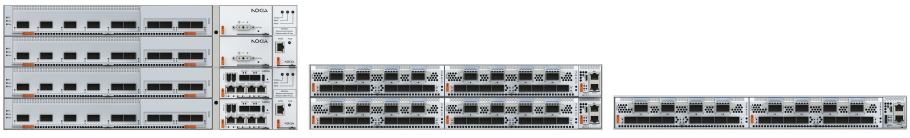
Nokia Open OTN Switchponders SPN2 and SPN2C

Expanding the market-leading Nokia 1830 Global Express (GX) compact modular transport with high-capacity OTN switching

The 1830 GX SPN2 and SPN2C open switchponders provide aggregation-optimized OTN switching for open, compact modular metro and regional optical networks. The SPN2/SPN2C 1.2 Tb/s switching sleds utilize the latest high-performance 400G QSFP-DD DWDM coherent pluggables for maximum solution density and optical networking capabilities. Supporting a flexible range of coherent technologies, such as OIF 400G ZR, OpenZR+, ITU-T/OpenROADM-defined coherent FlexO/FlexOGroup, and XR standards, as well as variable line rates and modulation formats, the solution provides a rich set of deployment options, including support for legacy fixed-grid and modern flexible-grid infrastructure. Using the SPN2/SPN2C sleds, network operators can increase the capacity of their installed base, improve wavelength utilization, improve fiber utilization, lower cost and power per bit, and reduce footprint. With less than 0.18 W/G, the switch-on-a-blade design of the SPN2/SPN2C sleds enables low-power network architectures drawing considerably less power than traditional OTN switching solutions with a centralized switching fabric.

The solution provides native open APIs with OpenConfig YANG-based data models as well as streaming telemetry and supports a wide range of network applications, from bespoke enterprise networks to the largest service provider networks.

The SPN2/SPN2C OTN switchponder is available for both 600-mm and 300-mm installation environments, and through the common feature set and software it can be deployed seamlessly in any network.



1830 GX G34c/G34Xc – ETSI 300 mm | 1830 GX G32 – 600 mm | 1830 GX G31 – 600 mm

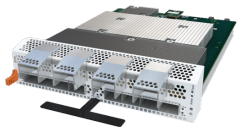
Figure 1: Nokia 1830 GX and OTN switching

OTN ADM and Multi-Degree OTN Switching

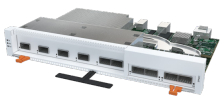
Network operators with linear add-drop chains, rings, or meshed networks and with multi-service requirements can benefit from the low-speed service grooming and Layer 1 OTN switching capabilities of the SPN2/SPN2C to ensure wavelength resources are efficiently utilized and optimally deployed across the network. Add-drop multiplexing functionality enables network operators to optimize bandwidth by sharing wavelength resources along linear add-drop or ring networks, with flexible service allocation at any node.

Benefits of the SPN2 and SPN2C Sleds

- Enables high-capacity OTN switching in the 1830 GX G30 Series/1830 GX G30c Series
- 1.2T switch on a blade with up to four directions; up to 2.4T with paired sleds with up to eight directions
- Leverages high-performance QSFP-DD 400 Gb/s DWDM pluggables, supporting multiple sources including XR optics
- Provides cost-effective transport and switching of Ethernet, OTN, and Fibre Channel services over a wide range of distances, from metro to long-haul
- Flexibly supports muxponder, transponder, ADM, SNC-P, and hairpin configurations
- Improves wavelength and fiber utilization with 400 Gb/s-based switching
- Supports deployments over fixed-grid and flexible-grid line systems from both Nokia and third parties
- Provides security utilizing Layer 1 ODU payload encryption
- Enhances 5G networks with line card timing for SyncE and IEEE 1588
- Minimizes operational costs and accelerates service delivery through highly automated 1830 GX G30 Series software feature set and native open APIs



SPN2 sled



SPN2C sled

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With up to four coherent DWDM line interfaces per sled and with the flexibility to pair with a second SPN2/SPN2C switchponder to create a larger switch, which doubles the number of coherent DWDM line interfaces to eight, the SPN2/SPN2C enables metro and regional networks to be built in the most efficient and economical manner. Multi-degree sites – sites with more than two fiber directions – can also be more efficiently designed, with back-to-back transponders or muxponders being eliminated entirely. These configurations also reduce the required number of line interfaces and wavelengths and reduce patch cabling requirements. Overall, the combination of these factors can significantly reduce the total cost of ownership of the network.

