LIGHT BRIGADE®
TRAINING & EDUCATION
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Instructor Corner

Optical Reflectance, Optical Return Loss and Bit Error Rate

Most installers and operators focus on optical attenuation and dispersion to handle increasing data rates. However, in single-mode systems, reflectance is just as critical to achieve the desired bit error rate (BER).

Lasers used with single-mode transmitters include the Fabry-Perot (FP) and the Distributed Feedback (DFB) types, both of which are susceptible to optical reflectance. The reflected energy disturbs the standing optical wave (oscillation) in the laser's cavity, increasing its noise floor. This in turn affects the BER.

There are two types of reflections. **Rayleigh backscatter** results when impurities introduced during fiber manufacturing cause light to be reflected in all directions, including back to the optical source. **Fresnel reflections** are caused by abrupt changes between two media with different refractive indexes, such as a glass to air interface. These commonly occur at mechanical splices, lensed components, or at mated, contaminated, or open connector ports.

When we speak of reflection, there are two terms often used. "Back reflection" refers to a single reflective event such as a connection or mechanical splice. "Optical return loss" (ORL) represents the combined amount of reflectance from all the link components plus the Rayleigh backscatter from the fiber itself. System manufacturers specify maximum ORL values to ensure quality of signal performance. Passive networks will often have back reflection specifications for the connector components to be installed in each span.

When testing with an OTDR or loss test set with ORL capability, the operator can measure the ORL of the span. If it is out of spec, it is most often caused by one or more Fresnel reflections at a connection point in that span. This is why it is critical to define the proper connector specifications for both loss and back reflection. For single-mode networks where ORL is critical, angled physical contact (APC) connectors should be specified. APC connectors are typically specified at –65dB. At a minimum, a –55dB back reflection specification should be placed on UPC connectors for today's high speed networks.

When using an OTDR to measure reflections, a dead-zone box or launch cord must be used to connect to the span under test. The ideal test set up adds a second receive cord to the far end. This will show the results of loss and reflections on the entire link without adding a falsely high reflection from the far end.

In This Issue

OTDR displaying optical return loss

We will have a free training webinar on May 18
"Optical Return Loss and Reflectance"

Click here for more information and to register.

Did You Know...

Fiber Optic Cables have an Enemy?

Fiber is immune to many things that would impact a copper based system, such as electromagnetic interference (EMI) and radio-frequency interference (RFI) – but it's not immune to Mother Nature! The main enemy of optical fiber is water. While water will not create a short circuit as it does with copper, any water introduced into a cable can cause several problems. Once inside the cable, swelling of materials and freezing can add stresses to the fiber, causing microbends and adding attenuation to a link. Extended exposure to water can cause hydrogen ions to be absorbed by the glass itself, creating added loss at certain transmission wavelengths (often referred to as the 'water peak') over time. Outside plant (OSP) cables should be used in outdoor environments as they are made from more water resistant materials and have moisture blocking materials inside to prevent water ingress.

Light Brigade News

Light Brigade Busy at OFC 2016

Light Brigade once again had a significant presence at the annual Optical Fiber Conference (OFC) in Anaheim in March. OFC is a large and well respected conference for optical communications and networking professionals. This year, there were 13,000 attendees from over 65 countries and 580 exhibiting companies.

OFC is a great resource for a fiber optic training company like ours. We get the opportunity to discuss the latest trends in the industry as well as learn about the newest products and technologies on the market. This information helps us keep our training materials current and relevant.

Light Brigade also provided training at OFC. We taught two well attended courses: Safety in Fiber Optics and Hands-on Polishing, Inspection and Testing of Connectors. In addition, our show floor presentations, Understanding Back Reflectance and Understanding Optical Signal-to-noise Ratio, were well received.

At our booth, we enjoyed performing many fiber skill demonstrations focused on ribbonizing and mass fusion splicing, OTDR testing on a PON network, and building fan-out cables. In addition, video monitors displayed our staff development DVDs and Light Bites online training course, Single-mode Technology: Theory and Fibers.

All in all, OFC 2016 was a successful show. We look forward to OFC 2017 in Los Angeles on March 20-23.

Training Tidbit

Don't Let Contamination Ruin Your Splices

Courtesy Fiber Optic Center

Today's splicing equipment is fast, efficient, and requires minimal maintenance due to advances in splicing technology. However, contamination in the V-groove of the splicer is still a primary source of trouble for the splicing technician. This is especially problematic when splicing with a fixed V-groove fusion splicer. Environmental contamination — such as dust, dirt, and fiber coating debris, as well as the silica deposits generated during the fusion process — eventually find their way to the surface of the v-groove. This contamination will offset the fibers and degrade performance. To help control this problem, a disciplined cleaning regimen and specific tooling is required to ensure the splice is right the first time.

Here at the Light Brigade, we have found some great information on v-groove cleaning from the world leader in splicing technology – AFL/Fujikura. Click here to watch a short video demonstrating their recommended method for keeping your splicer's v-groove alignment in top shape. As with most tools and equipment, Light Brigade can provide these supplies and much more. For more information on products, contact John deWitt at 206-575-0404 ext. 115.

