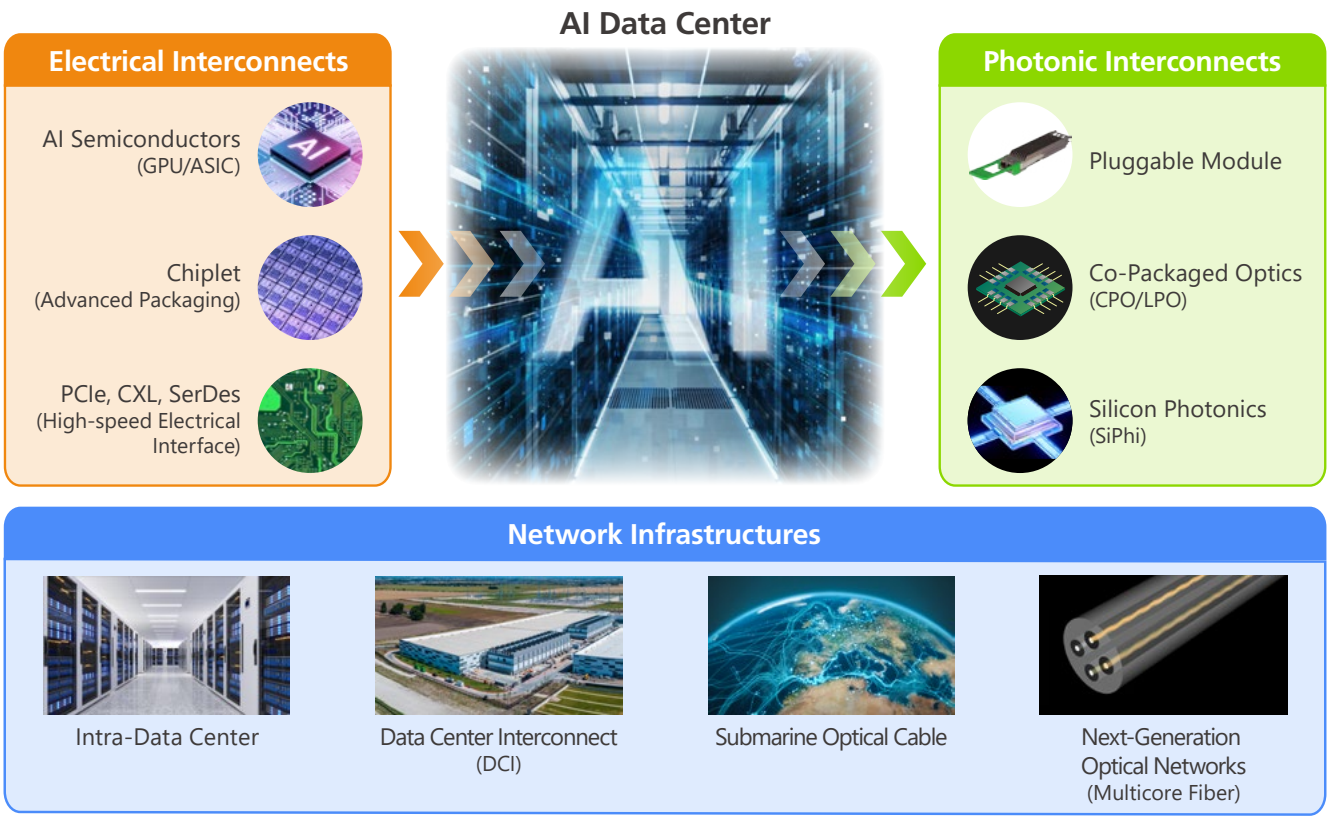
Anritsu Advancing beyond

Test & Measurement Solutions for Every Layer of the AI Data Center

Solving Evaluation Challenges Across Semiconductors, High-Speed Interconnects, and Optical Networks

AI Data Center Configurations



With the rapid adoption of generative AI, the performance requirements for AI data centers are increasing at an unprecedented pace. To meet these demands, technological innovation is advancing across semiconductors, interconnects, optical technologies, and networking, driving higher speeds, greater capacity, and improved energy efficiency. To translate these innovations into real-world system performance, comprehensive evaluation is essential at every stage, from devices and modules to systems and networks.

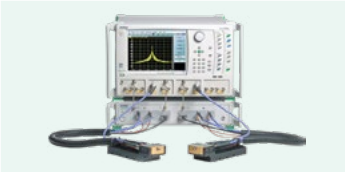
Anritsu provides test and measurement solutions covering the broad range of technologies that make up AI data centers. This document highlights the testing challenges associated with AI data center technologies and introduces Anritsu's solutions for evaluating devices, high-speed interconnects, optical networks, and the infrastructures that connect them.

Anritsu Test Solutions Portfolio

Anritsu Test and Evaluation Solutions Covering Every Layer of AI Data Centers

Comprehensive support from semiconductors and optical interconnects to networks and submarine cables, spanning R&D through mass production.

AI Semiconductors and Chiplets / High-Speed Interconnects

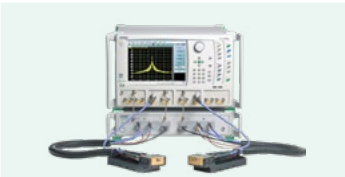


Device Characteristics

Signal Integrity (BER, Jitter), Compliance Test, Link Training

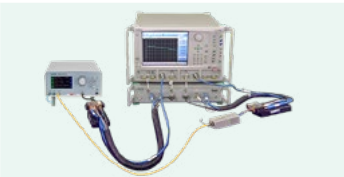
Signal Integrity (BER, Jitter)

Optical Transceivers / CPO and LPO / Silicon Photonics



Device Characteristics, Coupling Loss, Reflection, Crosstalk, Millimeter-wave Characterization

Device Characteristics Evaluation, Coupling Loss, Reflection, Crosstalk



Optical Modulation and EO/OE Characteristics

Optical Spectrum Analysis

Signal Integrity (BER, Jitter)

BER, Eye Diagram, TDECQ

Submarine Optical Cables, Data Center Interconnects, and Next-Generation Optical Networks

Optical Transmission Quality, Network Verification, Operation Monitoring, Failure Analysis

Optical Loss, Fault Localization and Analysis

Optical Loss and Crosstalk for Multicore Fibers, Fault Localization and Analysis

Loss and for Submarine Optical Cables, Fault Localization and Analysis

Optical Loss, Fault Localization and Analysis

Optical Loss, Fault Localization and Analysis

Virtual and Cloud Networks

Network Communication Quality, Service Quality, Operation Monitoring, Failure Analysis

Optical Network Communication Quality, Operation Monitoring, Failure Analysis

Technology Trends in AI Data Centers

The rapid adoption of generative AI is driving unprecedented demand for computing performance in AI data centers. To support these requirements, AI servers equipped with GPUs and AI accelerators capable of high-speed digital signal processing are being deployed at an increasing pace. In addition, large-scale GPU clusters comprising tens of thousands of GPUs are being built to support AI training and inference workloads. As a result, the volume of data processed and transmitted both within and between servers continues to grow, increasing the need for high-speed interconnect and optical transmission technologies.

To meet these demands, AI data centers require significant increases in data transmission capacity both within servers and across server networks. Optical transceiver speeds are evolving from 800G to 1.6T and ultimately to 3.2T, accelerating the trend toward higher-bandwidth data transmission. At the same time, higher data rates are exposing challenges such as transmission loss and increased power consumption in electrical interconnects, driving broader adoption of optical interconnect technologies. Co-Packaged Optics (CPO), which places optical transceivers in close proximity to ASICs, has recently begun transitioning from development to practical deployment, bringing significant changes to AI data center architectures.

Within servers, migration from PCI Express® (PCIe®) 6.0 to PCIe 7.0 is underway, while Compute Express Link® (CXL®) is expected to expand resource sharing and memory pooling capabilities. In the optical communications domain, network capacities are advancing from 800G to 1.6T and eventually 3.2T. Alongside conventional pluggable optical transceivers, new architectures such as CPO and Linear-drive Pluggable Optics (LPO) are attracting growing interest and investment. Furthermore, research and development in optoelectronic integration technologies, including silicon photonics, continues to advance. From semiconductors to optical networks, the technologies that underpin AI data centers are evolving rapidly.

As these technologies advance, evaluation requirements are expanding beyond individual devices to encompass packages, modules, systems, and entire networks. Rather than evaluating electrical characteristics, optical characteristics, and signal integrity independently, engineers increasingly need to correlate and validate these parameters through comprehensive, system-level evaluation and verification.

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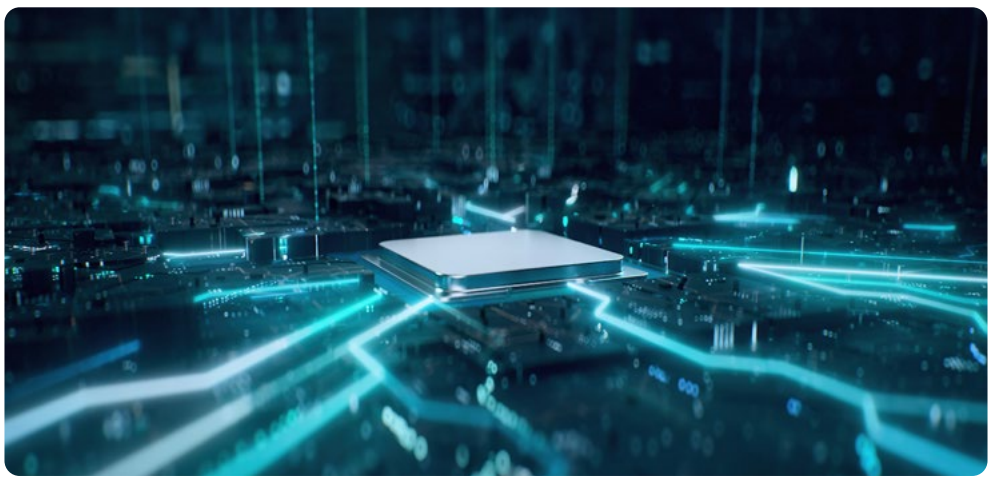
AI Semiconductors and High-Speed Interconnects

Ensuring signal integrity for AI semiconductors and high-speed interconnects

The rapid adoption of generative AI is driving unprecedented volumes of data exchange between GPUs and AI accelerators within AI servers. These data streams are transmitted through high-speed electrical interconnects consisting of semiconductor packages, printed circuit boards (PCBs), connectors, and cables. As data rates continue to increase, signal integrity challenges such as loss, reflections, crosstalk, and jitter become more severe, making it increasingly difficult to maintain reliable signal quality. In addition, the importance of design validation is growing for high-speed interfaces such as PCIe and CXL, where link establishment, performance validation, and stress testing are critical for ensuring system reliability.



