Loss Testing of Premises Fiber Optic Links

The testing of premises fiber optic cabling links requires precise methods for referencing to obtain accurate and valid test results. Loss testing for multimode fiber cabling is specified in ANSI/TIA/EIA-526-14A. This standard contains two test procedures: Method A and Method B. This application note describes Methods A and B, and explains why Method B is the proper method for testing fiber links contained in premises networks.

This note also proposes a new test procedure as an adaptation to Method B to overcome some disadvantages associated with Method B. This new test procedure is the preferred method because it provides results conforming to Method B while offering installers more flexibility for testing fiber links with all types of connectors, including Small Form Factor (SFF) connectors. This note also details other advantages of the Method B adaptation for simplifying the testing process and reducing the opportunity for errors.

Method A

Method A is used for testing links in which the total attenuation is dominated by the loss in the fiber cable, rather than the loss of the connectors, as is often the case for telecom networks. The referencing procedure for Method A uses two patch cords and an adapter connector per fiber link to be tested (See Figure 1).

The two patch cords and one adapter connection are referenced out when the test is performed. Therefore, the test results include the loss of the fiber link under test plus only one connection **(Note the blue section in Figure 2).**

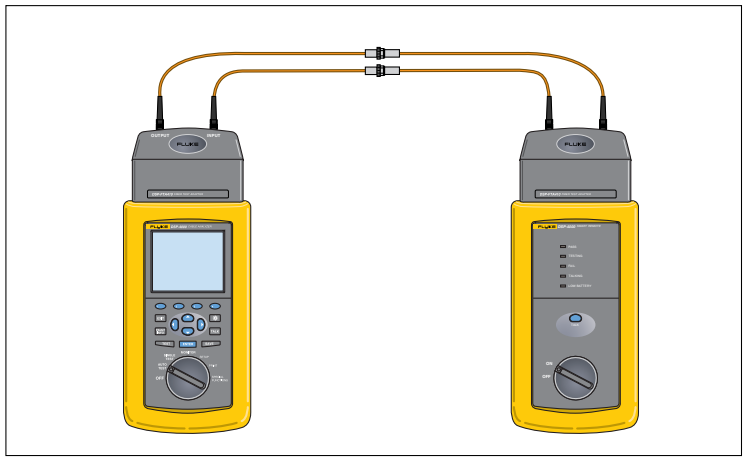

Figure 1. Reference configuration with a dual fiber tester simultaneously testing two fiber links

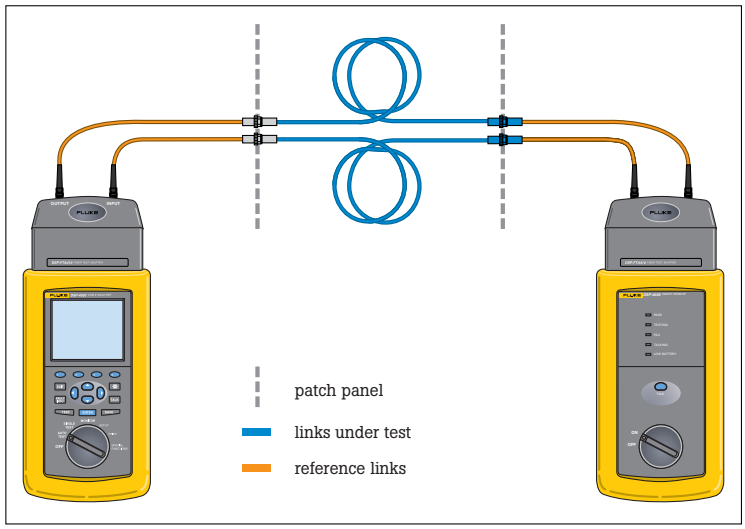

Figure 2. Test configuration with dual fiber tester

While this method has been used effectively in the testing of long haul telecom fiber links, it is less precise than what is necessary for the premises market today. Because the network operation actually sees the loss of the fiber link plus the connections at **both** ends, Method A understates the power loss in the link since it includes only one connection. For long-haul telecom links, this is not an issue since the majority of the loss is in the long lengths of fiber with minimal loss in the precision connectors. However, in premises applications, fiber lengths are very short and the amount of loss in the fiber cable itself is minimal. The majority of power loss is found in the connections at either end. The increasingly stringent power loss budgets of applications like Gigabit Ethernet require that the entire link loss be measured. That is where Method B becomes applicable.

