Fiber Best Practice: Fiber Plant Characterization and Troubleshooting (Tier 2 Certification)

Introduction to fiber best practices

The Fiber Best Practice Series was designed by Fluke Networks to educate about important optical fiber best practices, including:

- *Fiber inspection and cleaning*
- *Loss-length (Tier 1) fiber certification*
- *Fiber plant characterization and troubleshooting (Tier 2 certification)*

This white paper details the best practice of fiber plant characterization and troubleshooting (Tier 2 certification).

With 40 G/100 G infrastructure deployments in the datacenter quickly becoming reality, the shrinking loss budgets of optical fiber cabling due to increasing bandwidth demands mean that reliable and efficient initial installations are now more important than ever. To minimize costly installer or contractor callbacks, network technician troubleshooting time, and unnecessary network downtimes, fiber-handling best practices should always be followed.

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Why you should care

In gaining full visibility into the fiber plant's attenuation, insertion loss, and reflectance at connectors, splice locations, and unanticipated loss events, an optical time domain reflectometer (OTDR) provides valuable insight into a fiber installation that cannot be obtained from an optical loss test set (OLTS). Such an ability to pinpoint events is critical for troubleshooting and rooting out potential cabling component problems in the fiber plant to prevent or minimize costly network downtime. Although currently considered a complementary test by industry standards such as Telecommunication Industry Association's (TIA) TIA-568-C.0 and International Organization for Standardization's (ISO) ISO 14763-3, it has long been considered a best practice by fiber experts.

How it works

An OTDR infers loss, reflectance, and locations of events by shooting pulses of light into one end of a fiber link and using a photodetector to sense reflections from loss-causing incidents such as connectors, splices, and bends. These incidents are often referred to as "events" - some of which are expected and others, unexpected. When a pulse of light travels down the fiber, most of it continues in the direction of the fiber. However, due to the inherent composition of the glass fiber, a small fraction of the light, called "backscatter", is dispersed in different directions. Some of this backscatter makes its way back to the sensitive detectors at the OTDR source, which is analyzed before being graphically displayed to depict the link-under-test. Such a characterization of the fiber link is called a "trace", and plots the measured reflectance and loss over time. See Figure 1 for an example. Legacy OTDRs used to require years of technical experience in order to read and interpret traces; however, the majority of present-day OTDRs contain comprehensive software that automate trace analysis and test parameter set-up, among other advanced analytical capabilities (see Figure 2).

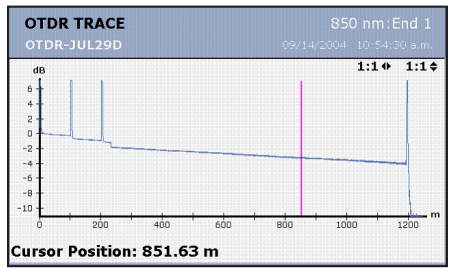

Figure 1. Depiction of a typical OTDR trace.

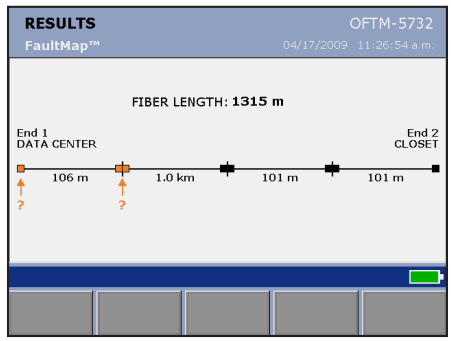

Figure 2. Advanced troubleshooting capability, such as highlighting questionable connectors in the link-under-test.

Fiber plant characterization and troubleshooting procedures

- Connect[1] the OTDR to one end of the fiber link-under-test.
- Configure or select the appropriate limits to test against.
- Shoot a trace of the fiber link-under-test.
- Review the testing results for any passes or failures. Results are typically conveyed in a graphical plot or event chart format. As shown in Figure 1, the OTDR trace should decrease gradually from left to right because of loss from scattering and events such as connections and splices. Reflections, in the form of spikes on the trace, can be caused by breaks, cracks, splices, connections, and sharp bends.
- Compare to the limits being tested against to ensure that the component measurements are within the specified limits. Certain events such as splices, connectors, and the end of the fiber are expected on OTDR traces and thus factored into overall loss budgets. However, their loss must still conform to specifications, whether they are industry standards or determined by the user. Based on the guidelines being compared to, OTDRs can return PASS or FAIL results for each event.

[1] Similar to using test reference cords when using an OLTS, ensure a launch fiber is used to connect the OTDR to the link-under-test. Launch fibers are test leads that enable the tester to overcome deadzone limitations to measure the loss and reflectance of the first connector in the cabling. To test the last connector on the far end of the link, attach a receive fiber on the opposite end of the link-under-test.

Additional fiber best practice resources

To download other Fiber Best Practice white papers and for additional resources, visit **www.flukenetworks.com/FiberBP**

Contact Fluke Networks: Phone **800-283-5853** (US/Canada) or **425-446-4519** (other locations). **Email: info@flukenetworks.com**.

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