Test challenge: Ensuring signal integrity in AI hardware platforms

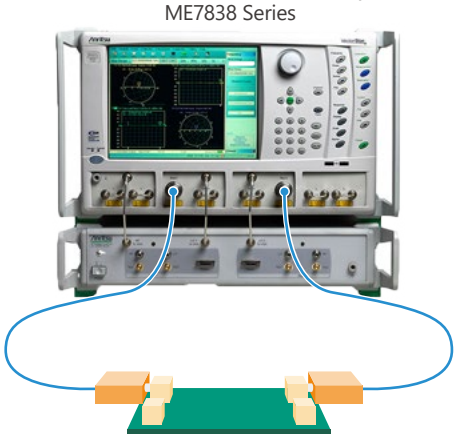
In systems incorporating AI semiconductors, overall system performance depends not only on the semiconductor devices themselves, but also on the characteristics of the entire signal path, including PCBs, connectors, and cables. Insufficient channel bandwidth, crosstalk, and reflections can distort signal waveforms and prevent the system from achieving its intended performance. Therefore, developers must evaluate frequency response, return loss, impedance characteristics, and other key parameters to ensure adequate signal integrity throughout the design process.

Solution: Comprehensive evaluation from frequency characteristics to BER

The VectorStar™ ME7838 Series and MS4640B Series Vector Network Analyzers enable characterization of S-parameters and impedance characteristics for PCBs, connectors, cables, and materials. They also support crosstalk evaluation through multiport measurements. In addition, the Signal Quality Analyzer-R MP1900A enables evaluation of high-speed digital signal integrity parameters such as Bit Error Ratio (BER) and jitter, while the BERTWave™ MP2110A Optical Sampling Oscilloscope supports signal quality analysis through measurements such as eye diagrams.

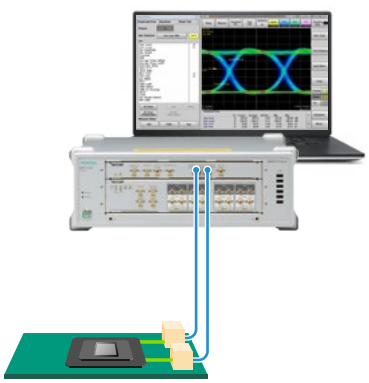
By utilizing these solutions, engineers can perform consistent quality verification throughout the product lifecycle, from design validation to final product evaluation for AI-based hardware systems. This enables comprehensive quality assurance for AI hardware platforms, from design validation through final product evaluation.

Broadband Vector Network Analyzer
ME7838 Series



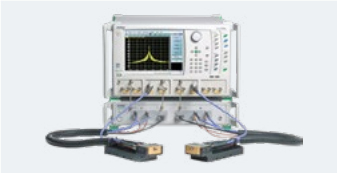
Insertion Loss and Return Loss Measurement

Optical Sampling Oscilloscope
BERTWave
MP2110A



Signal Quality Evaluation

Key Products



Broadband
Vector Network Analyzer
ME7838 Series

VectorStar Family of
RF, µW, mmW VNAs
MS4640B Series

Signal Quality Analyzer-R
MP1900A

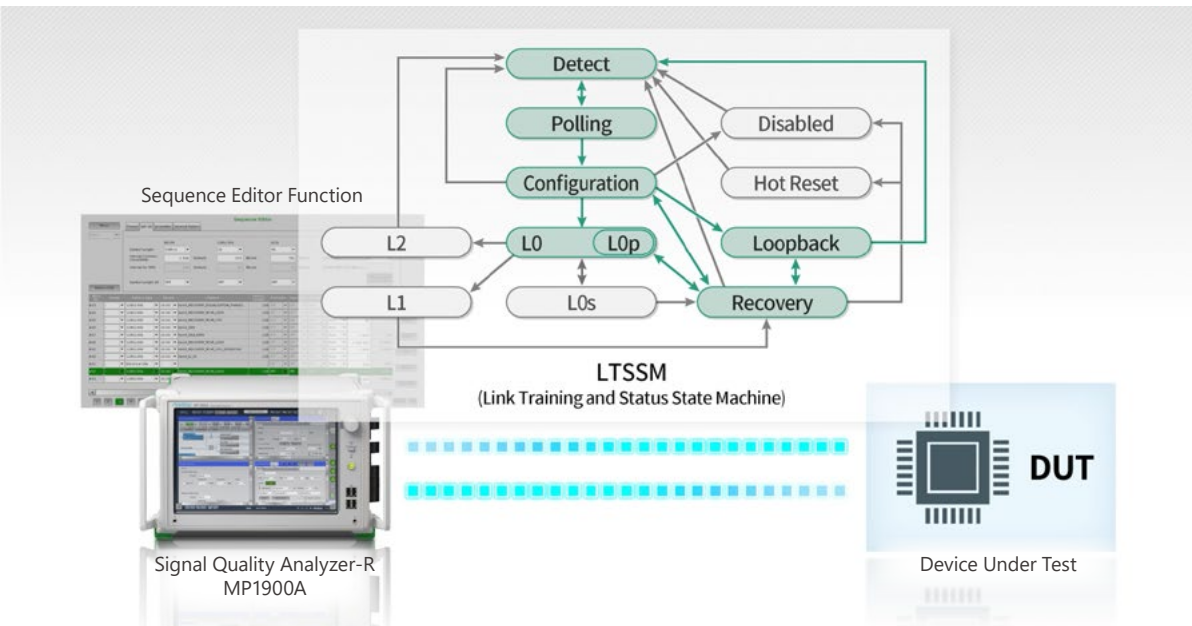
Optical Sampling Oscilloscope
BERTWave™
MP2110A

Test challenge: Reproducing and debugging PCIe and CXL Link Training issues

For PCIe devices and CXL devices that utilize PCIe PHY technology, link training is performed during connection establishment to determine the data rate, lane configuration, and equalization settings required to bring up the link. During development, however, issues can arise such as link failures, inability to achieve the expected data rate, or unstable link operation under specific conditions. Because these issues are often difficult to reproduce in an actual system environment, identifying the root cause and isolating the problem can be time-consuming.

Solution: Flexible control of Link Training conditions

The Sequence Editor Function of the Signal Quality Analyzer-R MP1900A enables flexible modification of test sequences and training patterns used during link training. By adjusting training patterns, transmission counts, and sequence configurations, engineers can reproduce specific link training conditions and abnormal scenarios that are difficult to recreate in actual hardware environments. This capability enables more efficient analysis of complex interoperability and link initialization issues, helping accelerate root cause identification while reducing debugging effort and overall development time.



Key Products

Signal Quality Analyzer-R
MP1900A

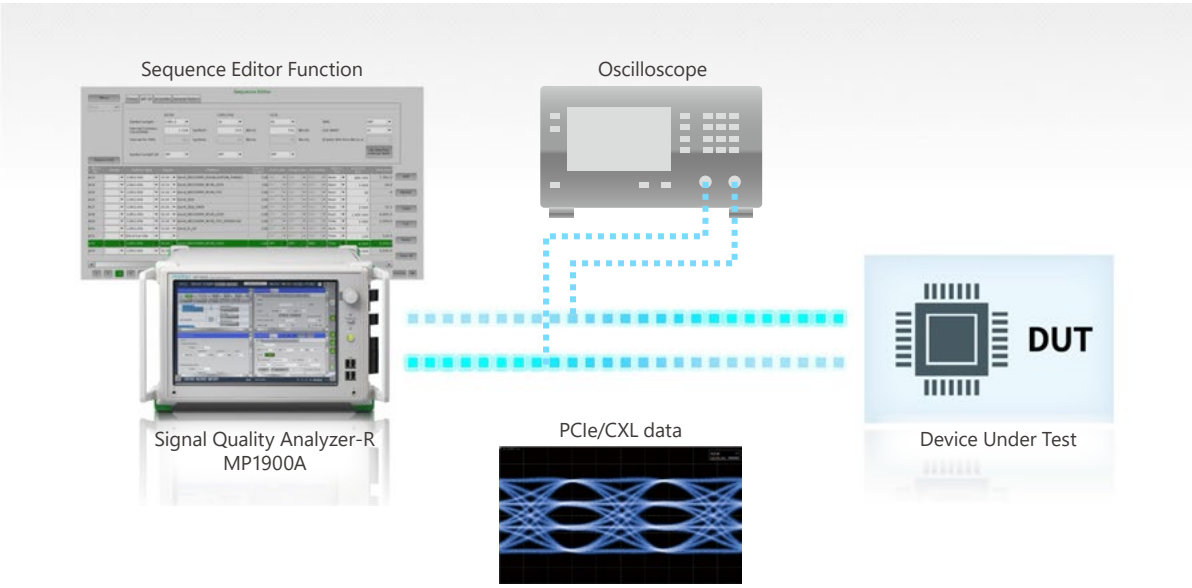
Test challenge: Evaluating noise and jitter margins in CXL communications

In CXL systems, large volumes of data are continuously exchanged to maintain cache coherency between shared memory resources and the caches of connected devices. As a result, sufficient signal integrity and communication margin must be ensured even under sustained high-traffic conditions. However, conventional test environments often struggle to simultaneously emulate realistic traffic loads and introduce controlled noise and jitter impairments for margin testing.

Solution: Quantitative margin analysis under heavy traffic conditions

Using the Sequence Editor Function of the Signal Quality Analyzer-R MP1900A, engineers can generate test sequences that emulate PCIe and CXL traffic patterns, enabling the creation of evaluation environments that simulate high-volume data transfer conditions. In addition, BER measurements can be performed while applying controlled amounts of noise and jitter, allowing efficient and quantitative evaluation of device noise and jitter tolerance margins.

The solution also supports testing of multi-lane configurations and lane-to-lane skew conditions, helping engineers identify potential signal integrity issues during development and reduce the risk of performance degradation or communication failures after deployment.



Key Products

Signal Quality Analyzer-R MP1900A

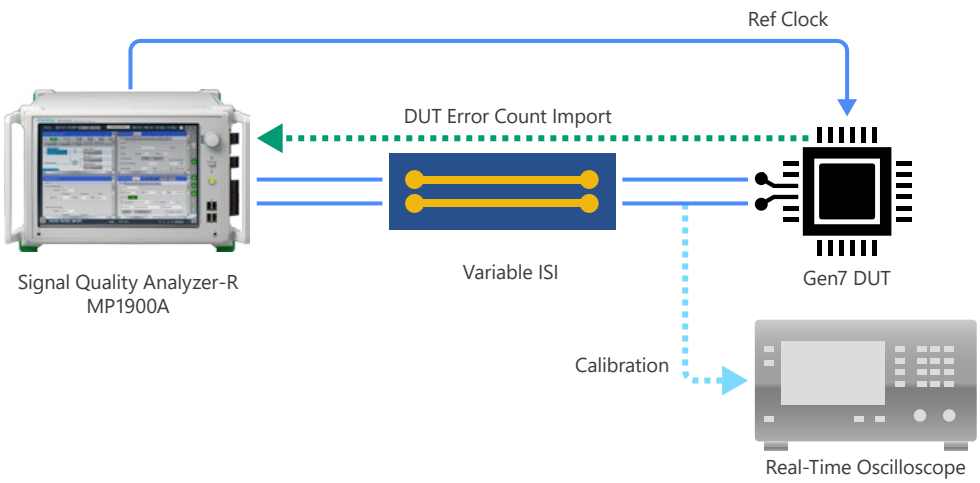
Test challenge: Ensuring repeatable PCIe 7.0 device testing

PCIe 7.0 adopts 128 GT/s PAM4 signaling, significantly reducing signal margins and increasing sensitivity to channel impairments. In addition to losses and reflections caused by packages, printed circuit boards, and connectors, variations in test signal quality and measurement conditions can lead to inconsistent results, even when evaluating the same device. Such measurement variability makes it difficult to accurately assess design performance and efficiently debug system issues.

