smartoptics

The DCP-F Family

A family for unprecedented flexibility

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Lowering the cost and increasing the flexibility of the optical network is high on the agenda for most enterprises and operators. Smartoptics, recognizing the need for a modern and open approach to optical networking, has therefore developed the versatile DCP-F family of open line system units. The family allows for an unprecedented flexibility in configuring point-to-point, ring, and mesh topologies at the lowest possible cost

Introducing the DCP-F Family

Leveraging the current breakthroughs in DWDM transceiver technologies requires an open architecture approach to optical networks, using pluggable transceivers embedded in standard switches and where the routing of the optical channels is done by an open line system. To cater for the diverse requirements on open line systems, Smartoptics has developed the DCP-M and DCP-R families of fixed form factor active multiplexers and ROADMs and the versatile DCP-F family of pluggable, active optical units.

The DCP-F family is designed for maximum configuration flexibility with the active units available as individual modules plugged directly into the standard Smartoptics DCP-2 chassis, each module occupying one slot. The module also has an integrated expansion field for optional passive plug-in modules (PPM), used for example for dispersion compensation. The small footprint of the DCP2 chassis and the pluggable configuration allows for excellent flexibility in various applications and in all types of network topologies.

Figure 1. DCP-F unit with expansion field in a DCP-2 chassis and two DCP-2 chassis in a rack mount

The first members of the DCP-F family are the **DCP-F-R22** 1x2 ROADM and the **DCP-F-A22** EDFA amplifier, both with room for two optional Passive Plug-in Modules (PPM).

The DCP-F-R22 and the DCP-F-A22 are designed as multi-purpose building blocks that handle one signal direction per physical unit. Support for the topologies required by any type of optical network is then easily achieved by simply combining one or more DCP-F-R22 and one or more DCP-F-A22 per site, if required supplemented with passive plug-in modules. You just interconnect the units and plug-in modules required for the site by patch cords at the front of the DCP-2 chassis to achieve the desired site functionality.

DCP-F-R22

The DCP-F-R22 is an extremely versatile active unit for use in any type of optical network topology, for example as a very compact 1x2 ROADM in metro access applications. It includes equalizer, amplifier, monitor and extra OCM port and has room for two optional Passive Plug-in Modules (PPM). The PPM:s extend the functionality further and can be used for optional dispersion compensation, for an Optical Surveillance Channel (OSC) OADM, or as a passive splitter.

