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In this issue we present one subject: a recommendation that a requirement for OTDR testing be excluded from TIA/EIA-568-C.

Feel free to send or call us with your comments or experiences. If you'd like to see a specific subject, let us know.

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Exclude OTDR Testing Requirement From TIA/EIA-568-C

Executive Summary

Pearson Technologies presents and justifies the position that OTDR testing be excluded in TIA/EIA-568-C.

Introduction

Cable Installation and Maintenance published a letter to the editor that I wrote.[1] This letter presented the justification for requiring OTDR testing on fiber optic networks. Subsequent to this publication, conversations indicated that the arguments in this letter could be used to justify inclusion of a requirement for OTDR testing in the data standards, specifically TIA/EIA-568-C. Such inclusion is not the position of Pearson Technologies. In this issue of Eye On Fiber, we present and justify the position that a requirement for OTDR testing be excluded from TIA/EIA-568-C.

Position Summary

This position has three parts: first, that OTDR testing should not be part of the data standards; second, that Pearson Technologies recommends OTDR testing to clients; third, that clients should make the decision to require OTDR testing only after weighing the cost and benefits; fourth, such a requirement benefits certain parties more than the network manager.

Exclude OTDR Testing Requirement From TIA/EIA-568-C

There are fouThe first argument is that there are two situations in which OTDR testing will not reveal the desired information. These situations result from the dead zone. [See Successful Fiber Optic Installation, Section 13.3.3.2 for a presentation on the dead zone].

The dead zone creates two problems. The first problem is that the dead zone conceals features. Testing to reveal these features requires OTDR testing in both directions.

The second problem is that the dead zone can be longer than the cable length. In this case, the OTDR cannot test the cable. Depending on the OTDR and the pulse width setting, cable lengths shorter than a dead zone can occur for the low floors in a vertical riser network and in a data center.

The inclusion of a universal and unqualified requirement for OTDR testing would make compliance with TIA/EIA-568-C impossible.

[1] The original letter is at the end of this issue.

If compliance is impossible, the requirement is meaningless. In addition, a meaningless requirement makes the industry and the standards setting process look, at best, foolish and, at worst, absurd.

The second argument for this exclusion is that there is a cost impact of requiring such tests. This cost impact can range from small to large. If the cost increase is small or large, there must be a benefit worth the cost.

The cost impact can be significant. It is our understanding that OTDR testing is being considered with a requirement for both a lead in and a lead out cable. To a certain extent, such testing simulates insertion loss testing. The requirement for a lead out cable doubles the labor cost of such testing. In addition, the need for testing in both directions to reveal features concealed in the dead zones results in a second doubling of the labor cost. In other words, the requirement for OTDR testing could be four times as expensive as a single direction test.

As I presented in CIM letter to the editor, the benefit of OTDR is increased reliability. OTDR testing is like insurance: if the insured event does not occur, there is no benefit to the cost of the insurance. If the link is properly installed, OTDR testing produces no useful information. The reliability will not be improved by the testing. The network manager may feel good, but the information is of little use. If the link is not properly installed, such testing indicates the locations at which corrective action need be taken in order to improve reliability.

Insurance is a voluntary choice. Making OTDR testing a requirement of TIA/EIA-568-C makes this 'insurance-like' requirement mandatory. In addition, the network manager cannot make a choice to require/not require such testing. With a mandatory requirement, the network manager may incur increased cost without adequate benefit without realization.

The third argument for this exclusion is that inclusion of OTDR testing contradicts the logic of the standard. It is my understanding that the standard includes requirements, which, if met, enables the network to function at the specified performance parameters. Implicit in this statement is the assumption that the link components are properly installed. Requirement of OTDR testing is based on the assumption that link components will be improperly installed. If the components are assumed to properly installed. OTDR testing is not required.

The fourth argument for this exclusion is that testing requires determination of acceptance values. The reality of the standard setting process is that the values agreed upon are the lowest performance values upon which competing manufacturers can agree.[2] OTDR acceptance

[2] A standard is a politically negotiated agreement between competing manufacturers. As such, a standard cannot be a technically optimum solution.

values based on the lowest performance values do not benefit the network manager to an extent that justifies the cost.