Solution: Building a highly repeatable receiver test environment

The Signal Quality Analyzer-R MP1900A generates PCIe 7.0-compliant 128 GT/s PAM4 signals and supports receiver test signal calibration as well as jitter and noise tolerance testing. By providing a stable and repeatable test environment, it minimizes measurement variability and enables accurate assessment of design changes and their impact on system performance.

As a result, engineers can reduce the need for repeated testing, shorten debugging cycles, and improve the efficiency of design validation.



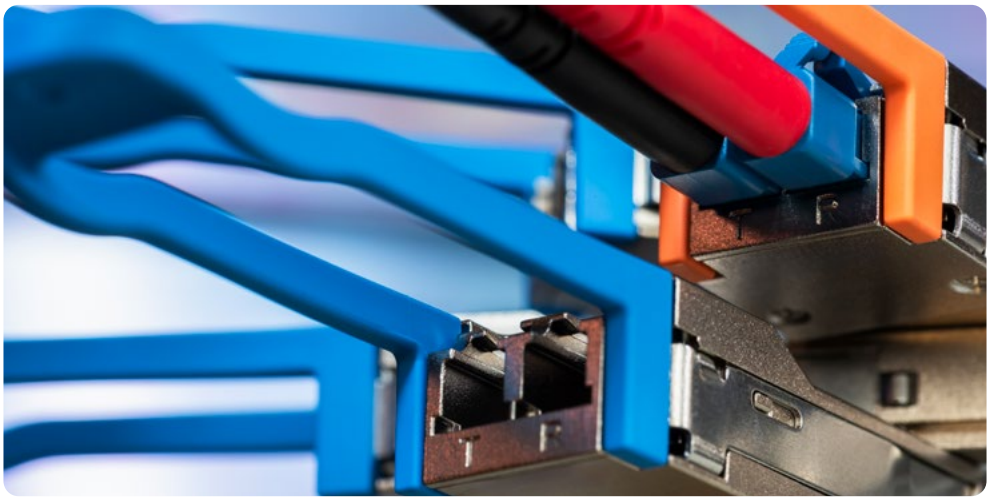
Key Products

Signal Quality Analyzer-R MP1900A

Optical Interconnects: Optical Transceivers

Test and measurement for high-speed optical communications in AI data centers

AI data centers handle massive volumes of data exchanged between GPU clusters and across data centers. To meet growing bandwidth demands, optical interconnect technologies are evolving from 800G to 1.6T and beyond. Optical transceivers play a critical role by converting high-speed electrical signals from servers and switches into optical signals for transmission over optical fibers. However, as transmission speeds continue to increase, challenges related to signal integrity, error correction, and wavelength management have become more significant, creating a need for comprehensive evaluation throughout both development and manufacturing processes.



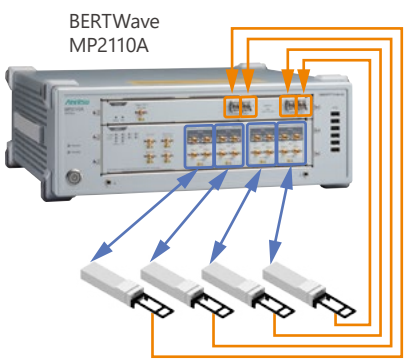
Test Challenge: Increasingly stringent signal integrity requirements at higher data rates

800G and 1.6T optical transceivers widely employ multilevel modulation schemes such as PAM4. While PAM4 doubles data throughput by transmitting two bits per symbol, its reduced signal level spacing makes it more susceptible to jitter, noise, and waveform distortion. In addition, optical transceivers integrate multiple high-speed components, including electrical interconnects, driver ICs, optical modulators, and photodetectors. As a result, electrical characteristics, optical performance, and optical signal quality must be evaluated comprehensively to ensure overall system performance.

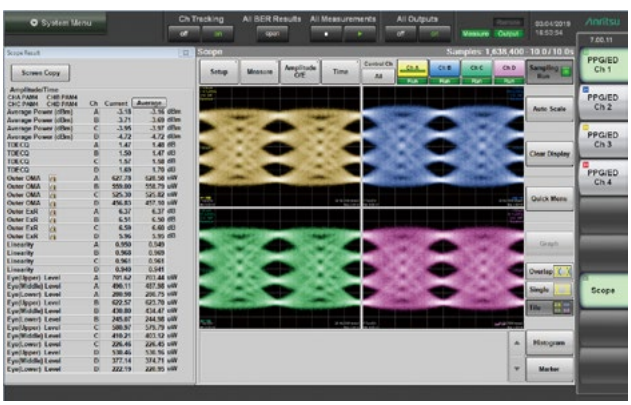
Solution: Integrated evaluation of electrical, optical, and signal integrity performance

Optical Sampling Oscilloscope BERTWave™ MP2110A supports the evaluation of optical transceivers ranging from 10G and 800G to next-generation 1.6T devices. It enables comprehensive analysis of key signal quality parameters, including PAM4 eye diagrams, amplitude, jitter, skew, and TDECQ, within a single instrument, providing efficient validation of high-speed optical signals.

In addition, the MP2110A supports simultaneous measurement of up to four channels, making it well suited for the evaluation of multi-lane optical transceivers. As a result, it can be used across a wide range of applications, from R&D and design verification to manufacturing and production testing, helping ensure the quality and reliability of high-speed optical communication systems.



Parallel 4-Channel Measurement



4ch PAM4 TDECQ Measurement

Key Products

Optical Sampling Oscilloscope
BERTWave™
MP2110A

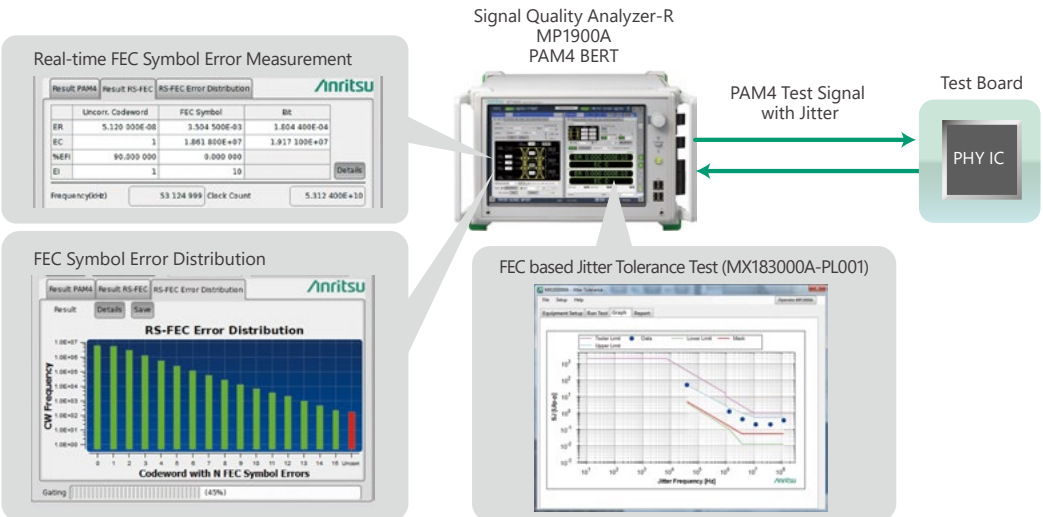
Test challenge: Validating communication quality including FEC performance

As data rates continue to increase, Forward Error Correction (FEC) has become an essential technology in optical transceivers. Compared with NRZ signaling, PAM4 signals have narrower signal level spacing and are therefore more susceptible to impairments caused by signal degradation. As a result, communication quality must be evaluated not only in terms of BER, but also with consideration of the error-correction capability provided by FEC. However, because actual operating environments contain jitter and noise, ideal laboratory conditions alone may not accurately predict real-world system performance.

Solution: BER and FEC validation under realistic operating conditions

The Signal Quality Analyzer-R MP1900A supports both high-quality test signal generation and BER measurements. By performing tests under controlled jitter and noise conditions, it enables BER evaluation and FEC-aware communication quality verification in environments that closely emulate real-world operating conditions.

This approach helps identify potential signal integrity issues during the development phase, reducing the risk of communication failures and performance degradation in deployed systems.



Key Products

Signal Quality Analyzer-R
MP1900A

Test challenge: Ensuring frequency response and optical performance of optical transceivers

Optical transceivers designed for 800G and 1.6T applications consist of key components such as lasers (LDs), photodiodes (PDs), and optical modulators. The frequency response of these devices has a direct impact on communication performance, and insufficient bandwidth can lead to signal distortion and increased BER.

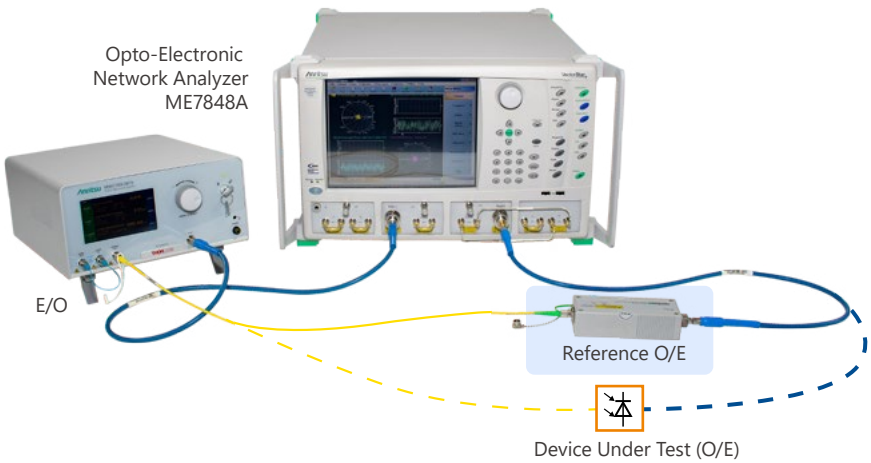
In addition, data center networks rely on WDM technology to transmit multiple optical signals simultaneously. As a result, optical transceivers need to meet stringent requirements not only for wavelength and output power in optical signal, and spectral characteristics, but also for optical parameters such as Optical Signal-to-Noise Ratio (OSNR), which directly affect transmission performance. If these parameters deviate from specified limits, communication quality may degrade and transmission reach may be reduced. Therefore, evaluating both the frequency response and optical performance of optical transceivers is essential to ensure the required performance of high-speed optical interconnects.

