Optical breakout solution for Nokia IP and data center platforms

The Nokia optical breakout solution delivers flexible, scalable options with the elegant fiber management required for IP and data center network deployments.

As fiber network infrastructure undergoes significant expansion to meet the evolving needs in modern, dynamic IP and data center networks, an efficient optical breakout solution is essential. Nokia delivers a complete solution that simplifies fiber management, maximizes equipment resource utilization, improves cost-effectiveness, and enhances performance.

The solution breaks out high-speed optical connectors into lower-speed ports, allowing operators to maximize interface density and bandwidth utilization on the host Nokia platform while minimizing the number of systems and line cards required to meet deployment needs. Far-end systems can be connected one port at a time at the breakout connector without service impact to the host platform port.

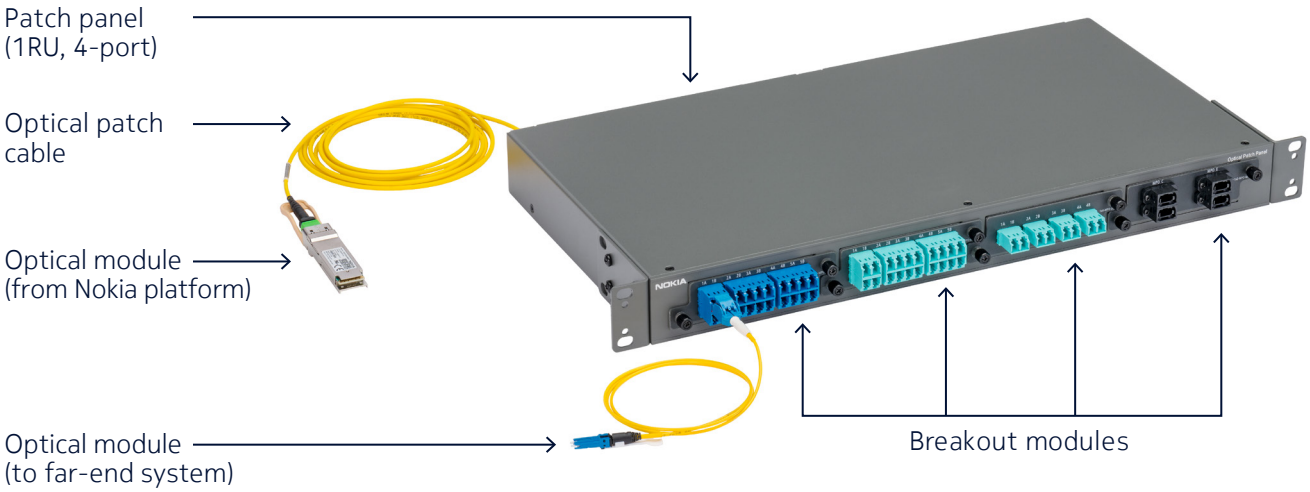
Supporting QSFP+, QSFP28 and QSFP-DD optical modules with breakout capabilities on Nokia platforms, the modular solution offers operators the flexibility to mix and match connector breakout options, and include 4 x 10GE, 8 x 10GE, 10 x 10GE, 4 x 25GE, 2 x 100GE, 4 x 100GE, 8 x 100GE and 2 x 400GE. These options can be deployed in the same rack or an adjacent rack to meet diverse operational and deployment and operational requirements.

Optical patch panel with four breakout modules

A complete solution

Ensuring maximum end-to-end signal performance and ultra-low loss connectivity, the solution provides elegant cable and connectivity management for efficient aggregation of an ever-increasing number of far-end, lower-speed systems. Components include a patch panel, breakout modules, optical cables and optical modules.

Figure 1. Nokia optical breakout solution overview



Patch panel

Maximizing rack space utilization, the 1RU, rack-mountable patch panel accommodates up to four breakout modules. It offers the flexibility to mix and match breakout modules in any slot to support the desired configuration. The panel is NEBS compliant, includes grounding support, and features fully passive modules.

Cables from the host platform connect at the rear of the panel, while breakout interfaces at the front simplify interconnections to far-end systems, ensuring a neat and manageable setup. An optional filler panel is available to restrict airflow in any unused module positions.

Breakout modules

Breakout modules provide clean and efficient cable management with simple plug-in installation. These modules internally cross-connect unique transmit/receive fiber pairs in a Multi-fiber Push On (MPO) patch cable to duplex Lucent Connectors (LCs) or MPO connectors, simplifying connectivity. Offering exceptional design flexibility, they are available in a variety of MPO-to-LC breakout options with single-mode fiber (SMF) and multi-mode fiber (MMF) variants.

