Guide to Using and Selecting the Right Launch Fibers for OTDR Test Sets

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OTDRs are often used with a launch fiber/cable, and may also use a receive fiber/cable. The launch cable, sometimes called a "pulse suppressor" or "dummy fiber," allows the OTDR to recover after the test pulse is sent into the fiber. This cable also provides an invaluable reference on the first connector of the cable under test for determining its loss and reflectance. Typically, the first connector is the connector on the optical distribution frame (ODF) or patch panel. A receive cable may be used on the far end to enable measurements of the connector (loss and reflectance) on the end of the cable under test as well, which will in turn confirm the continuity of the fiber under test.

Selecting the correct length of launch cable is dependent upon several factors, including:

- The fiber type that you will be measuring
- The maximum length of fiber that you intend to measure, which will determine the largest pulse width being used in the OTDR
- The connector types on the ODF

FIBER TYPE

The fiber type and geometrical characteristics of the launch fiber should be the same as those for the fiber under test. For singlemode fiber, if the fiber under test is G.655 and a G.652-style launch fiber is used, an additional loss may be incurred. However, if documented and accounted for, the loss is acceptable. This is especially critical for multimode fiber, because the launch condition must be stabilized for accurate loss measurements, and this is also true for the two different multimode fiber core sizes of 50 µm and 62.5 µm.

In addition, the launch fiber should ideally be terminated at the polished end. There should not be any presence of internal splices, which would directly add to the total loss of the connector loss.

PULSE WIDTH

Once you have established the typical maximum length, you must then select a pulse width to be used at this length. Keep in mind that an OTDR will calculate the loss from the fiber link, so it is important to consider loss rather than length. For example, a link with a 2.5 dB macrobend equates to a fiber length of 10 km at 1550 nm.

A general rule of thumb is to take the length of the pulse width in meters (take the ns and divide it by 10, i.e. 1,000 ns = 100 m), and then add 20% for the "attenuation dead zone." Although this varies across the range of pulse widths available on an OTDR (typically from 5 ns to 20 000 ns [20 µs]), this calculation serves to provide an upper-end/worst-case estimate.

Therefore, if you are expecting to use a 5,000 ns pulse width, the length of the launch fiber should be equal to 5,000 divided by 10, plus 20% = 600 m. Therefore, a 1 km launch cable would suffice in all situations. However, if you were to then use a 10 µs pulse width, the length of the launch cable would be too short, falling under the required 1.2 km.

If you needed a launch fiber that would suffice for all fiber lengths, the only solution would be to go with a length greater than the maximum pulse width of your OTDR. For example, if your OTDR has a maximum pulse width of 20 µs, a 2.5 km cable may be required.

For PON/FTTx MDU testing, a pulse width no greater than 500 ns would be used. Therefore, a launch fiber from 150 m to 300 m would be sufficient.

CONNECTOR TYPE

The primary purpose of using the launch cable is to isolate the ODF connector in order to measure its loss and reflectance. It is therefore VITAL for the selected launch fiber to have the correct ODF termination available. If the network is SC/UPC and your launch fiber is FC/UPC, using a "3 m jumper" to connect to the SC/UPC will result in two connector pairs being measured at the ODF, which is clearly not desirable.

As a result, there may be a need to keep more than one launch fiber in your accessories for the purpose of testing fiber networks. Because most OTDRs have a fixed launch (for example, an SC/APC output), a wide range of SC/APC to xx/xPC cables can be utilized.

Another important use of the pulse suppressor/launch lead is to minimize the number of times the OTDR connector is used, ultimately reducing the risk of damage to the OTDR connector and prolonging its service life.

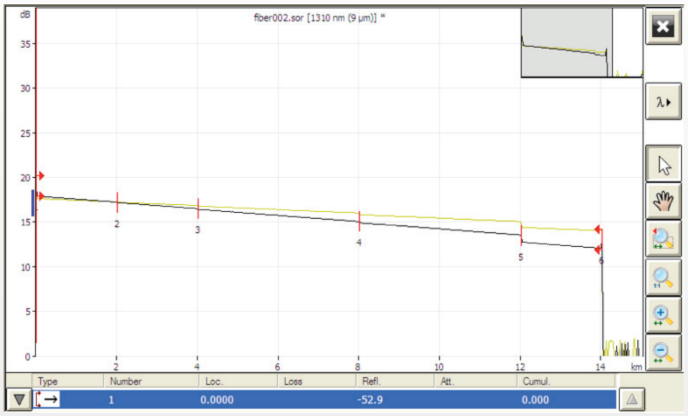

Figure 1. Testing a fiber link WITHOUT the use of a launch cable

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When testing a fiber link without a launch cable, the results will only indicate the reflectance of the first connector (pair). This causes an issue because the reflectance is associated with two pairs (OTDR and ODF), however the result DOES NOT account for the loss associated with the ODF connection.

