# Successful fiber deployment with automated Bi-Directional testing

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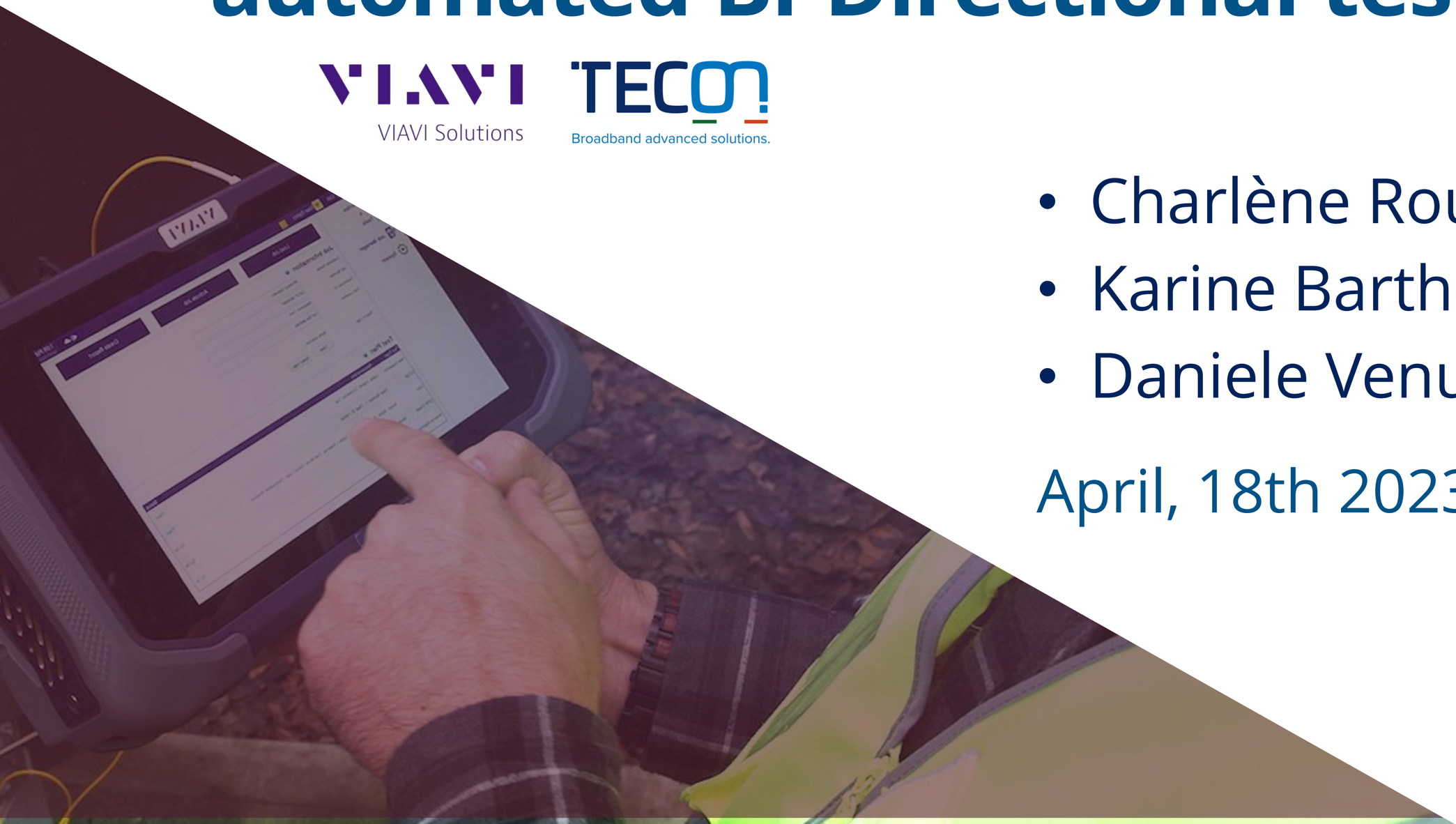


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# Agenda

- **Best Practices**
  - Tier 1 Tests
  - Tier 2 Tests
- **Zoom on Bi-Directional Tests**
  - What Standards Say
  - Benefits
  - Solutions: Single vs Two Instruments

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# Best Practices
## Tier 1 & Tier 2 Tests

When testing?