Optical patch cables

MPO cables connect the optical transceivers on the host platform to the breakout patch panel. Available in SMF and MMF types, the cables come in 3m and 10m lengths. Cable options include MPO-12 to MPO-12, MPO-16 to MPO-16 and MPO-24 to MPO-24 variants.

Pluggable optical modules

Optical transceiver options include a wide range of variants such as 40G QSFP+,100G QSFP28, 2x100G QSFP28-DD, 400G QSFP56-DD, 400G QSFP112-DD and 800G QSFP112-DD to support connector breakouts of 4 x 10GE, 8 x 10GE, 10 x 10GE, 4 x 25GE, 2 x 100GE, 4 x 100GE, 8 x 100GE and 2 x 400GE. These optical modules include support for short reach (SR), long reach (LR), DR, FR, LR and CWDM (coarse wavelength division multiplexing), meeting requirements for speed, density, distance and wavelength. The easily expandable ecosystem is future ready, designed to accommodate additional breakout options as they become commercially available.

Nokia IP and data center platform support

The solution is supported on Nokia IP and data center platforms, including the 7220 Interconnect Router (IXR), 7250 Interconnect Router (IXR), 7730 Service Interconnect Router (SXR), 7750 Service Router (SR) and 7950 Extensible Routing System (XRS). Table 1 outlines the breakout support for each platform. Refer to the Optical Breakout Installation Guide and product release notices found at the Nokia IP Documentation Center for platform details on breakout speed and optics module support.

Table 1. Optical breakout support on Nokia IP and data center platforms

Breakout	7220 IXR	7250 IXR	7730 SXR	7750 SR	7950 XRS
4 x 10GE	x	x	x	x	x
8 x 10GE				x	
10 x 10GE				x	x
4 x 25GE	x	x	x	x	
2 x 100GE	x	x	x	x	x
4 x 100GE	x	x	x	x	
8 x 100GE		x*		x	
2 x 400GE		x*		x	

* Note: Planned future functionality

Optical breakout deployment options

The following figures and tables detail the optical breakout deployment options, showing the connectivity between key solution components.

10GE breakout solution: 4 x 10GE

The 4 x 10GE layout shown in Figure 2 begins with a QSFP+ optical module connector in a Nokia platform. An MPO-12 patch cable provides the connection to a one- or two-connector breakout module.

Each 10GE signal is carried on a unique transmit/receive fiber pair in the MPO-12 patch cable. The breakout module cross-connects each MPO fiber pair to a duplex LC connector. Using a two-connector 2 x 1 x 4 breakout module doubles the 10GE breakout density per 1RU rack space, enabling up to 8 x 10GE ports per breakout module. Far-end systems can use SFP+ or XFP optics.