Pearson Technologies Recommends OTDR Testing

As detailed in the original letter [at the end of this issue], Pearson Technologies recommends that network managers require OTDR testing of all networks for which: 1] testing is possible; and 2] for which testing provides a benefit. As described above, there are situations in which the testing will provide no useful information.

Pearson Technologies makes this recommendation with an additional qualifier: the benefit of OTDR testing be worth the cost. With this qualifier, a network manager must know the cost of the testing prior to making such testing a requirement.

Pearson Technologies recommends that professional installers make single direction OTDR tests of all links with a launch cable. With one exception, such a test will enable certification of all link components outside of the dead zones. The exception is the loss of the far end connector. If both the insertion loss test and the OTDR test produce values that can be certified, it is unlikely that the far end connector has an unacceptable loss. [See Chapter 14 of Successful Fiber Optic Installation for a strategy for developing certification values.]

In the event of a claim by the client of improper or unreliable installation, these test results can be used as proof of proper installation. In such a case, the installer will be justified for charging for repair of damage caused by the client's personnel.

If the network manager does not pay for the tests, the installer need not provide such test results to the network manager. In the event of a lawsuit, such tests provide inexpensive insurance. Finally, such an OTDR test can be less expensive than the cost of a repair visit.

Who Benefits From OTDR Testing?

There are four groups that might benefit from a requirement of OTDR testing: OTDR manufacturers, installers, fiber optic equipment manufacturers, and the end user, or client.

OTDR manufacturers will benefit from a requirement for OTDR testing. With such a requirement, manufacturers can experience two benefits: they will sell more OTDRs and they may decide to increase prices over those charged at this time, when OTDR testing is optional.

Installers may benefit: it the installer can charge enough for OTDR testing to make a profit on its labor and recover the cost of the OTDR, the installer will benefit. However, competitive pressures may prevent such recovery. In such a case, installers will not benefit.

Fiber optic equipment manufacturers will not benefit, as an OTDR testing requirement can increase the total cost of the fiber network. Increased cost can result in reduced implementations. In this case, manufacturers will not benefit.

End users may, or may not, benefit. If the network is properly installed, there will be no benefit from an OTDR testing requirement. If the network is improperly installed, OTDR testing can result in discovery and correction of conditions of reduced reliability.

The Original Letter To The Editor

Observation 1

As noted in the article, 'bad connectors and too tight bends can be masked by other good connections'. One point missing from the article is network reliability. OTDR testing of a premises network results in verification of maximum possible reliability (or not). This is the prime benefit of OTDR certification: examination of each connector pair, splice, and cable segment, with automatic analysis, allows the installer to prove that each part of each link is properly and reliably installed.

On the other hand, the OLTS result provides absolutely no verification of reliability, as indicated by the quote above. In addition, the OLTS,

if programmed to the TIA/EIA-568-B values, will pass a link with reduced reliability. [Note that I provide consulting to attorneys in that the OLTS provides no proof of installation reliability while the OTDR can provide such proof. In rebuttal, I might state that the OLTS provides an inference, but no proof of, installed reliability.]Here are three examples from our installation training programs. The multimode, 3M Hot Melt connector is rated at a typical loss of 0.3 dB/pair and a maximum loss of 0.75 dB/pair. We have installed or supervised approximately 12000 Hot Melts. Whenever the loss exceeds 0. 4 dB/pair, there is damage visible on the core. Such damage reduces the additional damage the connector can experience before its loss becomes unacceptable. The OLTS will not detect such damage. With a sufficiently short dead zone, an OTDR will.

As a second example, TIA/EIA-568-B allows a maximum splice loss of 0.3 dB. During more than 2000 splices made with 6 different fusion splicers and two different mechanical splices, we never see more than 0.15 dB unless the installer makes an error. As a general statement, installer errors reduce the reliability of a fiber link. The OTDR will detect this increased splice loss. The OLTS will not detect the difference between a 0.05 dB and 0.15 dB splice.

