VIAVI Solutions

Application Note

Faster Deployment and Monetization of Hyperscale and Edge Data Centers

A case for multi-functional instruments and test process automation (TPA) to support Tier 1 and Tier 2 certification of high fiber count multifiber push-on (MPO) cable assemblies

Unprecedented demand for increased bandwidth is driving the deployment of high fiber count ribbon cables with multifiber push-on (MPO) connectors. These cables are used in hyperscale networks to provide campus and metro connectivity between individual data centers and edge compute deployments in support of low latency 5G network applications. Owners and operators of these networks rely on a vast base of contractors to support the test and turn-up of these links. This application note makes a case for the contractor's use of multi-functional instruments and test process automation (TPA) during data center construction and commissioning. Proven to enhance testing quality and consistency, increase resource utilization (financial and human), and reduce overall cost, this novel approach achieves faster deployment and monetization of data center networks comprised of high fiber count MPO cables.

MPO Testing Challenges

Lack of Expertise

Since legacy data centers used mostly single-fiber or duplex connectors, such as SC or LC, even experienced data center contractor technicians often lack the expertise required to quickly, accurately and cost-effectively test high-fiber-count ribbon MPO cables. While Tier 1 and Tier 2 tests are the same — measure optical link length and loss, check polarity, locate and characterize each passive optical element and impairment, and ensure endface condition — the process of MPO cables is more complex, more time-consuming and therefore more costly.

Prevalence of Legacy Equipment

Many of the challenges that technicians encounter when testing MPO connectors result from using tools designed for testing single-fiber connectors. Using single-fiber legacy test devices on MPO networks requires adaptive equipment – adding time, complexity and cost to the test process as shown in Figure 1. For example, an Optical Loss Test Set (OLTS) can be used to measure length, insertion loss and optical return loss and check the continuity of MPO links with the addition of fan out cables that break the MPO down to individual LC or SC connectors. However, this adds significant complexity and costs (expensive cable fan out assemblies) to the process.

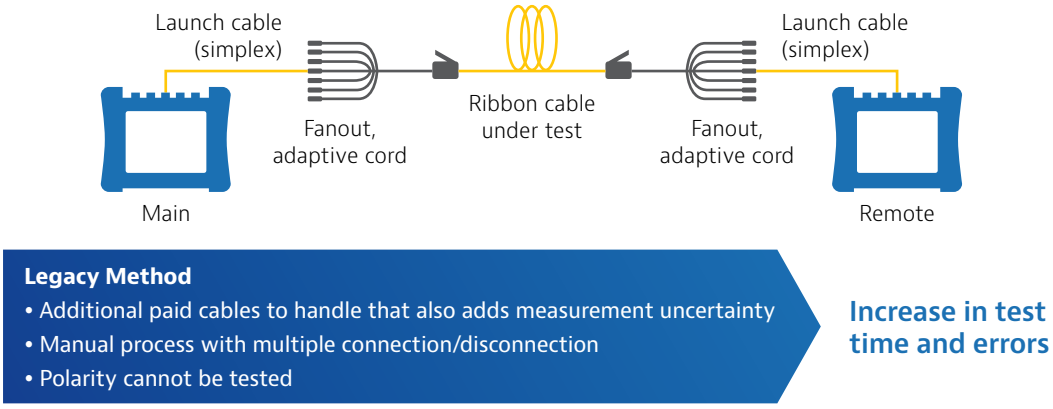

Figure 1. Equipment Use in Legacy Testing Process

Turn-up Urgency

Contractors are often charged with scaling up a network in the shortest timeframe possible in order to quickly turn-up and monetize the data center. This urgency often results in the decision to reduce testing timeframes and the number of tests performed and recorded. This is despite data that reducing the number of tests can negatively impact testing accuracy where averaging results is critical to the testing process. For example, averaging results in Tier 2 Optical Time Domain Reflectometer (OTDR) testing is imperative to reduce the noise level enough to identify passive elements such as splices and provide a more accurate measurement of loss value. Reducing the number of tests reduces averaging, which may result in missing events and invalid results being recorded in the network management database.

Bi-directional Testing

In addition to test averaging, bi-directional testing is required by industry standards and for manufacturer warranties, adding more time to the testing process. The need for the fastest testing and qualification process makes bi-directional testing vital to maintaining MPO connectivity visibility into Data Center Interconnects (DCIs) that form the longer external data pipelines connecting data centers on hyperscale data center campuses (Access Networks) and edge data centers across a larger geographical area (Metro Networks). Not only is bi-directional testing faster, but it is also more accurate. Only bi-directional testing gives a true loss value, which is critical to tight budget and higher transmission networks.

Increasing Fiber Counts

In hyperscale data centers and 5G networks, current fiber counts can be as high as 6,912 and even higher-count fibers are being manufactured. Testing a cable of this high-fiber-count using adapted legacy single-fiber test equipment could take contractors as long as 21 days, and that's not including the time and costs to manually/visually audit all the recorded test results.

Network Database Visibility

As noted in the previous paragraph, the time to test high fiber count cables takes an equal amount of time to manually/visually audit and store all the recorded test results, providing an equal amount of opportunity for more human error. How qualification test results are labeled and stored also impacts their utility when data extraction for visibility into network connectivity is required.