Figure 2. 4 x 10GE and 2 x 4 x 10GE breakout solution

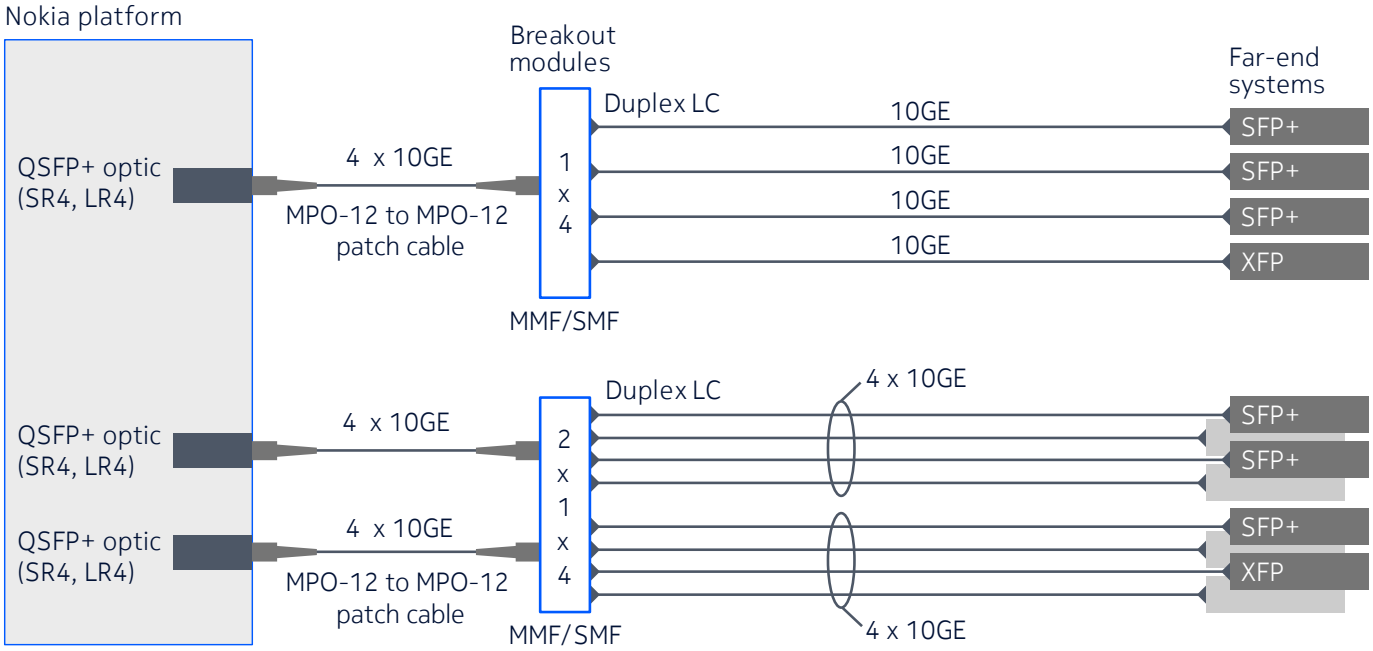


Table 2. 4 x 10GE and 2 x 4 x 10GE optical breakout components

4 x 10GE breakout components	
Component	Description
QSFP+ SR4 optics	40G QSFP+ 4x10G SR4 MMF, 100m, MPO ROHS6/6, 0/70C
QSFP+ LR4 optics	4x10G QSFP+ LR4 SMF, 10km, MPO ROHS6/6, 0/70C
Patch panel	1RU chassis to host 4 breakout modules
Optical breakout module	1 x MPO-12 to 6 (4 used) duplex LC breakout module, MMF
Optical breakout module	1 x MPO-12 to 6 (4 used) duplex LC breakout module, SMF
Optical breakout module	2 x MPO-12 to 12 (8 used) duplex LC module, MMF
Optical breakout module	2 x MPO-12 to 12 (8 used) duplex LC module, SMF
Optical patch cable	12F MMF MPO-12 to MPO-12 jumper, 3M
Optical patch cable	12F MMF MPO-12 to MPO-12 jumper, 10M

10GE breakout solution: 8 x 10GE

The 8 x 10GE layout shown in Figure 3 begins with a universal QSFP-DD optical module connector in a Nokia IP platform. An MPO-16 patch cable provides the connection to an eight-connector breakout module.

Each 10GE signal is carried on a unique transmit/receive fiber pair in the MPO-16 patch cable. The breakout module cross-connects each MPO fiber pair to an MPO-16 connector. Far-end routing systems can use SFP+ and XFP optics.

Using the 8x10GE solution doubles the 10GE density of a 4x10GE breakout. For sparing efficiency, this 8x10GE breakout layout uses the same MPO-16 cable and breakout module as the 8x100GE QSFP-DD breakout solution.