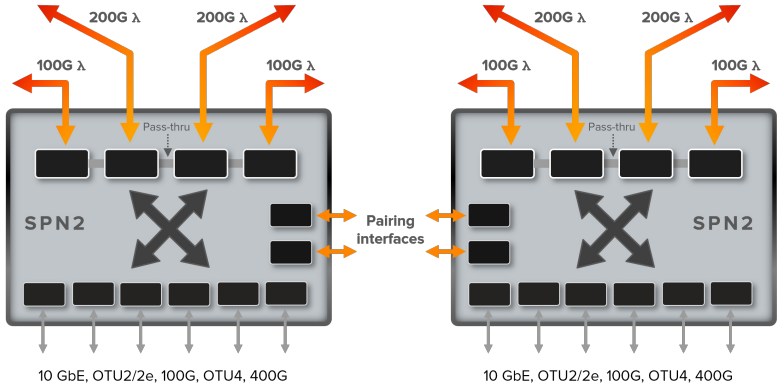

Figure 2: Nokia 1830 GX SPN2 sled and paired configuration

In combination with 1830 GX G30 Series transponders and muxponders, the OTN switchponders complement the service layer of the Nokia 1830 GX open compact modular solution, providing maximum efficiency for all service types, including from 1 GbE to 400 GbE, from ODU0 to ODU4, FC16G/32G, and FlexE/FlexO. The 1830 GX G30 Series supports standalone switching configurations and a mixed configuration of DWDM optical line system functionality and transponders, muxponders, and switching functionality within the same chassis.

1830 GX G30 Series SPN2 and SPN2C

The SPN2/SPN2C sleds utilize high-performance QSFP-DD DCO pluggable interfaces, including 0 dBm output power options, and support both FOADM and ROADM deployments. SPN2/SPN2C sleds provide up to four QSFP-DD coherent flexible-rate line interfaces, with each interface capable of supporting 400G-DP-16QAM, 300G-DP-8QAM, 200G-DP-16QAM, 200G-DP-QPSK, and 100G-DP-QPSK line rate and modulation formats. Forward error correction options include concatenated FEC (CFEC), open FEC (oFEC), and XR optics FEC (XR-FEC). The QSFP-DD line-side interface types are 100-400G FlexO/OTUCn/OTU4 or XR/ZR/ZR+ optics.

The SPN2/SPN2C sleds support up to 1.2 Tb/s of OTN switching within a single sled and up to 2.4 Tb/s in paired sled configurations. 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.

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/SPN2C sled. On the client side, the SPN2/SPN2C provides six pluggable client interfaces, one QSFP28/56/DD, and five QSFP+/28/56, and supports 10 GbE, 25 GbE, 40 GbE, 50G, FC16G, FC32G, 100 GbE, OTU2, OTU4, 200G, 400 GbE, 400G ZR, 100G ZR, FlexE, FlexO, or a flexible mix of these client interfaces.

Other service-related features include Layer 1 ODU payload encryption, RMON and LLDP for Ethernet client ports, PRBS/null/idle test, delay measurement, facility/terminal loopback, line card timing mode for SyncE and IEEE 1588, GCC, and ODUk TCM support.

The SPN2/SPN2C's line-side 100G-400G interoperability with the 1830 GX G30 Series CHM1R sled enables cost-efficient network architectures utilizing the SPN2/SPN2C for OTN switching in aggregation nodes and the CHM1R for high-capacity 400G handover in core nodes.

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SPN2

The double-slot SPN2 sled is designed for the 1830 GX G31 and 1830 GX G32 shelf variants for 600-mm-deep deployment environments. In addition to the 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.

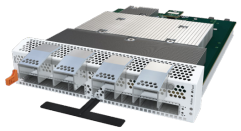

Figure 3: SPN2 sled

Up to two SPN2 sleds are supported per 1RU 1830 GX G31 chassis and up to four SPN2 sleds are supported per 2RU 1830 GX G32 chassis, providing up to 4.8 Tb/s of OTN switching within a single chassis. The 1830 GX G31/1830 GX G32 supports any mix of 1830 GX G30 Series sleds within the chassis, including optical layer sleds. Multiple 1830 GX chassis (1830 GX G31, 1830 GX G32, 1830 GX G34c, and 1830 GX G42) can also be stacked within a single network element to create network nodes with even higher levels of OTN switching if required.

