

Open Modular Platforms & Pluggable Optics in DCI

System- and module-level trends reshaping metro and long-haul Data Center Interconnect in the AI era — from 400ZR/ZR+ to 800G and 1.6 Tbps — and where Anritsu Test & Measurement assures every layer.

Assuring Every Layer of the Modern Network

From 400ZR coherent optics to hollow-core fiber — test and measurement built for AI-scale DCI.

Executive Summary

The Biggest DCI Shift in a Decade

Data center interconnect (DCI) is undergoing its most significant architectural shift in a decade. Open, compact modular platforms that host **pluggable coherent optics** directly in router and switch ports are displacing bulky, purpose-built transponder shelves — collapsing cost, power, and rack space out of the network. With **400ZR/ZR+ now the de facto** DCI standard and shipping in volume, the industry is rapidly layering **800G and 1.6 Tbps (1.6T)** optics on top for the next wave of capacity.

The forcing function is artificial intelligence. AI/ML workloads are reshaping data center requirements and the demand for interconnection — traffic between data centers is now growing faster than traffic inside them, as GPU clusters outgrow a single building and must be stitched together across metro and regional sites. The market for AI data centers is projected to grow at a **28.3% CAGR through 2030**, rising from roughly USD 13.6 billion in 2024 to about USD 60.5 billion by 2030.

Because each shift in coherent optics, architecture, performance, and fiber **creates a new place to test**, these brief maps where **Anritsu Test & Measurement** solutions add value — assuring every layer of the modern interconnect from the installed fiber to the virtualized cloud edge.

28.3%

CAGR of the AI data center market through 2030

400ZR

De-facto DCI standard, shipping in volume today

800G

ZR/ZR+ ramping now for AI scale-across

1.6T

Pluggable moving from demo to deployment

1. The AI Inflection Point

Why DCI Is Changing Now

Scale-across and the new traffic pattern

For years, the dominant growth story was traffic *within* the data center. AI has changed that. Training and inference clusters have outgrown the power and space envelope of a single building, so operators now distribute GPUs across multiple facilities and connect them over latency-bounded optical links — a pattern the industry calls “**scale-across**.” Inter-data-center bandwidth is exploding as a result, and connectivity has become part of the site-selection decision: a location must prove it can both **scale** and **connect** before it is viable.

Underlying this is an “AI supercycle” in infrastructure spending. Global data center capital investment is forecast to grow at roughly a 23% CAGR through 2030, intra-data-center capacity is growing far faster still (on the order of a 65% CAGR), and coherent optical port shipments are scaling from hundreds of thousands to millions per year. Capacity, architecture, and fiber are all changing at once — and each change is a new place where performance must be measured and assured.

Where ANRITSU Adds Value

Network Master Pro MT1040A + MT1000A — The 400G Tester MT1040A and 100G Tester MT1000A enable field turn-up of 100G/400G links carrying AI traffic, combining multi-rate transport testing, FEC validation, and optical KPI measurement in single portable unit — so operators can prove diverse-route capacity and SLA before handoff in the fast-moving AI buildout.

2. System-Level Trends

Open, Compact Modular Platforms

Collapsing layers with IP-over-DWDM and OpenROADM

The defining system-level trend in DCI is the collapse of network layers. Coherent **pluggable** move the transponder function into the router or switch line-card port and — combined with OpenROADM interoperability — enable an **IP-over-DWDM (IPoDWDM)** model that removes an entire equipment layer from the interconnect.

Traditional DCI

- Separate router + external transponder + line system
- More boxes → more power, more rack space
- Gray optics between router and transponder
- Vendor-siloed optical layer

Router-Hosted Coherent

- ZR/ZR+ pluggable directly in the router/switch port
- One converged IP + optical layer (IPoDWDM)
- Fewer boxes → lower cost, power, and OpEx
- OpenZR+ and OpenROADM multivendor interoperability

The trade-off matters. Simpler hardware is a clear win, but responsibility for the optical link now spans both the IP and optical domains and multiple vendors. When a link degrades, ownership of the problem is no longer obvious — which makes **independent, standards-based verification** essential at turn-up and in service.

Where ANRITSU Adds Value

MT1040A — Verifies router-hosted 400G coherent links end-to-end and reads live ZR/ZR+ module registers to isolate faults across the converged IPoDWDM layer, restoring the independent, standards-based visibility that layer collapse takes away.