Solution: Comprehensive evaluation of frequency response and optical performance

The Opto-Electronic Network Analyzer ME7848A enables characterization of the frequency response of E/O and O/E devices, including optical modulators, PDs, and optical transceivers. By measuring frequency response across the entire E/O and O/E signal path, it allows engineers to verify the bandwidth performance required for high-speed optical transmission.

In addition, the MS9740B Optical Spectrum Analyzer provides high-accuracy measurements of optical characteristics, including WDM spectra, center wavelength, optical power level, and OSNR.

By combining these solutions, engineers can comprehensively evaluate both the frequency response and optical characteristics required for optical transceivers. This enables support for the entire product lifecycle, from development and design verification to production quality control for 800G and 1.6T high-speed optical interconnects, helping ensure stable and reliable communication performance.



O/E Converter Frequency Response Measurement

Key Products

Opto-Electronic Network Analyzer ME7848A

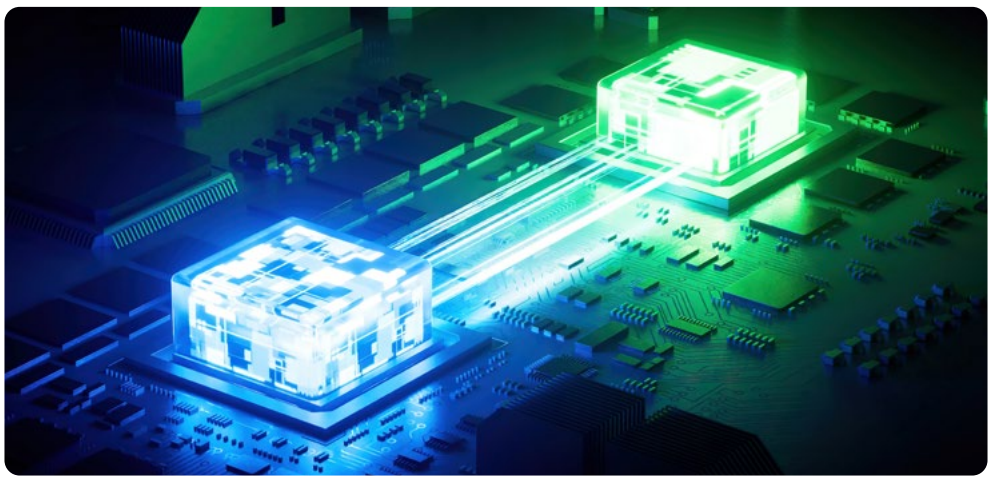
Optical Spectrum Analyzer MS9740B

Optical Interconnects: CPO and LPO

Next-generation optical interconnects for high-density AI clusters

As AI data centers continue to scale, optical interconnect technologies are evolving from 800G to 1.6T and are expected to exceed 3.2T in the future. As bandwidth requirements increase, conventional pluggable transceivers face growing challenges related to electrical channel loss, power consumption, and overall system efficiency.

To address these challenges, new architectures such as Co-Packaged Optics (CPO), Near-Package Optics (NPO), and Linear Pluggable Optics (LPO) are gaining momentum. By bringing optical engines closer to switch ASICs or reducing DSP complexity, these technologies improve bandwidth density and power efficiency. At the same time, they introduce new test requirements that demand comprehensive evaluation of electrical signal integrity, optical performance, and Ethernet communication quality.



Test challenge: Ensuring signal integrity between ASICs and optical engines

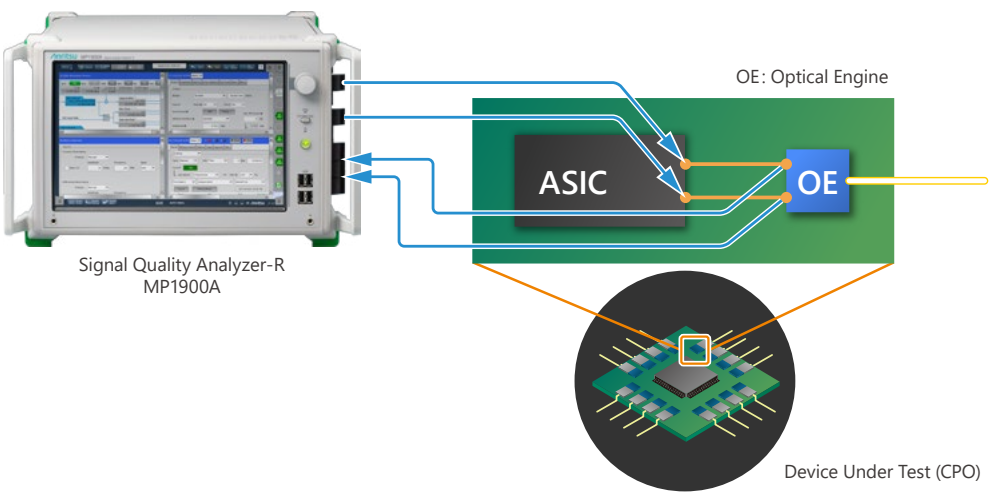
In CPO architectures, high-speed electrical signals such as 112G PAM4 and 224G PAM4 are transmitted between switch ASICs and optical engines. As signaling speeds increase, the impact of jitter, noise, insertion loss, and crosstalk becomes more pronounced, reducing signal margins and making reliable operation more difficult.

For LPO architectures, power consumption is reduced by minimizing or eliminating DSP functionality. As a result, electrical channel quality has a more direct impact on overall system performance, making validation of receiver sensitivity and jitter tolerance increasingly important.

Solution: Evaluating electrical interfaces under stressed conditions

The Signal Quality Analyzer-R MP1900A supports high-speed PAM4 signal generation and BER measurements for advanced electrical interface characterization. By applying controlled jitter and noise to the transmitted signal, engineers can perform stressed receiver testing and evaluate the tolerance of electrical interfaces under realistic operating conditions.

This enables accurate validation of signal integrity margins and receiver robustness, helping developers improve the reliability of next-generation CPO and LPO systems.



Key Products

Signal Quality Analyzer-R
MP1900A

Test challenge: Characterizing signal integrity across multi-lane optical engines

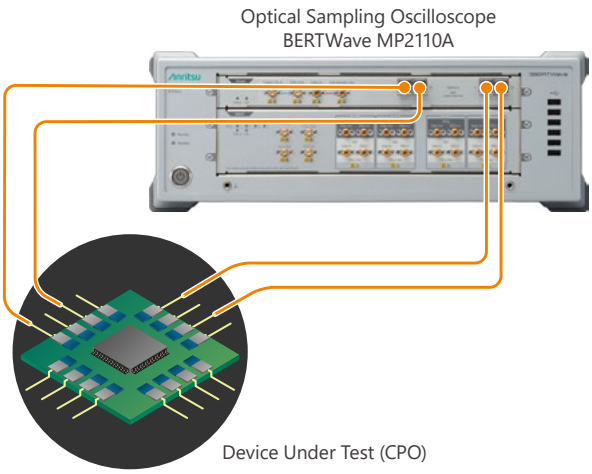
CPO architectures achieve multi-terabit throughput by distributing traffic across multiple optical lanes. Compared with conventional pluggable transceivers, the number of channels requiring characterization increases significantly, creating new challenges for efficient and scalable testing.

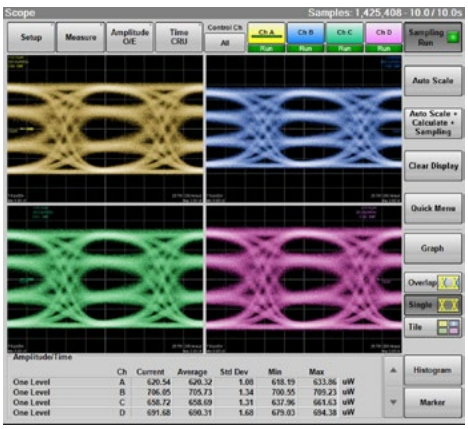
In addition, PAM4 signaling provides higher bandwidth efficiency at the cost of reduced signal margins. Even minor waveform impairments can adversely affect communication performance, making accurate characterization of signal integrity across all lanes essential for ensuring reliable operation of high-speed optical interconnects.

Solution: High-efficiency PAM4 signal quality characterization

The BERTWave™ MP2110A Optical Sampling Oscilloscope supports characterization of optical devices ranging from 10G and 800G to next-generation 1.6T technologies. It provides comprehensive analysis of PAM4 eye diagrams, jitter, amplitude, skew, and TDECQ, enabling efficient verification of high-speed optical signal quality.

With support for simultaneous measurement of up to four channels, the MP2110A significantly improves the efficiency of multi-lane optical engine testing. This enables rapid signal quality validation throughout the product lifecycle, from technology development and design verification to manufacturing and production testing.





PAM4 Eye Pattern

Key Products

Optical Sampling Oscilloscope
BERTWave™
MP2110A

Test challenge: Characterizing the optical performance of light sources and optical engines

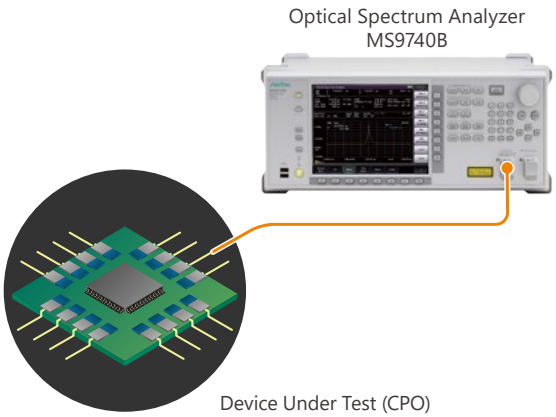
Emerging CPO and NPO architectures increasingly separate optical engines from external laser sources to improve scalability and system efficiency. In these architectures, optical parameters such as center wavelength, optical output power, spectral width, and Side-Mode Suppression Ratio (SMSR) have a direct impact on transmission performance and overall communication quality.

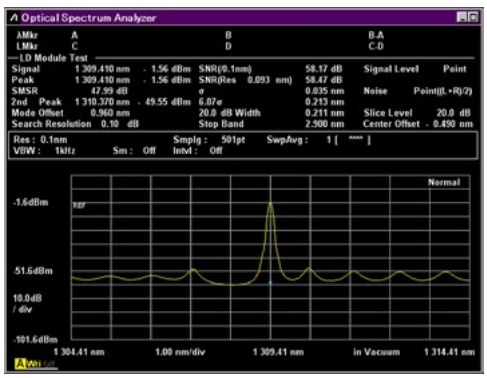
Furthermore, high-power laser sources can experience performance variations caused by temperature fluctuations and long-term aging effects. To ensure stable system operation, these optical characteristics must be accurately measured and controlled throughout the development and manufacturing process.

Solution: Comprehensive characterization of optical spectrum and signal performance

The MS9740B Optical Spectrum Analyzer delivers high-accuracy measurements of critical optical parameters, including center wavelength, spectral width, optical power, and SMSR.

When combined with waveform and signal quality measurements performed using the BERTWave™ MP2110A, engineers can comprehensively evaluate both the optical characteristics and communication performance of optical engines. This integrated approach enables reliable validation of next-generation optical interconnect architectures and supports quality assurance from development through production.