Figure 4: Nokia 1830 GX G31 with two SPN2s and 2.4T (2 x 1.2T) OTN switching configuration

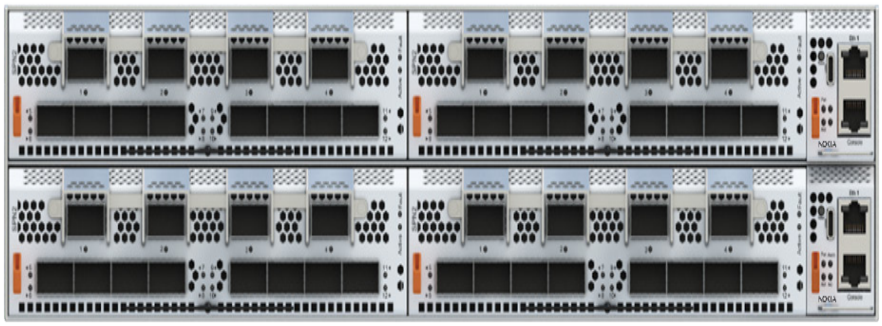

Figure 5: Nokia 1830 GX G32 with four SPN2s and 4.8T (4 x 1.2T) OTN switching configuration

SPN2C

The double-slot SPN2C sled is designed for the 1830 GX G34c and 1830 GX G34Xc shelf variants for compact 300-mm-deep deployment environments. In additional to the four line interface ports and six client interface ports, the SPN2 sled supports backplane connectivity for connection to a paired SPN2C sled. Using the 1830 GX G34Xc chassis backplane, two SPN2C sleds can be interconnected to double the switching capacity within the same chassis. In paired mode, two SPN2C 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.

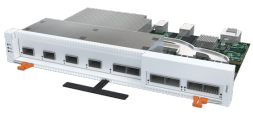

Figure 6: SPN2C sled

Up to four SPN2 sleds are supported per 4RU 1830 GX G34c/G34Xc chassis. The 1830 GX G34c/1830 GX 34Xc supports any mix of 1830 GX G30 Series compact (300-mm-deep) sleds within the chassis, including optical layer sleds.

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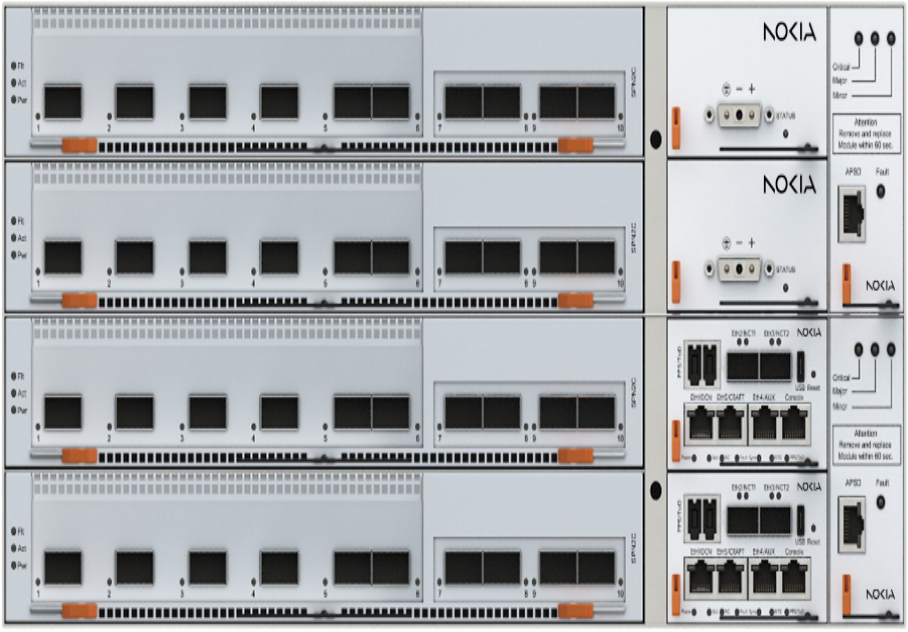

Figure 7: Nokia 1830 GX G34c/1830 GX G34Xc with four SPN2Cs and 4.8T (4 x 1.2T or 2 x 2.4T) OTN switching configuration

Maximize Capacity-Reach and Fiber Capacity

The 400G technology supported by the SPN2/SPN2C significantly improves optical networking performance when compared to the previous generation of 200G pluggable technology. Furthermore, the SPN2/SPN2C can be programmed to operate over a wide range of interface rates, from 100 Gb/s DP-QPSK to 400G DP-16QAM, to support multiple network application scenarios and requirements from metro to long-haul. The sleds also improve wavelength capacity-reach significantly over the previous generation of 200G technology, supporting both higher capacity per wavelength and significantly longer reach at 100G/200G, which substantially reduces signal regeneration requirements.

