumption for a fully loaded chassis of around 0.2 W per Gb/s.



CHMQ6: QSFP-DD Pluggable 800G Thin Transponder

Utilizing ICE-X 800G and QSFP-DD form factor, the CHMQ6 module supports up to six pluggables in a single width sled format within the 1830 GX G31 and 1830 GX G32 chassis. ICE-X 800G multi-haul intelligent coherent pluggables are 800G coherent pluggables with low power consumption, multi-vendor probabilistic constellation shaping (PCS) and multi-haul reach. They support 800G ZR, 400G ZR OIF, OpenROADM 6.0 standards and are interoperable with OIF-800ZR-01.0 and OIF-400ZR-03.0 implementation agreements as well as OpenZR+ Rev 3.0.

The flexible solution provides up to 3.2 Tb/s of module capacity and 100GbE, 400GbE, 800GbE client interfaces. It can be configured for Transponder functionality e.g., 3x 800GbE to 3x 800G-WDM, Muxponder functionality e.g., 2x 400GbE to 1x 800G-WDM, OEO conversion e.g., 3x 800G-WDM to 3x 800G-WDM, and supports client splitting e.g., 1x 800GbE to 2x 400G-WDM.



CHMS8: OSFP Pluggable 800G Thin Transponder

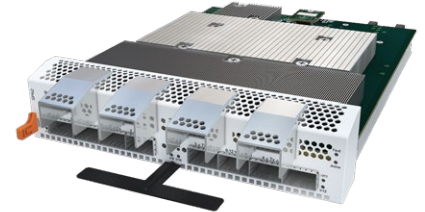
Utilizing ICE-X 800G and OSFP form factor, the CHMS8 module supports up to eight OSFP pluggables in a double width sled format within the 1830 GX G31 and 1830 GX G32 chassis. ICE-X 800G multi-haul intelligent coherent pluggables are 800G coherent pluggables with low power consumption, multi-vendor probabilistic constellation shaping (PCS) and multi-haul reach. They support 800G ZR, 400G ZR OIF, OpenROADM 6.0 standards and are interoperable with OIF-800ZR-01.0 and OIF-400ZR-03.0 implementation agreements as well as OpenZR+ Rev 3.0.



The flexible solution provides up to 6.4 Tb/s of module capacity and 100GbE, 400GbE, 800GbE client interfaces. It can be configured for Transponder functionality e.g., 4x 800GbE to 4x 800G-WDM, Muxponder functionality e.g., 4x 400GbE to 2x 800G-WDM, OEO conversion e.g., 4x 800G-WDM to 4x 800G-WDM, and supports client splitting e.g., 3x 800GbE to 4x 600G-WDM.

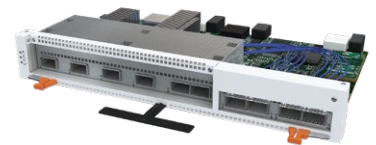
SPN2: 1.2T OTN Switchponder

The double-slot SPN2 sled supports four line interface ports and six client interface ports. The SPN2 sled supports two additional pluggable interfaces for interconnecting with a second SPN2 card within the same chassis. In paired mode, two SPN2 sleds create a 2.4 Tb/s OTN switch with up to 1.2 Tb/s of line capacity and 1.2 Tb/s of client capacity. The interconnection is realized using 500G interconnection and 400G QSFP-DD DAC cables. The line-side capacity can be configured to support up to 600 Gb/s per sled with up to four directions, or up to 1.2 Tb/s line-side capacity with up to eight directions when paired with another SPN2/SPN2C sled with 400G ZR+ and ICE-X 400G ZR+. The client-side capacity can be configured to support up to 600 Gb/s worth of client services per sled or up 1.2 Tb/s of client capacity when paired with another SPN2 sled. On the client side, the SPN2 provides six pluggable client interfaces, one QSFP28/56/DD, and five QSFP+/28/56, and it supports 10 GbE, 25 GbE, 40 GbE, 50G, 16G Fibre Channel, 32G Fibre Channel, 100 GbE, OTU2, OTU4, 200G, 400 GbE, 400G ZR, 100G ZR, FlexE, FlexO, or a flexible mix of these client interfaces.