In summary, the lack of MPO testing expertise, prevalence of legacy test equipment, increased process complexity, urgency to turn-up and ever-increasing fiber counts all increase the opportunity for human miscommunication and error during the MPO testing and qualification process. Each of these challenges increase the likelihood of future site visits and retesting, adding to commissioning costs long after this phase of the project has ended and further delay data center monetization.

MPO Testing Solution

Multi-functional instruments and test process automation

While technicians are doing all that is humanly possible to overcome MPO testing challenges, the need to speed the process, maintain accuracy and reduce the opportunity for human error makes clear the need to fully automate the MPO testing process. This is possible using purpose-built multi-functional equipment that intuitively guides the contractor through the different steps of the testing process, manages bi-directional testing and fully automates the acceptance and reporting process for high-fiber-count ribbon MPO cables.

VIAVI FiberComplete™ v2

FiberComplete gives contractors of all skill levels the multi-functional, bi-directional testing capabilities necessary to accurately test high-fiber-count MPO cables faster and easier and with far less opportunity for human error. Multi-functional and fully automated, FiberComplete™ performs five fundamental MPO fiber qualification tests with one connection and the key press of one button.

ONE (1) Connection and ONE (1) Key Press START >>> FIVE (5) Fundamental Tests

- Automatic Continuity & Polarity Check
- Bi-Directional Insertion Loss (IL)
- Bi-Directional Optical Return Loss (ORL)
- Bi-Directional OTDR or Fault Finder Tracing
- Distance

ONE (1) Fully Automated Process

By automating five fundamental fiber qualification tests into one connection and a single key press, technicians of all skill levels can maintain inspection and testing best practices while streamlining the MPO testing workflow and reducing the total test time and costs of fiber testing and certification by as much as 60-80%.

Contractor Value Add: Lean Testing Process

While FiberComplete is automatically testing multiple fibers sequentially, contractors can perform other tasks in parallel. In lean process, each step is studied to identify any possibility of speeding the process and keep the user continuously working, i.e., no dead or idle time. The Test Process Automation enabled by FiberComplete creates added value for the contractor by enabling a Lean Testing process.

For example, testing a cable of 576 fiber strands with an OTDR will take about three (3) days with a conventional process, but with VIAVI lean process it only takes 1.2 days. The main sources of optimization are:

- OTDR measurement and patch panel port inspection is performed at the same time by the same technician. While the switch is performing the OTDR measurements automatically on 12 fibers, the technician is free to do something else such as fiber inspection of the next 12 fibers to be tested.
- There is no time lost between launch leads/cables connections. As soon as the OTDR is done for the first port of the 12, the technician can move the launch lead of the fanout to the first port of the next 12 to be tested, while the switch continues testing the rest of the 11 fibers.
- Automatic saving and reporting, requiring no human action.
- No need for entering the individual file name for each tested fiber, the cable IDs/labels can directly be imported on the instrument from a .csv file.

Hyperscaler and Service Provider Value Add: Faster Visibility into Network Performance

Because the FiberComplete test process is fully automated, the data/reports can be collected in the VIAVI cloud data management system. For example, when physical installation has occurred and there is a desire to pre-test connectivity to confirm its ability to carry desired bandwidth with necessary performance metrics, e.g., 10-100G or 100G-400G with characterization and BER testing. Visibility into these Key Performance Indicators (KPIs) and graphics provide prompt identification of issues or low-quality deployment, providing an instant health check of the fiber infrastructure and the ability to quickly adapt or change process.

Why Bi-Directional Testing?

Bi-directional testing is the recommended method for accurate loss measurement per IEC Standards 62316 and 60793-1-40 and TIA Standard FOTP61, which state: Splice and attenuation measurements with an OTDR must be conducted from both directions and averaged for accuracy to eliminate the effects of back scatter differences, also referred to as gainers and exaggerated losses.

Improves event detection reliability

- Due to dead zones, some elements might be hidden when testing from one end while it could be seen from the other end.
- The principle behind bi-directional OTDR analysis is to distribute events coming from A->B trace onto B->A trace and vice versa, so that all events match.

Improves measurement accuracy

- See statement above for fiber sections mismatch.
- The measurement uncertainty is reduced as you average the loss value of the two (2) measurements.
- ORL may be different from one direction to the other.

Improves reporting

- Automatic bi-directional IL/ORL/OTDR report from the test device negates the need for manually writing and calculating average IL results.
- Combine test results in a single folder for easy data extraction with consistency in the naming convention, e.g. .blts and .sor.

VIAVI FiberComplete™ v2

Multi-functional instruments leveraging test process automation (TPA) to support high fiber count MPO cable certification

Features

- All-in-One testing: OLTS and OTDR through a single MPO test port
- Fully automated measurements with the push of one START button
- Bi-directional Sequencing from both sides (bi-directionally) of the fiber link/cable
- Tier 1 Testing: Insertion Loss (IL), Optical Return Loss (ORL), Length
- Tier 2 Testing: Onboard OTDR measurement, bi-directional analysis/reporting with capability to switch between OTDR and bi-directional loss results
- Real time <<True>> averaged loss values
- Onboard bi-directional OTDR reporting
- Only bi-directional OLTS & OTDR test solution on the market

Benefits

- Greater agility around human and financial resource utilization
- Increases testing speed and quality while decreasing room for human error
- Accelerates data center deployment and monetization

VIAVI Solutions

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