3. Optical-Module Trends

From 400ZR to 1.6T

Coherent goes mainstream — and scales across

At the module level, coherent optics have gone mainstream and are being layered by rate. The market is **not replacing 400G** — it is adding 800G and 1.6T on top, so operators will run multiple coherent rates side by side for years.

Class	Status	Role in DCI
400ZR/ZR+/OpenZR+	<i>De facto standard</i>	Mature, multi-vendor interoperable. Widely deployed in DCI, IPoDWDM, and metro regional. Lower cost, power, and OpEx; the volume backbone.
800ZR/ZR+	<i>Volume in 2026</i>	Single-λ 800G: ~120 km (800ZR) to 1,000+ km (ZR+/OpenROADM PCS). Purpose-built for AI scale-across over IP-over-DWDM.
1.6T · 1600ZR/ZR+	<i>Demo → deployment</i>	OIF 1600ZR/ZR+ IAs advancing; ~200G/λ electrical and 16QAM at ~236 GBd. Volume ramps as 1.6T router ports arrive.

Whatever the rate, it has to be proven to work — and operators are not picking one rate, they are supporting all of them at once.

Where ANRITSU Adds Value

MT1040A · MP1900A · MP2110A — In the field, the **MT1040A** tests 400G client plus the coherent line side (pre-FEC BER, OSNR) with live module-register monitoring. In R&D and manufacturing, the Signal Quality Analyzer-R **MP1900A** validates 400ZR/800ZR transceivers with 64 GBd PAM4 BER, jitter tolerance, and FEC analysis — an 8-slot path future-proofed to 800G/1.6T — while the BERTWave **MP2110A** sampling scope + BERT covers 10G–800G/1.6T module eye and BER.

4. Key Issues for Long-Haul Networks

Six Challenges Serving DCI

The migration to open modular platforms and higher-rate pluggables introduces six inter-related challenges for the long-haul networks that carry DCI traffic. Each is examined below, with the Anritsu solution that assures it.

4.1 Ensuring network SLA across hybrid metro/long-haul cloud

Cloud and virtualization deliver the flexibility that scale-across needs — but they also **hide performance**. Across multi-domain metro and long-haul paths, operators must still prove the latency, jitter, and SLA compliance the end user actually experiences.

Averaged round-trip metrics are not sufficient: **one-way latency and jitter peaks** are what break real-time services, and SLA verification now spans multiple vendors and administrative domains. Latency budgets are unforgiving — on the order of **<200 ms for remote surgery** and **<10 ms for vehicle-to-vehicle/autonomous** applications — ceilings that cannot be met by averaging.

Where ANRITSU Adds Value

MT1000A + Virtual Network Master — The MT1000A portable tester delivers Ethernet quality to 100G with high-precision latency and PTP/1588v2 time-sync verification — the field workhorse for turn-up and troubleshooting. The Virtual Network Master software probe MX109030PC/MX109031PC catches one-way latency and jitter peaks with per-packet inspection where physical instruments can't reach (AWS AMI/KVM QCOW2, DPDK/SR-IOV). Together they prove SLA from the physical fiber up to the virtualized cloud edge.

4.2 How power and space are distributed in data center networks

Power and space have become the primary constraints on where and how networks are built. Electricity demand for data infrastructure is rising at roughly a **13% CAGR**, and power scarcity — not just land — increasingly dictates site selection. This is precisely why AI clusters are distributed across multiple buildings and regions: no single site can supply the power envelope a full cluster requires. Moving the transponder into the router port removes an entire class of boxes and their power draws, while fiber capacity per generation **plateaus against the Shannon limit**.

Where ANRITSU Adds Value

MT1040A — Reads live ZR/ZR+ module registers (optical power, pre-FEC BER, OSNR) to validate that low-power pluggable optics are performing in service, confirming the power and margin budgets that the space- and energy-constrained design depends on.

4.3 Optical engines and optical line systems: lower power, space, and cost

Both the optical **engines** (the coherent modules) and the optical **line systems** (OLS) that carry them are being re-engineered for lower power, space, and cost. Engines follow a building-block approach — from low-power “coherent-lite” optics through IPoDWDM pluggables to high-performance embedded engines. On the line side, wider bands (C+L, Super-C/L) push single system capacity toward **50–92+ Tbps**, and multi-rail in-line amplifiers improve density roughly 8× (from ~20 to as many as 160 ILAs per rack).