- At Greenfield, new network installation
- At Brownfield, network expansion
- On unused/dark fiber links before turn-up

### End Face Inspection/Certification

- Ensure pristine end-face condition PRIOR to mating
- IEC 61300-3-35

### Tier-1 (or basic) Certification (OLTS)

- Test procedures: IEC 61280-4-2 (Singlemode) and IEC 61280-4-1 (Multimode)
- Provides overall loss of link/channel
- Measures length via “time of flight”

### Tier-2 (or advanced) Certification (OTDR)

- Locate and characterize each passive optical elements (events): loss/attenuation and reflectance
- OTDR: Ideal fiber troubleshooting tool to quickly find the cause AND location of excess loss (incl. breaks) and reflectance
- Improve measurement accuracy and get the “true” loss values of all individual optical elements with bi-directional OTDR

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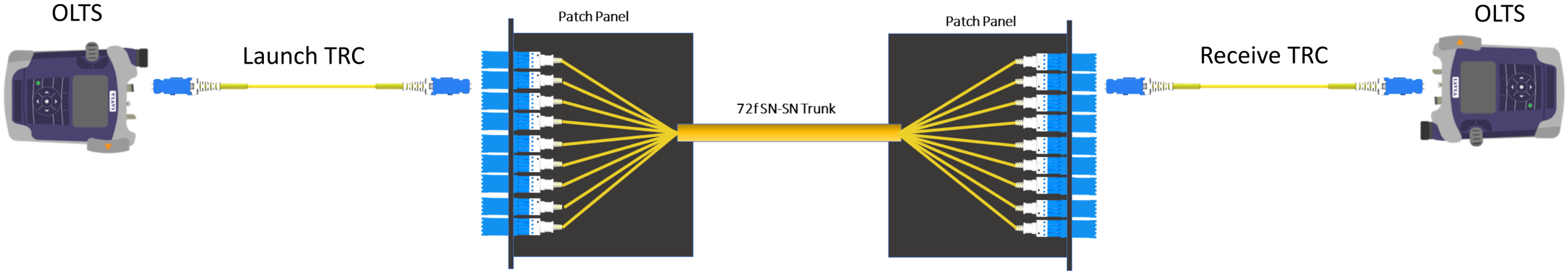
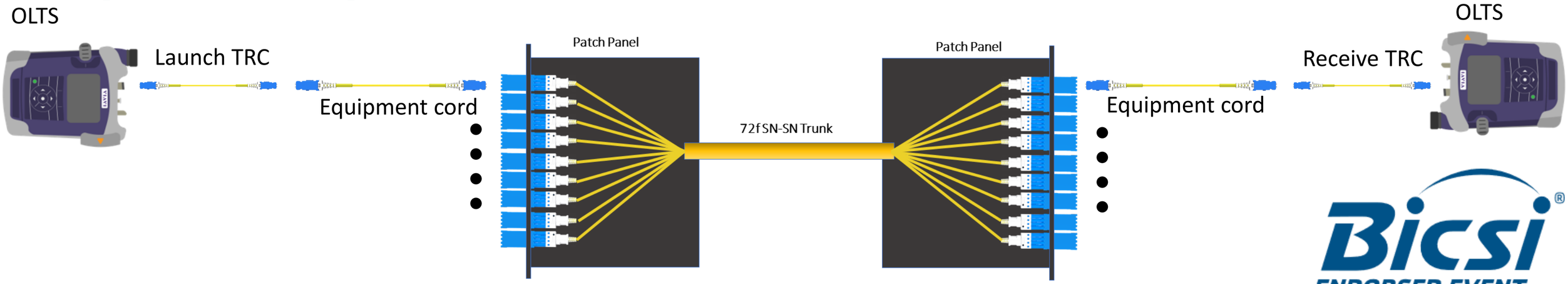
# What do we test?