Figure 3. 8 x 10GE breakout solution

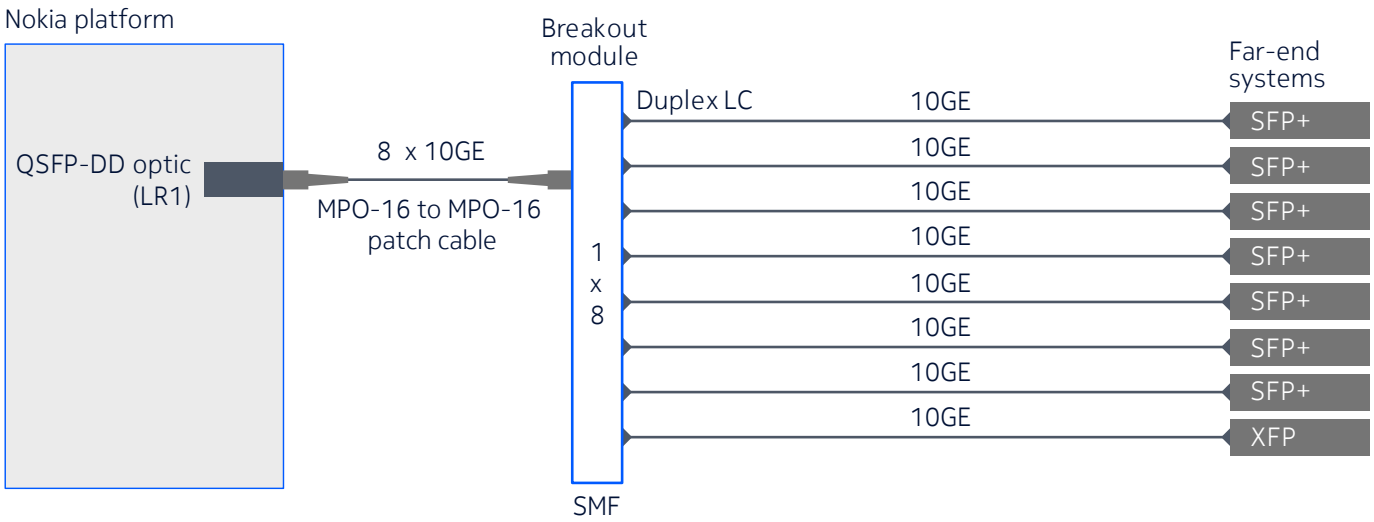


Table 3. 8 x 10GE optical breakout solution components

8 x 10GE breakout components	
Component	Description
QSFP-DD LR1 optics*	100G QSFP112-DD 8 x 10G LR1, 10km, 0/70C
Optical patch panel	1RU holder to host 4 pluggable modules
Optical breakout module	1 x MPO16 to 8 duplex, LC breakout, SMF
Optical patch cable	16F SMF MPO-16 to MPO-16 jumper, 3M
Optical patch cable	16F SMF MPO-16 to MPO-16 jumper, 10M

* Note: Patent pending

10GE breakout solution: 10 x 10GE

The 10x10GE layout shown in Figure 4 begins with a universal QSFP28 optical module connector in a Nokia platform. An MPO-24 patch cable provides the connection to a one connector breakout module.

Each 10GE signal is carried on a unique transmit/receive fiber pair in the MPO-24 patch cable. The breakout module cross-connects each MPO fiber pair to a duplex LC connector. Far-end systems can use SFP+ or XFP optics.

Figure 4. 10 x 10GE breakout solution

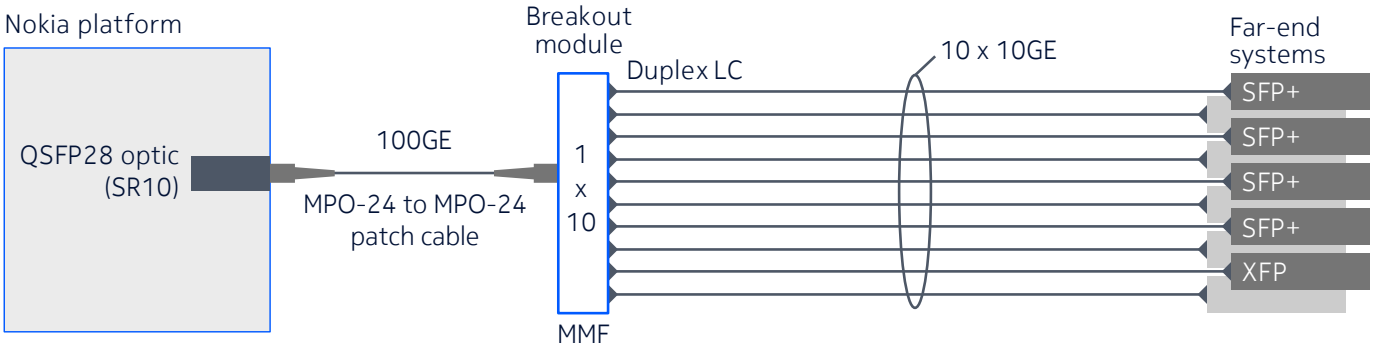


Table 4. 10 x 10GE optical breakout solution components

10 x 10GE breakout components	
Component	Description
QSFP28 SR10 optics	100G QSFP28 10 x 10G SR10, 100m, ROHS6/6, 0/70C
Optical patch panel	1RU chassis to host 4 breakout modules
Optical breakout module	1x MPO-24 to 12 (10 used) duplex LC module, MMF
Optical patch cable	24F MMF MPO-24 to MPO-24 jumper, 3M
Optical patch cable	24F MMF MPO-24 to MPO-24 jumper, 10M

25GE breakout solution: 4 x 25GE

The 4 x 25GE layout shown in Figure 5 begins with a QSFP28 optical module connector in a Nokia platform. An MPO-12 patch cable provides the connection to a one- or two-connector breakout module.

Each 25GE signal is carried on a unique transmit/receive fiber pair in the MPO-12 patch cable. The breakout module cross-connects each MPO fiber pair to a duplex LC connector. Using the two-connector 2 x 1 x 4 breakout module doubles the 25GE breakout density per 1RU rack space, enabling up to 8 x 25GE ports per breakout module. Far-end systems can use SFP28 optics.