What's New

Light Brigade has three new training offerings:

High-speed Fiber Optic Systems Training DVD

This educational DVD has been reorganized and significantly updated with material that covers optical signal-to-noise ratio, optical amplifiers advanced modulation techniques, coherent detection, forward error correction, transmission systems, WDM systems, and more. Look for its release on April 15.

Amp Mobile Field Tool

Putting easy access to useful technical information into the hands of fiber optic technicians is now a reality with Amp. When a field technician needs a refresher on a task in the field, Amp is there to put instructions and information at their fingertips. The Amp pilot program began on April 5 and the final product will be available June 1.

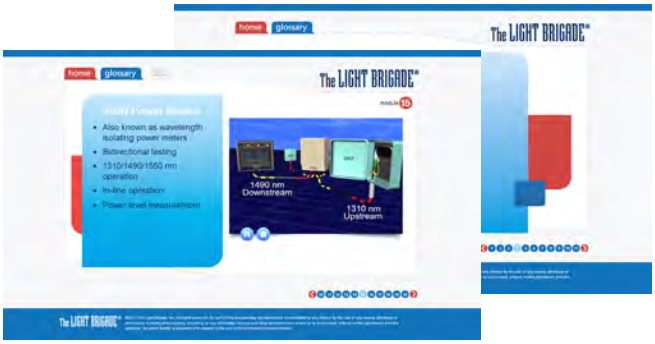
Spanish Bilingual Fiber Optic Training Class

We will be offering our first bilingual Spanish-English fiber optic training class in Puerto Rico on September 27-30.

Online Training Sale

CFHP Online Training Sale Ends Soon!

The Certified Fiber to the Home Professional (CFHP) online training course is on sale for $295. Save over $200 off of our regular price of $500. Hurry! This offer ends April 30.



Upcoming Classes

Click on Location to Register

Fiber Optics 1-2-3

Geneva, IL	April 19-22
Albuquerque, NM	April 26-29
Minneapolis, MN	May 3-6
Nashville, TN	May 3-6
Anaheim, CA	May 10-13
Topeka, KS	May 10-13
Baton Rouge, LA	May 17-20
Honolulu, HI	May 17-20
Raleigh, NC	May 23-26
Spokane, WA	May 23-26
St. Louis, MO	June 7-10
Ft. Worth, TX	June 7-10
Jacksonville, FL	June 14-17
Baltimore, MD	June 14-17
Riverside, CA	June 21-24
Seattle, WA	June 21-24
Salt Lake City, UT	June 27-30
Jackson, MS	July 12-15
Spartanburg, SC	July 19-22
Milwaukee, WI	July 26-29

Advanced Hands-on Training

Houston, TX	April 19-22
Salt Lake City, UT	June 7-10
Vancouver, BC	July 5-8

* at UTC Telecom & Technology

** at FTTH Connect

To view schedule of 2016 training dates and locations, click here and download the 2016 training catalog.

Emergency Restoration

Lowell, MA	June 21-23

Fiber Characterization: PMD, CD and ORL

Spartanburg, SC	June 1-3
Seattle, WA	July 19-21

Premises/LAN Installation and Maintenance

Lowell, MA	June 28-30

FTTx for Installers and Technicians

Miami, FL	May 17-20
Atlanta, GA	July 19-22
Austin, TX	July 19-22

FTTx OSP Design

Atlanta, GA	May 24-26
Nashville, TN**	June 15-17
Sacramento, CA	June 28-30
Seattle, WA	July 26-28

Certified Fiber to the Home Professional (CFHP)

Austin, TX	May 24-25
Seattle, WA	June 8-9
Nashville, TN**	June 16-17

Fiber Optics for Oil & Gas

New Orleans, LA	July 12-15

Fiber Optics for Pro-AV and Broadcast

Orlando, FL	July 26-29

Fiber Optics for Utilities

Level 1 Technician

Spartanburg, SC	May 10-12
Seattle, WA	June 27-29
Anaheim, CA	July 12-14
Salt Lake City, UT	July 26-28

Level 2 Designer

Denver, CO*	May 2
Spartanburg, SC	May 13
Seattle, WA	June 30
Anaheim, CA	July 15
Salt Lake City, UT	July 29

Level 3 Advanced Designer

Denver, CO*	May 3

Fiber Optics for ITS, Traffic, Fire Alarm, and Communication Systems

Technician Level I

Seattle, WA	May 16-17

Field Technician Level II

Seattle, WA	May 18-19

Design Technician Level II

Seattle, WA	May 20

Upcoming Events

Click on any Event for more Information

Trade Shows	Dates	Location	Booth Number
Offshore Technology Conference (OTC)	May 2-5	Houston, TX	AFL Booth 1270
UTC Telecom & Technology	May 3-6	Denver, CO	TBD
• *Training Class: Fiber Optics for Utilities: Level 2 Designer, May 2*			
• *Training Class: Fiber Optics for Utilities: Level 3 Advanced Designer, May 3*			
FTTH Connect	June 13-17	Nashville, TN	618
• *Training Class: FTTX OSP Design, June 15-17*			
• *Training Class: Certified Fiber to the Home Professional, June 16-17*			

Webinars	Dates	Location
Wavelength Division Multiplexing - Passive Optical Networks	April 19	Hosted by ISE Magazine
Optical Return Loss & Reflection	May 18	Hosted by Lightwave