The family allows for an unprecedented flexibility in configuring point-to-point, ring, and mesh topologies at the lowest possible cost.
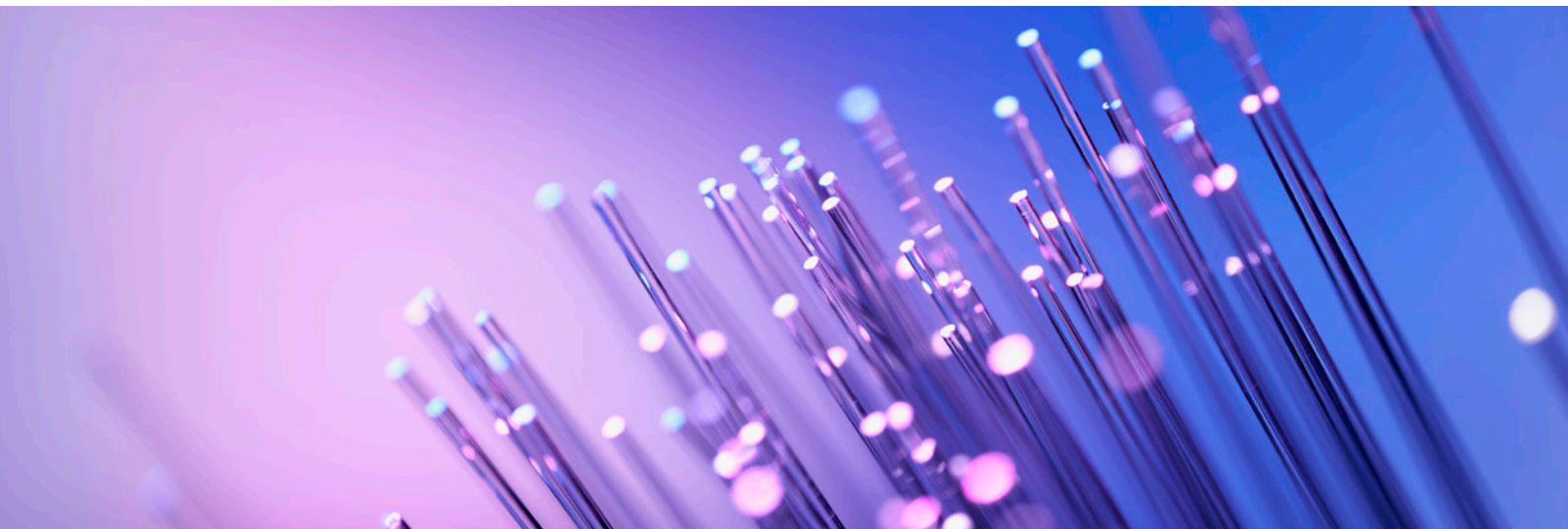
The DCP-F-R22 fits into one slot of the DCP-2 chassis and is typically controlled and managed via a command line interface (CLI).
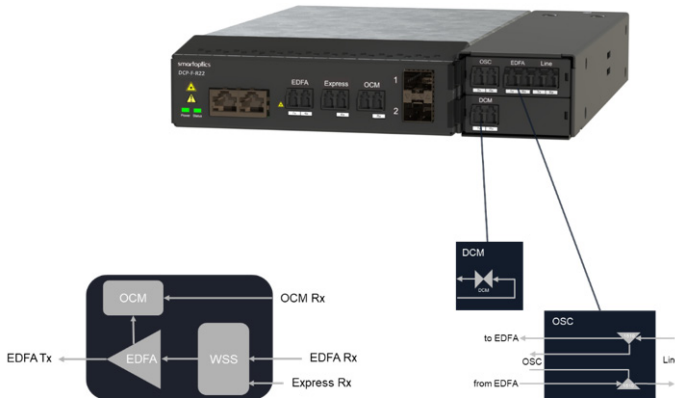

Figure 2. DCP-F-R22

DCP-F-A22

The DCP-F-A22 is a dedicated EDFA amplifier with room for two Passive Plug-in Modules (PPM) which can be of the same types as for the DCP-F-R22 described above.

The DCP-F-A22 fits into one slot of the DCP-2 chassis and is typically controlled and managed via a command line interface (CLI).
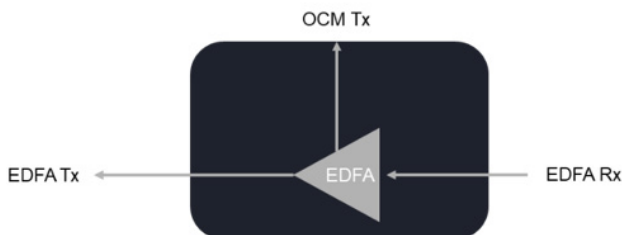

Figure 3. DCP-F-A22

DCP-F for Maximum Application Flexibility

The small footprint of the DCP-2 chassis and the pluggable configuration of active units allow for excellent flexibility when using the DCP-F family in various applications and network topologies. The DCP-F units can be leveraged on their own in point-to-point applications, as well as in ROADM-based rings and mesh networks. They may also be used to expand the functionality of the DCP-M and DCP-R families or they may be combined with e.g. the Smartoptics H-series Passive Optical Networking Platform in active/passive configurations.

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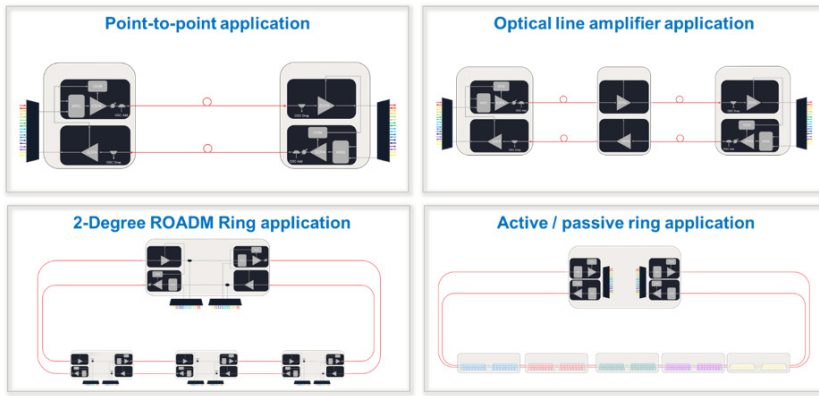
Figure 4. Examples of DCP-F applications