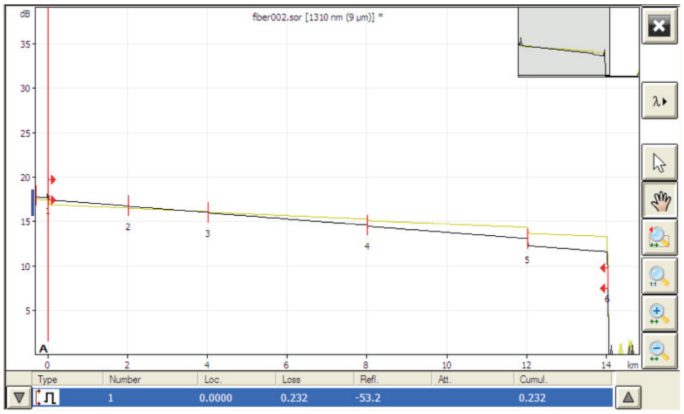

Figure 2. Testing with a 300 m launch cable and offset/zeroing

In Figure 2, a 300 m launch cable and a 300 m offset/zeroing is used in order to present BOTH loss and reflectance of the ODF connection.

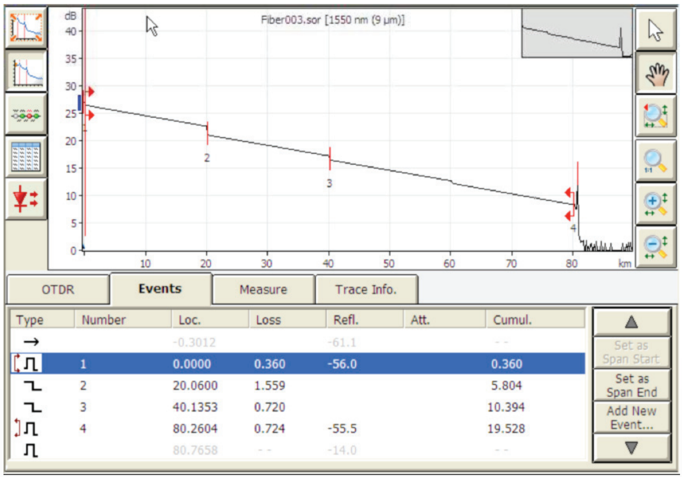

Figure 3. Testing with a 300 m launch cable with offset/zeroing and a 500m receive cable with offset/zeroing

In Figure 3, the launch and receive cables are used in order to present BOTH loss and reflectance of both ODF connections.

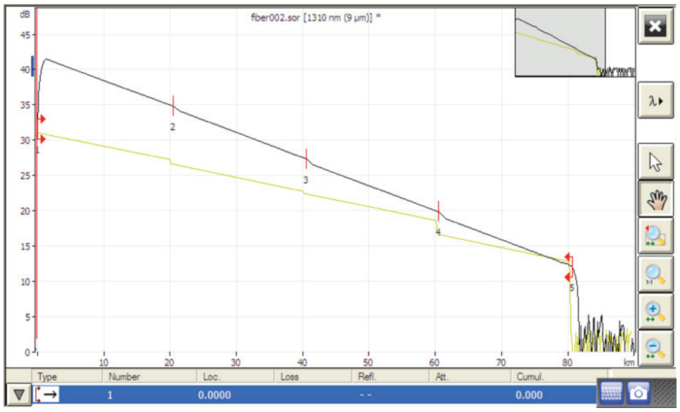

Figure 4. Example using an overly large pulse width

In the example above, the same 300 m launch cable is used with a pulse width that is too large, and as a result, the pulse overtakes the launch cable. The benefit is therefore lost, and the network is 300 m longer than it should be.

Above 90 km, it is common to use 1550 nm/1625 nm in order to permit macrobend detection. If macrobend detection is not required, the current practice is to just use 1550 nm.

CONCLUSION

In addition to allowing the OTDR to recover after a test pulse is sent into a fiber, use of a launch fiber is invaluable to determining loss and reflectance on the cable under test. However, to achieve the desired results, care must be taken to select the appropriate fiber type and length, in addition to the pulse width and cable termination needed to isolate the ODF connector. When these factors are taken into account, along with the dynamic range when macrobend detection is needed, the result is more accurate insertion loss and reflectance measurements, and improved long-term OTDR performance.

See additional content on related topics

Application Note 253 – Maximizing the Long-Term Performance of your OTDR/iOLM by Using APC Connectors

Application Note 245 – Reducing FTTH OPEX with the iOLM

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