Improve the quality of fiber installations with Extended fiber certification

A study of network owners, conducted by Gilmore Research Group, indicated that the need for greater bandwidth, greater storage demands, and transition to higher network speeds are the top three growth drivers for their fiber networks. The quality of the fiber cabling installed to meet these demands is increasingly important. The same study revealed that more than 25% of respondents frequently experience problems with their fiber networks. And more than 62% of respondents have not yet upgraded to 10 Gigabit. Just like copper cabling, the best way to avoid latent problems is with fiber is by proper certification. New fiber test solutions that snap onto copper cable testers have made certification per industry standards more cost effective and easier. This white paper will explain how contractors and consultant/designers – in addition to network owners – can benefit from performing complete fiber certification.

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Both TIA and ISO standards refer to two levels of fiber certification. The terms "Basic" or "Tier 1" refer to primary test regimen which involves the use of a power meter and source (PMLS or OLTS) test equipment. The terms "Extended" or "Tier 2" refer to a second test regimen that involves the use of an Optical Time Domain Reflectometer (OTDR). These tools utilize different technologies to certify fiber optic cabling. Rather than being competitive, OLTS and OTDR are actually complementary tools that play an important role in the majority of fiber installation projects. Neither one can provide the complete and necessary results on their own. A power meter and source provide a direct measurement of the fiber plant losses, while these values are inferred from an OTDR measurement. Conversely, an OTDR is the only tester that provides measurements of individual connectors and splices.

Basic or Tier 1 certification

Power meter and source have long been the primary method of testing premises fiber optic cabling. The test is designed to determine the total amount of light loss over the fiber link. The test is performed with a stable light source that produces a continuous wave at specific wavelengths. The light source is connected to one end of the fiber. A power meter with a photo detector is connected at the opposite end of the fiber link. The detector measures optical power at the wavelengths the light source is transmitting. These two devices determine the total amount of light loss.

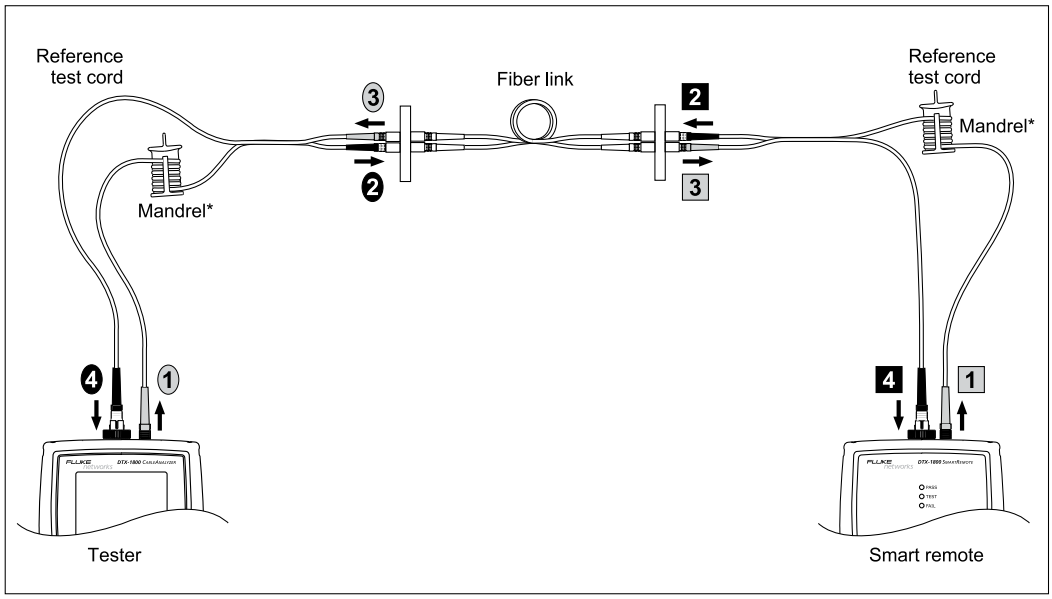

Figure 1: Diagram shows OLTS Operation – Smart Remote test connection

Simple power meters and sources are available, but for efficient Tier 1 fiber certification – it is important to consider the capabilities of a more sophisticated Optical Loss Test Set (OLTS) that measures length, loss, and calculates loss margins. The DTX CableAnalyzer™ with fiber modules does this quickly, and is capable of testing in both directions at multiple wavelengths over multiple fibers. Moreover, it leverages the investment and experience with the industry leading cable tester.