Point-to-Point Applications

In one of the simplest applications, e.g. for data center interconnect (DCI), a set of individual DWDM channels are to be multiplexed over a point-to-point connection between sites some kilometers apart. Such a two-way, point-to-point link is easily configured, for example by combining one DCP-F-R22 and one DCP-F-A22 per site, as shown in the figure below.
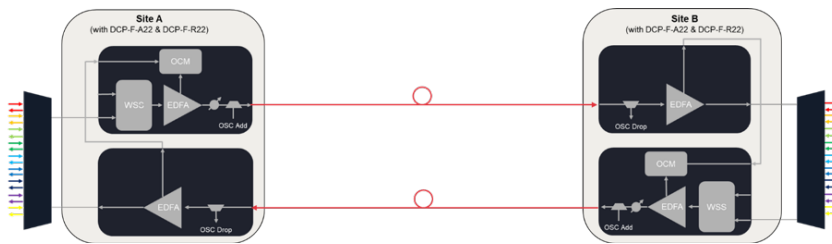

Figure 5. A two-way, point-to-point link with DCP-F units

Patching the integrated Optical Channel Monitor (OCM) in the DCP-F-R22 to the EDFA of the DCP-F-A22 makes it is possible to monitor the Line RX signal. A Variable Optical Attenuator (VOA) in each DCP-F-A22 can then be used to attenuate and balance the Line RX signal.
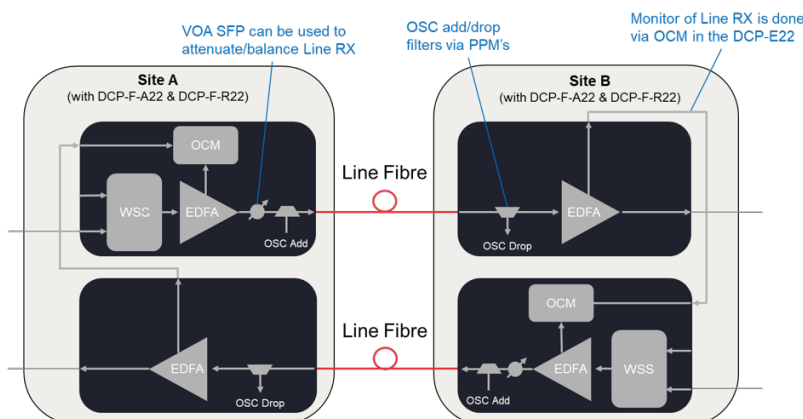

Figure 6. Details of the point-to-point configuration with DCP-F-R22 and DCP-F-A22

The multiplexing of incoming/outgoing wavelengths must be done externally to the DCP-F-R22/DCP-F-A22 combination. Several alternatives are possible, using e.g. the H-Series Passive Optical Networking Platform. The multiplexing capacity can be expanded even further by adding a separate multiplexer to the free port of the DCP-F-R22 Wavelength Selectable Switch (WSS) and a passive optical coupler plug-in module to the DCP-F-A22 as shown in the following figure.
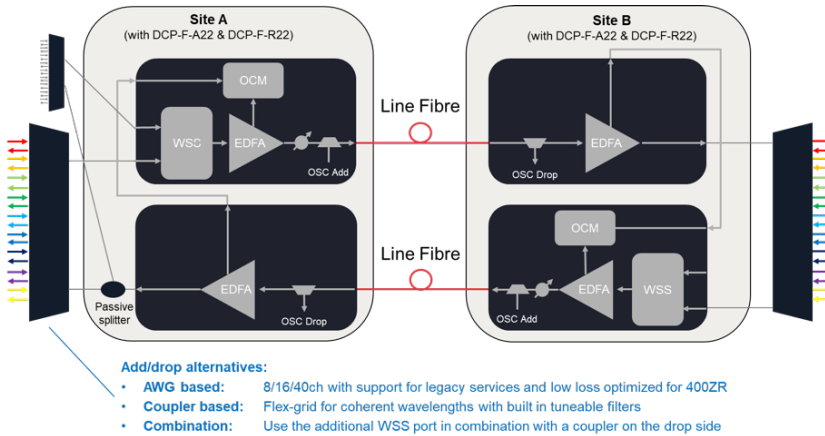
Figure 7. DCP-F point-to-point link with external, passive multiplexers