SPN2C: 1.2T OTN Switchponder

The SPN2C utilises the same technology as the SPN2 sled, offering four line interface ports and six client interface ports. It is compatible with both the G34c and G34Xc platforms and provides a backplane connection enabling interconnection between two SPN2C cards within a single G34Xc chassis. When operating in paired mode, two SPN2 sleds form a 2.4 Tb/s OTN switch, supporting up to 1.2 Tb/s of line capacity and 1.2 Tb/s of client capacity. This interconnection is achieved via the high-speed backplane integrated in the G34Xc chassis. The line-side capacity can be configured to support up to 600 Gb/s per sled with up to four directions, or up to 1.2 Tb/s line-side capacity with up to eight directions when paired with another SPN2C sled with 400G ZR+ and ICE-X 400G ZR+. The client-side capacity can be configured to support up to 600 Gb/s worth of client services per sled or up 1.2 Tb/s of client capacity when paired with another SPN2C sled. On the client side, the SPN2C provides six pluggable client interfaces, one QSFP28/56/DD, and five QSFP+/28/56, and it supports 10 GbE, 25 GbE, 40 GbE, 50G, 16G Fibre Channel, 32G Fibre Channel, 100 GbE, OTU2, OTU4, 200G, 400 GbE, 400G ZR, 100G ZR, FlexE, FlexO, or a flexible mix of these client interfaces.



CHM1R: 400G OpenROADM-compliant Coherent Pluggable Muxponder

The single-slot CHM1R sled provides two CFP2-DCO coherent flexible-rate interfaces with each interface able to support 400G-DP-16QAM, 300G-DP-8QAM, 200G-DP-QPSK, and 100G-DP-QPSK. FEC options include CFEC and oFEC. The CFP2s supported are ICE-X 400G ZR+, 400G ZR+, 400G Open ZR+, OpenROADM, and proprietary modes. The CHM1R enables 100G-400G muxponder, 100G-400G transponder, and OEO 3R regeneration applications. On the client side, the CHM1R provides four QSFP-DD cages for QSFP-DD/QSFP28 pluggable interfaces enabling up to 4 x 100 GbE (DAC, AOC, SR4, SR4.2, LR4, PSM4, CWDM4, ER4, ER, DR, FR), up to 4 x OTU4 (LR4, ER, DR, FR), up to 2 x 400 GbE (DAC, DR4, FR4, LR8, LR4, SR8, XDR4), or a mix of these interfaces. LLDP is supported for Ethernet clients. Other features include OTN L1 encryption; RMON and test signal; delay measurements; loopbacks; and OTS, OMS, and OCH protection. Up to four CHM1R sleds are supported in a single chassis, providing up to 6.4 Tb/s of total capacity in 1RU with 3.2 Tb/s line and 3.2 Tb/s client capacity.



UTM2: OpenROADM-compliant Transponder/Muxponder/ADM

The UTM2 is a dual-slot transponder/muxponder/ADM with two CFP2 ports, two QSFP28 ports, two QSFP+ ports, and 12 SFP+ ports. The UTM2 can deliver 2 x 100G or 1 x 200G coherent leveraging CFP2-DCOs with 16-nm DSP technology, with support for 100G (PM-QSPK), 200G (PM-16QAM), and 200G (PM-8QAM). When available, it will also leverage 7-nm CFP2-DCOs with 100G/PM-QSPK, 200G/PM-16QAM, 200G/PM-8QAM, and 200G/PM-QPSK. It provides OpenROADM-compliant oFEC and ZR/ZR+-compliant CFEC/CFEC+. The two QSFP28 interfaces can support 100G/OTU4. The 12 SFP/SFP+ interfaces can support 1 GbE, 10G DWDM, 10 GbE, OTU2/OTU2e, STM-16, OC-48, STM-64, OC-192, and 1G/4G/8G/16G Fibre Channel. Applications include muxponder (i.e., 8 x 1Gà10G, 6 x 10Gà100G, 20 x 10Gà200G, 2 x 100Gà200G), transponder (i.e., 10Gà10G DWDM, 100Gà100G DWDM), and OTN ADM with support for ODUk hairpinning on both the coherent line and client ports.