Example of Optical Spectrum Analysis

Key Products

Optical Spectrum Analyzer
MS9740B

Optical Sampling Oscilloscope
BERTWave™
MP2110A

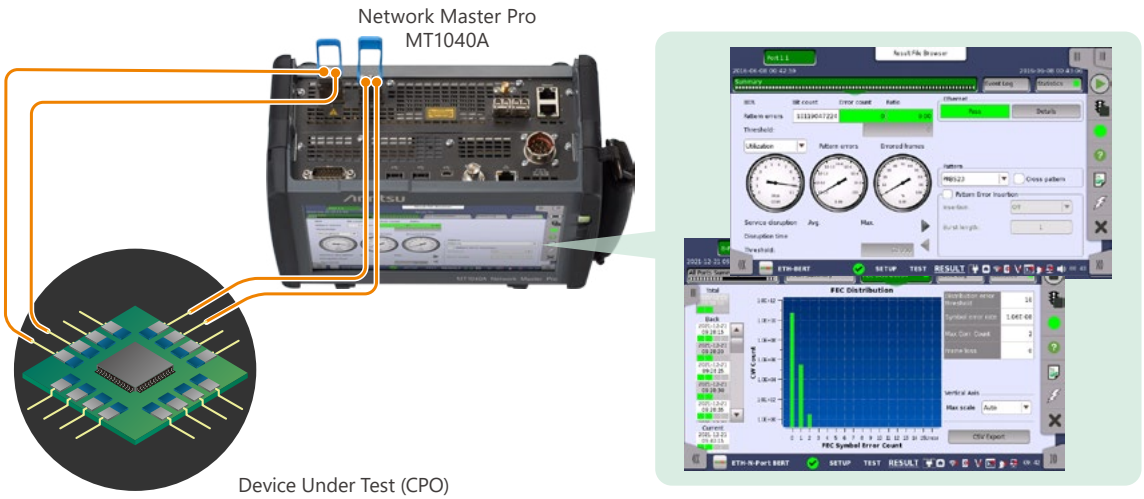
Test challenge: Verifying system-level communication quality in CPO and LPO architectures

In CPO and LPO architectures, communication quality must be validated at the system level rather than at the physical layer alone. While PAM4 signaling enables higher data rates, its reduced signal margins make Forward Error Correction (FEC) essential for maintaining reliable data transmission. However, communication performance can degrade when burst errors or other signal impairments approach or exceed the correction capability of FEC. As a result, system-level validation requires visibility into both Ethernet traffic performance and FEC behavior to ensure reliable operation under real-world conditions.

Solution: Correlating Ethernet performance with FEC behavior

The Network Master Pro MT1040A enables simultaneous evaluation of Ethernet traffic and FEC performance. In addition to measuring frame loss, latency, and errored frames, it provides visibility into the distribution of FEC codeword errors, offering deeper insight into communication quality at the system level.

By correlating Ethernet performance metrics with FEC-related measurements, engineers can identify issues that may not be apparent through device-level testing alone. This enables comprehensive validation of communication quality and helps ensure the reliability of networking equipment incorporating CPO and LPO technologies.



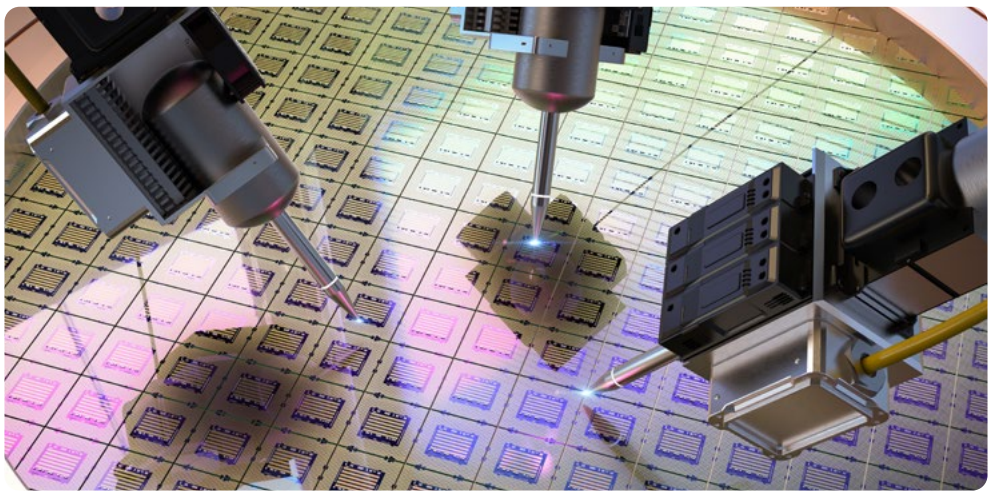
Key Products

Network Master Pro
MT1040A

Optical Interconnects: Silicon Photonics

Optoelectronic integration technologies enabling scalable AI data centers

Optoelectronic integration technologies based on silicon photonics combine optical devices such as LDs, optical waveguides, modulators, and PDs with electronic circuits on a silicon substrate, enabling high-density and energy-efficient optical communications. These technologies have become key building blocks for advanced optical interconnect architectures, including optical transceivers, CPO, and NPO. As device integration continues to increase, accurate characterization of E/O and O/E conversion performance, optical waveguide transmission characteristics, and frequency response becomes increasingly important. In addition to evaluating individual device performance, engineers must verify the behavior of integrated photonic and electronic subsystems, creating new challenges that require advanced test and measurement capabilities.

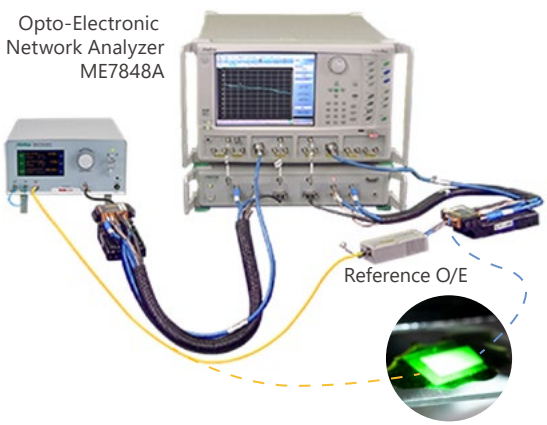


Test challenge: Characterizing the performance of highly integrated optoelectronic devices

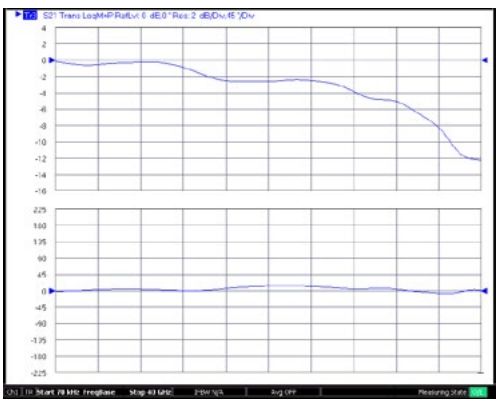
Optoelectronic devices integrate a wide range of components, including LDs, modulators, PDs, and driver ICs, into a compact platform. As a result, evaluating individual device characteristics alone is no longer sufficient. The transmission performance of the complete optoelectronic system, including both optical and electrical domains, must be thoroughly characterized. Furthermore, the E/O and O/E conversion characteristics of these devices directly affect communication performance. Insufficient characterization of frequency response and conversion efficiency can lead to degraded communication quality, performance variation, and reduced system margins after deployment.

Solution: Broadband characterization of E/O and O/E performance

The Opto-Electronic Network Analyzer ME7848A enables broadband characterization of the E/O and O/E performance of optoelectronic devices. By measuring frequency response across the complete optical-electrical signal path, including E/O and O/E conversion stages, it provides accurate verification of the transmission characteristics required for high-speed optical communications. The ME7848A also supports evaluation of integrated photonic and electronic subsystems, making it well suited for design verification and performance optimization of silicon photonics-based devices. By enabling quantitative characterization during the development phase, it helps accelerate innovation while supporting the realization of high-performance optoelectronic technologies.



Device Under Test (CPO)



Example of Frequency Response

Key Products

Opto-Electronic Network Analyzer
ME7848A

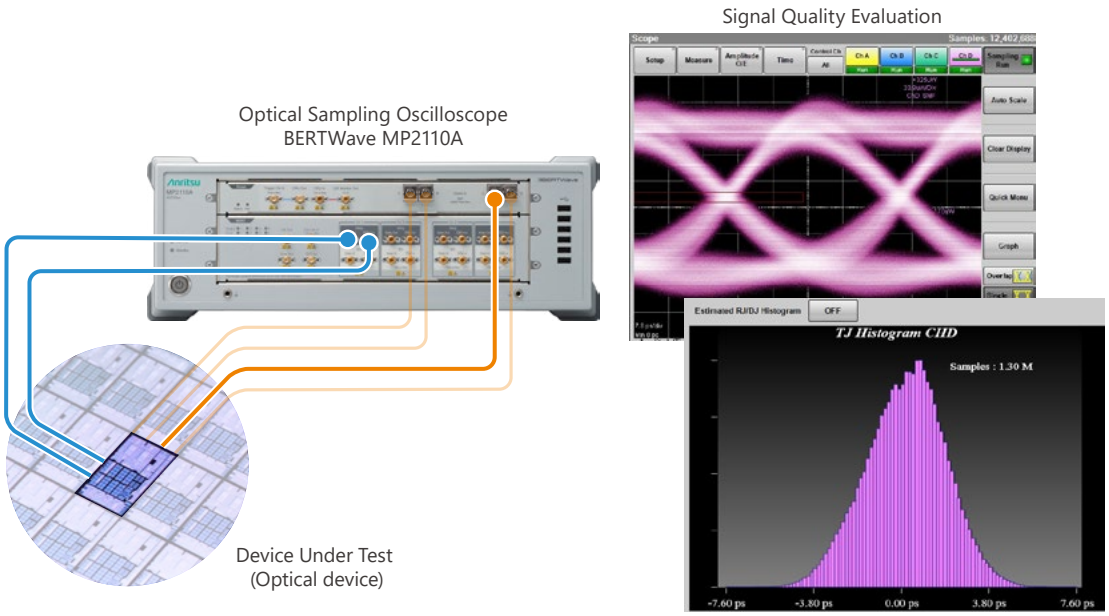
Test challenge: Evaluating channel-to-channel consistency in multi-channel photonic devices

Silicon photonics-based optoelectronic devices achieve high-density, high-capacity optical communications by integrating multiple modulators, photodetectors, and other photonic components on a single chip. However, manufacturing variations and packaging conditions can introduce channel-to-channel differences in optical signal quality and transmission performance. Such variations can directly impact communication performance, production yield, and overall system reliability. Therefore, efficient and quantitative characterization of signal quality across multiple optical channels is essential throughout both development and manufacturing.

