Non-Intrusive, "Clip-On" Design Suitable for FDH Splitter-Port Identification

By Vincent Racine, Product Line Manager, Optical Business Unit

INTRODUCTION

A number of problems can arise in the field when deploying fiber-to-the-home (FTTH). One such problem is the fact that physical-layer splitter connections are not always in agreement with the documented provisioning information. Even though records are kept, they are often outdated and incorrect due to misconnections and user churn. In order to resolve the differences between the provisioning information and field information, a field-deployable, measuring method that does not disrupt traffic is needed. This will allow operators to maximize port utilization at the fiber distribution hub (FDH) by correctly associating fibers with specific users.

TECHNOLOGY

Before discussing the splitter-port identification application, it is important to understand the uniqueness of the EXFO solution. The LFD-300 (live fiber detector) and TG-300 (tone generator) employ an innovative and patented approach[1] that automatically controls the insertion loss when these devices are "clipped on" a fiber under test. This approach applies to nearly all deployed telecom fiber types as well as most commercially available jacket and coating types.

Most live fiber detectors (LFD) on the market employ a fixed macrobending approach, meaning that the bend radius does not change during the measurement. One disadvantage of this approach is that insertion loss (IL) depends on wavelength, making it impractical to simultaneously optimize both the IL and sensitivity.

For example, let's say 1310 nm and 1550 nm signals are concurrently counter-propagating along the fiber. Most LFDs will bend the fiber in such a way as to detect the 1310 nm signal. Unfortunately, this will also induce high insertion loss on the 1550 nm signal. So, if the 1550 nm signal is a video signal, then the subscriber's video service will likely be disrupted.

Another disadvantage of a fixed macrobending structure is the need to change the adapter heads, which increases the risk of breaking the fiber. Since different adapters are needed to accommodate different fiber jacket and coating sizes, users can waste time trying to figure out which adapter to use. If the appropriate adapter size is not used, the LFD will not detect the signal.

Furthermore, a pull-down clamping mechanism is often used to clip the LFD on the fiber, but this can also break or damage the fiber.

Today, bend insensitive and bend-resistant fibers are widely deployed in access networks because they reduce the risk of macrobend problems during the construction and service-activation phases. Since the bend radius needed to detect the signal on these fibers varies and is very small, fixed-macrobending-structure LFDs do not normally work.

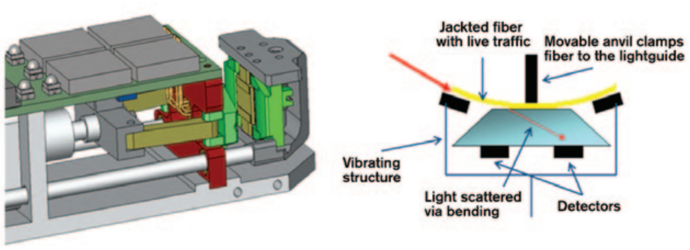


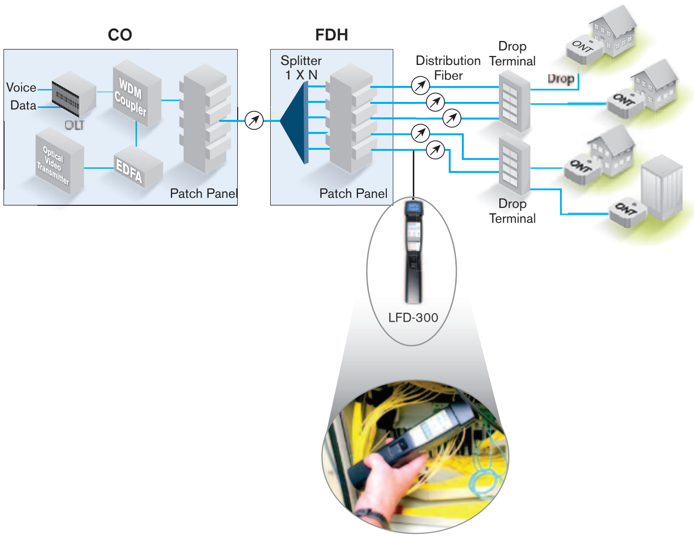
Figure 1. LFD-300/TG-300 underlying mechanical design.

[1] *Protected by US patent 7,710,552, and pending and granted equivalents in other countries.*

[2] *Protected by PCT published patent application WO/2006/092051, US patent no. 7,283,688, and associated national entries in several countries.*

Test Scenario 1

The technician must first take three or four power readings on the ONT to establish a baseline. After clipping the LFD-300 on the fiber, the technician can compare the before and after power levels to determine the impact at the subscriber premises (1490 nm or 1550 nm). A typical 0.5 dB power difference will be observed, thus clearly identifying the ONT at the subscriber premises and the associated FDH output port.