Method B

Method B is used for testing links for which the connector loss is a significant portion of the total attenuation. This is the case for premises links. The referencing procedure for Method B uses one patch cord per fiber link to be tested (See Figure 3). (Note: This figure depicts a dual fiber tester that tests two fiber links at a time.)

Since only one patch cord (per link) is part of the reference, the test results will include loss from the fiber cable under test plus the connections at BOTH ends **(see blue section in Figure 4).** Technically, it will also include any loss in the additional patch cord but this is negligible because the length is so short.

Figure 3. Method B reference configuration

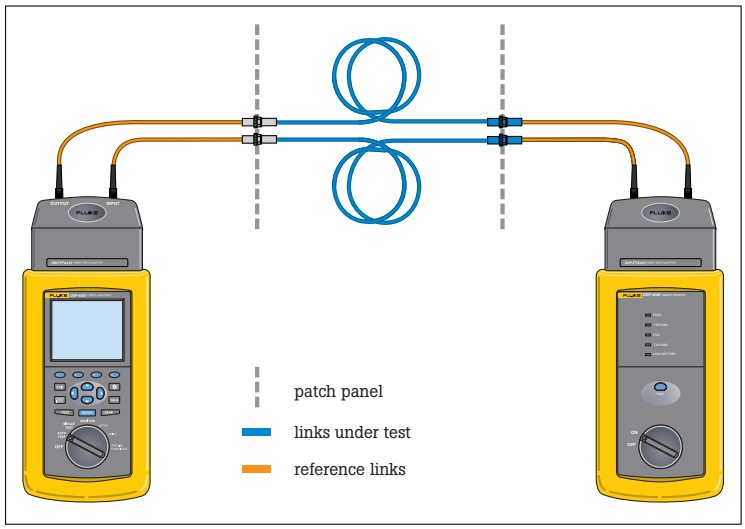

Figure 4. Method B test configuration

For premises fiber networks, this method provides an accurate measure of the loss in the fiber link because it includes the fiber cable plus the connections at BOTH ends. However, when using Method B, be aware of the following shortcomings:

1. When going from the reference setup to the test setup, it is necessary to disconnect one end of the patch cords from the tester. It is very important to never disturb the connection at the OUTPUT or source end. If this connection is disrupted, the reference is lost, and proceeding without re-referencing will seriously compromise the test results. Unfortunately, one could easily disconnect the patch cord from the source (OUTPUT) end instead of from the detector (INPUT) end.
2. Although you must disconnect the patch cords from the detector (INPUT) end of the tester, extreme care is required as dirt and other elements can cause damage to the detector.
3. To test SFF connectors that have the transmit and receive fibers in the same connector, you are forced to disconnect from the source (OUTPUT) end in violation of proper referencing and test procedures.