Solution: Efficient characterization of multi-channel optical signals

The Optical Sampling Oscilloscope BERTWave™ MP2110A enables comprehensive evaluation of optical signal quality parameters, including eye diagrams, TDECQ, amplitude, jitter, and skew. With support for simultaneous measurement of up to four channels, it provides an efficient solution for evaluating increasingly complex multi-channel optoelectronic devices.

By enabling quantitative comparison of channel-to-channel performance, the MP2110A helps engineers identify variations across optical channels and supports applications ranging from design verification and performance optimization to manufacturing quality control.



Jitter Analysis

Key Products

Optical Sampling Oscilloscope
BERTWave™
MP2110A

Test challenge: Characterizing WDM spectral performance in silicon photonics devices

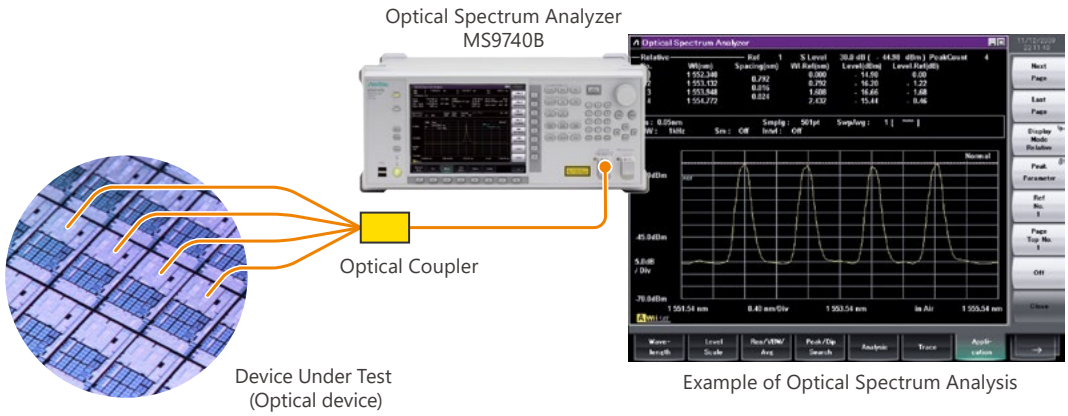
Silicon photonics-based optoelectronic devices widely employ WDM technologies to increase transmission capacity by utilizing multiple optical wavelengths within a single device. In these systems, optical characteristics such as center wavelength, spectral width, optical output power, and SMSR directly influence transmission performance and interoperability.

To ensure reliable operation, variations in wavelength characteristics and optical power among WDM channels must be carefully controlled. In addition, performance variations caused by laser drift, manufacturing tolerances, or environmental conditions can affect overall system performance and interoperability. As a result, accurate characterization of optical spectrum characteristics is essential throughout the device development process.

Solution: High-accuracy characterization of optical performance

The Optical Spectrum Analyzer MS9740B provides high-accuracy measurements of key optical parameters, including center wavelength, spectral width, optical output power, OSNR, and SMSR.

By enabling detailed visualization of WDM channel characteristics and laser performance, the MS9740B supports both design verification and manufacturing quality control for silicon photonics-based devices. It also helps engineers evaluate performance variations caused by manufacturing tolerances and temperature-induced drift, contributing to the realization of stable and reliable optical communication systems.



Example of Optical Spectrum Analysis

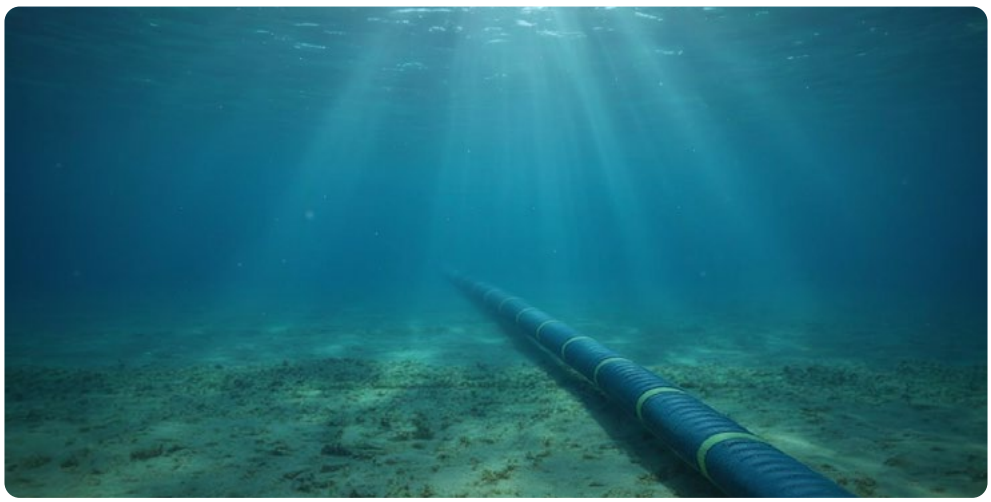
Key Products

Optical Spectrum Analyzer
MS9740B

Submarine Optical Cables, Data Center Interconnects, and Next-Generation Optical Networks

High-capacity optical networks connecting AI data centers

The rapid adoption of generative AI is driving demand for higher-capacity and more efficient long-haul communications across submarine optical cable systems, data center interconnect (DCI) networks, and intra-data-center networks. To meet these requirements, pluggable coherent optical transceivers such as 100ZR, 400ZR, and OpenZR+ are being widely deployed. At the same time, research and development of next-generation optical networking technologies, including multicore fiber (MCF) based on Space Division Multiplexing (SDM), is advancing to support future growth in network capacity.



Test challenge: Ensuring communication quality of coherent optical transceivers

Pluggable coherent optical transceivers such as 100ZR, 400ZR, and OpenZR+ enable high-capacity, long-reach transmission through advanced modulation technologies and Forward Error Correction (FEC). However, degradation of the optical transmission path and reductions in Optical Signal-to-Noise Ratio (OSNR) can push system operation closer to the FEC correction limit, potentially degrading communication performance.

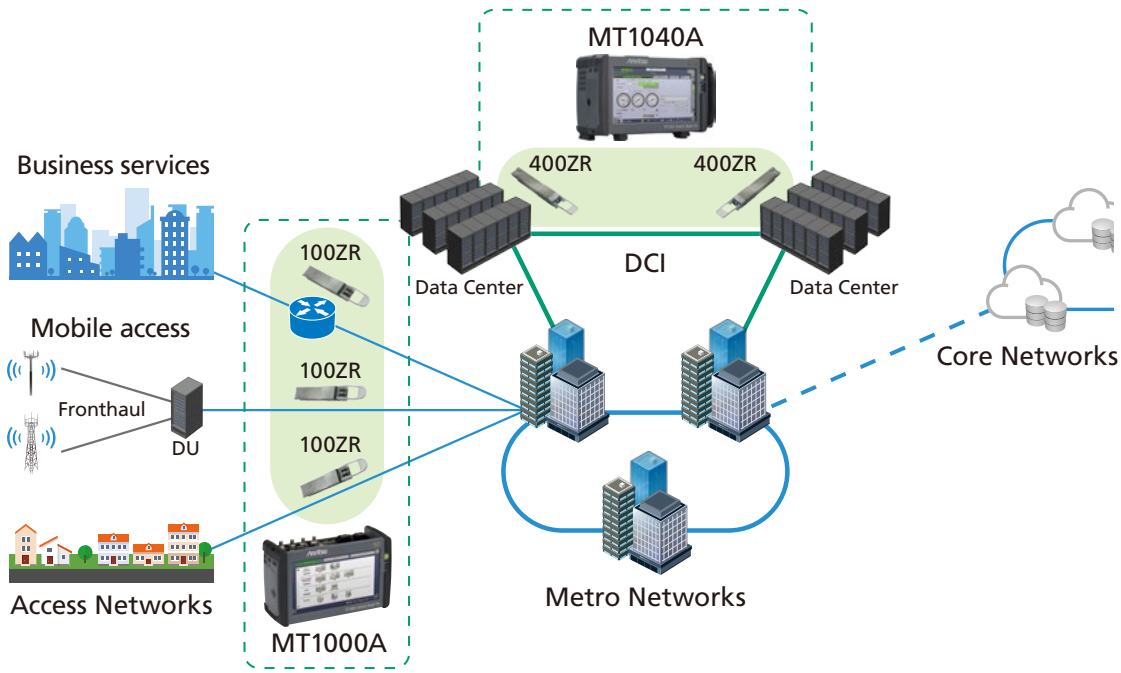
In addition, these transceivers are developed based on open specifications defined by organizations such as the OIF. As a result, interoperability between transceivers and networking equipment from different vendors must be thoroughly validated. To ensure reliable operation, both client-side Ethernet signals and line-side coherent optical signals must be evaluated.

Solution: Quantitative evaluation of high-speed optical signal quality

The Network Master Pro MT1040A provides direct testing of pluggable coherent optical transceivers, including 100ZR, 400ZR, and OpenZR+. The Network Master MT1000A supports 100ZR transceivers and offers an ideal test platform for DCI network deployment and maintenance.

In addition to Ethernet performance testing, the MT1040A and MT1000A measure frame loss, latency, and FEC-related parameters. They also provide real-time access to transceiver diagnostics, enabling visualization of key performance indicators such as Signal-to-Noise Ratio (SNR) and FEC error statistics.

By evaluating both client-side Ethernet traffic and line-side coherent optical signals, these solutions support efficient interoperability validation in multi-vendor environments and comprehensive communication quality assessment across DCI networks.



Key Products

Network Master Pro MT1000A

Network Master Pro MT1040A

Test challenge: Evaluating optical transmission performance and inter-core crosstalk in multicore fibers

MCF technology is being actively developed as a promising approach for dramatically increasing the transmission capacity of next-generation optical networks. However, optical signals propagating in one core can couple into adjacent cores, creating inter-core crosstalk that directly impacts communication quality. Increased inter-core crosstalk degrades the OSNR and can lead to reduced transmission performance. To ensure reliable system operation, inter-core crosstalk characteristics and their sources must be accurately characterized throughout the development, manufacturing, and deployment phases.

Solution: Visualizing inter-core crosstalk along the fiber

The Multi Channel Fiber Tester MT9100A is an OTDR-based solution designed for evaluating the transmission performance of multicore fibers. In addition to measuring insertion loss and reflectance, it enables high-accuracy visualization of inter-core crosstalk as a function of distance, helping identify where crosstalk occurs along the fiber link.The MT9100A supports simultaneous measurement of up to four cores, allowing core-by-core evaluation of splice losses, connector losses, and fiber faults. Because multiple cores can be measured without reconnecting the fiber, the solution significantly improves testing efficiency from MCF research and development through network deployment and maintenance.