Figure 5. 4 x 25GE and 2 x 4 x 25GE breakout solution

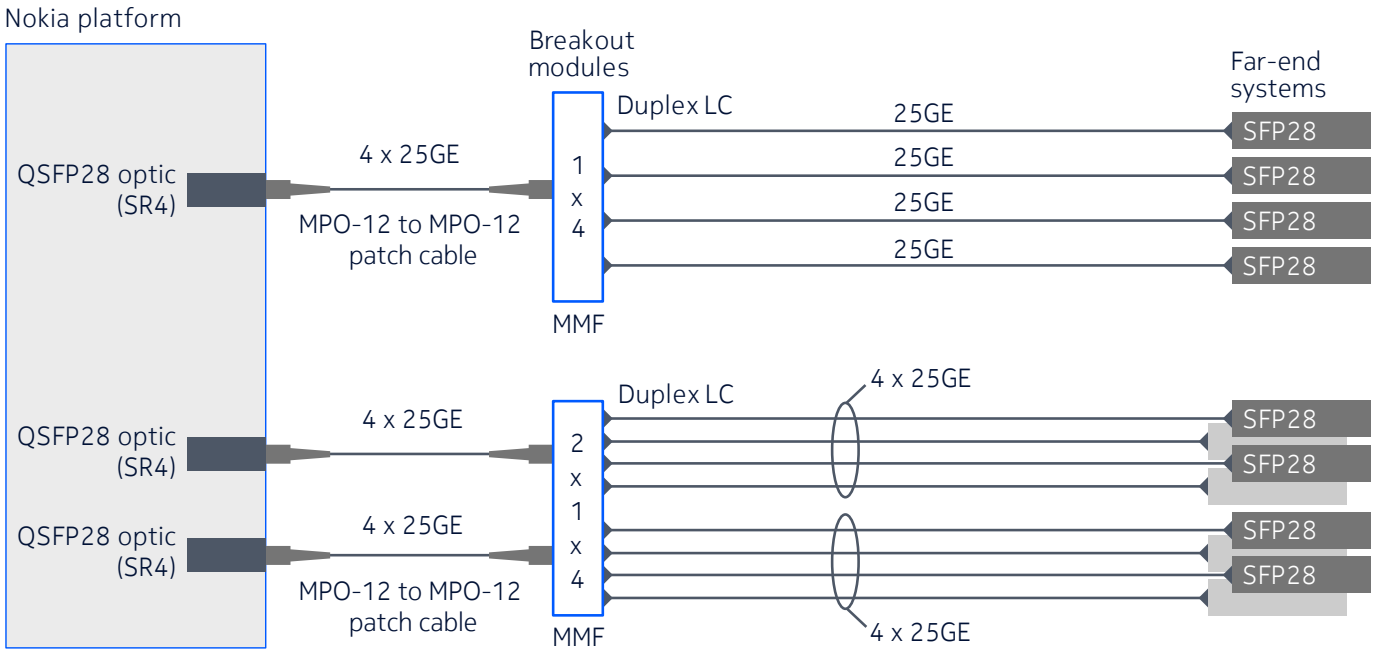


Table 5. 4 x 25GE and 2 x 4 x 25GE optical breakout solution components

4 x 25GE breakout components	
Component	Description
QSFP28 SR4 optics	100G QSFP28 4x25G SR4, 100m, MPO ROHS6/6, 0/70C
Optical patch panel	1RU chassis to host 4 breakout modules
Optical breakout module	1 x MPO12 to 6 (4 used) duplex LC module, MMF
Optical breakout module	2 x MPO-12 to 12 (8 used) duplex LC module, MMF
Optical patch cable	12F MMF MPO-12 to MPO-12 jumper, 3M
Optical patch cable	12F MMF MPO-12 to MPO-12 jumper, 10M

100GE breakout solution: 2 x 100GE

The 2 x 100GE layout shown in Figure 6 illustrates two breakout options. The first option begins with a universal 2x100G QSFP-DD optical module connector in a Nokia platform. An MPO-24 patch cable provides the connection to a two-connector breakout module.

Each 100GE signal is carried on a unique transmit/receive fiber pair in the MPO-24 patch cable. The breakout module cross-connects each MPO fiber pair to an MPO-12 connector. Using the two-connector 2 x 1 x 2 breakout module doubles the 100GE breakout density per rack space, enabling up to 4 x 100GE ports per breakout module. Far-end routing systems can use QSFP28 optics.

The second option begins with a QSFP-DD LR4 or CWDM4 optical module connector in a Nokia platform. A CS® connector provides a direct connection to far-end systems using a CS to LC optical jumper cable. This option eliminates the use of the patch panel and modules. Far-end systems can use QSFP28, CFP, CFP2 and CFP4 optics.