For longer distances the DCP-F-A22 and its integrated Erbium-Doped Fiber Amplifier (EDFA) is an efficient tool for amplification and signal regeneration. The total distance possible to bridge and the maximum distance between amplifiers is dependent on the modulation format used for the line system.
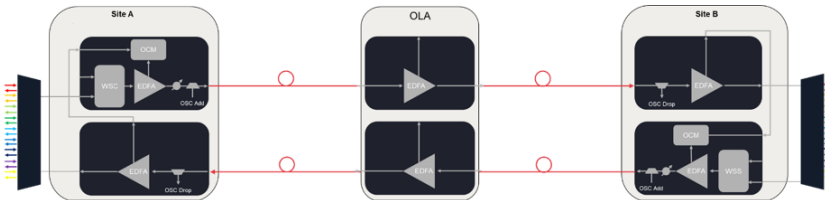

Figure 8. DCP-F-A22 as optical line amplifier

The DCP-F-A22 used as optical line amplifier is compatible with any other combination of DCP-F-R22 and DCP-F-R22 units as well as with all DCP-M family and DCP-R family products.

2-degree ROADM Applications

2-degree ROADMs, the standard building block of a metro access ring, are easily configured by combing one DCP-F-A22 and one DCP-F-R22 for each signal direction, i.e. using one 1U chassis with two active units per site. As shown in the figure below, two external passive multiplexors and two passive optical coupler plug-in modules is then all that is needed to implement a complete 2-degree ROADM.
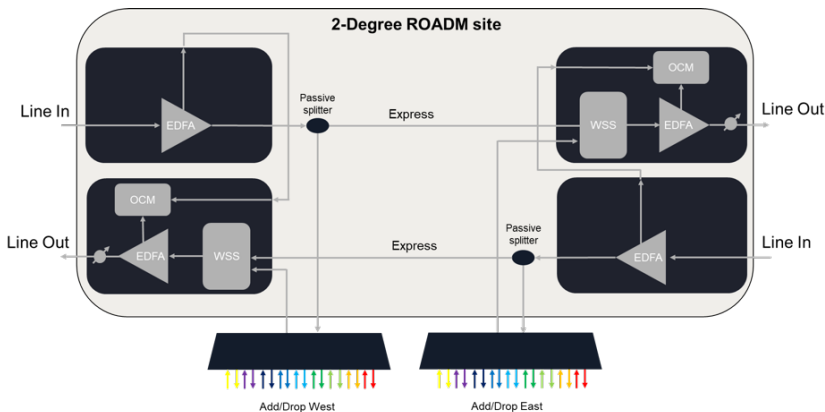
Due to its flexibility and the capability to leverage the increased reliability of a ring topology, this type of low cost, 2-degree ROADM is the ideal network element when expanding any optical metro access network.
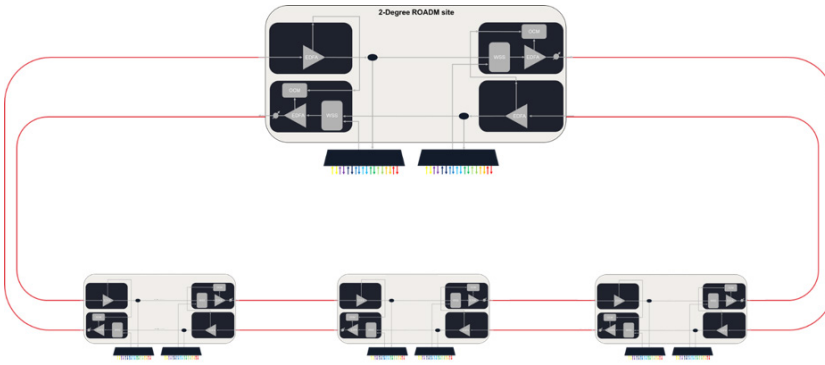
Figure 9. Typical metro access, 2-degreee ROADM ring with DCP-F-R22 and DCP-F-A22

Active/Passive Applications

To reduce overall cost, it is often desirable to use passive optical multiplexers in parts of the metro access network. The multiplexers are then typically deployed in a chain and at various distances from the active node, hence the signal strength will vary for different sets of wavelengths, emanating from different multiplexers.