Example of Crosstalk Measurement

Key Products

Multi Channel Fiber Tester MT9100A

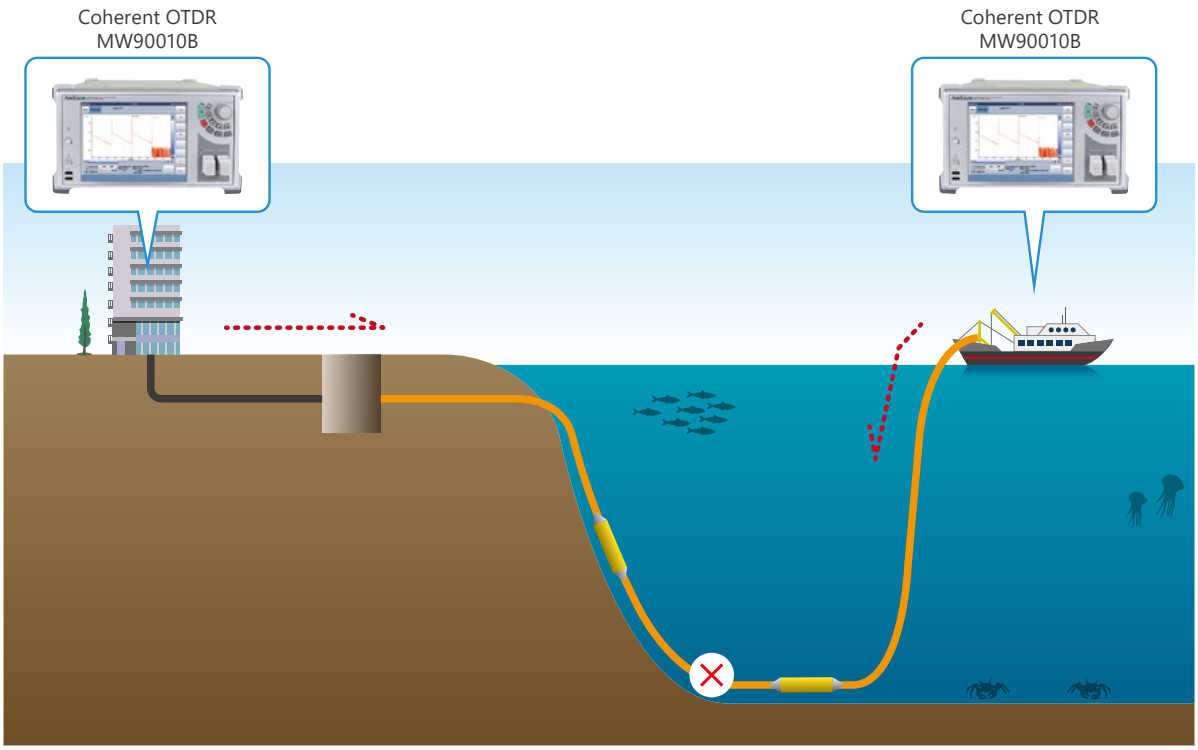
Test challenge: Rapid and accurate fault location identification in submarine optical cable systems

Submarine optical cable systems span thousands of kilometers, making accurate fault localization critical when failures occur. However, conventional measurement methods can suffer from longer test times and reduced location accuracy as transmission distances increase. Because repair vessel deployment and restoration activities involve significant cost and resources, rapid and accurate fault localization is essential for efficient network recovery.

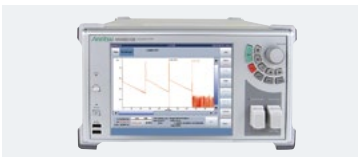
Solution: Identifying fault locations with 10-meter distance resolution

The Coherent OTDR MW90010B is a long-haul fiber characterization solution designed for submarine cable systems. It can locate faults in submarine cable networks spanning up to 20,000 km, enabling rapid identification of fault locations along the transmission path.

With a distance resolution of 10 meters, the MW90010B delivers highly accurate fault localization even in ultra-long-haul optical links. This helps accelerate fault isolation and restoration activities, improving operational efficiency and minimizing network downtime in the event of a submarine cable failure.



Key Products



Coherent OTDR
MW90010B

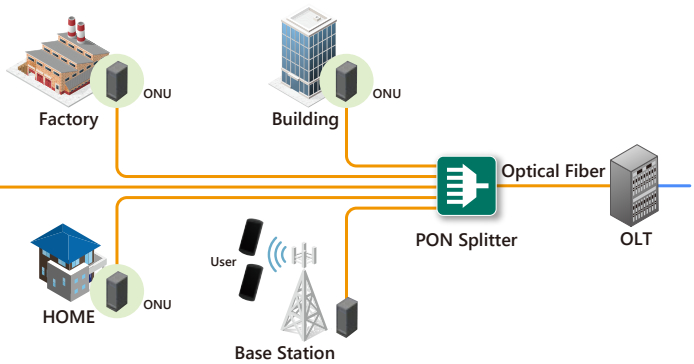
Test challenge: Verifying optical fiber loss before network deployment

Optical fibers connecting data centers may be leased from telecommunications carriers or installed directly by data center operators. In either case, excessive transmission loss or connection loss reduces received optical power, potentially causing it to fall below the receiver sensitivity specification. This can prevent reliable signal reception and compromise high-speed 400G data transmission. Therefore, it is essential to verify that optical fiber transmission and connection losses remain within acceptable limits before the network is commissioned.

Solution: OTDR-based characterization of optical fiber links

OTDRs Access Master MT9085 Series and µOTDR Series enable verification of transmission and connection losses throughout the optical fiber link before service deployment. By identifying and quantifying loss events along the fiber, OTDR testing helps ensure that optical links meet network performance requirements and support reliable high-speed transmission. In addition to long-haul DCI networks, OTDR measurements can also be applied to short-reach optical links within data centers, supporting quality assurance across a broad range of optical infrastructure.

µOTDR Module™ Series
MU909014x/15x



Key Products

OTDR - ACCESS Master
MT9085 Series

µOTDR Module™ Series
MU909014x/15x

Virtual and Cloud Networks

Communication quality evaluation for cloud infrastructure supporting AI services

As AI data centers continue to scale, the virtualization and cloud-native transformation of network functions are accelerating. Functions that were traditionally implemented using dedicated hardware are increasingly being deployed as software running on virtual machines and containers. At the same time, communication quality in virtualized and cloud environments can be affected by factors such as shared CPU and memory resources, dynamic configuration changes, and interactions between virtualization layers. As a result, challenges have emerged that cannot be fully understood through evaluation using conventional physical test instruments alone.

Test challenge: Understanding the impact of virtualization layers on communication quality

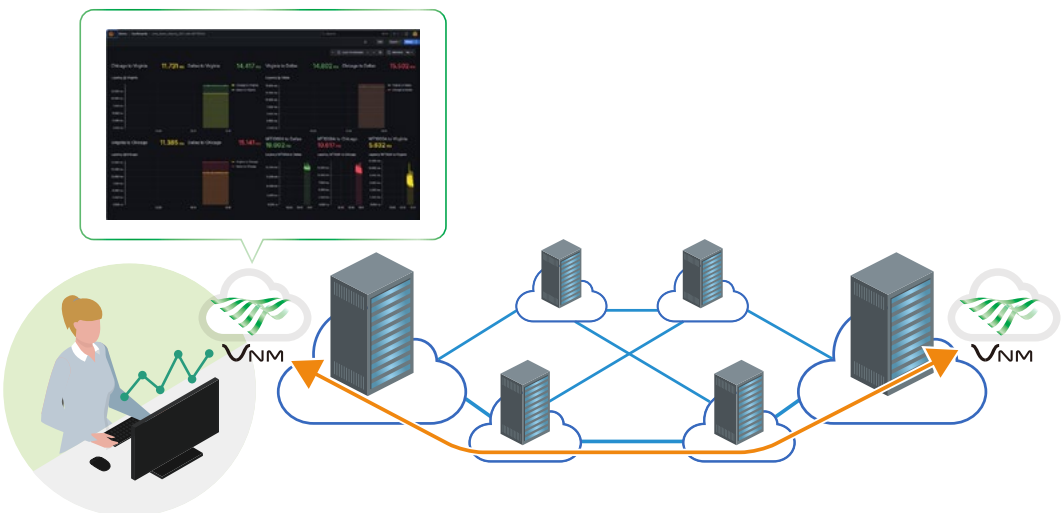
In traditional networks, communication quality could be evaluated relatively easily by connecting test instruments to physical devices such as routers and switches. However, in virtualized infrastructures and cloud environments, network functions operate as software, meaning that measurements of only the underlying physical infrastructure may not accurately reflect actual service quality.

In addition, factors such as CPU utilization, resource contention, and dynamic configuration changes can introduce latency variations and performance fluctuations. Therefore, it is important to gain visibility into communication quality within the virtualization layer and understand its impact on overall service performance.

Solution: Visualizing communication quality within virtual environments

Virtual Network Master is a software-based network performance evaluation solution that operates within virtualized and cloud environments. Without requiring dedicated physical test equipment, it enables measurement of key performance indicators such as latency, packet loss, and throughput within virtual networks, streamlining performance validation in cloud-native environments.

By providing visibility into how virtual networks affect service quality, Virtual Network Master supports quality assurance, performance optimization, and troubleshooting during network operation.



Virtual Network Master
MX109030PC/MX109031PC

Test challenge: Establishing a consistent validation environment across public and private clouds

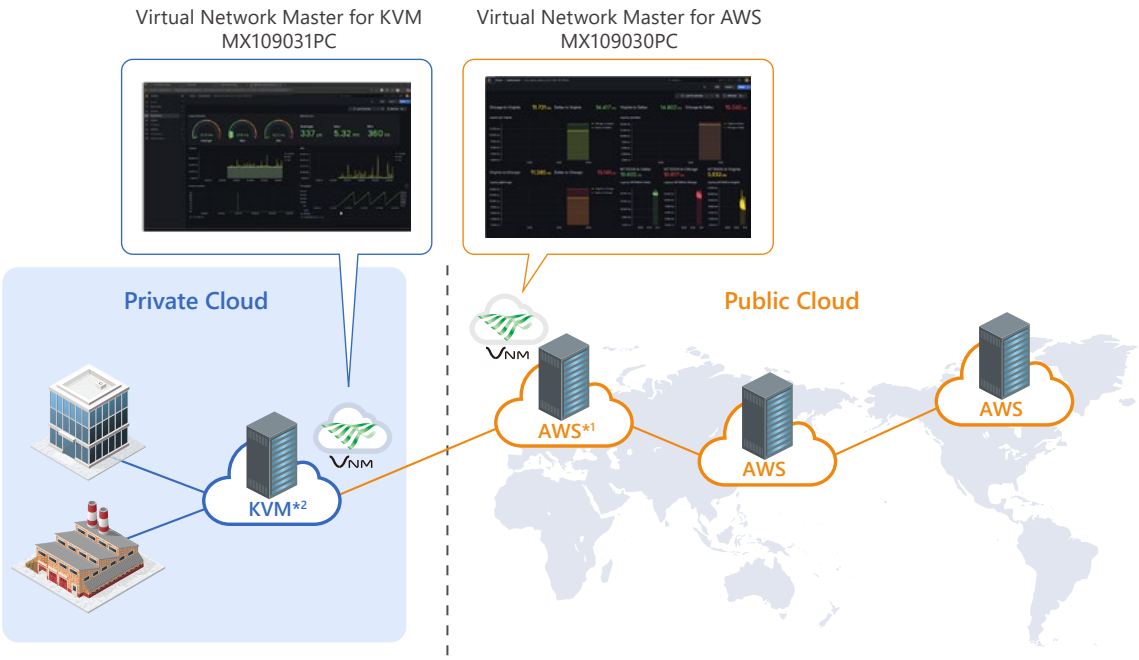
AI services are increasingly deployed in hybrid environments that combine public cloud platforms with on-premises infrastructure. Consequently, communication quality must be evaluated under consistent conditions across different cloud environments.

