New Breakthroughs in Faster and Easier Fiber Testing

All-In-One Solutions for One-Button, Automated Testing

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Business and consumer demand for bandwidth-intensive services such as video streaming, VoIP, HDTV, and smart-device applications continues to grow rapidly with no end in sight. To address this growth, service providers are scrambling to quickly deploy, expand, and upgrade their broadband access networks.

Ensuring the healthiness of the fiber network and making sure that it performs well requires a number of tests. Before activating the network system, technicians and contractors have to measure a wide variety of network parameters including insertion loss, distance, and optical return loss to verify compliance with system-manufacturer specifications. To minimize deployment costs and testing times for both installation and network maintenance, providers must equip technicians with the right testing tools.

The article discusses practical test-and-measurement best practices using an all-in-one test solution. This solution combines tests such as bidirectional insertion loss (IL), optical return loss (ORL), and optical time domain reflectometry (OTDR), performing measurements automatically through a single connection port. With this type of solution, a single tester per technician can perform all the tasks needed to install, turn up, and maintain metro and access point-to-point (P2P) and point-to-multipoint (PON) networks much faster than ever before.

Implementing an all-in-one test solution strategy has been proven to lower capital expenses (CapEx) by reducing the number of instruments that technicians must carry into the field. This reduces operational expenses (OpEx) as well and minimizes training times, lessens testing time with fewer connections and disconnections, and optimizes workflows by compiling test results into one test set.

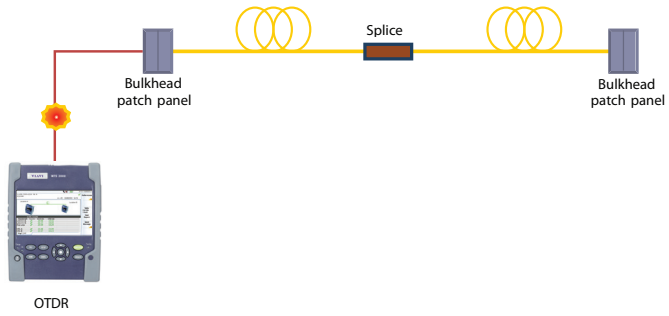
An All-In-One Tool for All Testing Needs

Traditional fiber tests include end-face inspection, optical power level, IL, ORL, and OTDR. These tests occur at different stages of the network lifecycle: during construction, acceptance, and maintenance. This testing often required multiple test sets.

An all-in-one tool (such as FiberComplete™ from Viavi) flexibly spans construction and troubleshooting applications. One technician can use it as a one-ended tester to do OTDR, power level measurement, video inspection, and source provisioning. When paired with another technician's all-in-one tester, it enables complete fiber-link acceptance testing. With one connection on each end, the paired testers automatically confirm continuity and then, with the press of a single button, perform a complete set of insertion loss (IL), optical return loss (ORL), and OTDR tests. Technicians can not only perform these tests uni- and bidirectionally; having the OTDR traces from both ends, they can instantly assess a problem in case IL or ORL tests fail.

Construction Splicing Phase

During the construction phase of optical networks, technicians and contractors commonly use an OTDR to characterize optical links and measure splices. An integrated testing function provides both averaged and realtime results to instantaneously validate splice loss, connectors' loss, and reflectance as well as locate any undesired events such as bends.



	Fiber end-face inspection	Broadband power meter	CW source	Talkset/ VFL	Loss	ORL	OTDR/ fault finder	Construction/ splices	Construction/ acceptance	Troubleshooting
Fiber-Complete solution (standalone)	Optional	x	x	Optional	N/A	x	x	x		X
Fiber-Complete solution (in pair)	Optional	x	x	Optional	x	x	x		x	

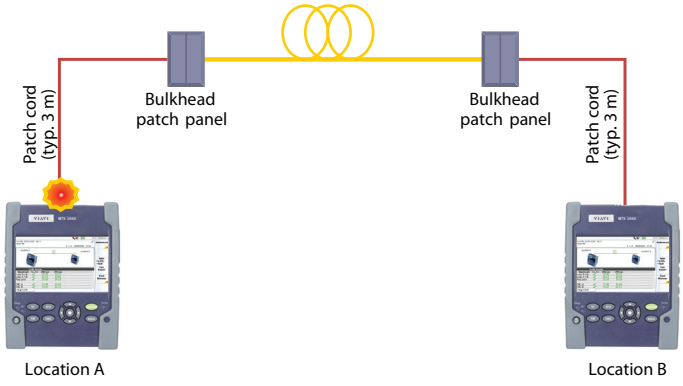
Fully auto bidirectional tests

Construction Acceptance Phase

Once a link is spliced and connectorized, the installer needs to provide a complete report that validates fiber-link performance. A loss test set (a light source and power meter) validates that the overall link loss meets network-equipment operational specifications.

An ORL meter is often required if a link is expected to be operated at a high-speed data rate (10 G+) or with high-power RF video transmissions. If the back reflection for these networks is too high, ORL can affect the transmitted signal, creating a high rate of bit errors (BER) as well as damaging the transmitter itself.

Very often, installers need OTDR traces at 1310/1550 nm to record a "picture" of the network that proves proper cable installation. Some cases require bidirectional-OTDR analysis to get true and accurate splice values. The combination of bidirectional measurements, OTDR from both extremities of the optical fiber link, and analysis takes into account fiber-section performance differences such as core diameters, back-scattering coefficients, and other optical mismatches.



