TESTING – HIGH SPEED FIBER LINKS

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Agenda

- Intro to FOTC
- Basic/Tier 1 Fiber Certification
- Tier-2 OTDR testing & troubleshooting
- Short break
- A Live demo

Fiber Optics Technology Consortium

Overview:

- Part of the Telecommunications Industry Association (www.tiaonline.org)Until 2013, we had been known as the Fiber Optics LAN Section (FOLS). Our new name was chosen to reflect our expanding charter.

- Formed 23 years ago

- Mission: to educate users about the benefits of deploying fiber in customer-owned networks

- FOTC provides vendor-neutral information

Fiber Optics Technology Consortium

Current Members

- AFL
- CommScope
- Corning
- EXFO
- Fluke Networks
- General Cable
- OFS

Current Members

- Legrand
- Panduit
- Sumitomo Electric Lightwave
- Superior Essex
- The Siemon Company
- Viavi

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Fiber Optics Technology Consortium

- Maintain a website with Fiber FAQs, White Papers and other resources – www.tiafotc.org.

- Developed and maintain a free Cost Model that allows users to compare installed first costs of several architectures.

- Host a webinar series throughout the year with all webinars available on demand.

- Speak at industry conferences like BICSI

- Contribute to industry publications – Like BICSI News.

- Conduct market research – like the surveys today

Fiber Optics Technology Consortium

- Recent Webinars Available on Demand
  - Keeping up with High Speed Migration in the Data Center
  - Data Center Design, Planning & Upcoming Changes to TIA-942
  - Best Practices for Achieving Tier 1 Fiber Certification

- Visit www.tiafotc.org or our channel on BrightTalk

- Webinars are eligible for CEC credit for up to <u>two years</u> after they are first broadcast. Email liz@goldsmithpr.com if you have completed a webinar and want to receive your CEC.

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Basic/Tier 1 Fiber Certification

Tyler Vander Ploeg, RCDD

Fiber Solutions Marketing Manager

VIAVI Solutions

Orlando, FL, February 5, 2018

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Agenda

- Testing Basics
  - Standards / Channels and Links / dB vs. dBm
- Tier 1 Testing
  - Certification Requirements
  - Main Challenges
  - Reference methods
- Tier 1 Testing for MPO
  - Additional Challenges
- Conclusion/Q&A

Testing Basics

Relevant TIA Standards

- 568.3-D – Optical fiber cabling and component standard
  - Updated to revision "D" in June 2016
  - Transmission performance and test requirements in Clause 7
  - Annex E (informative) provided guidelines for field testing
- ANSI/TIA-526-14-C-2015
  - Test procedures for installed multimode fiber cable plant
  - Released in April 2015
  - Adaptation of IEC 61280-4-1 Ed. 2.0
  - Encircled Flux for 850nm/50 micron
- ANSI/TIA-526-7-A
  - Test procedure for installed single mode fiber cable plant
  - Released in July 2015
  - Adoption of IEC 61280-4-2 Ed 2.0

What about MPO?

- Existing fiber test standards do not address MPO-specific concerns
- SC 86C WG 1 released a Technical Report (TR) on testing MPO

IEC 61282-15/TR

Testing Multi-fiber optic cable plant terminated with MPO connectors
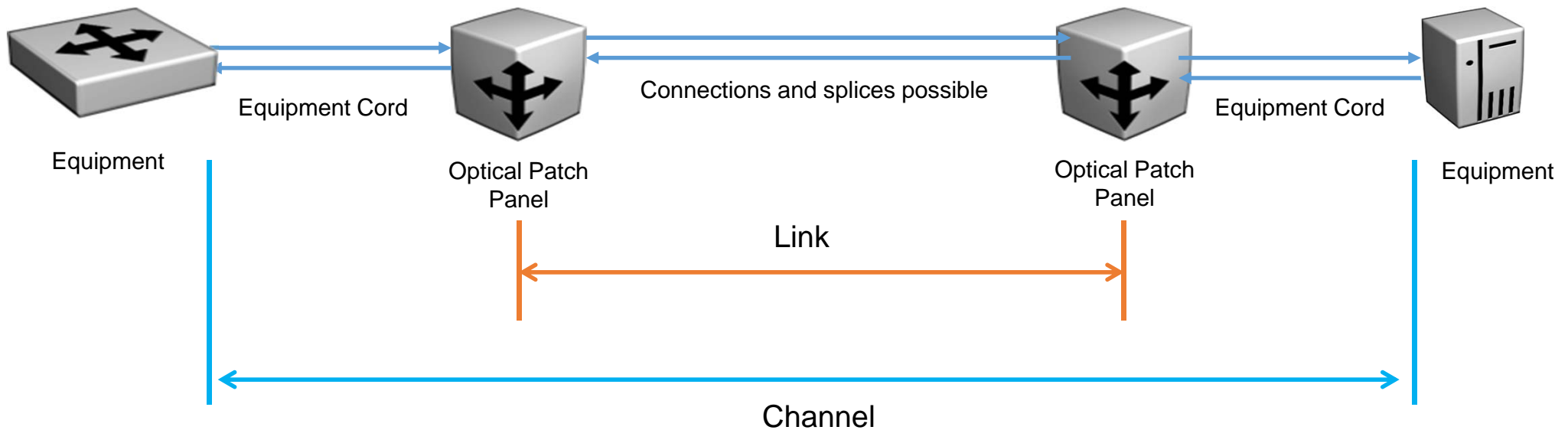
Tests Defined in Standards

- Both TIA and ISO/IEC standards specify to tiers of certification
  - Tier 1 (or basic): loss, length, and polarity
  - Tier 2 (or extended): Optical time domain reflectometer (OTDR)

- Tier 2 (extended) tests are an optional addition to tier 1 (basic) tests

- Fiber end-face inspection and certification is also a requirement to ensure pristine end-face condition PRIOR to mating

Channels and Links

Equipment Cord

Connections and splices possible

Equipment Cord

Equipment

Optical Patch Panel

Optical Patch Panel

Equipment

Link

Channel

dB vs. dBm

- **dBm** = an ABSOLUTE measurement of power (1mW = 0dBm)

- **dB** = a RELATIVE measurement

- **Loss** is a Reference Measurement (not an Absolute Measurement)

- First step in an accurate loss measurement is **performing a reference**!

- Purpose of a reference is to "**zero out**" any test cables and connectors

1 mW = 0 dBm   2 dB   .5 dB   5 dB   -7.5 dBm

Tx   **Rx**

Loss = 7.5 dB
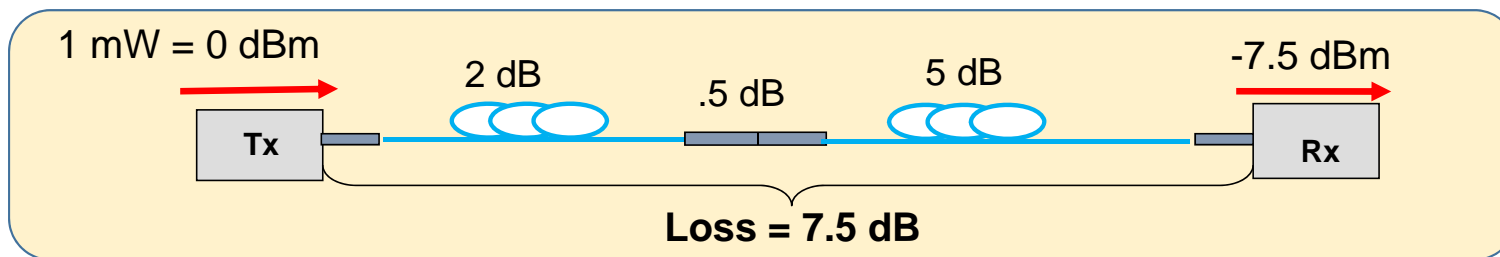
Testing to a specific Application

- Application is the protocol that will "ride" on the fiber (Typically Ethernet or Fiber Channel)

- Most Enterprise Optical Loss Test Sets will report "Compliant Networks" based on loss measurement

- Cautions!
  - Can "PASS" standards-based generic limit, but have too much loss for specific application
  - Most testing performed is on **links** – but applications run on **channels**

- If the Application to be carried on the fiber is known
  - …use Application (Network) limit on your test device

— Compliant Networks —————————

1000BASE-LX_MM	1000BASE-SX	100GBASE-ER4
100GBASE-LR4	100GBASE-SR4_OM3	100GBASE-SR4_OM4
10BASE-FB	10BASE-FL	10GBASE-LR/LW
10GBASE-LX4	10GBASE-SR/SW	40GBASE-SR4_OM3
40GBASE-SR4_OM4	1Gbps-FC_OM2_MM	1Gbps-FC_OM3_MM
2Gbps-FC_MM	2Gbps-FC_OM2_MM	2Gbps-FC_OM3_MM
4Gbps-FC_OM1_MM	4Gbps-FC_OM2_MM	4Gbps-FC_OM3_MM
8Gbps-FC_OM1_MM	8Gbps-FC_OM2_MM	8Gbps-FC_OM3_MM
ISO-14165-111_MM		

Tier 1 Testing

Tier 1 Certification Requirements

- Measure Length

- Measure Loss

- Check Polarity

- Ensure Loss does not exceed a "limit" (AKA loss budget)

- Document results

Main Challenges with Tier 1 Testing

1. Contaminated Fiber Endfaces

2. Multimode Transmitter Launch Condition

3. Not using Test Reference Cords (TRCs)

4. Errors with Referencing

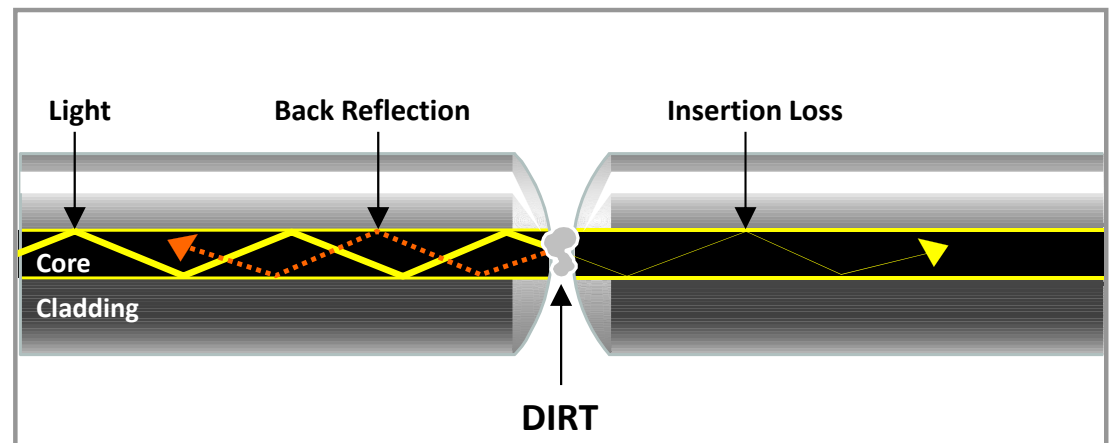2018 BICSI WINTER
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What Makes a BAD Fiber Connection?

Today's connector design and production techniques have eliminated most of the challenges to achieving Core Alignment and Physical Contact.

What remains challenging is maintaining a **Pristine End-face.** As a result, **CONTAMINATION is the #1 source of troubleshooting** in optical networks.