To ensure end-to-end service quality, organizations require a common evaluation methodology and set of performance metrics rather than adopting different validation approaches for each cloud platform. Continuous performance verification based on unified criteria is therefore becoming increasingly important.

Solution: Flexible deployment across diverse cloud environments

Virtual Network Master is available in versions optimized for AWS environments and KVM-based private cloud infrastructures. This enables deployment across a wide range of environments, from public clouds to private clouds, while maintaining a consistent methodology for communication quality evaluation.

In addition, Virtual Network Master provides a unified validation platform for hybrid cloud environments, supporting end-to-end communication quality management throughout the lifecycle, from performance validation and quality assurance to operational maintenance.



*1: Amazon Web Services and AWS are registered trademarks of Amazon.com, Inc. or its affiliates.
*2: KVM is an abbreviation for Kernel-based Virtual Machine and runs on Linux environments.

Key Products

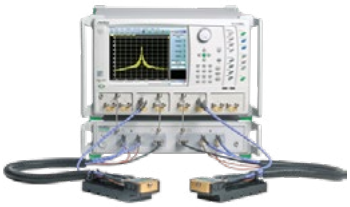
Virtual Network Master for AWS
MX109030PC

Virtual Network Master for KVM
MX109031PC

Related Products

Broadband Vector Network Analyzer ME7838 Series

ME7838AX: 70 kHz to 125 GHz
ME7838EX: 70 kHz to 110 GHz
ME7838D: 70 kHz to 145 GHz
ME7838G: 70 kHz to 220 GHz



The Broadband Vector Network Analyzer ME7838A/D/G is a two-port vector network analyzer that supports high-frequency bands up to 220 GHz. This series offers excellent measurement accuracy and stability across a wide frequency range from 70 kHz to 220 GHz. Its high dynamic range and low noise performance make it ideal for S-parameter measurements and the characterization of both passive and active devices in the millimeter-wave and sub-terahertz bands.

Learn more

VectorStar Family of RF, µW, mmW VNAs MS4640B Series

MS4642B: 10 MHz to 20 GHz
MS4644B: 10 MHz to 40 GHz
MS4647B: 10 MHz to 70 GHz

The MS4640B VectorStar VNA offers the broadest coverage in a single instrument, 70 kHz to 70 GHz. It offers a performance benchmark for S-parameter measurements of RF, microwave and millimeter-wave devices providing engineers access to a powerful measurement tool for performance analysis.

Learn more

Signal Quality Analyzer-R MP1900A

The Signal Quality Analyzer-R MP1900A is a high-performance BERT with an 8-slot modular design, allowing flexible expansion based on the measurement application. Its multi-channel functionality enables a single unit to support a wide range of measurement needs, including physical layer testing for Ethernet, PCI Express, USB, and more. By using the PAM4 PPG MU196020A and PAM4 ED MU196040B modules, the MP1900A can perform testing of 400ZR and 800ZR optical transceivers.

Learn more

BERTWave™ MP2110A

The BERTWave MP2110A sampling oscilloscope is a measurement instrument ideal for manufacturing evaluation of 10G to 800G/1.6T optical modules, integrating a sampling oscilloscope (for eye pattern analysis) and a bit error rate tester for up to four channels in a single unit. Both the sampling oscilloscope and BERT can perform simultaneous measurements across all channels or measure each channel in parallel.
This flexibility allows for both parallel testing of multiple single-channel modules and batch testing of multi-channel modules, enabling engineers to configure an evaluation system tailored to their specific application.

Learn more

Opto-Electronic Network Analyzer ME7848A

The VectorStar Opto-Electronic Network Analyzer (ONA) ME7848A combines the performance of a wideband vector network analyzer with low noise and high dynamic range, enabling a detailed analysis of the frequency characteristics and S-parameters of optical devices. It provides traceable, high-precision measurements up to 110 GHz for optical-to-electrical (O/E), electrical-to-optical (E/O), and optical-to-optical (O/O) devices. The instrument supports light wavelengths of 850, 1310, and 1550 nm, making it ideal for evaluating the coherent light sources, modulators, and photoreceivers used in high-speed optical communication systems.

Learn more

Optical Spectrum Analyzer **MS9740B**

The Optical Spectrum Analyzer MS9740B provides the essential measurement functions required for evaluating optical devices and supports a wide range of active optical components, including LD modules, DF-LDs, FP-LDs, LEDs, PMDs, WDMs, optical amplifiers, and WDM filters. This instrument can measure all major parameters, such as center wavelength, optical power level, OSNR, and spectrum width, which are commonly used as evaluation criteria in the manufacturing process. Furthermore, measurement results are displayed on a single screen via an intuitive user interface, contributing to improved analysis efficiency. This allows engineers to quickly and accurately assess the characteristics of multiple optical devices, enhancing the efficiency of quality control and evaluation workflows from design and development to mass production.

Learn more

Network Master Pro **MT1000A**
10G Multirate Module **MU100010A1**
100G Multirate Module **MU100011A**

The Network Master Pro MT1000A is a handheld measurement instrument that enables quantitative evaluation of communication quality during the construction and operation phases of mobile networks and optical networks. Because dedicated hardware allows stable measurement of communication quality metrics such as communication latency, packet loss, and jitter, the instrument can be used for pass fail judgment of communication quality and for isolating root causes. It also supports evaluation of PTP time synchronization and Ethernet testing up to 100 Gbps, thereby assisting verification tasks during network construction and operation.

Learn more

Network Master Pro **MT1040A**
100G Multirate Module **MU104011A**
400G Multirate Module (QSFP-DD) **MU104014B**
400G Multirate Module (OSFP) **MU104015A**

The Network Master Pro MT1040A is a measurement instrument that supports pass fail judgment of communication quality and root cause isolation during the construction and operation of mobile networks and optical networks using 100G, 200G, and 400G Ethernet. As higher transmission speeds make latency variation and packet loss more apparent, the instrument visualizes these phenomena through stable traffic generation and measurement using dedicated hardware. This capability improves the efficiency of communication quality verification during network construction and operation, as well as root cause isolation during troubleshooting.

Learn more

Multi Channel Fiber Tester **MT9100A**

The Multi Channel Fiber Tester MT9100A is the industry's first* OTDR capable of evaluating optical transmission characteristics of multicore fiber, including inter-core crosstalk between optical transmission paths (cores). By enabling simultaneous measurement of up to four cores and visualizing optical transmission characteristics — including inter-core crosstalk — along the distance axis, the MT9100A makes it possible to accurately identify fault locations in multicore fiber.
By introducing the MT9100A, highly accurate and efficient measurement and analysis can be performed not only in research and development and manufacturing processes, but also across all stages of network construction and operation involving multicore fiber. For engineers, it represents an ideal test solution that dramatically improves both work quality and productivity through innovative technology.

* As of November 2025, according to research by Anritsu.

Learn more

Coherent OTDR **MW90010B**

The Coherent OTDR MW90010B can measure ultra-long submarine cables of up to 20,000 km to locate faults with 10 m measurement resolution.
Coherent detection technology captures waveform data, including fault location, cable loss, bending loss, fiber length, etc., for detailed evaluation of submarine cables. Its excellent basic performance, such as measurement time and dynamic range, accurately measures submarine cables with optical-amplifier repeaters separated by distances of 80 km or more.

Learn more

OTDR - ACCESS Master **MT9085 Series**

The ACCESS Master MT9085 series is a compact handheld all-in-one tester for performing optical pulse tests, optical loss/power measurements, and optical fiber end-face inspections. It has a wide variety of applications, ranging from installation and maintenance (I&M) of trunk fibers (Core, Metro, Mobile Fronthaul, Mobile Backhaul) to troubleshooting Access networks, such as breaks in drop cables.

Learn more

µOTDR Module™ Series **MU909014x/15x**

The µOTDR MU909014x/5x features 5 cm resolution for accurate mapping of events, deadzones of less than 1 meter (3-feet) and a dynamic range of up to 37 dB – enough to test over 150 km (90 miles) or PON-based FTTx networks featuring up to a 1 × 64 split.

It also takes portability to a level by being the handheld OTDR that truly fits in the palm of your hand.

MU909014Cx/15Cx MU909014Bx/15Bx MU909014A1

Learn more Learn more Learn more

Virtual Network Master for AWS **MX109030PC**
Virtual Network Master for KVM **MX109031PC**

Virtual Network Master for AWS MX109030PC and Virtual Network Master for KVM MX109031PC are testing solutions designed for virtualization and cloud environments, enabling the high-precision and quantitative evaluation of application communication quality even in situations where the installation of physical measuring instruments is challenging.
The MX10903xPC can assess key network quality metrics, including communication latency, jitter, and frame loss rate. By implementing the capabilities of traditional physical measuring devices as software, it offers flexible operation without dependence on physical instruments. As an essential tool for evaluating communication quality in the era of virtualization and cloud computing, it enables engineers to solve practical challenges and improve overall network quality.
Amazon Web Services and AWS are registered trademarks of Amazon.com, Inc. or its affiliates.
KVM is an abbreviation for Kernel-based Virtual Machine and runs on Linux environments.

Learn more

Autofocus Video Inspection Probe G0382A

Dirty or damaged optical connectors can greatly effect network performance. The Autofocus Video Inspection Probe G0382A eliminates these issues by verifying the condition and cleanliness of connector end faces during the installation phase where they are easily correctly.
G0382A is available for the Network Master Pro MT1000A, Network Master Flex MT1040A and Windows® based PCs.

Learn more

Video Inspection Probe G0306C

Connecting the G0306C to the Network Master MT1000A/MT1040A series, ACCESS Master MT9085 series, Network Master MT9090A (µOTDR module) series or a Windows® PC displays provides a safe way to view, analyze and document connector end face condition and quality. This function is useful for determining whether a ferrule end face is clean, or whether connector replacement is required due to the presence of scratches.

Learn more

Optical Loss Test Set CMA5

The CMA5 series are compact and lightweight, its excellent cost performance and simple operation with the required minimum number of functions make it ideal for onsite I&M.
The CMA5 series Optical Loss Test Set is an all-in-one light source and optical power meter supporting single-mode (1310 nm/1550 nm) and multimode (850 nm/1300 nm) fibers.

Learn more

Optical Light Source/Optical Power Meter CMA5

The CMA5 Series Light Sources provide an economical and stable laser source for use in point-to-point attenuation measurement.
The CMA5 Series Power Meters are economical, accurate and easy to use handheld units for attenuation and power throughput measurements on point-to-point fiber optic links.
They feature a rugged design, built to withstand the difficult testing environment of fiber optic cable installation and maintenance.

Learn more