UCM4: Universal Client Module 400G

The Universal Client Module 400G (UCM4), functions as a 100G/10G service aggregator and provides up to 400G bandwidth capacity for the GX G42 utilizing pluggable interfaces for processing and mapping of 100 GbE, OTU4, 10 GbE, OTU2, OTU2e, OC-192, and/or STM-64 client signals. The UCM4 is a single-sled type and can be arbitrarily equipped in the G42 chassis. 14 client interfaces are available for 100G QSFP28, 40G QSFP+, and/or third-party client types. Ports 1 through 4 are dedicated OTU4 uplink ports used for interconnection with the client side of a CHM6/CHM7 where each port supports a 100G QSFP28. Ports 5 through 14 are client ports where ports 5, 6, 10, and 11 each support a 100G QSFP28 or a 40G QSFP+ configured for 4 x 10G breakout mode, and ports 7, 8, 9, 12, 13, and 14 each support a 40G QSFP+ configured for 4 x 10G breakout mode. Y-cable protection is supported on the UCM4 for the protection of 10 GbE, OTU2, OTU2e, OC-192, and/or STM-64 transport services.



Leverage the Same Platform for Open Line System Functions

The GX G30 Series supports a wide range of optical layer functions, including variable gain amplifiers; Raman amplifiers; OTDR; optical protection switching; optical channel monitoring; optical supervisory channel; tuneable dispersion compensation; dynamic gain equalization (DGE); fixed DWDM filters; 9D-, 12D-, 20D-, 32D-, and 66D- ROADMs on blades; CAD and CDC; and Super C+L-band functionality. For more details, see the GX G30 Series Open Line System Data Sheet.

Automation Enabled by Open APIs and Streaming Telemetry

The GX platform supports management, automation, and streaming telemetry via open interfaces. It supports WebGUI, CLI, SNMP, TACACS+, syslog, YANG-modeled NETCONF and RESTCONF APIs, and gNMI/gRPC streaming telemetry. It is OpenConfig and OpenROADM compliant. An OSPF-based DCN is supported with in-band management via GCC (or OSC with GX G30 OLS) and out-of-band management via RJ-45 Ethernet interfaces. Multiple GX chassis can be stacked and managed as a single entity. Additional manageability features include zero-touch commissioning (ZTC), RMON, LLDP, and PRBS test generation and loopbacks. The GX platform is supported under NokiaTranscend Controller/NMS.

Technical Specifications

GX Platform System Configuration and Modularity

- G42 with four single-slot sleds
- G32 with eight single-slot sleds, four dual-slot sleds respectively
- G31 with four single-slot sleds respectively two dual-slot sleds
- G34c with four single-slot sleds
- G34Xc with four single-slot sleds and a high-speed backplane
- Single-slot sleds and dual-slot sleds can be mixed within the same system
- All sleds are field replaceable and hot swappable
- G31, G32, G34c and G34Xc support optical layer and transponder within the same chassis

Environmental

- The GX is designed to meet both NEBS and ETSI standards specifications
- Operating temperature: 0°C to 40°C/32°F to 104°F and GX G42: -5°C to 55°C/23°F to 131°F
- Transport and storage: -40°C to 70°C/-40°F to 158°F/40°C + 93% RH
- Humidity: 5% to 90% non-condensing

CHM7 and CHM7X

- CHM7: Single-slot sled - up to four per GX G42 chassis
- CHM7X: Double-slot sled - up to four per GX G32 chassis and up to two per GX G31 chassis
- 2 x embedded coherent line interfaces
- Data rate tuneability: 200 Gb/s to 1200 Gb/s in 100 Gb/s increments
- Baud rate tuneability: 68 to 140+ Gbaud in 0.1 Gbaud Increments
- Nyquist shaping and configurable roll-off: 0.1% to 100% in 0.1% increments
- Linear and non-linear compensation
- Equalization-enhanced phase noise (EPPN) compensation fiber capacity
- CHM7 wavelength tuneability range: Super C- and Super L-band
- CHM7X wavelength tuneability range: Super C-band
- Spectrum: Extended C: 4.8 THz, Super C: 6.1 THz, Extended L: 4.8 THz, Super L: 5.5 THz
- TX optical output power: -10 dBm to 0 dBm