The DCP-F-R22 can be used for spectral equalization of incoming wavelengths from the passive multiplexers before the EDFA amplifier as well as for power balancing of the outgoing signal to the passive multiplexers, ensuring optimal performance of the optical links.
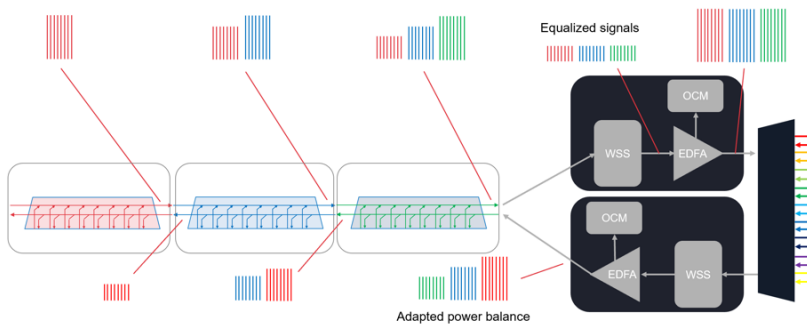

Figure 10. Active/Passive chain configuration application

As a concrete topology example, the illustration below shows how to create a hybrid active/passive access ring using the DCP-F-R22 and H-series multiplexers. The H-series multiplexers are installed in manholes, on poles or at other industrial temperature (-40 °C to +85 °C) locations without any need for external power, and the optical channels are then conveniently aggregated at one single active site.
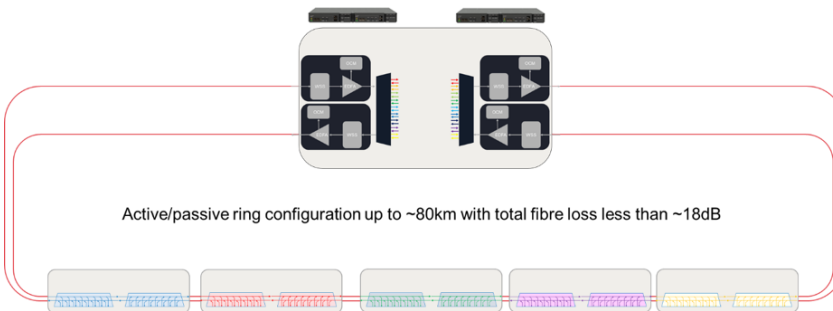

Figure 11. Active/Passive ring with DCP-F-R22, DCP-F-A22 at one active site and remote signal aggregation with the H-series Passive Optical Networking Platform

Adding just two more DCP-F-R22 units to the ring extends its reach up to ~ 140 km.
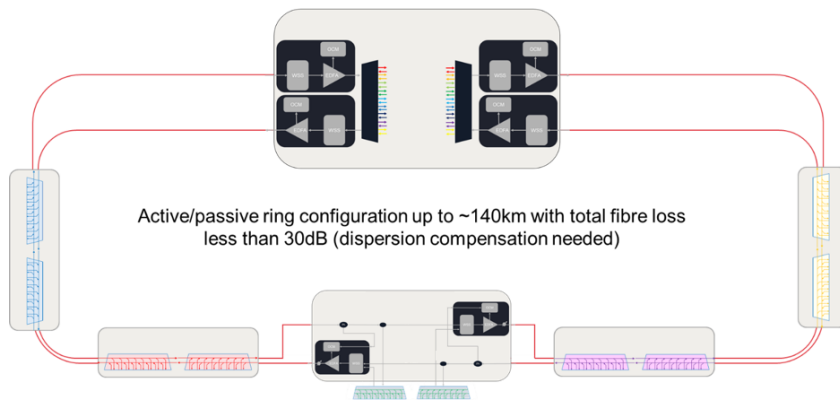

Figure 12. Extended active/passive ring with two active sites

Combining the DCP Families

The common basis of the Dynamic Connectivity Platform (DCP) allows the products from different DCP families to be mixed and matched for creation of the most cost-efficient open line system under the same management architecture.

