

RAD's Coherent-Enabled EADs: A New Era of Packet-Optical Convergence

Evolving Carrier Ethernet Optical Transport

Service providers face growing pressure to deliver high-capacity 100G and 400G Ethernet services across metro, regional, and access networks – while reducing transport costs, minimizing equipment sprawl, and accelerating service deployment. Traditional optical transport architectures rely on dedicated transponders and tightly integrated platforms, increasing network cost, complexity, and operational overhead. Operators are increasingly moving toward open, multi-vendor optical networks to improve flexibility and reduce vendor lock-in.

Coherent pluggable optics address these challenges by embedding high-capacity DWDM transport directly into packet networking equipment. **This eliminates dedicated transport layers and enables a simpler, more scalable packet-over-DWDM architecture.**

What Are Coherent Pluggables

Coherent pluggable optics are compact optical transceivers that integrate **coherent digital signal processing (DSP)** into industry-standard form factors such as QSFP28 100G ZR/ZR+ and QSFP-DD 400G ZR/ZR+. Compared to traditional modules such as CFP2, they offer:

- Greater density
- Lower power consumption
- Simpler deployment

All while supporting 100G, 400G, and higher-capacity services.



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Solution Brief

Coherent Pluggable Optics

Unlike conventional gray optics that operate on fixed wavelengths, coherent pluggables generate tunable DWDM wavelengths, enabling switches, routers, and Ethernet access and aggregation devices to connect directly to DWDM networks. This extends packet-over-DWDM architectures beyond the network core into metro, edge, and access environments, while allowing service providers to optimize fiber utilization.

Coherent pluggables can operate over existing DWDM infrastructure, open optical line systems, or dark fiber. Common capabilities include tunable wavelengths, automated wavelength provisioning, optical telemetry, BER/FEC monitoring, link margin analysis, and support for open optical networking. Some modules also provide enhanced fault isolation and service assurance capabilities.

Using Coherent Pluggables with RAD's 100G and 400G EADs

RAD's 100G and 400G Carrier Ethernet access, demarcation and aggregation devices leverage coherent pluggable optics to integrate directly with DWDM network infrastructure, enabling high-capacity Carrier Ethernet, mobile backhaul, and DCI services over metro and regional fiber networks.

With coherent optics embedded into a RAD EAD, it becomes both a Carrier Ethernet demarcation device and a coherent optical transport endpoint, transmitting native DWDM wavelengths across open optical networks and dark fiber infrastructure. Unlike fixed-wavelength optics, tunable coherent pluggables can be dynamically configured to operate on different DWDM channels across the optical spectrum.

ZR and ZR+: Deployment Flexibility

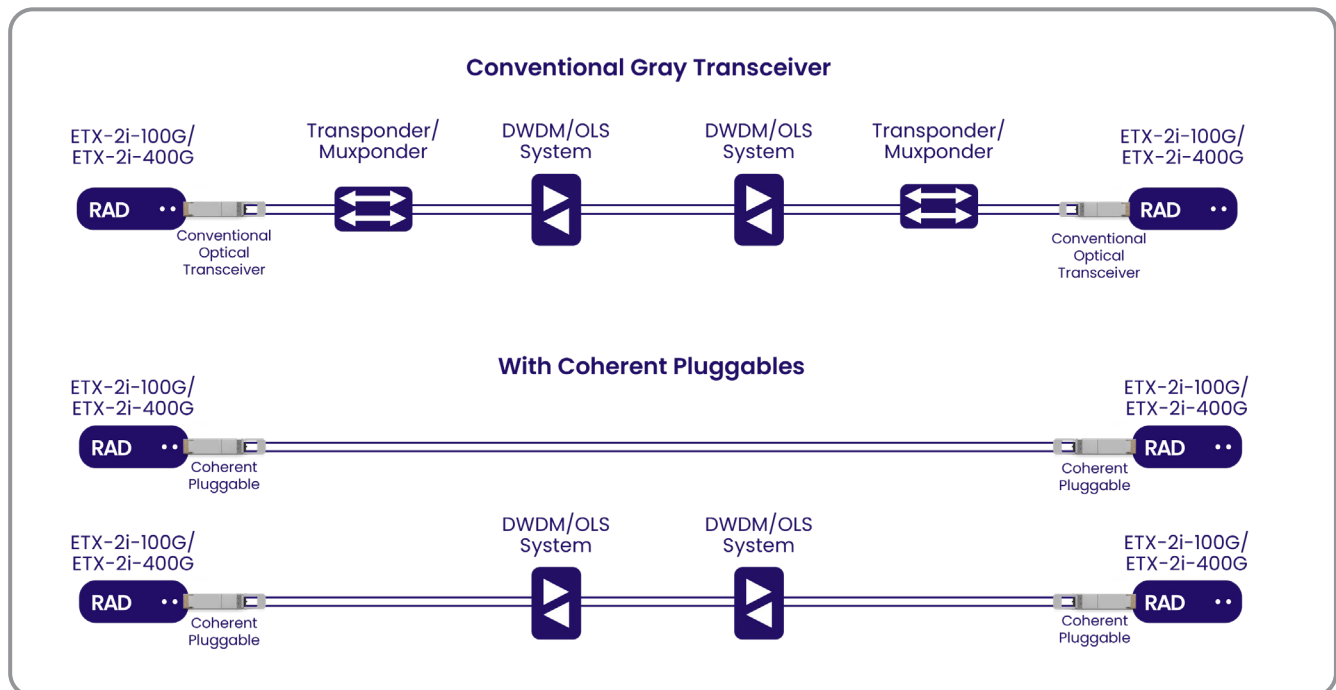
RAD's EADs support both ZR and ZR+ coherent options using QSFP28 100ZR (100GbE) and QSFP-DD 400G ZR/ZR+ (400GbE) transceivers:

Option	Typical Reach	Best For
ZR	Up to 80–120 km	Metro Ethernet, DCI, mobile xHaul, and edge cloud connectivity
ZR+	Hundreds to thousands of kilometers*	Amplified spans and ROADM networks for regional and long-haul connectivity

*Depending on line-rate and optical conditions

A Simpler Architecture

Coherent pluggables collapse two network layers into one. Dedicated transponders and muxponders are no longer required between the service edge and the optical line system:



Key Benefits for Service Providers

- ✓ **Maximize** utilization of existing metro and dark fiber assets and defer costly new fiber builds, especially in dense metro areas.
- ✓ **Cut CapEx and OpEx** by eliminating standalone transponders and reducing repeaters/amplifiers, cabling, power, and space.
- ✓ **Simplify metro edge deployments** with fewer devices and lower power consumption.
- ✓ **Accelerate service turn-up** and improve operational agility.
- ✓ **Scale capacity** to support AI traffic, cloud connectivity, and 5G xHaul expansion.
- ✓ **Supports open optical networking strategies and multi-vendor interoperability**
- ✓ **Deploy a compact, future-ready platform** for converged packet-optical service delivery.

Achieving Multi-Vendor Environments Through Standardization

RAD's ETX-2i manages coherent pluggables through standard interfaces: SFF-8636 for QSFP28 100ZR/ZR+ (with CMIS on some newer modules for enhanced DSP control and telemetry), and CMIS for QSFP-DD 400ZR/ZR+. Through these interfaces the ETX-2i automatically discovers modules, monitors optical and DSP performance, retrieves alarms and diagnostics, and manages tunable optics with no proprietary optical management system required. This lets operators tap a broad ecosystem of third-party coherent pluggables for Carrier Ethernet.

While coherent pluggables are based on industry standards and generally support multi-vendor interoperability, optimal performance is not always guaranteed when different module vendors or models are deployed at opposite ends of a fiber link. Variations in DSP implementations, firmware, FEC schemes, and wavelength tuning algorithms can impact interoperability, achievable reach, performance margins, and operational features. Many operators therefore deploy the same pluggable at both ends to ensure predictable performance.

Combined with RAD's advanced Carrier Ethernet OAM, synchronization, and MACsec capabilities, coherent-enabled NIDs deliver a compact, scalable, and cost-efficient platform for next-generation metro edge and transport, integrating directly into open line systems and ROADM infrastructures to support packet-optical convergence and disaggregated transport.

Key Use Cases



METRO BUSINESS ETHERNET OVER DWDM

Integrating RAD's EADs with existing DWDM, ROADM, and open optical transport networks, allows Carrier Ethernet services to be efficiently extended across metro and regional optical infrastructure without requiring dedicated transponder platforms. This supports packet-over-DWDM architectures and efficient delivery of enterprise, cloud, and wholesale services while reducing transport cost and complexity.



METRO BUSINESS ETHERNET OVER DARK FIBER

RAD's coherent-enabled EADs enable service providers to deliver 100G and 400G Carrier Ethernet services directly over metro dark fiber. By integrating coherent optics into the service edge device, operators can simplify packet-optical networks, eliminate external transponders, and maximize the value of existing fiber assets. This approach provides a cost-effective solution for connecting enterprise sites, campuses, data centers, and cloud access locations over point-to-point fiber infrastructure.



BUSINESS ETHERNET AGGREGATION

By combining service aggregation and coherent transport in a single platform, RAD's coherent-enabled EADs aggregate traffic from office buildings, business parks, campuses, and access sites onto 100G and 400G coherent wavelengths. This delivers a more scalable and efficient metro access architecture while reducing fiber usage and transport costs.



DATA CENTER INTERCONNECT (DCI)

Combining Carrier Ethernet demarcation, SLA assurance, MACsec encryption (ETX-2i-400G), and coherent transport in a single device, RAD's EADs simplify metro and regional DCI while delivering secure, low-latency, high-capacity connectivity between enterprise, colocation, edge, and cloud data centers over dark fiber, DWDM, or open line systems.



MOBILE BACKHAUL

RAD's coherent-enabled EADs provide a cost-effective platform for aggregating mobile backhaul traffic onto high-capacity links. By combining Carrier Ethernet demarcation, SLA assurance, synchronization, and coherent transport in a single device, operators can simplify network architectures, improve fiber efficiency, and scale mobile networks more economically.



WHOLESALE ETHERNET AND MOBILE BACKHAUL

RAD's coherent-enabled EADs enable service providers to deliver wholesale E-Line, E-Access, and mobile backhaul services directly over DWDM infrastructure. By combining Carrier Ethernet OAM, SLA assurance, synchronization capabilities and coherent transport in a single platform, operators can reduce transport complexity, lower space and power requirements, and scale wholesale services more efficiently.



MULTI-TENANT DATA CENTER AND CLOUD ON-RAMP CONNECTIVITY

Coherent-enabled EADs can provide high-capacity Ethernet connectivity between enterprise locations, cloud on-ramps, colocation facilities, and AI/data center campuses. By extending coherent transport directly to the service edge, operators can offer high-capacity cloud connectivity services while simplifying network architecture and reducing transport costs.

For more information contact us at: market@rad.com



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