A single particle mated into the core of a fiber can cause significant **back reflection**, **insertion loss** and even **equipment damage.**

Light   Back Reflection   Insertion Loss

Core

Cladding

DIRT
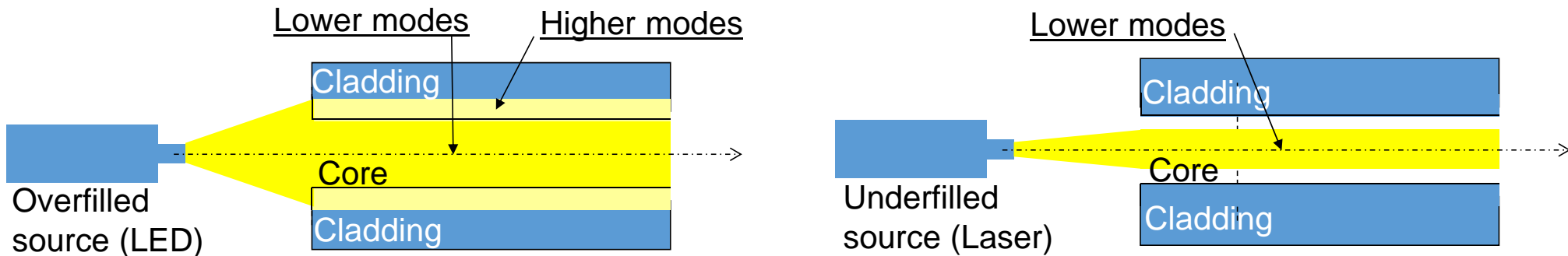
Follow this simple **"INSPECT BEFORE YOU CONNECT"** process to ensure fiber end faces are clean prior to mating connectors.
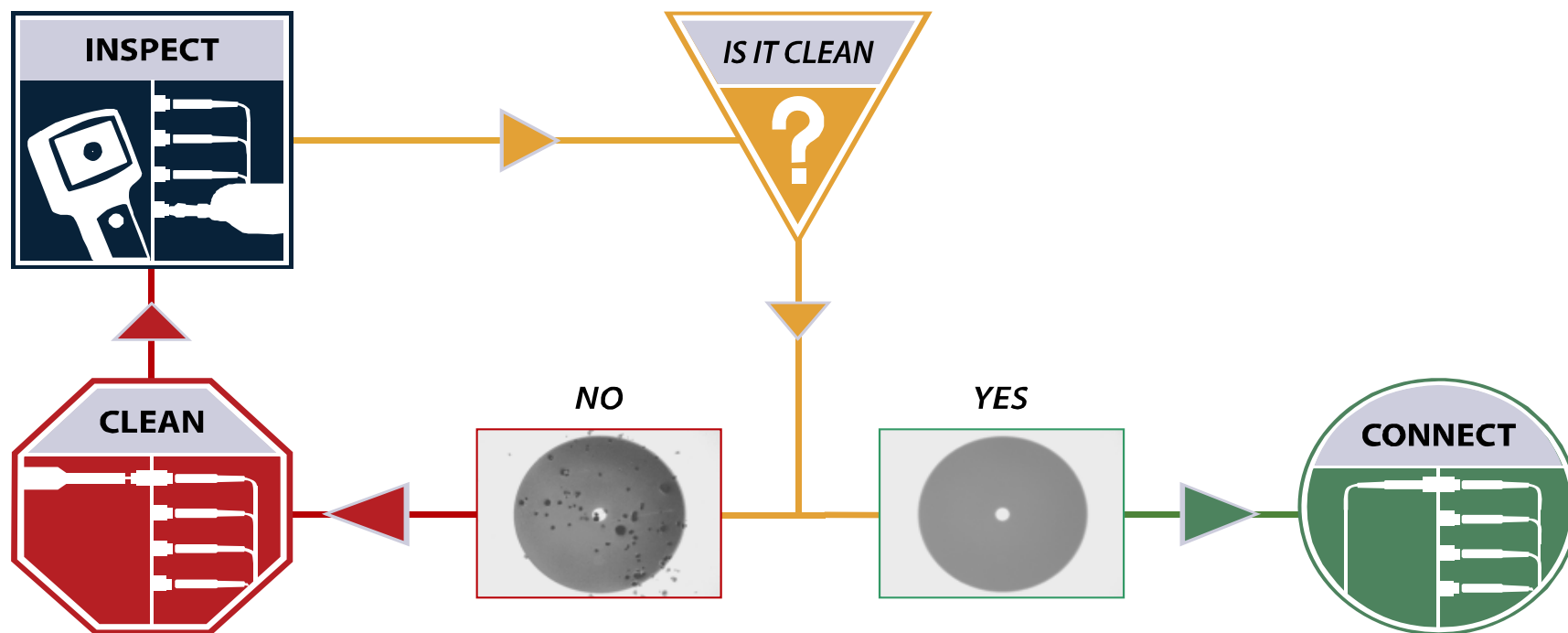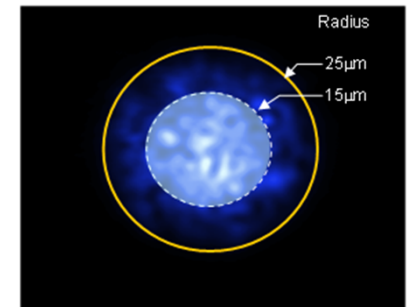
Multimode Launch Conditions

- Different multimode light sources = different modal power distributions
  - Commonly referred to as "launch conditions"

- Launch conditions directly impact link loss measurements accuracy
  - LED overfills a multimode fiber tending to overstate loss
  - Laser underfills a multimode fiber tending to understate loss

Lower modes   Higher modes

Cladding

Core

Cladding

Overfilled source (LED)

Lower modes

Cladding

Core

Cladding

Underfilled source (Laser)

IEC 61280-4-1 sets standards for MM launch conditions

- Ratio between the transmitted power at a given radius of the fiber core and the total injected power

- Defined in IEC 61280-4-1 standard to characterize the launch conditions of MM test sources

- Is measured at the launch cord connector – NOT at the source output

- Replaces older "launch condition" requires such as Coupled Power Ratio (CPR)

- Can be achieved by using a universal or matched modal controller
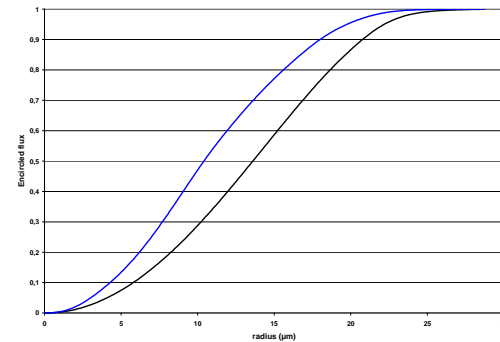
MM Launch Condition

Launch modal conditions for testing multimode optical fibre cabling

The launch modal condition at the point of measurement, at the output of launch cords, shall meet the requirements of IEC 62614 and IEC 61280-4-1. The launch modal condition at the point of measurement, the light emitted by the core of the reference connector may be achieved in several ways.
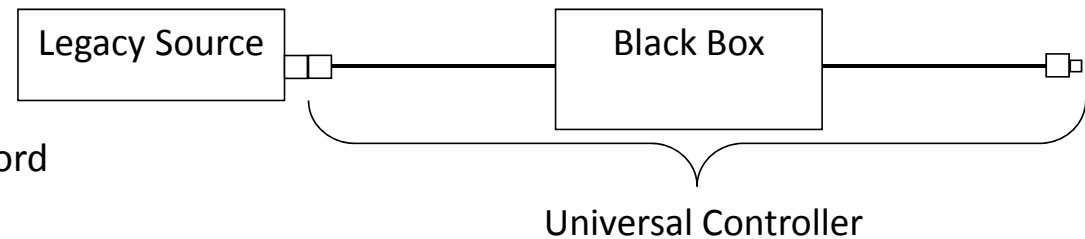
Source: IEC 14763-3

Universal and Matched Controllers

- **Universal Controller**
  - For legacy sources
  - Adds a "black box" to the output of the legacy source

Legacy Source		Black Box	

Universal Controller

- **Matched Controller**
  - Specific source matched with specific launch cord
  - Launch cord may have additional conditioning
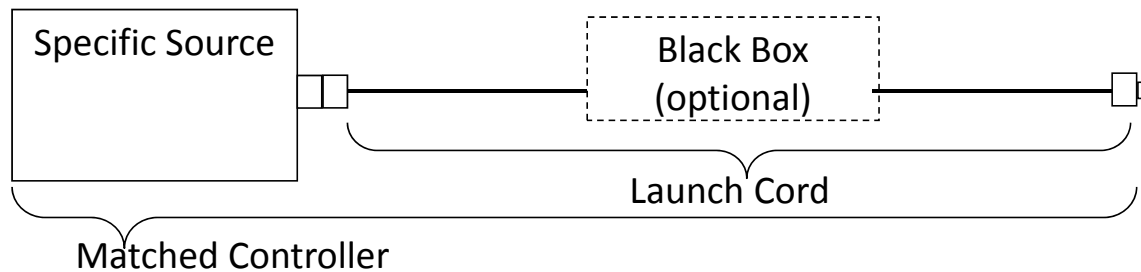
Specific Source		Black Box (optional)	

Launch Cord

Matched Controller

Test Reference Cords (TRCs)

- Use high performance (reference grade) connectors
  - Optimal optical and geometrical characteristics
    - Numerical aperture (NA)
    - Core/ferrule concentricity
- When mated with other TRCs produce near zero loss
- Minimizes uncertainty
- Called for in various standards for loss measurements of installed fiber cabling

> The connector or adapter terminating the launch cord shall be compatible with the cabling and the termination should be of reference grade to minimize the uncertainty of measurement results.

Losses associated with mating of TRCs

Table G.1 – Expected loss for examples (see NOTE 1)

Termination 1	Termination 2	Attenuation requirement
SM reference grade	SM reference grade	≤0,2 dB
SM reference grade	SM standard grade	≤0,5 dB
SM standard grade	SM standard grade	≤0,75 dB

NOTE 1 Table G.1 shows the required performance of standard and reference grade SC connectors in accordance with IEC 60874-14-2. These values are found in other, but not all, performance standards for connecting hardware.

NOTE 2 Current studies by JWG8 of IEC SC86A and SC86B on reference grade terminations may produce values for other connector styles.

Source: IEC 61280-4-2

Table F.1 – Expected loss for examples (Note 1)

Termination 1	Termination 2	Attenuation requirement
MM Reference grade	MM reference grade	≤ 0,1 dB
MM Reference grade	MM standard grade	≤ 0,3 dB
MM standard grade	MM standard grade	≤ 0,5 dB (note 2)

NOTE 1 Table F.1 shows the required performance of standard and reference grade terminations in accordance with IEC 60874-19-1. These values are found in other, but not all, performance standards for connecting hardware.

NOTE 2   97 % of individual connections are required meet this attenuation limit. As a minimum of two connections are present within installed cabling, a value of 0,5dB is quoted on a statistical basis.

Source: IEC 61280-4-1

Correct Steps for Referencing

- Turn units on and let sources warm up for 5 min

- Select and configure appropriate limit

- Set reference method on device

- Connect devices together according to reference method selected (+ Inspect)

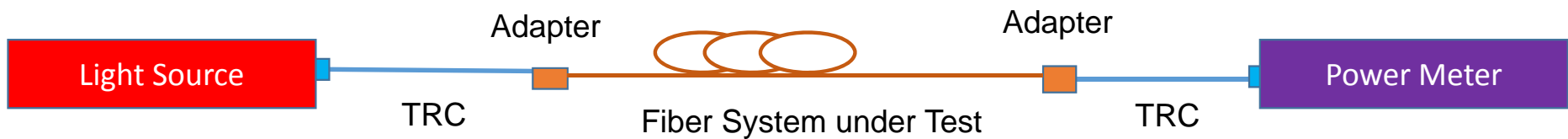- Perform reference

- Verify reference (+ Inspect)

- Test (+ Inspect)

Setting Reference – Three options:

1 Cord Reference

- Connect the OLTS together w/TRC – reference power meter (set to 0dB)

| Light Source |————————— TRC —————————| Power Meter |

- Disconnect the fiber at the power meter. Connect a TRC to the power meter. Connect to the fiber system under test

| Light Source |— TRC — Adapter — Fiber System under Test — Adapter — TRC —| Power Meter |

OLTS = Optical Loss Test Set. Typically has Light Source and Power Meter at both ends. Simplex shown for clarity.

One-Cord Reference Method

The one-cord reference method measurement includes the attenuation of both connections to the cabling under test. It is the RTM for measurement of installed cabling plant of configuration A (see 4.2).
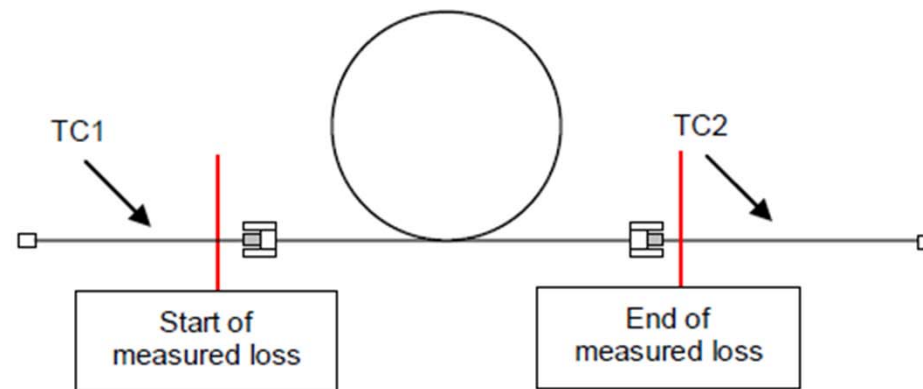

IEC xxxx/11

Figure 3 – Configuration A – Start and end of measured losses in reference test method

NOTE 1   Figure 3 is an example of cabling in configuration A with test cords TC1 and TC 2 attached, illustrating the start and end point of the measured losses when the reference test method is used (the one-cord reference method as detailed in Annex A).

