

# 1 6T Co-packaged Optical Test Report

## Article Overview

1.6T Co-Packaged Optical modules are tested for compliance and performance using stressed optical signals, high-speed BERTs, and silicon photonics-based integration to ensure reliable 1.6 Tb/s operation.

## Overview of 1.6T Co-Packaged Optics (CPO)

1.6T CPO integrates optical engines directly with switch ASICs, reducing electrical trace lengths from inches to millimeters, which dramatically lowers power consumption from ~30W in pluggable modules to ~9W per module . This architecture supports high-density AI and hyperscale data center deployments by minimizing DSP overhead and improving energy efficiency . The modules operate at 224 Gb/s per lane, leveraging silicon photonics and advanced packaging techniques to achieve high bandwidth and low latency .

## Testing Methodology

Testing 1.6T optical modules involves receiver conformance validation to IEEE 802.3dj standards . Key steps include:

- o Stressed Optical Signal Generation: Emulating worst-case transmitter behavior with precise metrics such as Outer Extinction Ratio (OER), Optical Modulation Amplitude (OMA), and Stress Eye Closure Quaternary (SECQ).
- o Instrumentation: Using a combination of 120 GBaud BERTs, tunable lasers, interference sources, optical reference transmitters, attenuators, and optical sampling scopes controlled by automated test software.
- o Calibration: Iterative optimization ensures stress signals remain stable and repeatable, accounting for inter-symbol interference, sinusoidal jitter, and Gaussian noise.
- o Multi-Lane Validation: Ensures repeatability across multiple lanes and test cycles, critical for silicon bring-up and transceiver validation.
- o Interface Flexibility: Supports DR1, FR4, and LR4 interfaces at symbol rates up to 113.4375 GBd .

## Performance Evaluation

Performance testing focuses on:

- o Signal Integrity: Measuring bit error rates (BER) and forward error correction (FEC) performance under stressed conditions.
- o Power Efficiency: Comparing CPO modules to conventional pluggable modules, highlighting reduced DSP power requirements and lower thermal load .
- o Bandwidth and Latency: Ensuring 1.6 Tb/s throughput with minimal signal degradation over short electrical paths.



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o Compliance: Verifying adherence to IEEE 802.3dj and other relevant standards for high-speed Ethernet and data center interconnects .

## Test Report Components

A comprehensive 1.6T CPO test report typically includes:

- o Module Identification: Part numbers, lane configuration, and optical engine specifications.
- o Test Setup Description: Instrumentation, calibration procedures, and environmental conditions.
- o Stressed Signal Metrics: OER, OMA, SECQ, jitter, and noise parameters.
- o Receiver Performance: BER, FEC margin, and eye diagram analysis.
- o Power and Thermal Data: Module power consumption, DSP load, and thermal performance.
- o Compliance Statement: Confirmation of IEEE 802.3dj conformance and multi-lane repeatability.

## Conclusion

1.6T Co-Packaged Optical modules are validated through rigorous, automated testing that combines stressed optical signal generation, high-speed BERTs, and silicon photonics integration. These tests ensure high-speed, low-power, and standard-compliant operation, enabling deployment in AI-scale and hyperscale data center networks while reducing energy consumption and improving system density .

Co-Packaged Optics (CPO) addresses this by relocating the optical conversion function -- the point at which electrical

Goals for Co-packaged Optics (CPO) Silicon Photonics Micro-ring resonator (MRM) based optical transceivers (TRx) Wavelength

Co-packaged optics (CPO) is a disruptive approach to increasing the interconnecting bandwidth density and energy

800G and 1.6T Optics In the 21st century, information technology has developed greatly, and the Internet, big data,

A circuit on glass with optical fiber interfaces, integrated planar waveguides, and through glass vias is demonstrated for

Due to the rise of 5G, IoT, AI, and high-performance computing applications, datacenter traffic has grown at a compound annual

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IDTechEx's "Co-Packaged Optics (CPO) 2025-2035" explores technical innovations and packaging trends,

Co-packaged optics involve integrating SERDES and optical interface electronics onto a package, potentially further integrating them

CPO - Co-Packaged Optics 200GE - 200 Gigabit Ethernet 400GE - 400 Gigabit Ethernet 400GBASE-FR4 - 400GE optical

Our latest forecast for CPO offers an estimate for shipments of 1.6T and 3.2T CPO with reach below 50m. Figure below compares

In the 5G era, the demand for high-bandwidth computing, transmission, and storage has led to the development of

1 Introduction1 The importance of co-packaged optics (CPO). Datacenter traffic keeps growing with the expansion of data-intensive

This section will explore the evolution of the market from copper to co-packaged copper and from digital signal

Meanwhile, the optical module, enabled by silicon photonics, is now treated similarly to electronic chips, and advanced

This paper describes the technical route of optical communication from 400G to 800G to 1.6T optical modules and

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