Extended or Tier 2 certification

A second level of testing involves the acquisition of a trace from an OTDR. An OTDR pinpoints the location of faults on a fiber link and certifies the workmanship of an installation. With an OTDR trace, it is possible to certify every fiber optic connector and splice and ensure there are no unplanned loss events due to poor cable management or installation.

An OTDR transmits a series of very short high-power light pulses that travel down the fiber, and uses highly sensitive light detectors to measure the light power reflected back. When a pulse of light meets connections, breaks, cracks, splices, sharp bends or the end of the fiber, it reflects due to the sudden change in the fiber's refractive index. OTDRs use this phenomenon to detect and measure the loss and reflectance of events such as connectors and splices.

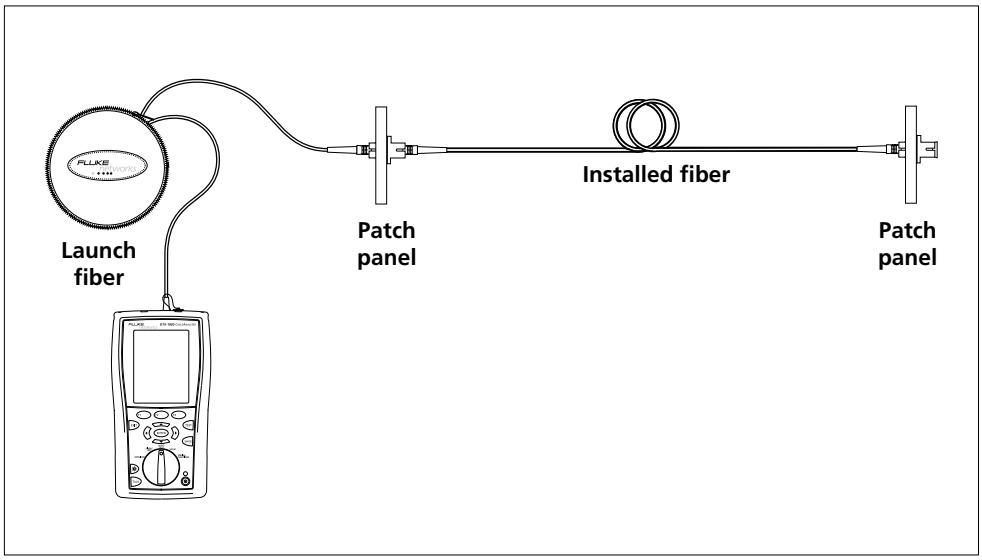

Figure 2: Diagram shows OTDR operation – Connecting the OTDR to installed fiber (no recieve fiber)

An OTDR trace makes it possible to certify that the workmanship and quality of the installation meets design and warranty specifications for current and future applications. For example, a common requirement is that the loss associated with a splice should be no larger than 0.3 dB and that associated with a connector should be no more than 0.75 dB. The losses associated with individual events are invisible to an OLTS. This explains why Tier 2 testing is becoming a requirement for many installation projects. A complete Tier 1 and Tier 2 fiber certification provides the most complete picture of the fiber installation and proof of a quality installation.