In addition to reach enhancements, the SPN2/SPN2C's 400G coherent technology improves spectral efficiency, supporting up to 25.6T over a single fiber pair in the extended C-band spectrum – 64 x 400 Gb/s wavelengths. Compared to the previous generation of 200G coherent technology that delivered up to 19.2T capacity per fiber pair, the 400G coherent technology improves fiber utilization by over 33%.

Automation Enabled by Open API and Streaming Telemetry

The 1830 GX is fully managed by Nokia's Transcend Network Management System and Transcend Controller in the Transcend Network Suite and also supports open management, automation, and streaming telemetry via standard open interfaces. The 1830 GX supports WebGUI, CLI, SNMP, TACACS+, syslog, YANG-modeled NETCONF and RESTCONF APIs, and gNMI/gRPC streaming telemetry. It is OpenConfig compliant for simple integration into SDN environments. In-band management is supported via GCC0 on all line interfaces, and on-site commissioning is also available via the local console interface. Additional manageability features include zero-touch commissioning, RMON, LLDP, and PRBS test generation and loopbacks.

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Technical Specifications

Application
- 100G to 400G OTN muxponder
- 400G to 400G OTN transponder
- 100G to 100G OTN transponder with multiple instances
- OTN add-drop multiplexer (OTN ADM)
- Multidirectional 1.2Tbit OTN switching
- Pairing either two SPN2 sleds or two SPN2C sleds provides up to 2.4T OTN switching capacity
- SNC-P

Physical Interface
- Line: QSFP-DD coherent DWDM
- Client: QSFP-DD, QSFP56, QSFP28, QSFP+

Line Interfaces
- 400G generation coherent technology
- 100 Gb/s-400 Gb/s in 100G increments
- 28-63 Gbaud range
- 4 x QSFP-DD DCO pluggables
  - ZR/OpenZR+/OR 400G and XR 400G pluggables
  - FEC: CFEC, OFEC, and XR FEC; 15% FEC and 7% FEC options
- DP-QPSK/8QAM/16QAM
- Time-domain hybrid modulation
- Non-differential encoding
- Spectral shaping including WSS filtering mitigation
- 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
- GCCO in-band management on the line port OTUk
- PRBS test and loopback

Client Interfaces
- 1 x QSFP+/28/56/DD + 5 x QSFP+/28/56 per SPN2/SPN2C
- 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
- FC32G
- OTUCn/FlexO hardware ready
- 25/40/50/200GE/FlexE hardware ready
- FC16G hardware ready

Other Features
- OTS, OMS, and OCH protection
- Interworking with RD20, RD09, POL, OPSM
- Generic Communication Channel (GCC0) support
- OTN L1 encryption
- Secure boot
- 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

Management Options
- Management and control platforms:
  - Nokia Transcend Network Management System
  - Nokia Transcend Controller
- Command line interface
- Zero-touch commissioning
- Syslog
- TACACS+/RADIUS
- WebGUI
- NETCONF
- RESTCONF
- Native YANG models
- OpenConfig
- gNMI/gRPC
- SNMP fault and performance management
- OSPF-based DCN

Environmental
- Max power dissipation 220 W
- Operating temperature: 0° C to 45° C/32° F to 113° F, NEBS 3 per GR-63 -5C to 40C long term
- Transport and storage: -40° C to 70° C/-40°F to 158° F/40° C + 93% RH
- Humidity: 5% to 90% non-condensing

Regulatory and Compliance
- ROHS 10 per Directive (EU) 2015/863
- GR-63-CORE, NEBS Requirements for Physical Protection
- GR-3160-Core Generic Requirements for Telecommunications Data Center Equipment and Spaces
- Telcordia GR-326-Core Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
- Telcordia GR-1435-Core Generic Requirements for Multi-Fiber Optical Connectors
- Emissions: FCC Part 15 Class A, EN55022/CISPR Class A Compliant, CE Laser Safety: ANSI Class 1M, IEC Class 1M, EN 60825-1/2, 21 CFR 1040 US FDA CDR, Class 1
- Electrical safety: UL/ IEC/EN 62368-1

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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