Setting Reference – Three options:

- Connect the OLTS together using two TRCs and an adapter – reference power meter (set to 0dB)

| Light Source | TRC | Adapter | TRC | Power Meter |

- Disconnect the fibers at the adapter and connect the system to be tested.

| Light Source | TRC | Adapter | Fiber System under Test | Adapter | TRC | Power Meter |

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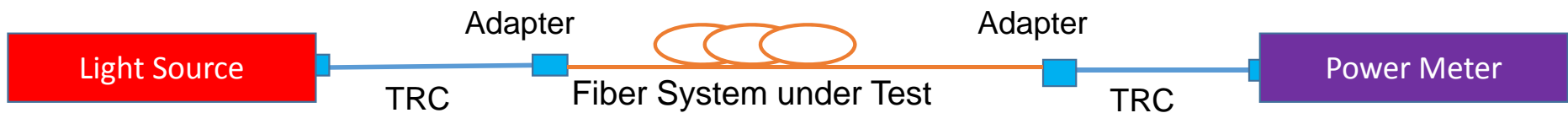# Setting Reference – Three options:

- Connect the OLTS together with two TRCs, two adapters AND a third TRC – reference power meter (set to 0dB)

| Light Source | TRC | Adapter | TRC | Adapter | TRC | Power Meter |

- Disconnect the fibers at the adapters, remove the third TRC and connect to the system to be tested.

| Light Source | TRC | Adapter | Fiber System under Test | Adapter | TRC | Power Meter |

Reference Verification

- Connect test cords together and measure loss
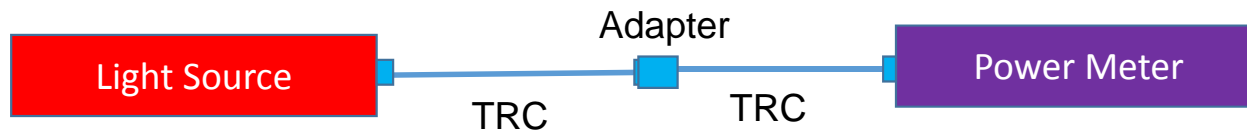

- Ensure no "gainers"
  - Negative loss on most loss test sets
- Ensure loss does not exceed the values for TRC-TRC connections
  - Multimode ≤ 0.1 dB
  - Single mode ≤ 0.2 dB
- Save result for proof of good reference

Summary of Reference Methods

- Difference is the number of bulkhead (coupler) connections included in the loss measurement.
- Use the method recommended by your local standards OR by your vendor!
- For link testing, 1 cord method is universally recommended

Losses included in measurement based on reference method

One cord

Two cord

Three cord

Light Source

Power Meter

Fiber System under Test
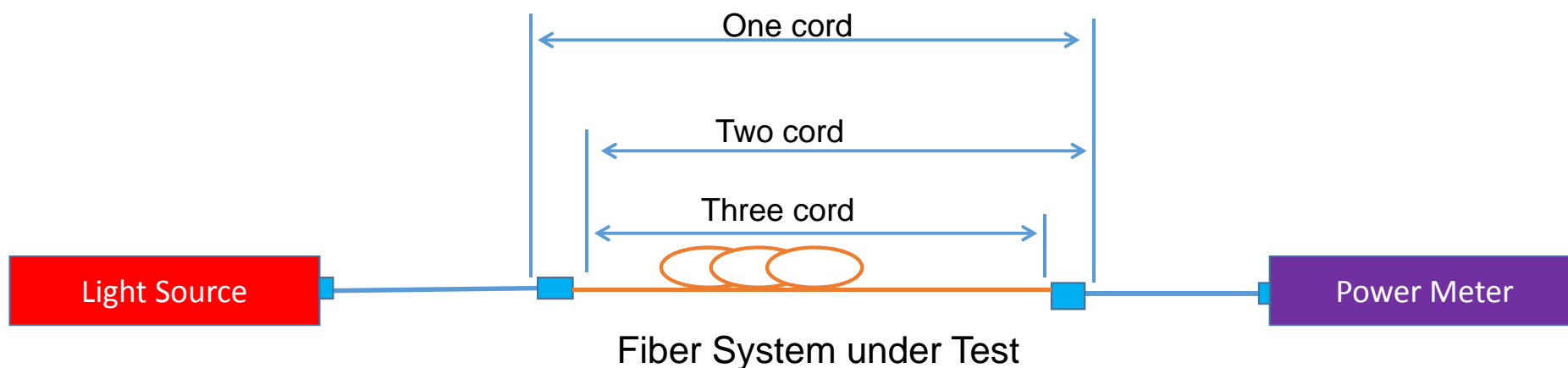
Loss Limits

- Acceptable loss limit is based on several factors:
  - Number of connections
  - Number of splices
  - Loss per Km (at specific wavelengths)

No of Connections	0 ▶
Loss Per Connection (dB)	0.75 ▶
No Of Splices	0 ▶
Loss Per Splice (dB)	0.30 ▶
Cable Loss (850nm)	3.0 dB/Km
Cable Loss (1300nm)	1.5 dB/Km

- Maximum **allowable** losses
  - Loss per connection = 0.75 dB
  - Loss per splice= 0.3dB
  - Loss per Km (slope)
    - 850nm = 3.0 dB
    - 1300nm = 1.5 dB
    - 1310 nm = 1.0 dB
    - 1550 nm = 1.0 dB

For Tier 1 Certification the user must tell the OLTS how many connections and splices are in the fiber system under test

Calculating Standards-Based Limits

Link Attenuation Allowance *(dB) = Cabled Fiber Attenuation Allowance (dB) + Connections Attenuation*

Allowance (dB) + Fiber Splices Attenuation Allowance (dB) + Test Cord Attenuation Allowance (dB)

Where:

- *Cabled Fiber Attenuation Allowance (dB) = Maximum Cabled Fiber Attenuation Coefficient (dB/km) × Length (km)*

- *Connections Attenuation Allowance (dB) = Number of Connections within the link × Connection Loss*
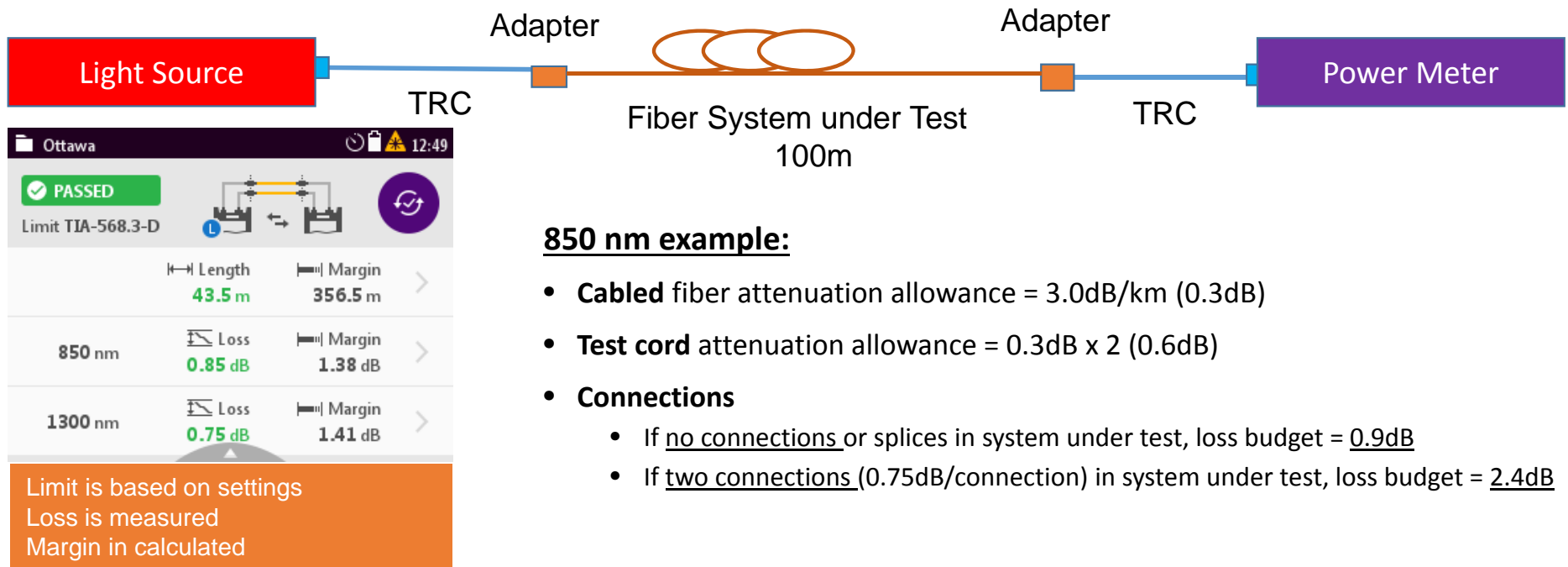
Allowance (dB/connection)

Note: The number of connections within the link excludes the connections on the ends of the link to the test cords that are accounted for subsequently as Test Cord Attenuation Allowance.

- *Fiber Splices Attenuation Allowance (dB) = Number of Splices × Fiber Splice Loss Allowance (dB/splice)*

- *Test Cord Attenuation Allowance for one-cord reference method = 2 × Test Cord Loss Allowance*

- *Test Cord Attenuation Allowance for two-cord reference method = 1 × Test Cord Loss Allowance*

- *Test Cord Attenuation Allowance for three-cord reference method = 0 × Test Cord Loss Allowance*

Loss Limit Example

Adapter   Adapter

Light Source   TRC   **Fiber System under Test**   TRC   **Power Meter**
100m

Ottawa   12:49

✓ **PASSED**
Limit TIA-568.3-D   L

Length	Margin
43.5 m	**356.5 m**

850 nm	Loss **0.85 dB**	Margin **1.38 dB**
1300 nm	Loss **0.75 dB**	Margin **1.41 dB**

Limit is based on settings
Loss is measured
Margin in calculated

850 nm example:

- **Cabled** fiber attenuation allowance = 3.0dB/km (0.3dB)

- **Test cord** attenuation allowance = 0.3dB x 2 (0.6dB)

- **Connections**
  - If no connections or splices in system under test, loss budget = 0.9dB
  - If two connections (0.75dB/connection) in system under test, loss budget = 2.4dB

Will My Application Actually Work?

- In this context, application is the protocol that will "ride" on the fiber.
  - Typically Ethernet or Fiber Channel
- What is the connection between the "limit" on the previous slide and what the application requires?
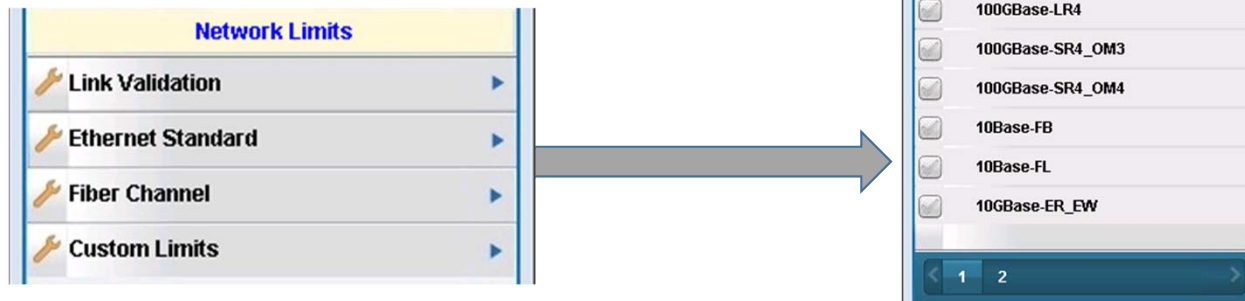 - Very little…

Loss and Length Limits at 850nm

Cable Type	1GbE		10GbE		40 /100GbE	
	Loss (dB)	Length (m)	Loss (dB)	Length (m)	Loss (dB)	Length (m)
OM3	4.5	1000	2.6	300	1.9	100
OM4	4.8	1100	3.1	1100	1.5	150

Compliant Networks

- Most Enterprise Optical Loss Test Sets will report "Compliant Networks" based on loss measurement

- **Cautions!**
  - Can "PASS" standards-based generic limit, but have too much loss for specific application
  - Most testing performed is on links – but applications run on channels

- **If the Application to be carried on the fiber is known**
 - Then use Application (Network) limit on your test device

Compliant Networks

1000BASE-LX_MM	1000BASE-SX	100GBASE-ER4
100GBASE-LR4	100GBASE-SR4_OM3	100GBASE-SR4_OM4
10BASE-FB	10BASE-FL	10GBASE-LR/LW
10GBASE-LX4	10GBASE-SR/SW	40GBASE-SR4_OM3
40GBASE-SR4_OM4	1Gbps-FC_OM2_MM	1Gbps-FC_OM3_MM
2Gbps-FC_MM	2Gbps-FC_OM2_MM	2Gbps-FC_OM3_MM
4Gbps-FC_OM1_MM	4Gbps-FC_OM2_MM	4Gbps-FC_OM3_MM
8Gbps-FC_OM1_MM	8Gbps-FC_OM2_MM	8Gbps-FC_OM3_MM
ISO-14165-111_MM		

Network Limits

- Link Validation ▶
- Ethernet Standard ▶
- Fiber Channel ▶
- Custom Limits ▶

- 1000Base-SX
- 100GBase-ER4
- 100GBase-LR4
- 100GBase-SR4_OM3
- 100GBase-SR4_OM4
- 10Base-FB
- 10Base-FL
- 10GBase-ER_EW

1 2

Wideband Multimode Fiber OM5 (WBMMF)