Figure 6. 2 x 2 x 100GE breakout solution

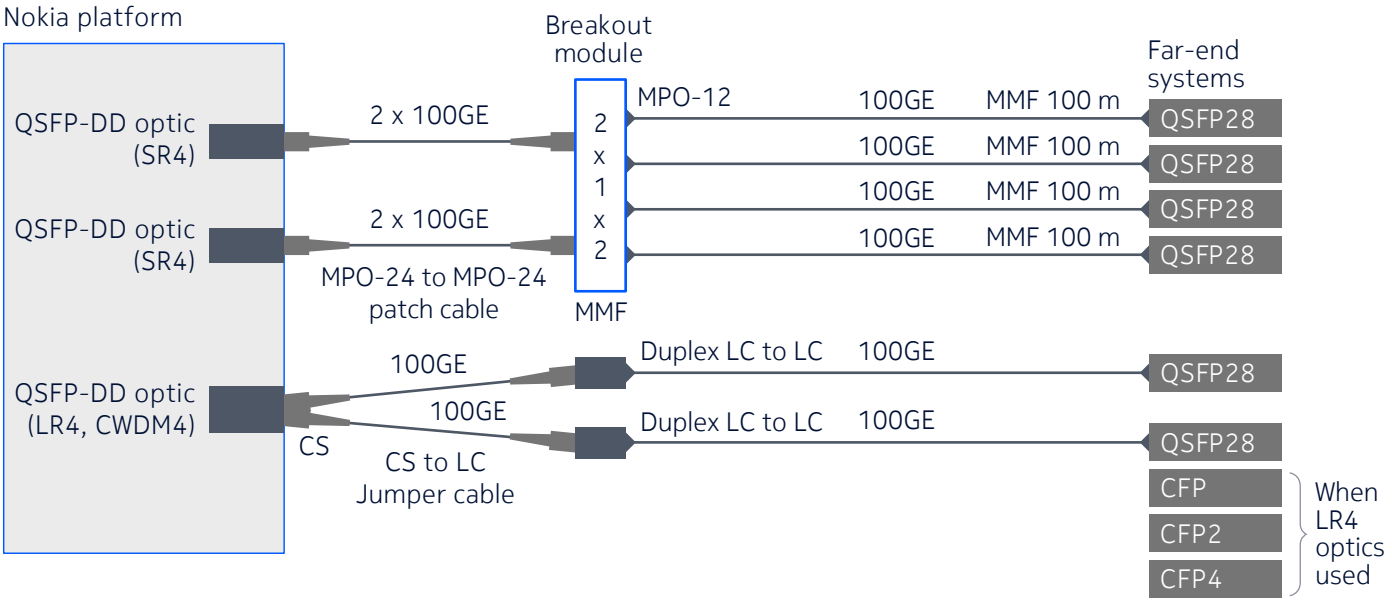


Table 6. 2 x 2 x 100GE optical breakout solution components

2 x 100GE breakout components	
Component	Description
QSFP-DD SR4 optics	2 x 100G QSFP28-DD SR4, 100m, MPO RoHS 6/6, 0/70C, Digital Diagnostic Monitor (DDM)
QSFP-DD LR4 optics	2 x 100G QSFP28-DD LR4, 10 km, CS RoHS 6/6, 0/70C, DDM
QSFP-DD CWDM4 optics	2 x 100G QSFP28-DD CWDM4, 2 km, CS RoHS 6/6, 0/70C, DDM
Optical patch panel	1RU chassis to host 4 breakout modules
Optical breakout module	2 MPO-24 to 4 MPO-12 module, MMF
Optical patch cable	24F MMF MPO-24 to MPO-24 jumper, 3 m
Optical patch cable	24F MMF MPO-24 to MPO-24 jumper, 10 m

100GE breakout solution: 4 x 100GE

The 4 x 100GE layout shown in Figure 7 begins with a universal 400G QSFP-DD optical module connector in a Nokia platform. An MPO-12 patch cable provides the connection to a four-connector breakout module.

Each 100GE signal is carried on a unique transmit/receive fiber pair in the MPO-12 patch cable. The breakout module cross-connects each MPO fiber pair to an MPO-12 connector.

The use of the two-connector 2 x 1 x 4 breakout module doubles the 100GE breakout density per rack space, enabling up to 8 x 100GE ports per breakout module. Far-end routing systems can use 100G QSFP28 or 100G SFP-DD single lambda optics.