- Modulation options:
 - Probabilistic constellation shaping (PCS)
 - PCS-64QAM (12 to 4 bits per symbol)
 - PCS-32QAM (10 to 4 bits per symbol)
 - PCS-16QAM (8 to 4 bits per symbol)
 - Conventional modulation: 64QAM, 32QAM, 16QAM, 8QAM, QPSK
 - High-gain soft-decision forward error correction (SD-FEC) with 15% overhead
 - Overhead-efficient Ethernet framing mode (Ethernet transponder/muxponder)
 - Bandwidth virtualization over two wavelengths (e.g., 5 x 400 GbE over 2 x 1 Tb/s wavelengths)
 - Chromatic dispersion tolerance
 - >500,000 ps/nm (depending on line mode)
 - >300,000 ps/nm at 140Gbaud
 - Max DGD: Up to 130 ps
 - SOP rotation tolerance: up to 20 Mrad/s (depending on line mode)
 - Client interfaces:
 - 800 GbE: max 3 - QSFP-DD800: DR8++
 - 400 GbE: max 6 - QSFP-DD: DR4, FR4, LR4, SR8, AOC, XDR4
 - 100 GbE/OTU4: max 24
 - SN 4 x 4 connectors: LR4, LR1
 - QSFP-DD: 4 x 100GBASE-DR
 - Protection
 - Y-cable
 - Single CHM7
 - Dual CHM7 within the same GX G42 chassis
 - 1+1 SNCP
 - 1+1 OCh protection
 - With line system optical protection switch (OPSM)
 - Including coherent colorless add/drop with optical protection switch-pilot tone (OPSM-PT)
 - Power dissipation CHM7: 2 x 1.2 Tb/s: 257 W (typical) to 432 W (max)
 - Power dissipation CHM7X: 2 x 1.2 Tb/s: 219 W (typical) to 405 W (max)
- ## CHM6
- Single-slot sled (up to four per GX G42 chassis)
 - 2 x embedded coherent line interfaces
 - Data rate tuneability: 100 Gb/s to 800 Gb/s in 50G increments
 - Baud rate tuneability: 31 to 96 Gbaud (ICE6)/100.4 Gbaud (ICE6 Turbo)
 - C-band and L-band tuneability
 - TX optical output power: -6 dBm to +9 dBm
 - Modulation options:
 - Probabilistic constellation shaping (PCS)
 - 64QAM
 - Long-codeword PCS (LC-PCS)
 - 12 to 4 bits per symbol
 - Gaussian and super-Gaussian distribution options
 - Conventional modulation: 64QAM, 32QAM, 16QAM, 8QAM, QPSK
 - Time-domain hybrid modulation (e.g., 64/32QAM, 4/3QAM)
 - Specialized 4D/8D modulation formats for dispersion-managed subsea
 - High-gain soft-decision forward error correction (SD-FEC) with 20% or 33% overhead options
 - Second-generation Nyquist subcarriers (8 subcarriers per wave)
 - Dynamic bandwidth allocation (per-subcarrier PCS)
 - SD-FEC gain sharing (over two waves)
 - Bandwidth virtualization over two wavelengths (e.g., 3 x 400 GbE over 2 x 600G wavelengths)
 - Chromatic dispersion tolerance: 150,000 ps/nm to 400,000 ps/nm (depending on line mode)

- 16 x pluggable client interfaces
 - 8 x QSFP28
 - 4 x QSFP28/56
 - 4 x QSFP28/56/DD
 - 400G: AOC, FR4, SR8, LR4, DR4, SR4.2, DAC, XDR4
 - 100G: LR4, FR1, SR4, CWDM4, DR, ER, CR4, LR1, ER4
- Protection
 - Y-cable
 - SNCP
 - 50-ms OCh protection
 - Including coherent colorless add/drop
 - With line system optical protection switch
- Power dissipation: 213 to 445 W depending on configuration