- **Construction phase (Links)**




- **Operational phase (Channels)**

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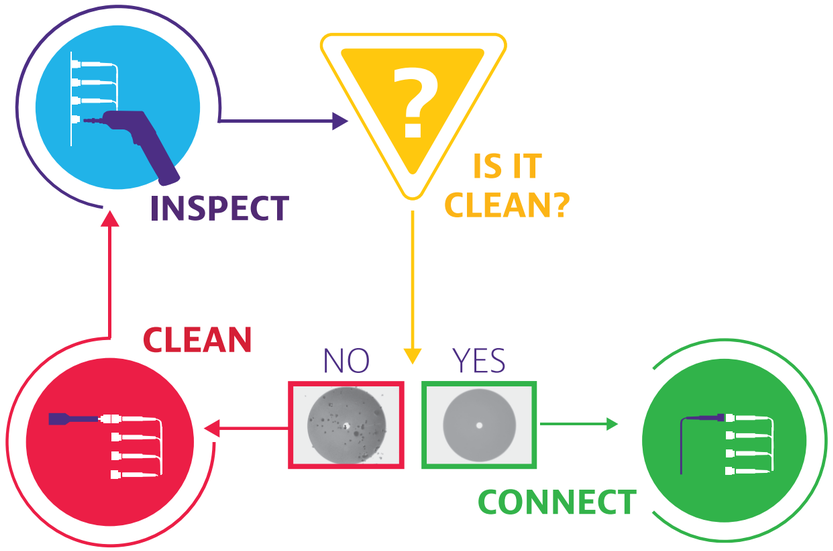
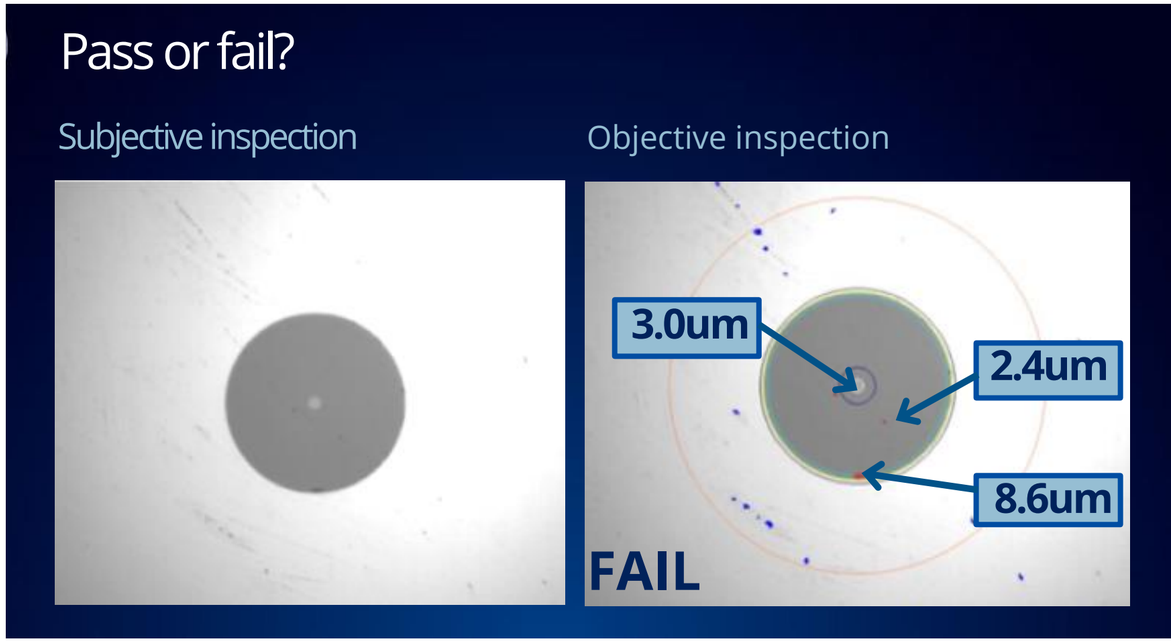
# Best Practices

## End Face Inspection & Certification

### Inspect Before You Connect℠ (IBYC)




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

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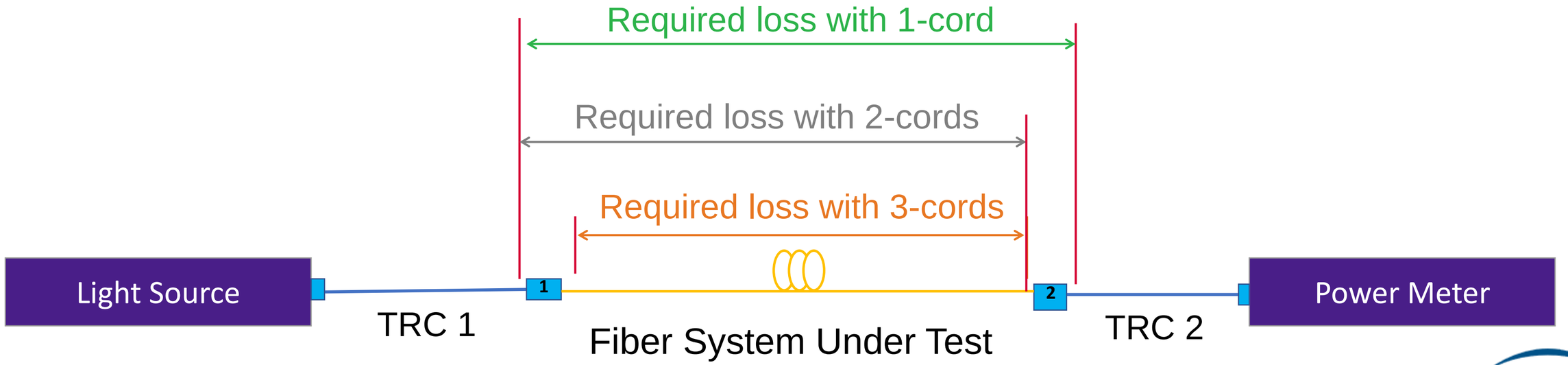
# Cabling Configuration & Applicable Test Methods (Tier-1)