Even if an OTDR trace is not required, if IL or ORL tests do not meet specification requirements, an OTDR/fault finder must be used to determine why and where a problem or failure originates. An all-in-one tester provides instantaneous troubleshooting without disconnection or reconnection. As soon as an IL and/or ORL value reaches a predefined threshold, the tester's OTDR or fault finder launches. The OTDR will provide a detailed view of the link with a table of all events. A fault finder can directly identify the worst issue (bend, connector, splice, and reflectance), avoiding a detailed interpretation of the trace.

Technicians usually work in pairs: for loss measurement, one person is at each end of the fiber link. An all-in-one tester enables simultaneous IL, ORL, and OTDR tests either uni- or bidirectionally—one connection at each end and the push of one button can perform the complete test series. Auto-store and fiber incrementing adds more automation to further speed the acceptance process.

Before starting a job, IL and ORL references must be taken to ensure accurate link measurements. Ideally, an all-in-one tester features a reference wizard, which steps the technician through the process onscreen.

Maintenance and Troubleshooting

During the maintenance phase, a power meter checks a transmitters' output power and validates that the light at the receiver side is strong enough for the system to properly function. Also, in case of high-BER issues, technicians can measure ORL from a central office or head end. If the power level at the receiver side and/or the ORL value is too low, then an OTDR can locate and determine the extent of the problem (for example, a cable cut, macro-bend, or bad connector pair). An all-in-one tester can integrate a power meter, ORL meter, and an OTDR on a single port, enabling single-connection, one-button troubleshooting. This can greatly simplify and speed the troubleshooting process, enabling faster network recovery.

Cost- and Time-Saving Considerations vs. Traditional Testers

CapEx and OpEx are major concerns for network operators. An all-in-one tester simplifies and speeds up fiber testing while improving productivity by offering the features and benefits that makes technicians' day-to-day jobs easier.

A modular platform, and the combination of up to 10 instruments in a single tester, enables a quick return on investment and helps reduce capital expenses. A friendly user interface and measurement automation lessen training time and reduce operational expenses.

An all-in-one tester is an investment not only for today's requirements, but also for future needs. One device can work independently as an OTDR, ORL tester, continuous-wave light source (CWLS), and power meter (PM). Pairing two units further extends testing benefits. And, managing assets requires valuable system and personnel resources. A one-tool, combined measurement approach helps reduce the number of assets deployed, reducing both CapEx and OpEx.

Typical measurement methods require multiple test sets to perform acceptance testing and troubleshooting, which result in having multiple connections/reconnections, additional fiber inspection and cleaning steps, and multiple tests to perform independently. This takes time and also results in complex reporting. The following graphs look at the typical test process and test time for inspection and cleaning, IL, ORL, and OTDR and compare it to the time needed to perform the same tests using an all-in-one tester.

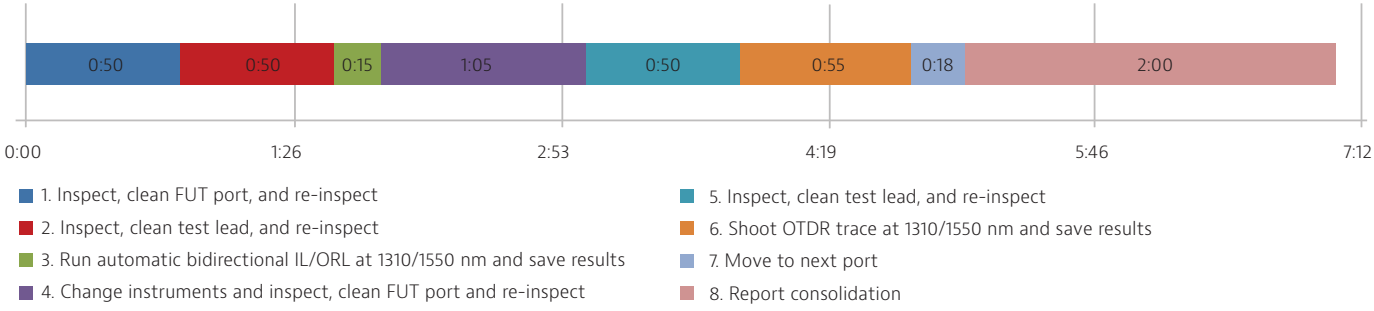
Reporting capabilities are very important, especially with a large number of fiber deployments. Saving results for properly tracking network data is a must. Being able to save all results at a single location is a key time saver and workflow improvement.

Conclusion

This application note shows how a single, all-in-one tester such as the Viavi FiberComplete instrument improves optical fiber network deployment and troubleshooting workflows. With an automated bidirectional process, an all-in-one tester yields the highest possible accuracy while simplifying the test process, making every technician an expert and reducing testing time by up to 50% compared to traditional testers. An all-in-one test-tool strategy helps service providers reduce CapEx and OpEx and helps them guarantee best services.

Typical link acceptance procedure:

- Total testing time = 7 min 03 s
- Number of steps = 8



1. Inspect, clean FUT port, and re-inspect
2. Inspect, clean test lead, and re-inspect
3. Run automatic bidirectional IL/ORL at 1310/1550 nm and save results
4. Change instruments and inspect, clean FUT port and re-inspect
5. Inspect, clean test lead, and re-inspect
6. Shoot OTDR trace at 1310/1550 nm and save results
7. Move to next port
8. Report consolidation

FiberComplete link acceptance procedure:

- Total testing time = 3 min 23 s
- Number of steps = 5

1. Inspect, clean FUT port, and re-inspect
2. Inspect, clean test lead, and re-inspect
3. Run automatic bidirectional IL/ORL at 1310/1550 nm and save results
4. Move to next Pport
5. Report consolidation

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