CHM2TX

- Dual-slot sled for G31/G32
- 600G generation coherent technology with 16-nm dual-wavelength DSP and high-performance indium phosphide modulators
- 2 x integrated coherent line interfaces
 - 100 Gb/s-600 Gb/s in 50G increments
 - Tuneable 28-72 Gbaud
 - PM-QPSK/8QAM/16QAM/32QAM/64QAM
 - Time-domain hybrid modulation
 - Geometric shaping
 - Set partitioning:
 - PM-SP-QPSK (2 bits/symbol), high-performance alternative to PM-BPSK
 - PM-SP-16QAM (6 bits/symbol), high-performance alternative to PM-8QAM
 - Non-differential encoding
 - FEC: 27% (12 dB NCG) or 15%
 - Spectral shaping including WSS filtering mitigation
 - Non-linear compensation

- 50 ms line protection including coherent colorless add/drop
- Performance monitoring: CD, PMD, PDL, Q-factor, pre-FEC BER, OTU-level PM, delay measurement
- Chromatic dispersion tolerance of >300 ns/nm (100 Gb/s PM-QPSK)
- PMD: Up to 50 ps mean DGD (100 Gb/s PM-QPSK)
- SOP rotation tolerance: >3 Mrad/s (100 Gb/s PM-QPSK)
- 12 x QSFP client interfaces
 - 12 x 100 GbE/OTU4 QSFP28 (SR4, LR4, ER4, PSM4, CWDM4, active optical cable)
 - 3 x 400 GbE QSFP-DD (SR8/AOC, FR4, DR4, LR8)
- GCC0 in-band management on the line port OTUK
- PRBS test and loopback
- LLDP and RMON support (100 GbE)
- Power dissipation: 240 W - 270 W including client pluggable interfaces

CHMQ6 and CHMS8

- CHMQ6: Singel slot sled for G31/G32
 - 6 x QSFP-DD800 pluggable interfaces
- CHMS8: Double slot sled for G31/G32
 - 8 x OSFP pluggable interfaces
- 800G generation coherent technology incl. ICE-X 800G ZR/ZR+
- Line rates from 200 Gb/s to 800 Gb/s
- Fully tunable over C-band or L-band
- OIF-800ZR-01.0 Implementation Agreement compliant
- OIF-400ZR-03.0 Implementation Agreement compliant
- OpenZR+ Rev 3.0 compliant
- Open ROADM 6.0 modes
- 800 GbE, 400 GbE, 100 GbE client support
 - OTU4, OTUCn in future releases

- Supports upgrade from 400G ZR to 800G ZR
- Data rate tunability: 200 Gb/s to 800 Gb/s in 200G increments
- TX optical output power: -2 dBm to -4 dBm
- Modulation formats:
 - Two Probabilistic constellation shaping (PCS) modes
 - Interoperable PCS
 - High Performance PCS
 - Conventional modulation: 16QAM, QPSK
- Secure boot
- MACSec encryption in future release
- Power dissipation CHMQ6: 73.7 Watt excluding pluggables
- Power dissipation CHMS8: 125 Watt excluding pluggables
- Non-differential encoding
- Spectral shaping including WSS filtering mitigation
- Client interfaces
 - 1 x QSFP+/28/56/DD + 5 x QSFP+/28/56 per SPN2
 - 400G: AOC, DAC, FR4, SR8, LR4, DR4, XDR4, LR8, 4 x LR1/4 x DR1/4 x FR1
 - 100G: ZR, LR4, LR4 DR, LR1, SR4, PSM4, CWDM4, ER4, DR1, AOC, MR ER4L, DAC
 - 10G: ER, LR, SR
 - OTU2e, OTU4,
 - 16G Fibre Channel
 - 32G Fibre Channel
 - OTUCn/FlexO hardware ready
 - 25/40/50/200 GbE/FlexE hardware ready
- 50-ms line protection including coherent colorless add/drop
- Performance monitoring: CD, PMD, PDL, Q-factor, pre-FEC BER, OTU-level PM, delay measurement
- Chromatic dispersion tolerance of >300 ns/nm (100 Gb/s PM-QPSK)
- PMD: Up to 50 ps mean DGD (100 Gb/s PM-QPSK)
- Wire-speed ODU4 AES-256 encryption for 100G and 400G clients
- GCC0 in-band management on the line port OTUk
- PRBS test and loopback
- LLDP snooping on each 400 GbE/100 GbE/10 GbE client port
- RMON and test signal
- TCM
- Delay measurement
- Facility and terminal loopback
- Client hairpin
- OEO 3R regen capability without client
- Power dissipation: 205W - 220 W including client and line interfaces