| Cabling Config. | End connections attenuation included | Reference Test Method (RTM) |
|---|---|---|
| A. Adapters/bulkheads at both ends | 2 | 1-Cord |
| B. Plugs/patch cords on  both ends | 0 | 3-Cords |
| C. Mixed: adapter at one end, plug at the other end | 1 | 2-Cords |

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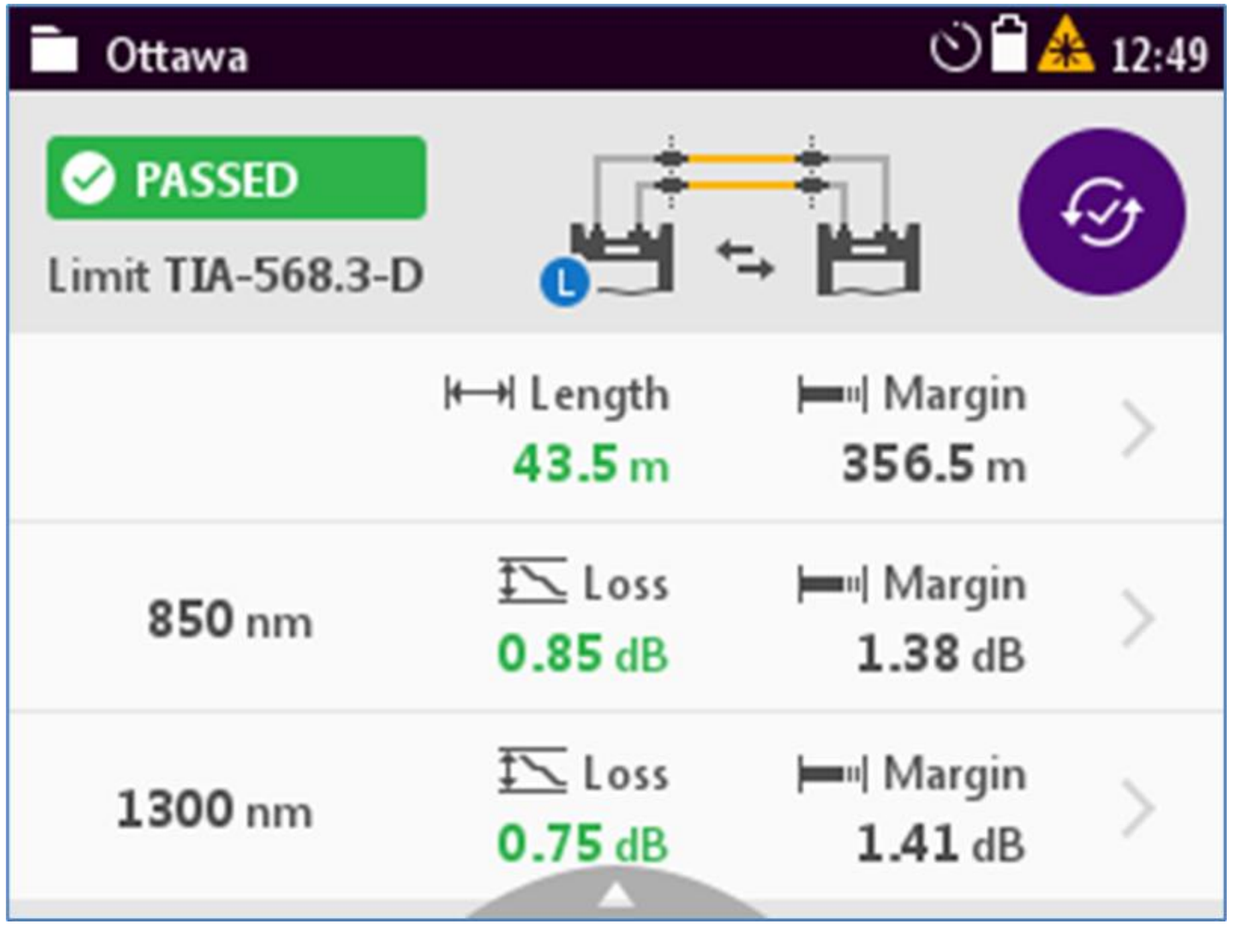
# Best Practices