Where ANRITSU Adds Value

MP2110A + MP1900A · MT9085A — In engine R&D and module production, the MP2110A (sampling scope + BERT) and MP1900A (64 GBd PAM4 BER, jitter, FEC) qualify 10G–800G/1.6T optics for the lowest power-per-bit. When the new line systems are commissioned, the Access Master OTDR MT9085A (up to 46 dB dynamic range) characterizes loss and events across the extended C+L wavelength range.

4.4 The move to multi-fiber connectivity

Because per-fiber capacity is approaching physical limits and higher line rates and wider bands multiply the fibers required per route, the industry is moving decisively toward **multi-fiber connectivity**. High-density, multi-rail line systems raise the manageable count from the low hundreds of fiber pairs into the **thousands** — illustratively toward 6,912 pairs and 160 ILAs per rack. The operational consequence is a sharp rise in the number of physical connection points that must be characterized, turned up, and monitored.

Where ANRITSU Adds Value

MT9085A/MT9090A with Fiber Visualizer — High-density, high-dynamic-range (up to 46 dB) **single-ended** loss and event testing commissions massive fiber counts at scale, with a small dead zone and one-button automation to compress phased turn-up and acceptance across thousands of fibers.

4.5 Advances in long-haul DCI: multi-core fiber (MCF)

Multi-core fiber is the density frontier for long-haul DCI. By placing **multiple cores inside a single fiber**, MCF adds capacity without extra cables or duct space — directly addressing the fiber-count and duct limits AI-driven DCI is now hitting (the MCF market is projected to grow roughly 6× over the decade).

New parameter to characterize: inter-core crosstalk (XT). MCF introduces a fundamentally new impairment — signal leakage between cores that acts as added noise, eroding OSNR/SNR margin and de-rating coherent reach or rate. NEXT peaks at fan-in/fan-out (FIFO) and connector junctions; FEXT accumulates along the span. Adjacent and diagonal core pairs behave differently, and XT varies with bend, temperature, and installation stress — so it must be **measured**, not assumed from a datasheet, across development, factory acceptance, field trials, and deployment.

Where ANRITSU Adds Value

MT9100A + MT1040A — The Multi Channel Fiber Tester MT9100A is built on Multi-Channel OTDR (MC-OTDR): four synchronized OTDRs probe every core of a 4-core fiber at once and derive inter-core XT plotted vs. distance — the only method giving a distributed XT profile from a single fiber end. No far-end worker, power meter, dummy fiber, or optical switch, cutting 4-core XT + loss testing from ~11 minutes to ~2 (a 3–5× efficiency gain). The MT1040A then validates per-core 400G coherent performance, proving each MCF path meets ZR/ZR+/OpenZR+ QoT.

A closely related advance is **hollow-core fiber (HCF)**, which guides light through air — cutting fiber latency by roughly **30–47%** and, at loss as low as ~0.05 dB/km, enabling longer amplifier-free spans and extending scale-across reach by ~50%. HCF is a fundamentally different waveguide, bringing its own new characterization needs for latency, loss, and dispersion.

Where ANRITSU Adds Value

MT1000A + MW90010B — The MT1000A with OTDR characterizes the latency and loss of the new waveguide, while the Coherent OTDR MW90010B (C-band tunable) extends fault-finding across amplified (EDFA) spans up to 20,000 km with 10 m resolution — covering HCF and long-haul/subsea DWDM routes.

4.6 The impact of ZR/ZR+/OpenZR optics in long-haul DCI

ZR-class coherent pluggables tie the whole transition together. **400ZR** is a single fixed mode reaching ~120 km, while **OpenZR+/ZR+** adds adaptive modes extending reach to 1,000–2,000 km — bringing coherent pluggables squarely into metro-regional and long-haul DCI. The impact is threefold: **economics** (lower cost/bit and cost/watt in a gray-optics form factor), **architecture** (ZR/ZR+ in router ports is the enabler of IP-over-DWDM), and **openness** (OpenZR+ bridges the 400ZR ecosystem and OpenROADM as rates climb to 800G and 1.6T).

Where ANRITSU Adds Value

MT1040A + MP1900A — The MT1040A provides independent, standards-based verification of ZR/ZR+/OpenZR+ links — multi-rate client (400G, 200G×2, 100G×4), pre-FEC BER, OSNR, SOP-ROC, and live register monitoring with user-defined Pass/Fail KPIs — proving diverse-route capacity and SLA before hand-off. In development, the MP1900A qualifies the high-baud transceivers behind these standards.