- Optical characteristics other than bandwidth remain essentially the same.
  - Field Testing is the same as OM4
- Test with traditional duplex fiber OLTS
  - Encircled Flux compliant
  - Wavelengths at 850/1300nm
    - Bounds all wavelengths between
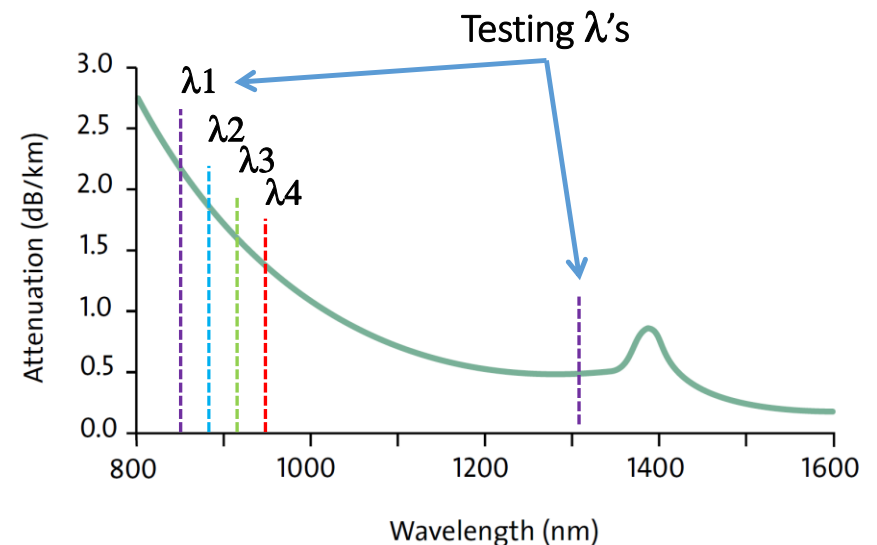
Tier 1 Testing for MPO

Additional Challenges for Tier 1 Testing of MPO

- Contaminated MPO Endfaces
- One-cord reference
  - If test set has pinned ports then unpinned to unpinned test cord must be used to perform reference
  - Receive cord is then added (unpinned to unpinned)
  - Can then test a pinned system
  - Cannot verify reference without adding a third cord
- There are MPO connectors available that allow pins to be retracted or removed
  - Helps solve pinned/unpinned challenges

Tier 1 Certification: MPO to MPO

- Test MPO Links and Channels
- Loss
- Length
- Polarity
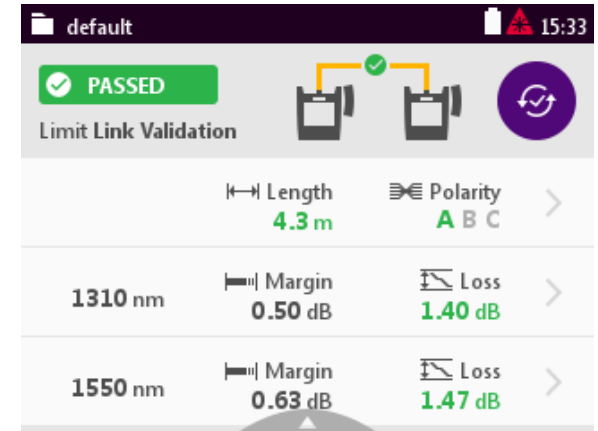
Tier 1 Certification: MPO to MPO

MPO Bulkhead

MPO Bulkhead

MPO Test Cord

MPO Backbone

MPO Test Cord

MPO
Optical Light Source

MPO
Optical Power Meter
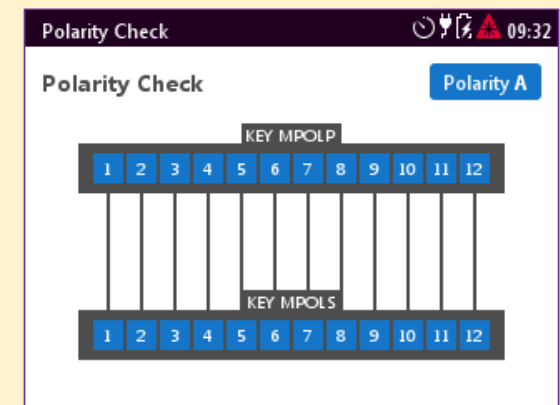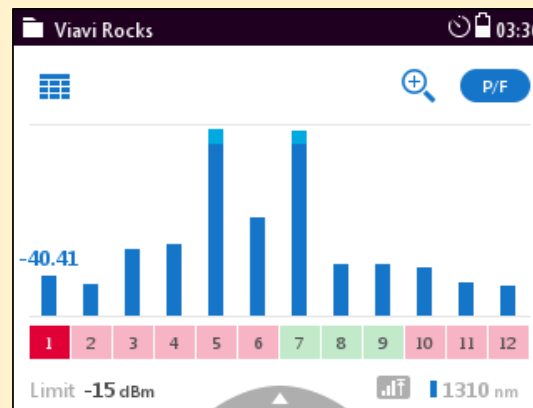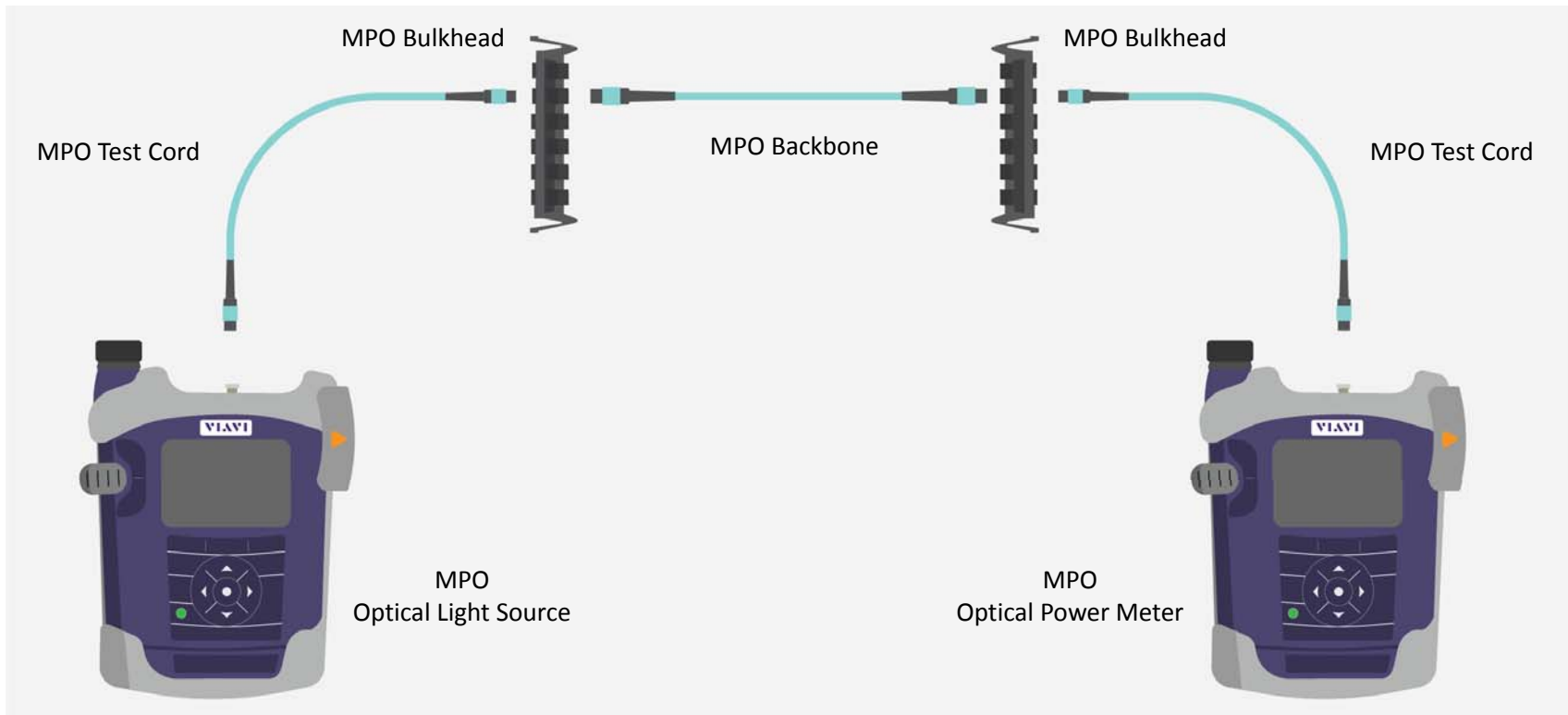
MPO Connectors are more likely to be contaminated

Single-Fiber Connector

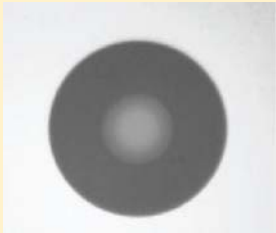**MPO Connector**
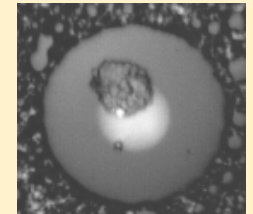
- White ceramic ferrule
- One fiber per connector
- Common types include LC, SC, FC, and ST
- Smaller Surface Area

- Polymer ferrule
- Multiple fibers in linear array
- 6x or 12x density connectivity
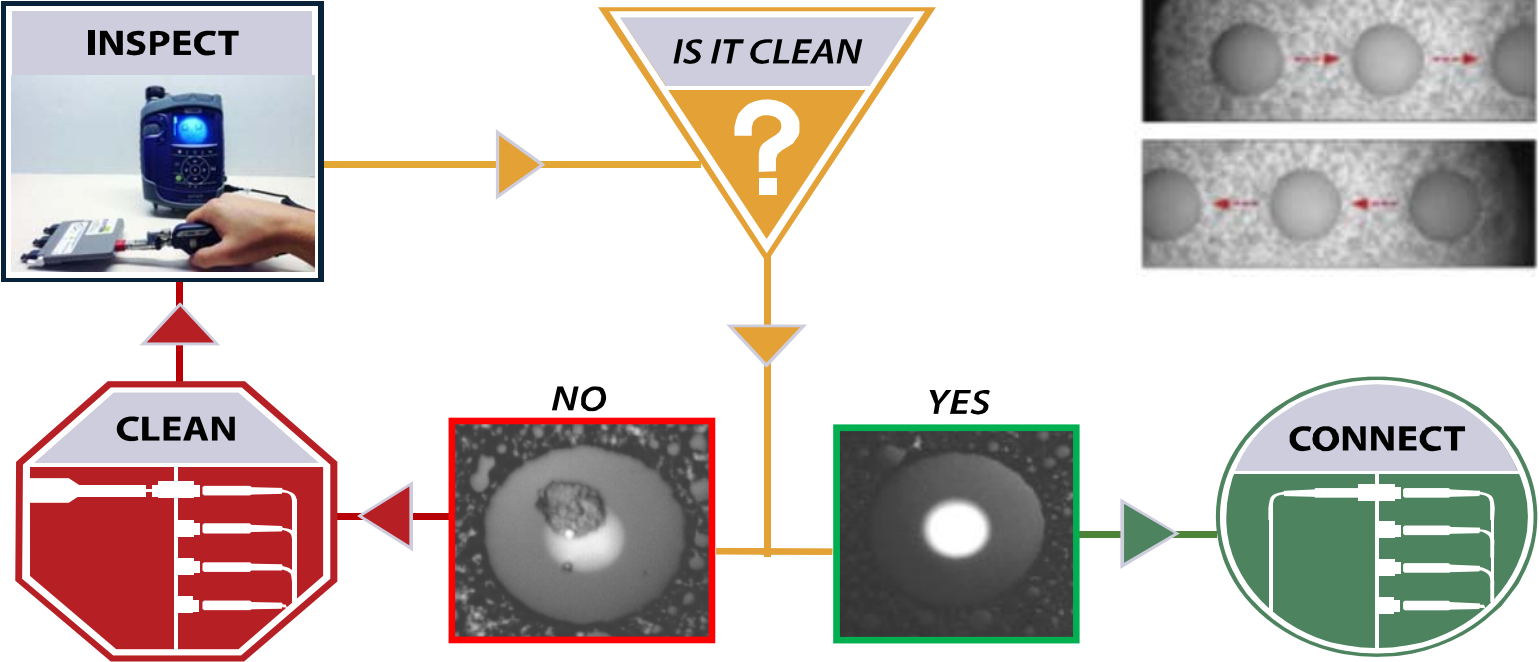- Larger Surface Area
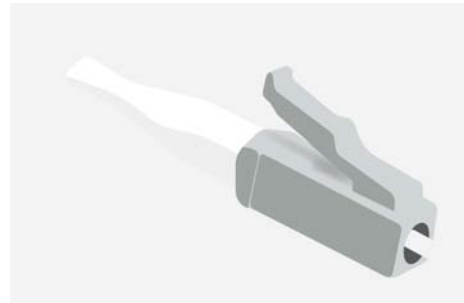
1.25mm ferrule = 1.2mm² area

9.5mm X 5.0mm opening = 47.5mm² area

If 1 fiber is 95% likely to be clean,
12 fibers are $(0.95)^{12}$ = 55% likely to be clean

Follow this simple **"INSPECT BEFORE YOU CONNECT"** process to ensure fiber end faces are clean prior to mating MPO connectors.