Advantages

- A controlled macrobend will not damage the fiber in any way
- Minimal fiber length needed to bend
- Subscriber connection is maintained, virtually no risk of service disruption
- Can be performed during normal business hours
- Resolves provisioning versus actual field deployment documentation errors
- Access to a subscriber ONT not required
- Short testing time
- No need to change heads – the LFD-300 is optimized for 900 µm, 1.6 mm and 3 mm fiber jackets
- Instrument adapts the bending radius to fiber/jacket type and color
- Compatible with standard and bend-resistant fibers (G.657A1)

Disadvantage

- The ONT power level must be monitored at the subscriber premises

Test Scenario 2

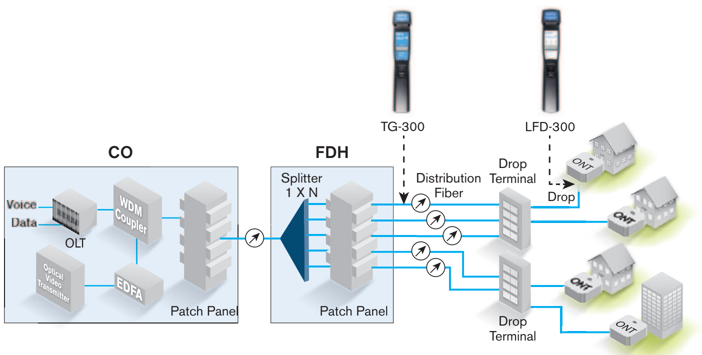
This scenario requires two technicians, one at the ONT at the subscriber premises and one at the FDH.

The technician at the FDH clips the TG-300 on the signal-carrying fiber at the FDH output port. The TG-300 applies a controlled bend inducing a slight, fixed attenuation (not exceeding 1 dB under most network conditions). However, a typical 0.5 dB power difference is typical for most singlemode telecom fibers and most jacket types at any wavelength.

At the same time, the TG-300 introduces an 11 Hz modulation on the transmitted signal (1490 nm or 1550 nm RX signal). This modulation has no impact on the transmitted signal because the amplitude of the sine wave is precisely controlled not to exceed 1 dB (typically 0.5 dB). This frequency was not randomly chosen. 11 Hz is very low compared to transmitted frequencies and will not to interfere with the transmission system.

The technician at the subscriber premises then clips the LFD-300 on the fiber at the ONT to apply a controlled macrobend.

When the LFD-300 detects the 11Hz modulation applied by the TG-300, it generates a visual and audible fiber ID confirmation. This confirms the physical connection between the FDH output port, the fiber, the subscriber and the ONT[2].



Advantages

- A controlled macrobend will not damage the fiber in any way
- Minimal fiber length needed to bend
- Subscriber connection is maintained, virtually no risk of service disruption
- Can be performed during normal business hours
- Resolves provisioning versus actual field deployment documentation errors
- No interaction with the OLT or ONT power monitoring required
- Short testing time
- No need to change heads – the TG-300 and LFD-300 are optimized for 900 µm, 1.6 mm and 3 mm fiber jackets
- Instrument adapts the bending radius to fiber/jacket type and color
- Compatible with standard and bend-resistant fibers (G.657A1)

Disadvantages

- Two field technicians are normally needed: one at the FDH and one at the subscriber premises (ONT)
- Access to ONT at the subscriber premises is required

CONCLUSION

For many countries around the world, aggressive FTTH deployment is becoming a commercial imperative and is putting tremendous pressure on OSP construction crews and service activation groups. The risk of mislabeling physical-layer connections is high and consequently, so are errors in the provisioning information. Therefore, physical-layer splitter connections may not always be in agreement with the provisioning information. To help mitigate this growing problem, EXFO offers two innovative, non-disruptive solutions: the TG-300 and LFD-300.

Forward-Looking Statements

Future versions of the LFD-300B may employ wireless communication in order to send results directly to a centralized documentation system. This feature will allow the system to automatically document fiber ID, test location and other useful information, potentially eliminating the need for field technicians to generate reports once testing is completed. This might also enable field work to be monitored in real time from the CO or any other centralized network database.

It is feasible that clip-on test sets will eventually detect supervisory or other diagnostic signals/tones, thereby enabling more advanced transmission-system testing and troubleshooting, such as splitter-port identification.

EXFO Headquarters > Tel.: +1 418 683-0211 | Toll-free: +1 800 663-3936 (USA and Canada) | Fax: +1 418 683-2170 | info@EXFO.com | **www.EXFO.com**

EXFO serves over 2000 customers in more than 100 countries. To find your local office contact details, please go to **www.EXFO.com/contact**.

APNOTE293.1AN

ISO 9001 2008

Printed in Canada 13/09/16