Figure 7. 4 x 100GE and 2 x 4 x 100GE optical breakout solution

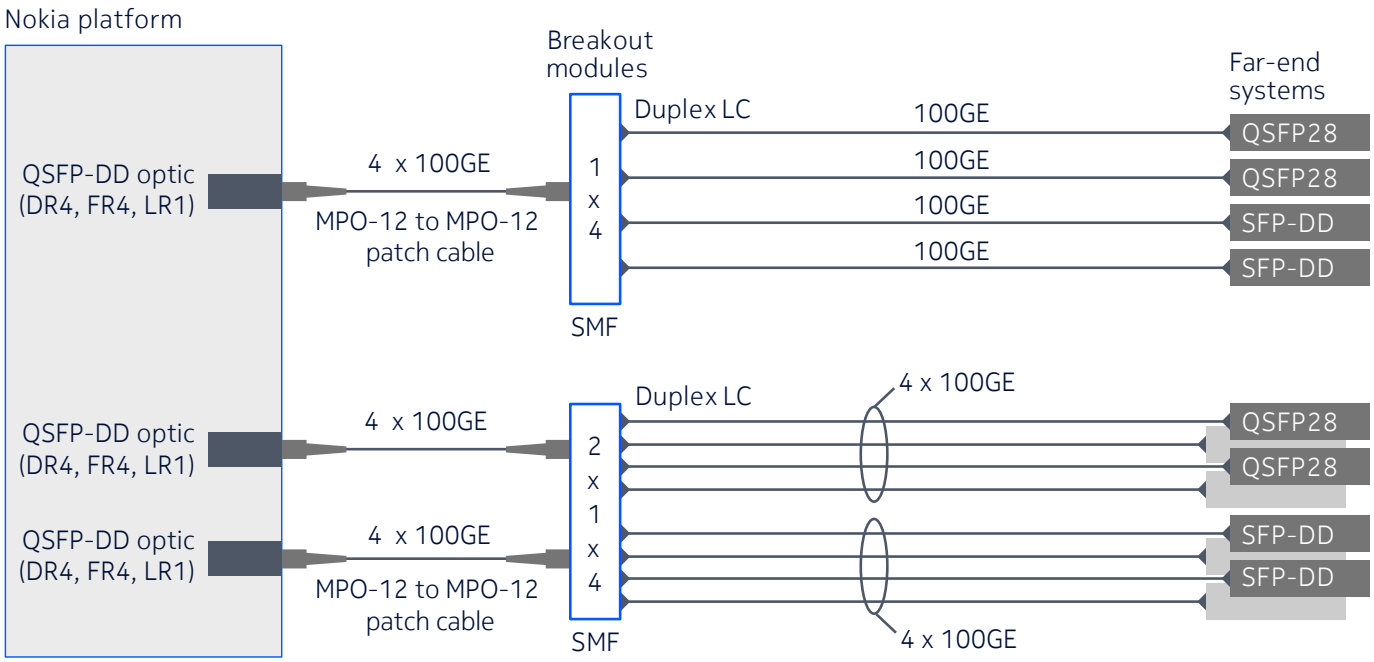


Table 7. 4 x 100GE and 2 x 4 x 100GE optical breakout solution components

4 x 100GE breakout components	
Component	Description
QSFP-DD DR4 optics	400G QSFP56-DD 4x100G DR4, 500m, MPO RoHS 6/6, 0/70C, DDM
QSFP-DD FR4 optics	4x100G QSFP56-DD FR4, 2km, MPO RoHS 6/6, 0/70C, DDM
QSFP-DD LR1 optics	4x100G QSFP56-DD LR1, 10km, MPO RoHS 6/6, 0/70C, DDM
Optical patch panel	1RU holder to host 4 pluggable modules
Optical breakout module	1 x MPO12 to 6 (4 used) duplex, LC breakout, SMF
Optical breakout module	2 x MPO-12 to 12 (8 used) duplex LC breakout, SMF
Optical patch cable	12F SMF MPO-12 to MPO-12 jumper, 3M
Optical patch cable	12F SMF MPO-12 to MPO-12 jumper, 10M

100GE breakout solution: 8 x 100GE

The 8 x 100GE layout shown is shown in Figure 8 begins with a universal 800G QSFP-DD optical module connector in a Nokia platform. An MPO-16 patch cable provides the connection to an eight-connector breakout module.

Each 100GE signal is carried on a unique transmit/receive fiber pair in the MPO-16 patch cable. The breakout module cross-connects each MPO fiber pair to an MPO-16 connector. Far-end routing systems can use QSFP28 or 100G SFP-DD single lambda optics.

For sparing efficiency, this 8x100GE breakout layout uses the same MPO-16 cable and breakout module as the 8x10GE QSFP-DD breakout solution.