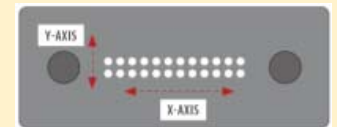# Anatomy of a 12-fiber Multi-Mode MPO Connector

Key

Fibers

Polymer Ferrule

Alignment pins/sockets
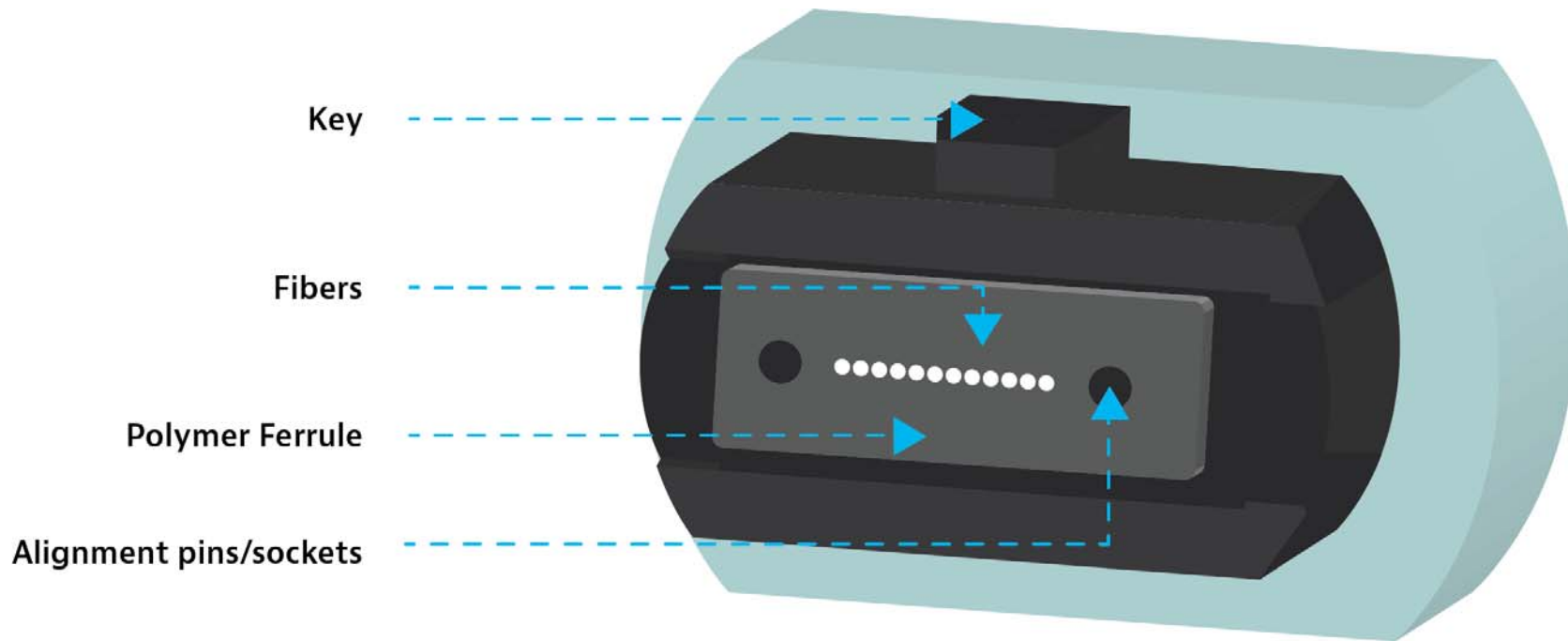
Note: MPO connectors with higher fiber counts (e.g. 24) will have multiple rows of fiber on the ferrule

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- Enhance your test tools for greater productivity
- Generate Tier 1 certification reports & more

LinkWare Live

EXFO Connect

AFL
aeROS®

VIAVI

CERTiFi

Conclusion: Tier 1 Testing

- Treat all of your connections with respect (TRCs AND fiber under test)
  - Inspect Before You Connect^{SM}
- Understand your multimode launch condition and have a plan to move to Encircled Flux
- Understand reference methods and their impact on limit, loss, and margin
  - Reference method chosen in tester setup is correct and matches actual physical setup
  - Verify and check the reference often
  - Use test reference cords
- Be aware of new challenges when performing Tier 1 Testing for MPO
  - MPO end-face condition is the most critical element in a channel with MPO connections
  - Polarity can be a challenge – especially when adapting existing MPO backbones to new services
  - Be aware of pinned/unpinned – presents challenges for testing (test cords must mate with system – challenges with test device and test cord gender)
- Consider Cloud Solutions for Tier 1 Certification

Tier-2 OTDR testing & troubleshooting

Jamie Humphreys

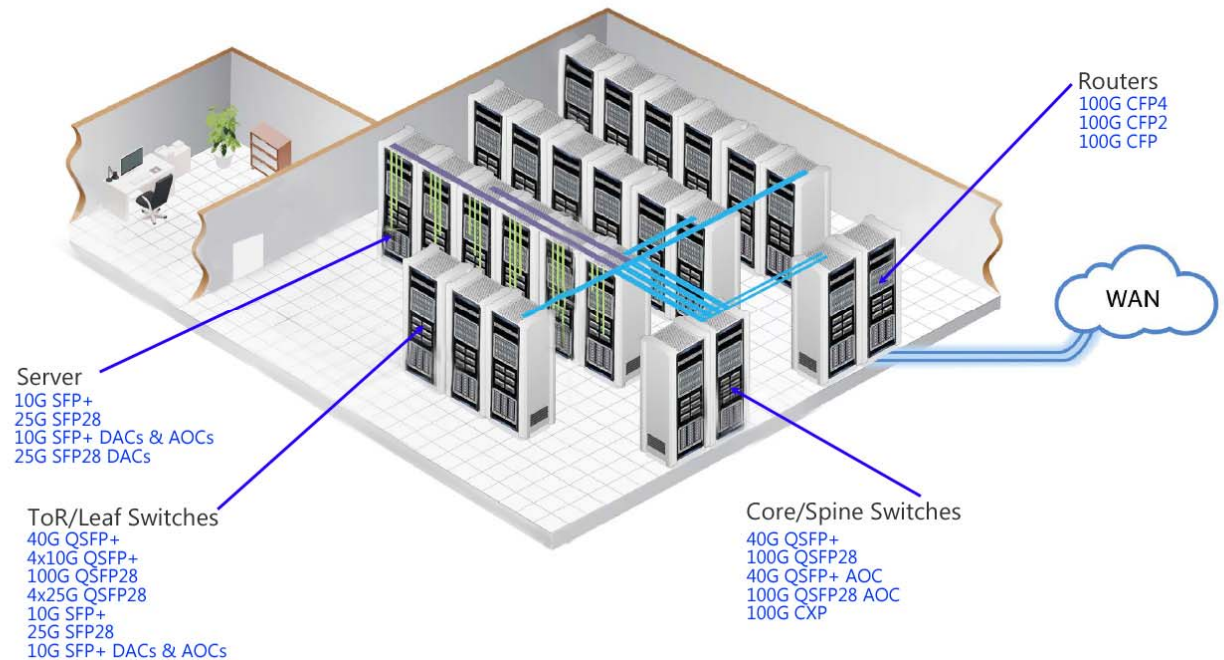Senior Technical Sales Specialist

EXFO

Data Center Evolution

Majority of Data Centers Today

- ✓ Mix of MM/SM Fiber
- ✓ Line Rates 10G-100G
- ✓ Legacy & New Optics

Migration of Data Centers

- ✓ HyperScale DC – 100% SM
- ✓ Line Rates 100G-400G-(Tbps?)
- ✓ New MM Fiber/Optics- SWDM

Routers
100G CFP4
100G CFP2
100G CFP

WAN

Server
10G SFP+
25G SFP28
10G SFP+ DACs & AOCs
25G SFP28 DACs

ToR/Leaf Switches
40G QSFP+
4x10G QSFP+
100G QSFP28
4x25G QSFP28
10G SFP+
25G SFP28
10G SFP+ DACs & AOCs

Core/Spine Switches
40G QSFP+
100G QSFP28
40G QSFP+ AOC
100G QSFP28 AOC
100G CXP

Architectural Changes

Traditional Distributed (3-tier) Architecture — Core Layer, Aggregation Layer, Access Layer, North-South

Spine and Leaf Mesh Architecture — 'Pod', Spine Switch Layer, Leaf Switch Layer, East-West

Greater Fiber Density

Tier 2- OTDR Functions

Link Loss/ Distance End of the Fiber

Link ORL

Adversely affects 100G + Transmission Performance

Loss/Location of each Splice and Connector

Connector Reflection

Assuring Quality Network Performance

Macrobends Located

Indication of Connector Cleanliness And quality of endface termination
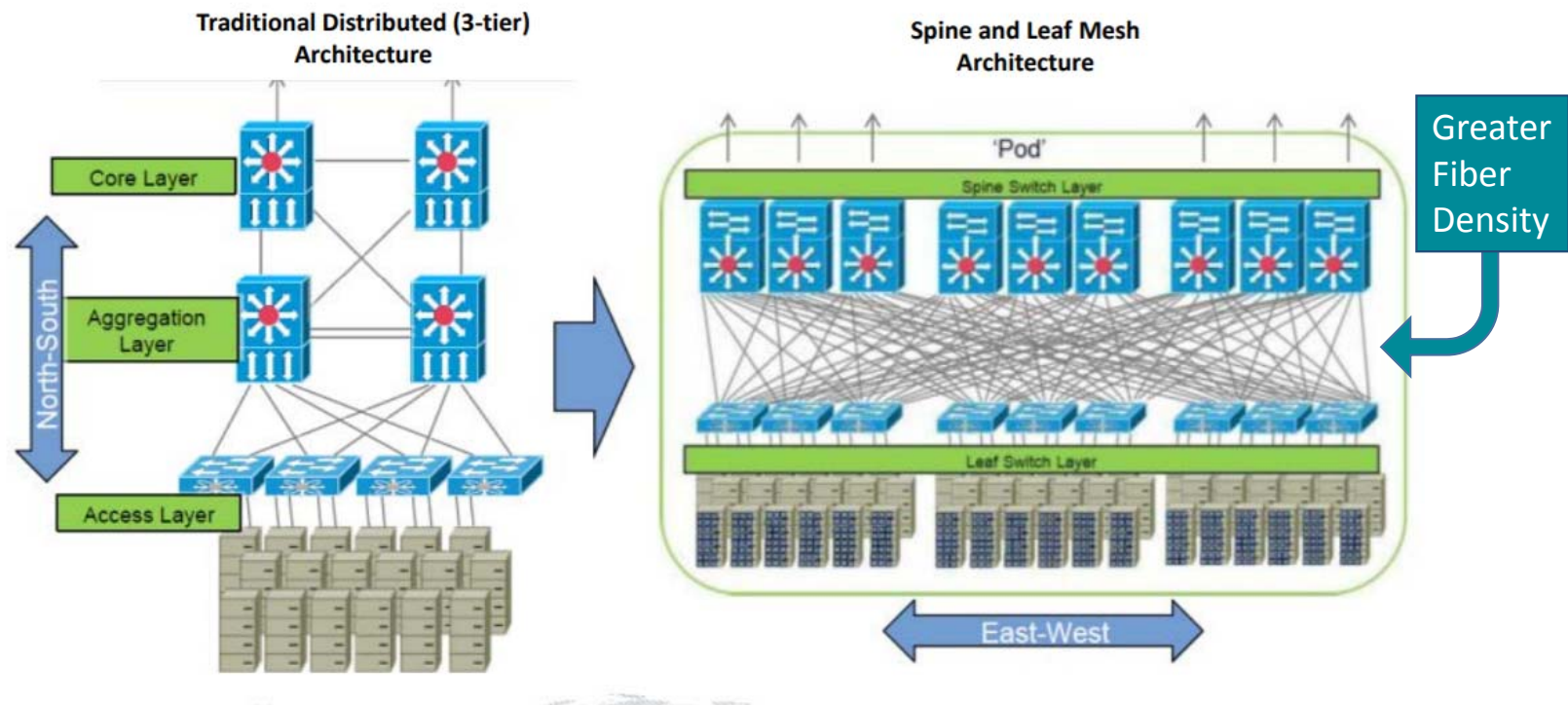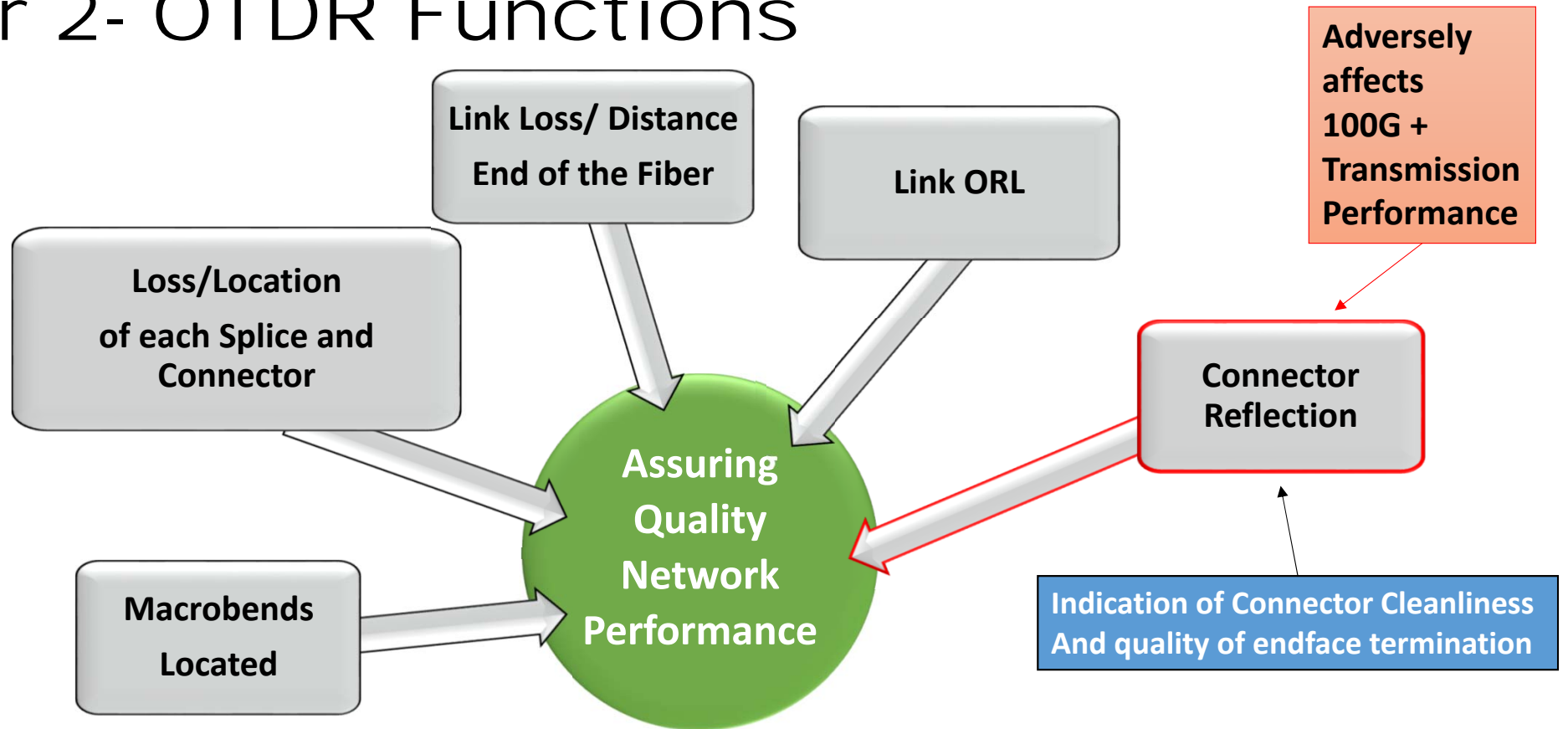
OTDR Helps Assure Network Quality