Why consultants should spec Extended fiber certification

Several years ago, fiber cabling was installed in local area networks primarily for backbones running aggregated 100 Mbps Ethernet traffic. The loss budgets for multimode fiber were easily achieved with 62.5um fiber and epoxy style connectors, originally designed for long haul environments. Simple continuity tests were often sufficient to ensure performance. Connectors that emphasized convenience and ease of termination over performance were sufficient. But when speeds moved to Gigabit Ethernet and beyond, loss budgets dropped by more than 70% and allowable distances decreased by more than 80%. Rigorous testing became critical.

When beginning a new system design, it is important to consider the application will run on the fiber cabling, the environment the cabling will be installed in, and the network owner's future needs. In addition to defining the maximum loss and distance per channel, industry standards also provide guidelines for how much loss should be allowed for connectors and splices. For example, a common, but generous requirement is that the loss associated with a splice should be no larger than 0.3 dB and that associated with a connector should be no more than 0.75 dB. A system designer will want to choose component specifications that are appropriate for the connecting hardware they have selected for the project. And they need to ensure it is installed as intended.

Once installed, a basic loss/length test will certify the system will support the application as designed. Extended certification with an OTDR ensures that the system is installed as required by the component specifications and meets the future needs of the client. It will also qualify the workmanship of the installation and provide documentation for the client.

Why network owners should ask for complete fiber certification

Network owners make a variety of choices before they begin investing in new fiber cabling. Among these choices are the expected life of the new cabling, the amount of money they are willing to spend on it, and what initial application they want to run over it. One assumption that is not necessarily expressed is that it must flawlessly run the initial application and be ready to support future applications. Basic continuity tests or even Tier 1 certification is not enough ensure of all of these things. Poorly terminated connectors can be overlooked by a simple loss test as they are masked by connectors that exhibit good performance. Only complete certification (Basic Tier 1 and Extended Tier 2) will eliminate latent problems that will inhibit successful implementation of current and future applications. Finally, it is important for a network owner to receive comprehensive documentation of these tests in reports they can understand. Without them, it may be impossible to know if the services performed met their requirements.

Why contractors should offer Extended fiber certification

Many contractors rely on their client to determine their fiber test strategy. Some believe Extended fiber certification requires use of OTDRs that are big, expensive and complicated. Some may entirely avoid jobs that require Extended certification and documentation. Or, they may subcontract the work to others who have the tools and expertise to perform the work. These attitudes could be driving away important revenue and profits.

Even where it is not required, smart contractors perform Tier 2 certification to document the workmanship of the complete installation. Most importantly, Tier 2 certification allows a contractor to check their work and make sure they are delivering a high-quality product to their customer. Also, Tier 2 demonstrates that every fiber connector is good, so if future problems emerge, the contractor normally will not be obligated to fix them without a charge. And finally, many end users are receptive to paying for complete certification and documentation of their fiber installation.

OTDR technology has improved significantly in recent years, making them smaller, less expensive and easier to operate. Traditionally, OTDR testing has been performed with stand-alone instruments that cost a significant amount of money and have their own unique and often complex user interface. Contractors that were afraid of equipping technicians with stand-alone instruments to perform Tier 2 fiber certification can now consider an OTDR module that snaps onto a cable tester they already own. The new DTX Compact OTDR makes it possible for every technician to test like a fiber expert. This tool allows a contractor to use existing staff to perform jobs that require Extended fiber certification.

OTDRs are very powerful troubleshooting tools. In addition to being able to deliver important elements of a contractor's certification strategy, they are invaluable for resolving fiber problems during installation.

Conclusion

Fears about fiber testing and misunderstandings between fiber cabling designers, network owners and cabling contractors have caused confusion and sometimes led to inadequate fiber certification testing. Basic (Tier 1) fiber certification and Extended (Tier 2) fiber certification are complementary tests that will increase the quality of fiber installations and benefit everyone from a network owner to a cabling contractor. These levels of testing were defined by standards bodies such as the TIA and ISO to give contractors, designers and network owners a reference for how to increase the quality of fiber cabling installations.

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

NETWORKSUPERVISION

Fluke Networks
P.O. Box 777, Everett, WA USA 98206-0777

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