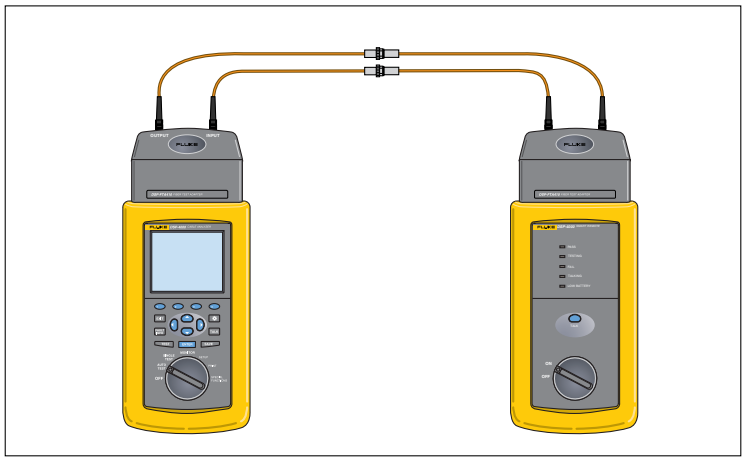

Figure 5. Adaptation to Method B reference configuration

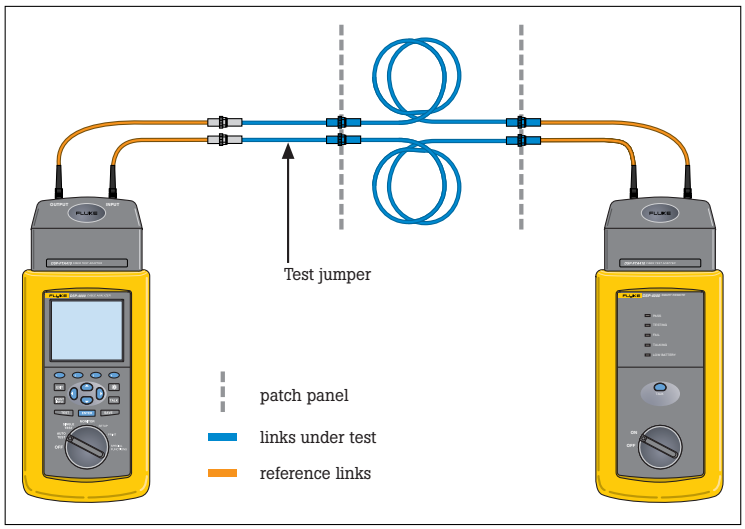

Figure 6. Adaptation to Method B testing configuration

4. Using Method B requires that you have the same type of connector on the tester as you will be testing in the fiber link.

Presented in the next section is a new test procedure that is an **adaptation to Method B**, but provides the same test results and preserves integrity to testing standards while overcoming the shortcomings listed above.

Adaptation to Method B

A simple adaptation to Method B allows us to retain the accuracy (every measurement includes the cable and both connections) but avoid the major disadvantages.

The referencing procedure for this adaptation is performed using 2 patch cords and an adapter connector per fiber link to be tested (See Figure 5). **However, the test procedure is new, and is depicted in Figure 6.**

The test procedure includes the addition of a short test jumper with a connector so that the test results will now be the same as the test results obtained with Method B. Just like Method B, the results contain the loss for the fiber cable plus the connections on BOTH ends (note the blue section in Figure 6). The two patch cords and one connection per link from the reference setup have been referenced out.

Make the correct loss measurements

The Method B adaptation gives us several key advantages over the original Method B while preserving its accuracy:

1. The Method B adaptation gives loss results that conform to ANSI/TIA/EIA-526-14A, Method B. According to Method B, to measure the link loss correctly, the test path must have two more adapters in each fiber link than in the Set Reference path. The test procedure described in this application note adheres precisely to this requirement. In this way, the measured loss will be the loss of the fiber in a link plus the loss of a connection at each end of the link. This value of loss is the real value encountered by network application hardware.
2. The Method B adaptation allows the use of hybrid patch cables to connect test equipment to the links under test. This allows consistent testing of links with all types of connectors, including those that use small form-factor (SFF) connectors.

Preserve the integrity of your test

The adaptation to Method B makes it unnecessary to disconnect the patch cords from the test equipment, thereby reducing the possibility of errors caused by reinsertion of patch cords or by contamination or damage of test equipment fiber interfaces.

Take the complexity out of testing SFF connectors

While single-fiber sources and power meters have been used effectively for testing fiber links containing single-fiber connectors, testing dual-fiber connectors with single-fiber testers is awkward and prone to errors. Dual-fiber testers are the best way to test duplex connectors and, therefore, are recommended for SFF testing. The Fluke Networks DSP-4000 and DSP-4100 Digital CableAnalyzer,™ with its Fiber Test Adapter, is perfect for SFF link testing because of the built-in SFF support and graphic Help screens that remind you what the proper test connections are for setting a reference and for testing a fiber link.

For more information on Small Form Factor test solutions, see the Fluke Networks data sheet *Small Form Factor Accessory Kits*, document #1566670 or visit www.flukenetworks.com.

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