LOCATES:
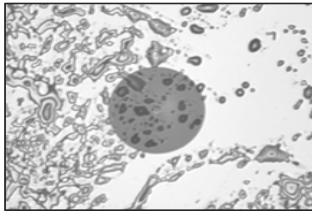
Dirty connectors   Macrobends   Fiber cuts /High loss

Clean connectors   Clean fiber management
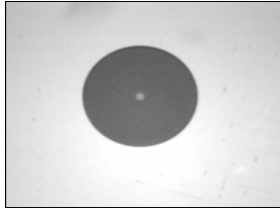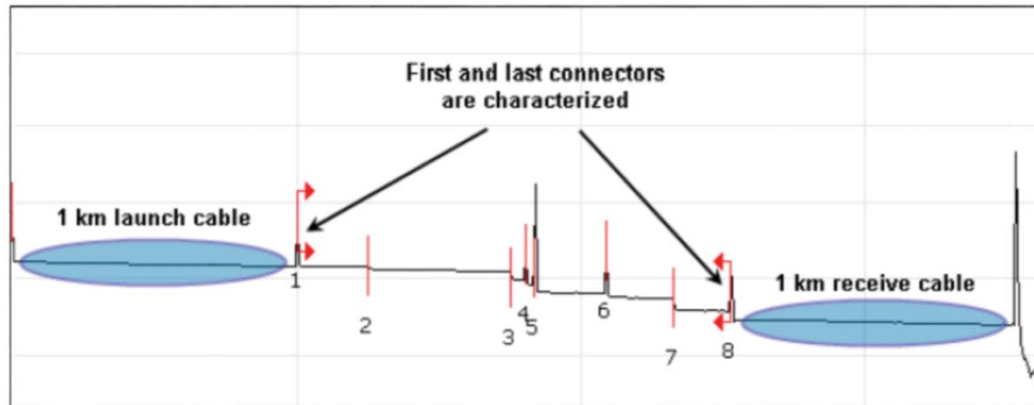
OTDR Basics- Launch/Receive Cable

In order to properly measure the loss and refection of the first and the last connectors, launch and receive cables are required
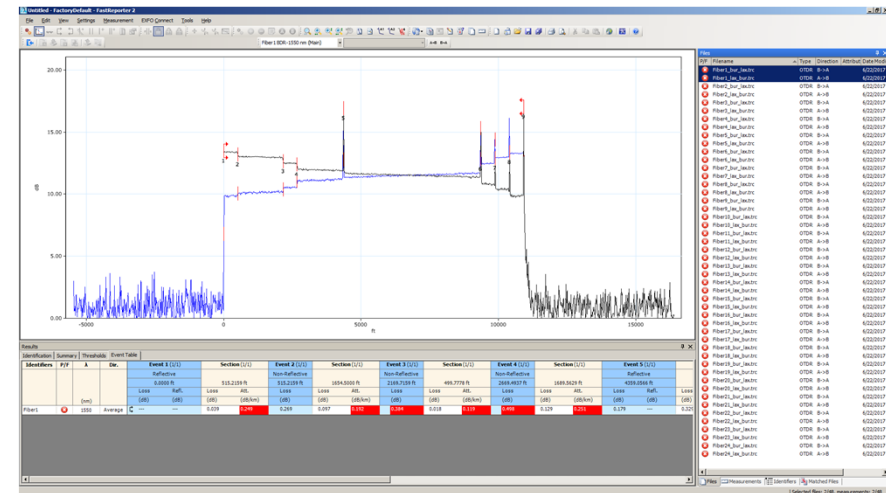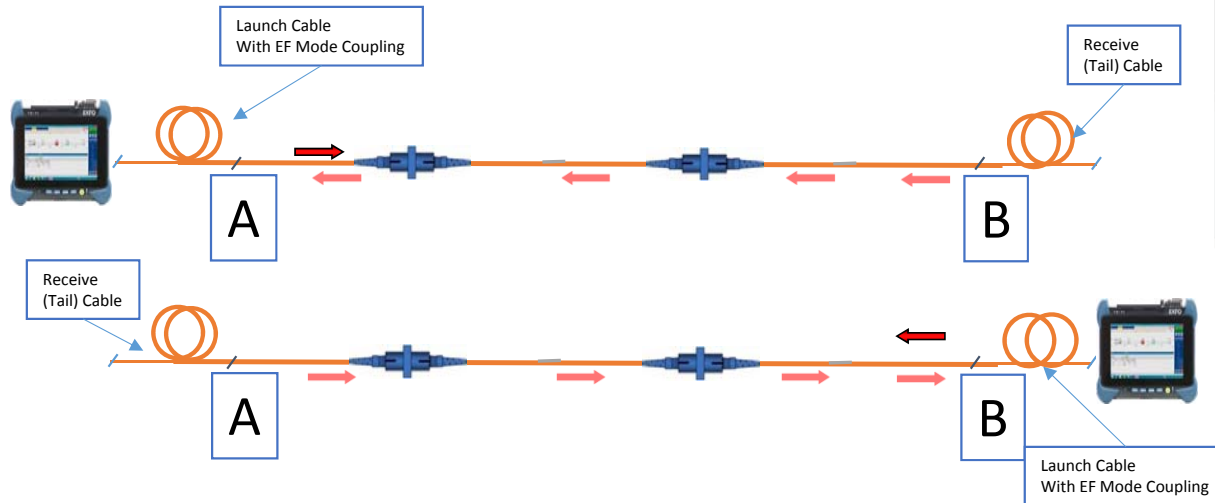
First and last connectors are characterized

1 km launch cable

1 km receive cable

1

2

3

4 5

6

7 8

OTDR Basics- MMF Bi-Directional Testing

TIA-526-14B (and IEC 61280-4-1).

Bi-directional testing is required if the fiber characteristics of the test cords differ from those of the cable under test. If the launch cord and tail cord have identical scattering characteristics and it is only the total insertion loss of the link that is required to be measured, then it is sufficient to carry out OTDR testing in one direction only.
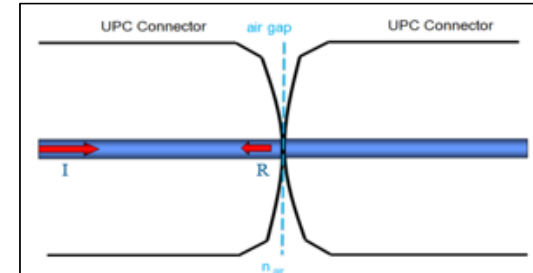

Launch Cable
With EF Mode Coupling

Receive
(Tail) Cable

A

B

Receive
(Tail) Cable

A

B

Launch Cable
With EF Mode Coupling

Post Analysis SoftwareAuto
Average the
A>B and B>A Traces

Reflectance

- **The amount of energy reflected back from <u>specific points</u> within the network**
- **Each reflectance point is independant (expressed as a negative value)**

The optical energy that is reflected back towards the source when significant change in the IOR occurs

Patch Panel

Fiber section

Connector

Fiber section

Mec. Splice

Fiber section

Patch Panel

Connector reflectance: **-33dB**

Connector reflectance: -50dB

Mechanical splice reflectance: -45dB
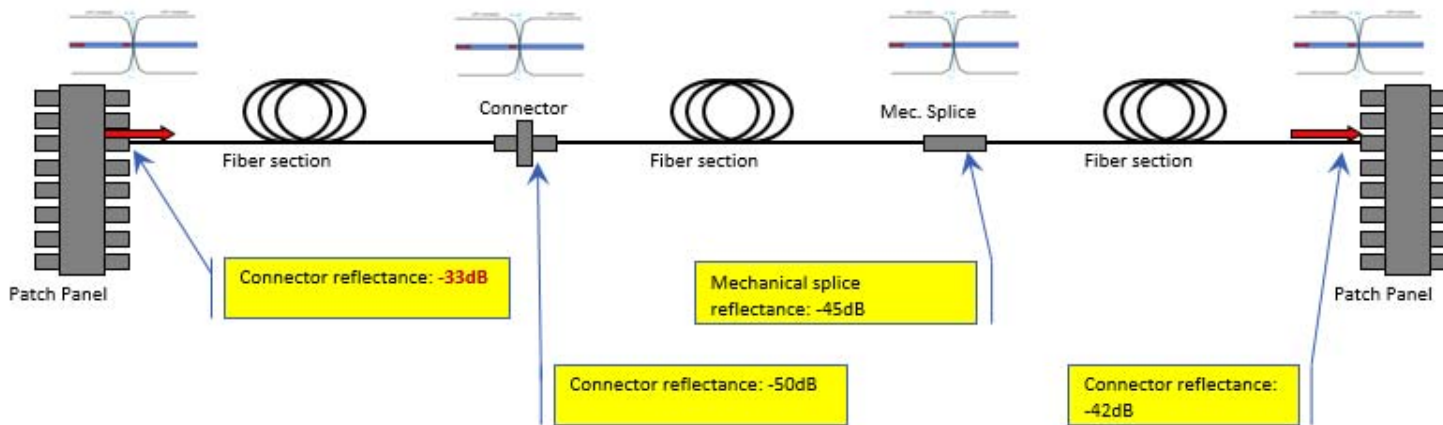
Connector reflectance: -42dB