SPN2/SPN2C

- SPN2: double-slot for G31/G32
 - Slot pairing with another SPN2 sled within same chassis
- SPN2C: single-slot for G34c and GX G34Xc
 - Slot pairing with another SPN2C sled within the same G34Xc chassis
- 400G generation coherent technology incl. ICE-X 400G XR
- 4 x coherent pluggable QSFP28-DD
 - QSFP ZR+, ICE-X QSFP-DD
 - ZR/Open ZR+/OpenROADM 400G and XR 400G pluggables
 - 100 Gb/s-400 Gb/s in 100G increments
 - DP-QPSK/8QAM/16QAM
 - Tuneable 27.9-63 Gbaud
 - FEC: CFEC, oFEC, XR FEC; 15% FEC and 7% FEC options
- Time-domain hybrid modulation



CHM1R

- Single-slot (up to four per GX G31 and max eight per GX G32)
- 400G generation coherent technology
- 2 x coherent pluggable CFP2 line interfaces
 - CFP2 ZR+, CFP2 oFEC, CFP2 XR
 - 100 Gb/s-400 Gb/s in 100G increments
 - Tuneable 27.9-63.1 Gbaud
 - PM-QPSK/8QAM/16QAM
 - CFEC and OpenROADM oFEC, Open XR FEC
- 4 x QSFP-DD client interfaces
 - 4 x 100 GbE/OTU4 QSFP28 (DAC, AOC, SR4, SR4.2, LR4, ER4, PSM4, CWDM4)
 - 2 x 400 GbE QSFP-DD (DAC, DR4, FR4, LR8, LR4, SR8, XDR4)
- IEEE 1588 timing ready
- Protection
 - Client OPSM, client Y-cable
 - Line OTS, OMS, OCH
- OTN L1 encryption
- GCC0 in-band management on the line ports
- LLDP snooping on 100 GbE/400 GbE
- RMON
- TCM
- PRBS test and loopback
- Power dissipation: 108 W - 120 W including client and line pluggable interfaces

UTM2

- Dual-slot (up two per GX G31 and max four per GX G32)
- Applications: transponder, muxponder, ADM, client hairpin
- 2 x 100G/200G CFP2-DCO
 - CFP2-DCO options with OpenROADM-compliant FEC (oFEC) and ZR/ZR+-compliant FEC (CFEC/CFEC+)
 - Max 2 x 100G coherent or 1 x 200G coherent per UTM2
- 2 x QSFP28
 - 100 GbE/OTU4
- 12 x SFP/SFP+
 - 1 GbE, 10 GbE, OTU2/OTU2e, STM-64, OC-192, and 1G/4G Fibre Channel
 - Tuneable DWDM SFP+ option
- 4 x 10 GbE breakout application supports using the MPO-MPO cable
- FEC: IEEE 802.3bj Clause 91 FEC, G709 RS-FEC, I4, I7, G709 RS-FEC
- Non-intrusive end-to-end sub-network connection protection (SNCP) on the ODU2(e)/ODU4 layer
- GCC0 in-band management on the line port OTUK
- PRBS test and loopback
- LLDP support (Ethernet clients)
- Wire-speed AES-256 encryption (hardware-ready)
- Power dissipation: 128 W-135 W including client and line pluggable interfaces

*Product features and specifications are subject to change

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

With truly open architectures that seamlessly integrate into any ecosystem, our high-performance networks create new opportunities for monetization and scale. Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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Document code: CID214590 (July)