5. The ANRITSU Assurance Stack

One Portfolio Across the DCI Lifecycle

Every shift in coherent optics, architecture, performance, and fiber creates a new place to test. Rather than assembling four vendors, operators can cover the full interconnect — **from the installed fiber to the virtualized cloud edge** — with a single Anritsu portfolio.

Challenge	Anritsu Solution	What It Delivers
Coherent capacity: 400ZR → 800ZR → 1.6T	MT1040A	400G client + coherent line-side test: multi-rate, pre-FEC BER, OSNR, live register monitoring.
Coherent & PAM4 engine R&D/production	MP1900A/MP2110A	64 GBd PAM4 BER, jitter tolerance, FEC analysis; sampling-scope eye + BER for 10G–800G/1.6T modules.
Field & timing: metro/long-haul turn-up	MT1000A	Portable Ethernet quality to 100G with high-precision latency and PTP/1588v2 time-sync verification.
Virtualized SLA: hybrid cloud performance	Virtual Network Master	Software probe for one-way latency & jitter where instruments can't go; AWS AMI/KVM QCOW2.
Multi-fiber & multi-band commissioning	MT9085A/MT9090A	Single-ended OTDR up to 46 dB dynamic range; high-density loss/event testing for massive fiber counts.
New fiber: MCF inter-core crosstalk & loss	MT9100A	Single-ended MC-OTDR: per-core attenuation + inter-core XT with a distance-resolved profile no other method gives.
Long-haul/subsea & amplified- span fault location	MW90010B	Coherent OTDR: C-band tunable source measures amplified (EDFA) spans up to 20,000 km at 10 m resolution.

Why operators choose Anritsu for DCI assurance

Reduced downtime

Earlier fault isolation across coherent, IP, and optical domains.

Faster turn-up

Field + virtual tools accelerate service activation and SLA sign-off.

One partner

A single portfolio spans fiber, coherent, timing, and virtualized cloud.

Future-ready

Coverage for 1.6T, MCF, and HCF as they move into deployment.

Proof Point — One Trial, The Full Stack

In a live field engagement on installed 4-core jetted MCF (3 km and 80 km spans), a single Anritsu toolset exercised the full acceptance envelope: the **MT9100A** for single-ended per-core loss and crosstalk mapping, and the **MT1040A** with a 400ZR module for coherent transmission validation (OSNR, CD, DGD, FEC-corrected bits) — optical, coherent, and crosstalk assured on real installed fiber, from a single cable end.

6. Outlook

Four Shifts, One Interconnect

Taken together, these trends describe a single, coherent transformation of the DCI landscape:

- **Coherent is the new normal.** 400ZR/ZR+ is the standard, 800ZR is shipping, and 1.6T is arriving; networks must support multiple rates simultaneously — assured by the MT1040A, MP1900A, and MP2110A.
- **Architectures are collapsing.** OpenROADM, IPoDWDM, and router-hosted optics remove a layer — and shift verification responsibility onto the operator, met by independent MT1040A testing.
- **Experience must be proven.** Across hybrid metro/long-haul cloud, the MT1000A and Virtual Network Master catch one-way latency, jitter, and SLA gaps that averages miss.
- **New fiber, new parameters.** Multi-core fiber adds inter-core crosstalk and hollow-core changes latency physics — characterized by the MT9100A, MT9085A, and MW90010B.

Open, compact modular platforms with pluggable optics have found a durable home in DCI because they answer the AI era's core constraints — power, space, cost, and latency — while preserving openness and interoperability. With a 28.3% CAGR in the AI data center market through 2030 and capacity, architecture, and fiber all evolving at once, the interconnect has become the strategic layer of the AI-scale network. Anritsu Test & Measurement assures every layer of it — **from the multi-core fiber in the ground to the virtualized cloud edge** — with one portfolio across the entire DCI lifecycle.

Learn More / See It in Action

Book a virtual demonstration of the MT1040A, MT1000A, MT9100A, and Virtual Network Master on your interconnect — without disrupting live systems. Contact your local Anritsu team at www.anritsu.com.

Market and technology figures are synthesized from public industry research (AI data center market size and 28.3% CAGR to 2030; coherent pluggable and 800ZR/1.6T forecasts) and from referenced DCI webinar material. Instrument capabilities are indicative and subject to change without notice. All trademarks are registered trademarks of their respective companies. © 2026 Anritsu Company. All Rights Reserved.