Loss/Reflectance Tolerances

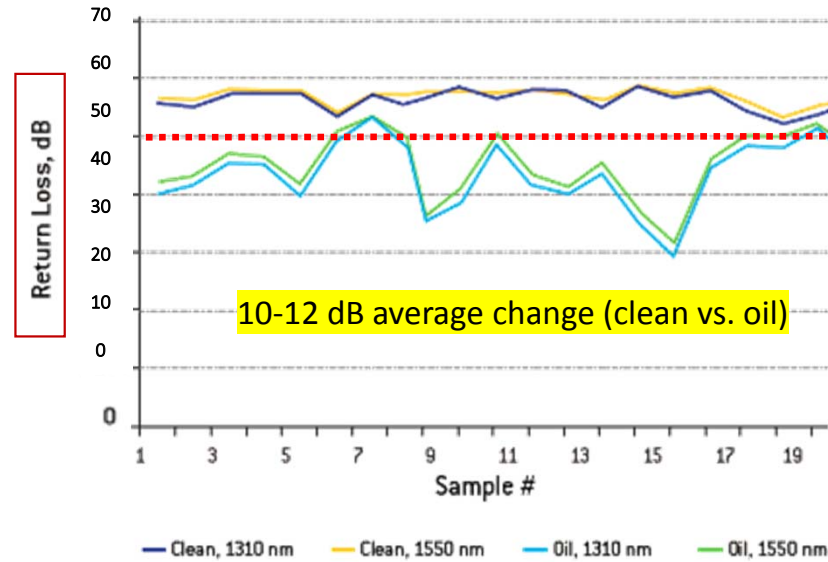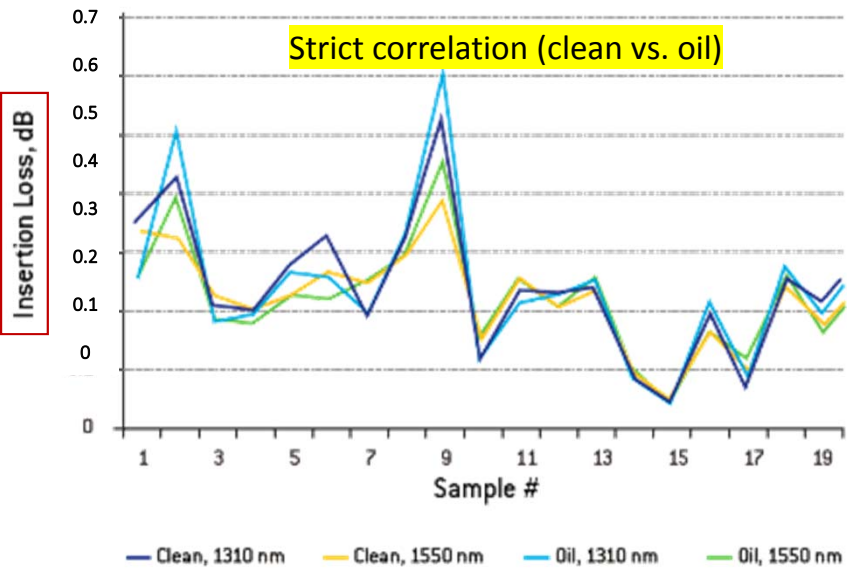| Rates	MMF Budget loss in dB @ 850 nm (Reach)	SMF Budget loss in dB @ 1310/1550 nm (Reach)	Connector Reflectance (dB) Standard	Connector Reflectance (dB) Customers
10GBASE *(IEEE 802.3ae 2002)*	**S- Serial (OM3/4)** 2.6 (300m)	**L- Serial (OS1-OS2)** 6.0 (10km)	-20 (MMF) -26 (SMF)	*No requirements*
40GBASE-SR4 100GBASE-SR10 40GBASE-LR4 100GBASE-LR4 *(IEEE 802.3bm – 2015)*	**SR4 / SR10** 1.9 (70m) (OM3) 1.5 (100m) (OM4)	**LR4 (OS1-OS2)** 6.7 (10km)	-20 (MMF) -26 (SMF) *-35 dB* *TIA-568.3-D*	**-40 to -45 dB** (SMF / UPC polish) 4x25G lanes
New MSAs: 100G-PSM4 (4X25 MPO) 100G-CWDM4 (4x25 LC) 100G-SWDM4 (LC)	**OM5/SWDM4** 1,5 (100m)	**OS1-OS2** 3.3 dB (500m) 5.0 dB (2km)	-20 (MMF) -26 (SMF)	**-40 to -45 dB**

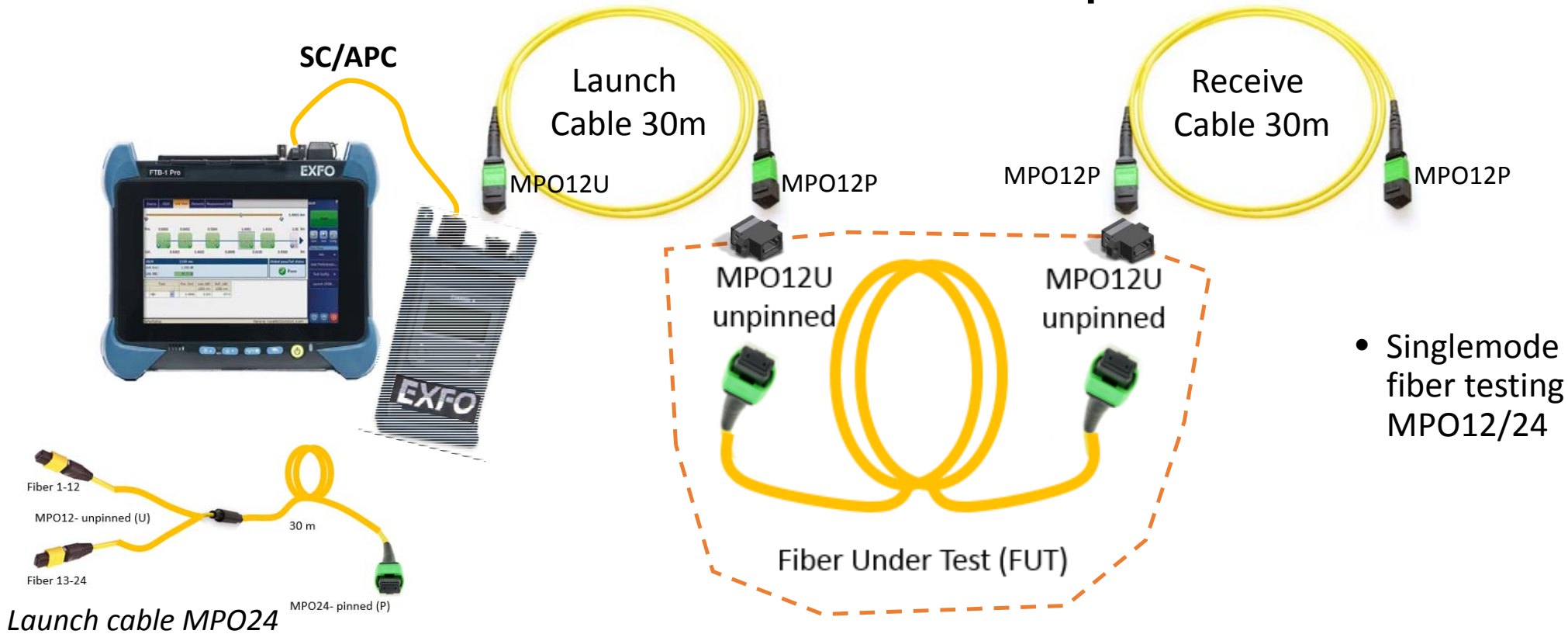# Reflectance : Growing Concern

Reflectance Thresholds:

Standards (TIA-568.3-D (2013, b.3), IEC-11801 (2010): SMF 35dB (MMF 20dB)

IEEE 802.3bs (200 – 400G): SMF -45 to -47dB for each discrete reflectance (4 connectors+) – *standard not yet ratified.*

Strict correlation (clean vs. oil)

10-12 dB average change (clean vs. oil)

Typical Operator Requirement

Finger oil

MPO OTDR/iOLM Test Setup
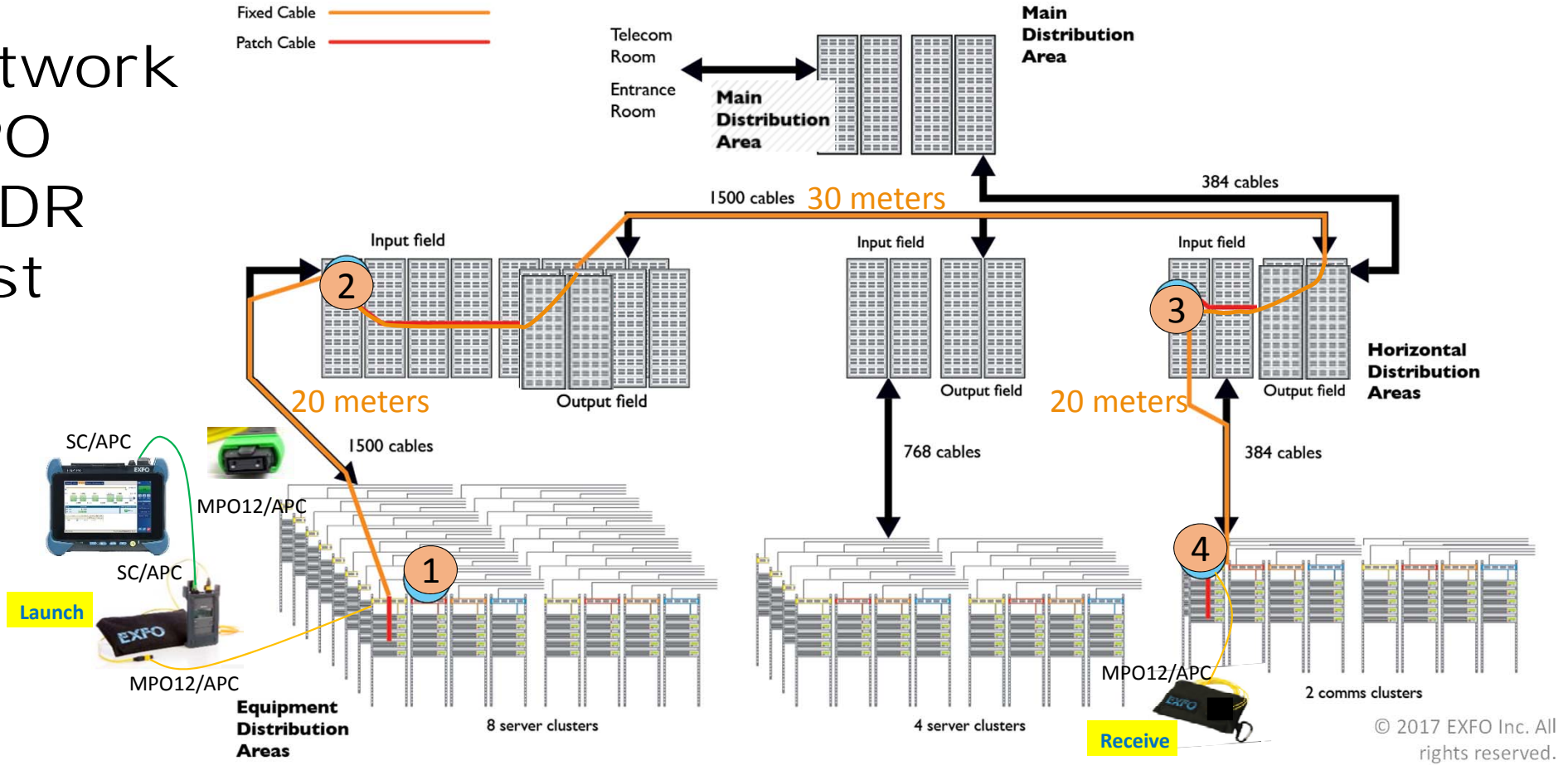
SC/APC

Launch
Cable 30m

MPO12U   MPO12P

Receive
Cable 30m

MPO12P   MPO12P

MPO12U
unpinned

MPO12U
unpinned

Fiber Under Test (FUT)

- Singlemode fiber testing MPO12/24

Fiber 1-12

MPO12- unpinned (U)

30 m

Fiber 13-24

MPO24- pinned (P)

Launch cable MPO24

60

Network MPO OTDR Test

MPO Cable 5

Fiber 2 has high Loss

Fiber 8 has high loss & Reflectance

Fiber 9 has high Loss

intelligent Optical Link Mapper (0)

| Source | iOLM | Link View | Elements | Info | Summary |

❌ **Fail**
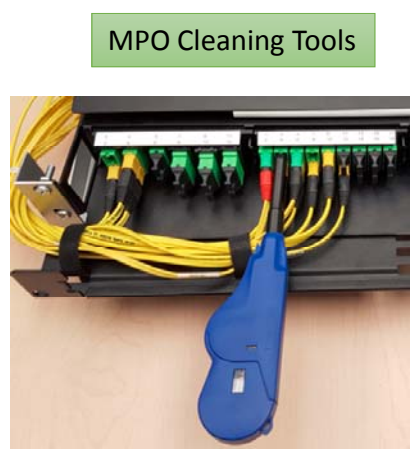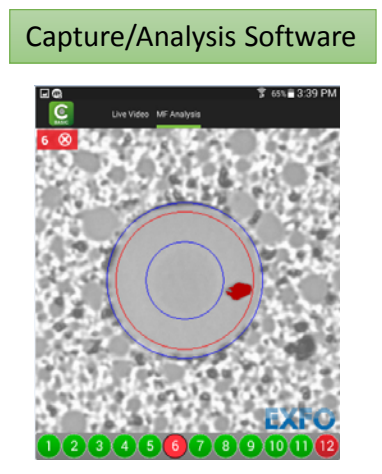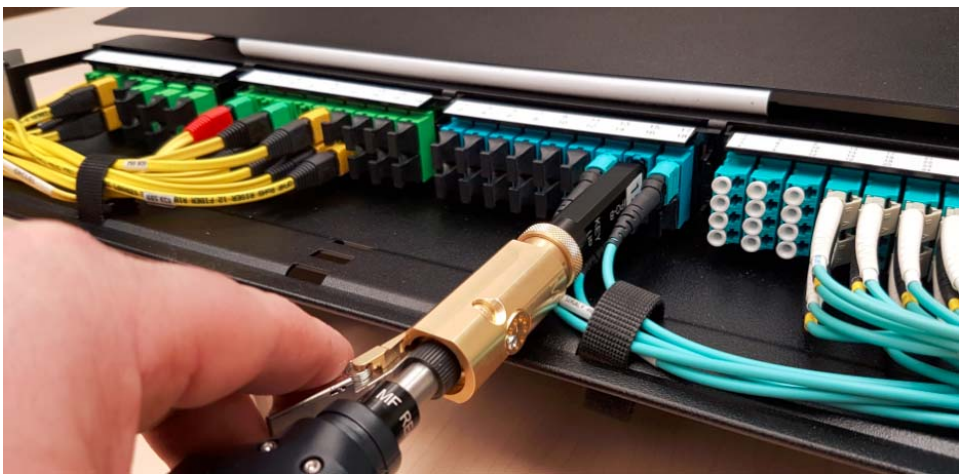
Launch cable calibration: **Within thresholds**