The following figures show some of the myriad of open network topologies that easily can be configured by combining the members of the DCP families. There is always an open solution from Smartoptics to your optical network requirements.
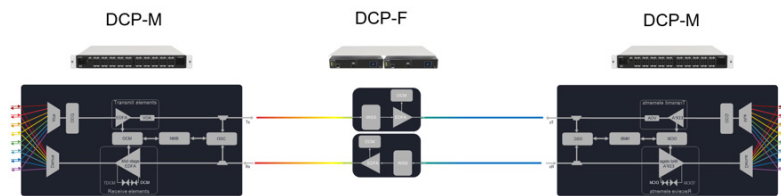

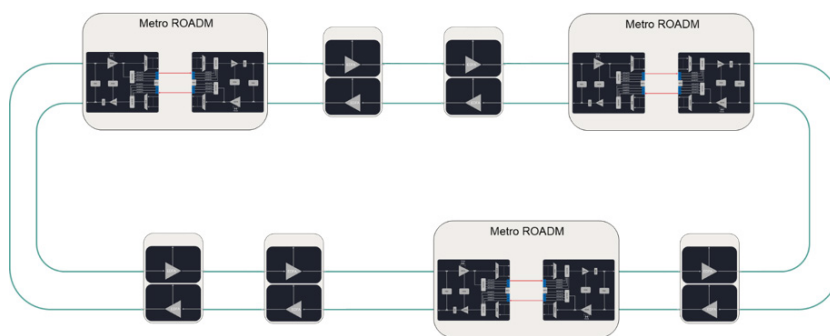Figure 13. DCP-F-R22 used as a line amplifier for a point-to-point link

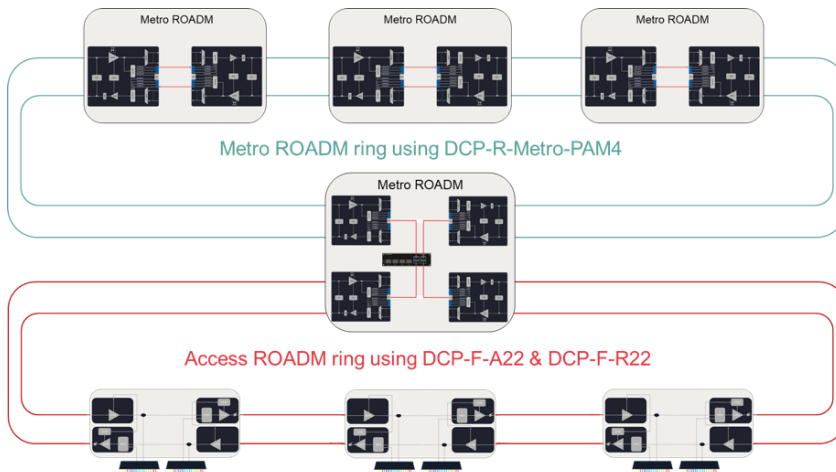Figure 14. An optical ring using a combination of DCP-R and DCP-F products

Figure 15. A two-tiered ring network using a combination of DCP-F-R22 ROADMs and
DCP-R ROADMs

Network and Wavelength Management

Looking at the total life cycle cost of a communications network, the recurring
operational and management expenses dominate. Capable network management tools
and network equipment designed for cost efficient maintenance are vital to make the
communication network investment profitable and the business case attractive.

Smartoptics is a pioneer in open optical networking systems and has paid significant
attention to the management of the DCP families. The DCP-M family, primarily used in
point-to-point networks for Data Center Interconnect (DCI), is optimized for zero-touch,
fully self-configuring/regulating deployment, while the DCP-R and DCP-F families, often
deployed in operator networks, are primarily designed to be externally managed. The
external management can either be via a command line interface (CLI) or by using
Software Defined Networking (SDN) principles based on the Open ROADM MSA initiative.
The availability of zero-touch, CLI and SDN-based management for each individual DCP
product is release dependent.

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About Smartoptics

Smartoptics provides innovative optical networking solutions and devices for the new era of open networking. Our customer base includes thousands of enterprises, governments, cloud providers, Internet exchanges as well as cable and telecom operators.

We have an open networking approach in everything we do which allows our customers to break unwanted vendor lock-in, remain flexible and minimize costs. Our solutions are used in metro and regional network applications that increasingly rely on data center services and specifications.

Smartoptics is a Scandinavian company founded in 2006. We partner with leading technology and network solution providers such as Brocade, Cisco, HPE and Dell EMC and have a global reach through more than 100 business partners.

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DCP-F Family_R1.0