Figure 8. 8 x 100GE breakout solution

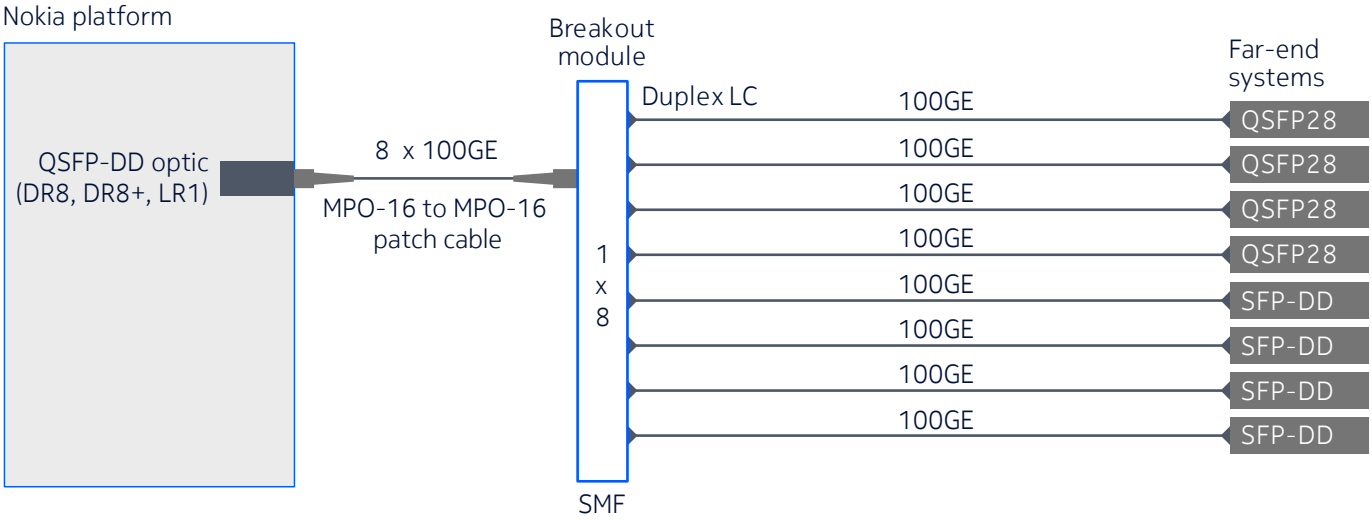


Table 8. 8 x 100GE optical breakout solution components

4 x 100GE breakout components	
Component	Description
QSFP-DD DR8 optics	800G QSFP112-DD 8x100G DR8, 500m, MPO RoHS 6/6, 0/70C
QSFP-DD DR8+ optics	800G QSFP112-DD 8x100G DR8+, 2km, MPO RoHS 6/6, 0/70C
QSFP-DD LR1 optics	8 x 100G QSFP-DD LR1, 10km, MPO RoHS 6/6, 0/70C
Optical patch panel	1RU holder to host 4 pluggable modules
Optical breakout module	1 x MPO16 to 8 duplex, LC breakout, SMF
Optical patch cable	16F SMF MPO-16 to MPO-16 jumper, 3M
Optical patch cable	16F SMF MPO-16 to MPO-16 jumper, 10M

400GE breakout solution: 2 x 400GE

The 2 x 400GE layout shown in Figure 9 begins with an 800G QSFP-DD optical module connector in a Nokia platform. A CS® connector provides a direct connection to far-end systems using a CS to LC optical jumper cable.

This option eliminates the use of the patch panel and breakout modules. The far end system can use the 400G QSFP-DD FR4 or LR4, depending on which interface is used.

Figure 9. 2 x 400GE breakout solution

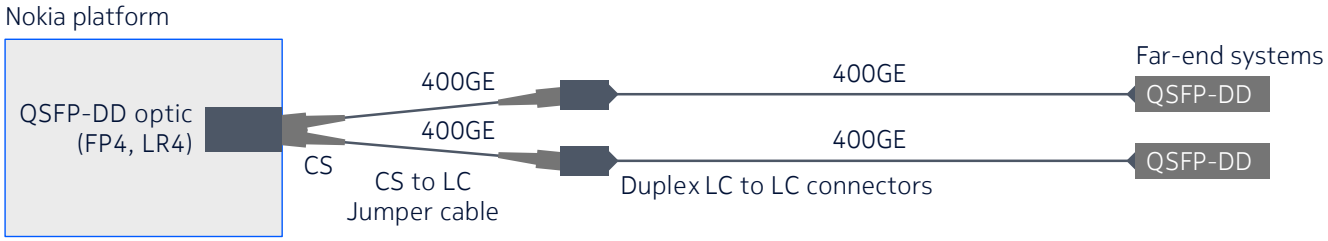


Table 9. 2 x 400GE optical breakout solution components

2 x 400GE breakout optics	
Component	Description
QSFP-DD FR4 optics	2 x 400G QSFP112-DD FR4, 2km, CS RoHS 6/6, 0/70C, DDM
QSFP-DD LR4 optics	2 x 400G QSFP112-DD LR4, 10km, CS RoHS 6/6, 0/70C, DDM

About Nokia

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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.

Nokia OYJ
Karakaari 7
02610 Espoo
Finland
Tel. +358 (0) 10 44 88 000

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