As a third example, we deliberately violated the bend radius of a 3 mm cable. The cable survived for 9 months as part of a troubleshooting hands-on activity. During month 10, the cable broke in the area of the violation. An OLTS would not detect this condition. The OTDR can.

Observation 2

The focus on the cost of the OTDR is misdirected. The cost of the OTDR, while important to the installation organization, is not the key issue. The issue is, and should be, focused both on the reduction of reliability that can occur without an OTDR test and on the cost per test of each link. The cost to rent an OTDR for a week is about $1000. Let's be conservative and use $2000. During that week, we assume testing of a hierarchical star vertical riser backbone of 36 fibers to each of 20 stories. That's a total of 720 fibers for a cost of $2000, or less than $3/fiber, plus the labor cost. At most, the labor cost will be several hours of testing time. The benefit of this testing is verification of reliability. The cost of repair of a link defective from installation and not revealed by an OTDR test will be a relatively expensive repair call.

Let's examine this repair call cost. The owner will want the repair for free. The installer will want to charge for the call. With an OTDR test, there will be evidence of proper installation. With such evidence, the installer will be able to charge for the call, since the problem arose from misuse of the cable system. Without such evidence, the owner will be unhappy about such a charge. Without such evidence, the installer may be forced, by a desire to keep his customer satisfied, to provide the repair without charge. Let’s look at the cost another way. A professional fiber installation firm can purchase on OTDR. Arbitrarily, let's assume that the cost is $12,000. Let's assume that the firm will install 12000 connectors within two years. 12k connectors is 3000 full duplex links in a vertical riser backbone. If the installer installs these 3000 links, at an amortized cost of $4/link, he recovers his investment in 2 years. Not a bad ROI. In summary, it is in the best interest of both the installer and the owner of a fiber network to require OTDR testing.

Observation 3

The article stated 'A minimum of 35 dB reflectance is required at connections' and 'most of the fiber in a premises environment is multimode.'' These two statements are somewhat contradictory. 35 dB reflectance, or –35 dB according to the test procedure, FOTP 107, is a singlemode value. A multimode value is –20 dB, which comes from the Gigabit Ethernet standard.

Previous Articles, White Papers & Other Publications

- Honey, I Shrunk the Wiring Closet!
- Spreadsheet for Comparing Costs of All Fiber to Fiber and Copper Networks
- Improving Fiber Network Reliability Through Choice of Certification Strategy

Maximizing Fiber Optic Network Reliability Through Choice of Installer
The Novice's 10 Minute Introduction to Fiber Optics
Myths and Reality: Fiber Vs. Copper

Eye on Fiber, Vol. 1, Issue 1
The Six Subtleties of Accurate Singlemode Testing
Unstable Test Measurements? Don't Blame the Test Equipment!
A Personal Perspective: Concern for the Future

Eye on Fiber, Vol. 1, Issue 2
How to Test Installed Links According to TIA/EIA-568 B.1 and B.3
Evaluation of the Panduit Prepolished SC Connector
The Proof Is In: Test Data Prove the Value of a Precision Cleaver
A Pearson Personal Perspective: Will Fiber Miss The Data Networks Boat?

Eye on Fiber, Vol. 2, Issue 1
Full Evaluation of the Panduit Prepolished SC Connector
Pay Less and Spend More: The Lesson of Total Hardware Cost

Eye on Fiber, Vol. 2, Issue 2
Part 1: Which Connector Installation Method to Use? The Qualitative Answer: It Depends
Part 2: Connector Installation Cost Model: A Strategy for Profitability
Part 3: How to Avoid Cursing at Cursers: An Introduction To Interpretation of OTDR Traces
Part 4: Fiber Optic Connector Update: Yesterday Today, and Tomorrow

Eye on Fiber, Vol. 2, Issue 3
Part 1: Category 1 Testing- Much Ado Nothing?
Part 2: True of False: Modified Method B Testing Works.
Part 3: True of False: FTTD Costs Less Than UTP/Fiber Networks [The Answer Will Surprise You]
Part 4: Difficult Connectors? Try an Alcohol Flush!

Eye on Fiber, Vol. 2, Issue 4
Part 1: Cleave and Leave Connectors: Finally, Acceptable Loss and Yield!