#	File name	Link Length (m)	Link Loss (dB) 1310 nm	Link Loss (dB) 1550 nm	Link ORL (dB) Worst value	
1	MPO_5_01.iolm	70.9	1.977	1.836	52.27	✓
2	MPO_5_02.iolm	70.9	2.488	2.804	51.71	❌
3	MPO_5_03.iolm	70.9	1.286	1.941	51.60	✓
4	MPO_5_04.iolm	70.6	1.966	1.490	51.72	❌
5	MPO_5_05.iolm	70.9	1.094	1.442	51.36	✓
6	MPO_5_06.iolm	70.3	1.734	1.531	51.63	✓
7	MPO_5_07.iolm	70.9	2.004	1.309	52.08	✓
8	MPO_5_08.iolm	70.9	2.645	1.560	38.96	❌
9	MPO_5_09.iolm	70.9	1.697	2.102	51.18	❌
10	MPO_5_10.iolm	70.9	1.319	1.470	51.62	✓
11	MPO_5_11.iolm	71.2	0.850	1.687	51.06	✓
12	MPO_5_12.iolm	70.9	1.291	0.726	51.35	✓

Start Optimode

Open Save Report

Main Menu

File ▶

Identification...

Test Configuration...

User Preferences...

Launch OTDR...

✓ 8   ❌ 4

Report...

MPO [Fast Short Link]

File name: MPO_5_02.iolm

MPO Fiber Inspection

FIP | TIP | NOZZLE | SPECIAL ADAPTER

Fiber Inspection Probe X400 Magnification

MPO FIP Tip

MPO Bulkhead Inspection

MPO Cable/fiber Inspection

Capture/Analysis Software

MPO Cleaning Tools

MPO Inspection Criteria
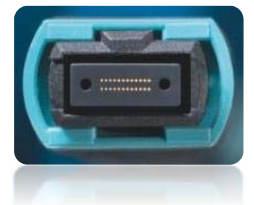
iOLM Trace

MPO Cable 5- Fiber 8

intelligent Optical Link Mapper (0)

| Source | iOLM | Link View | Elements | Info | Summary |

❌ **Fail**

70.9 m

Ⓐ   Ⓑ

| Pos. | -39.2 | -35.3 | 0.0 | 22.4 | 50.5 | 70.9 | 102.8 | m |

| Len. | 3.8 | 35.3 | 22.4 | 28.1 | 20.4 | 31.9 | | m |

iOLM	1310 nm	1550 nm
Link loss:	2.645 dB	1.560 dB
Link ORL:	41.81 dB	38.96 dB

Type	Pos. (m)	Loss (dB)		Reflectance (dB)	
		1310 nm	1550 nm	1310 nm	1550 nm
ℹ️	50.5	1.060	0.021	-40.5	-38.3

MPO_5_08

•The connector or bulkhead is damaged, dirty or not well connected. Inspect and clean as needed.

Fails Reflectance

Fiber 8 MPO(Unpinned) - Pass
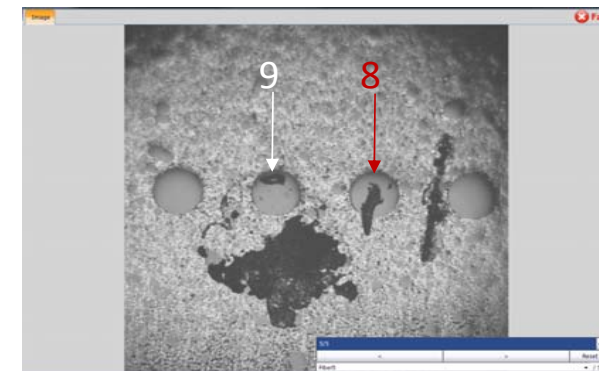
Fibers 8,9 MPO(Pinned) - Fail

65

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Orlando, FL | February 4-8

MPO-SMF OTDR/Switch Test Case

Fiber 9 MPO(U), after wet /dry

Fiber 8-9 MPO(P), after wet /dry
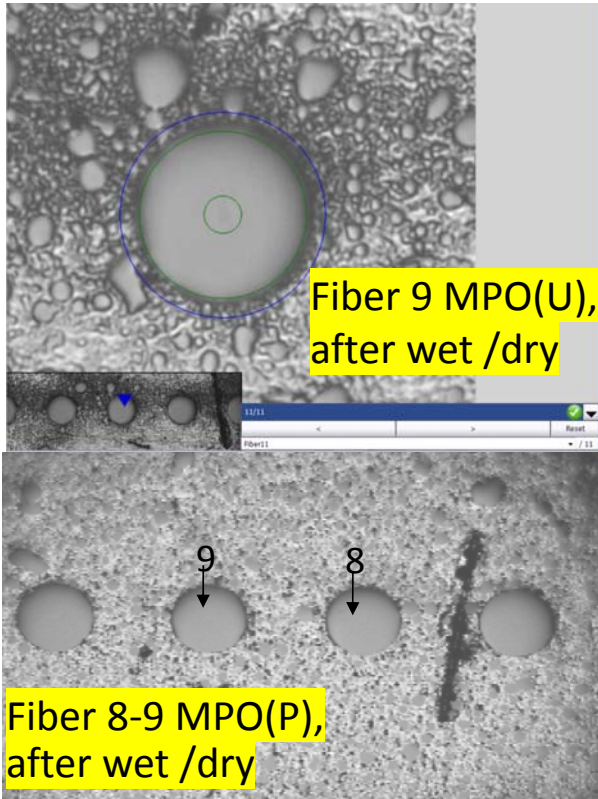
intelligent Optical Link Mapper (0)

Source | iOLM | Link View | Elements | Info | **Summary** | ✓ **Pass**

Launch cable calibration: **Within thresholds**

Start Optimode

#	File name	Link Length (m)	Link Loss (dB) 1310 nm	Link Loss (dB) 1550 nm	Link ORL (dB) Worst value	
1	MPO_5 T2_01.iolm	70.9	1.904	1.360	51.51	✓
2	MPO_5 T2_02.iolm	70.9	1.582	1.847	51.54	✓
3	MPO_5 T2_03.iolm	70.9	0.959	1.346	51.31	✓
4	MPO_5 T2_04.iolm	70.9	1.623	1.274	51.58	✓
5	MPO_5 T2_05.iolm	70.9	1.084	1.446	50.95	✓
6	MPO_5 T2_06.iolm	70.6	2.038	0.969	51.91	✓
7	MPO_5 T2_07.iolm	70.9	0.949	1.481	51.05	✓
8	MPO_5 T2_08.iolm	70.9	1.744	1.497	51.53	✓
9	MPO_5 T2_09.iolm	70.9	1.728	1.907	51.73	✓
10	MPO_5 T2_10.iolm	70.9	1.191	1.583	51.14	✓
11	MPO_5 T2_11.iolm	70.9	1.107	1.550	51.42	✓
12	MPO_5 T2_12.iolm	70.9	0.841	0.731	51.09	✓

Main Menu
- File ▶
- Identification...
- Test Configuration...
- User Preferences...
- Launch OTDR...

✓ 12   ✗ 0

MPO [Fast Short Link]

Source	iOLM	Link View	**Elements**	Info	Summary

Type		Pos. (m)	Loss (dB) 1310 nm	Loss (dB) 1550 nm	Reflectance (dB) 1310 nm	Reflectance (dB) 1550 nm
		-39.2	0.024	-0.033	-83.5	-83.3
		-35.3	2.056	1.917	-68.8	-59.6
	Ⓐ	0.0	0.271	0.159	-72.9	-76.5
		20.2	0.570	0.470	-65.8	-70.5
		50.0	0.577	0.057	-67.5	---
	Ⓑ	70.9	0.487	0.673	-73.6	-71.2
		102.8	---	---	-63.9	-64.9

Cloud Based Test Management
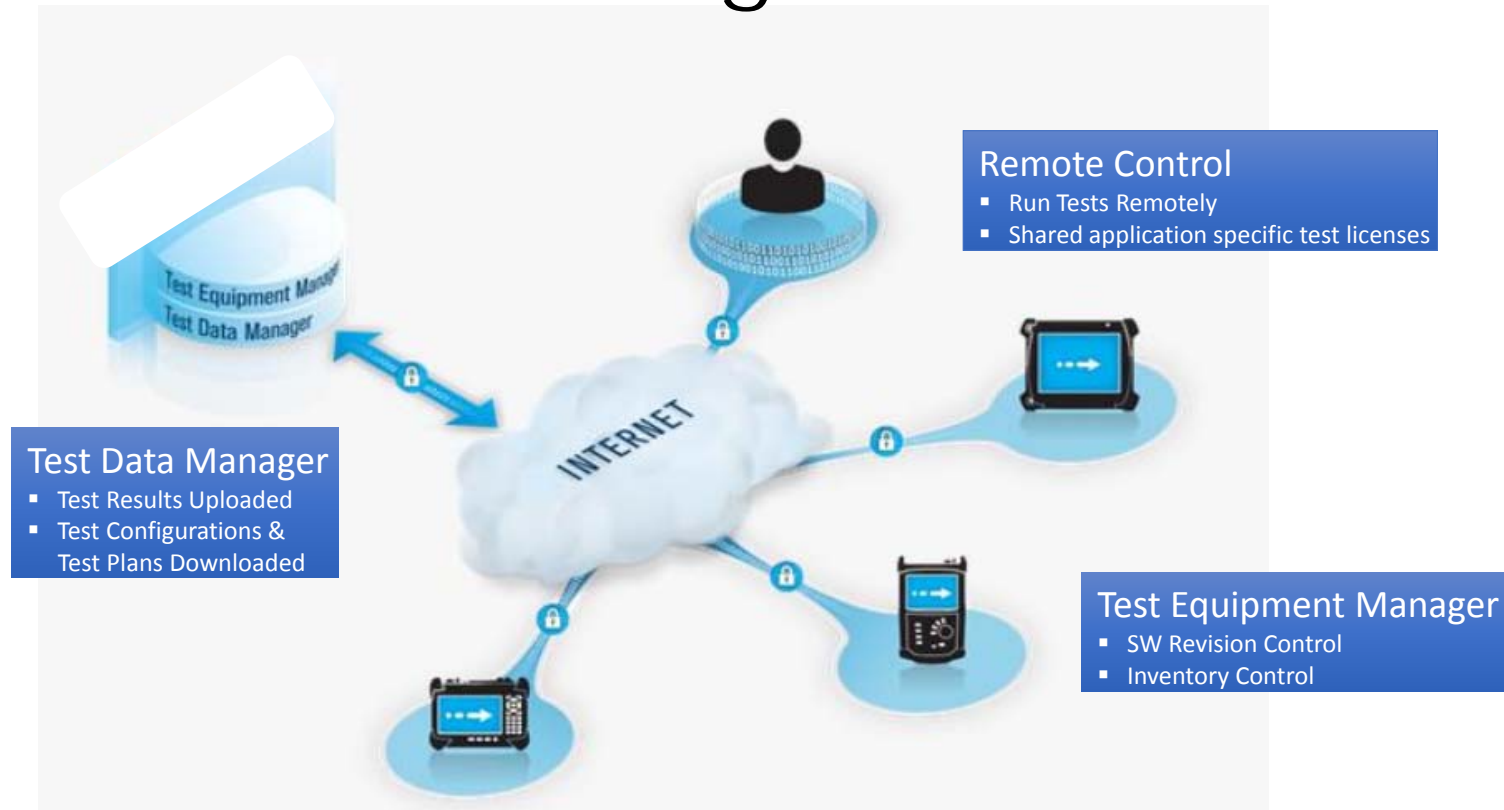

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Thank-You!

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