## Tier 1 Certification

### Loss/Length Certification




- Measure Length
- Measure Loss
- Validate E2E Polarity
- Ensure Loss does not exceed a “limit” (AKA loss budget)
- Document results

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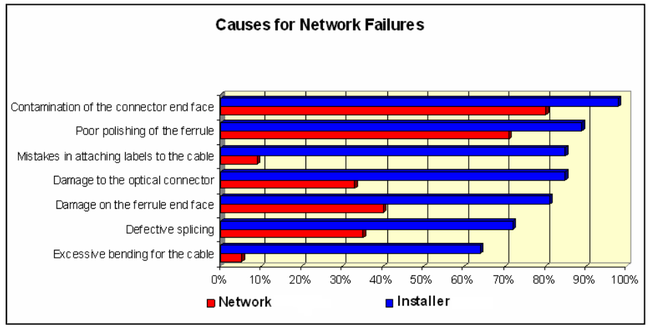
# Best Practices
## Tier 2 Test: using an OTDR

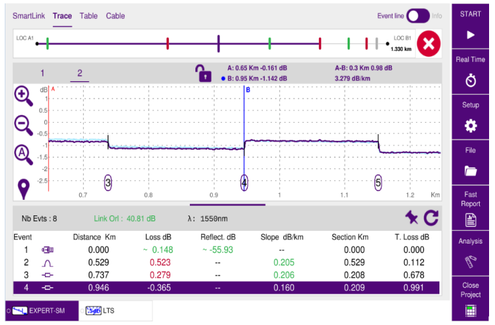
LAUNCH & RECEIVE test cables required

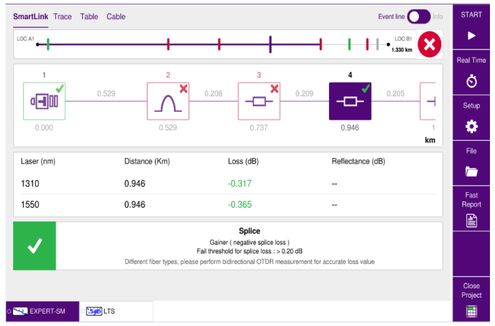
### Features
- IL & ORL : fiber link + Events
- Distance: link + Events localization

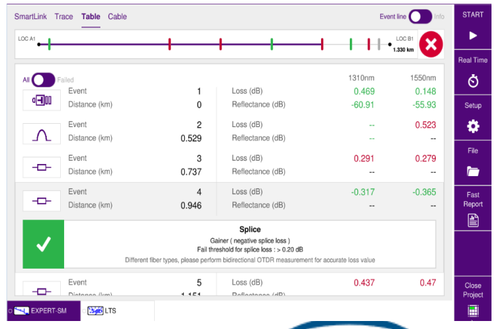




### Benefits
- Single ended measurement possible
- Precise Fault identification & location
- Permanent record of fiber

### User experience
- Trace
- Event table with pass/fail criteria
- Link map

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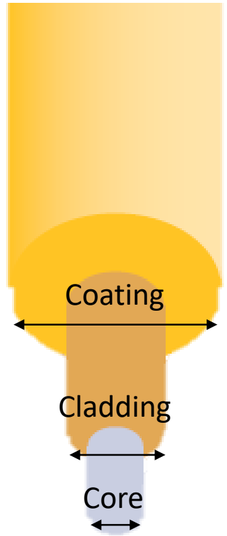
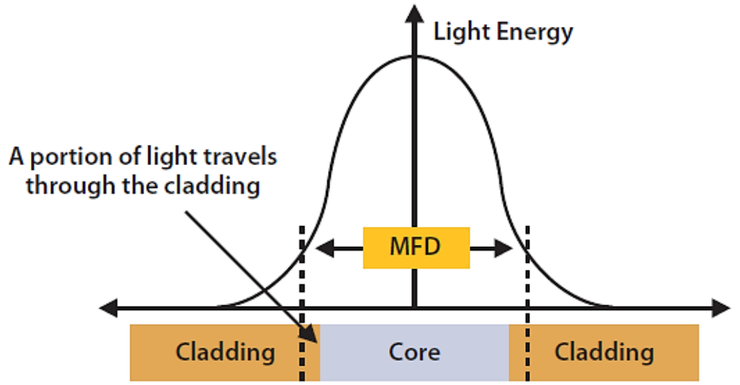
# Best Practices

## Tier 2 Test: Uni-directional OTDR limitations

1. **Close events detection**
2. **Proof of continuity**
3. **Total end to end loss** (including the end connector)
4. **Fiber mismatches leading to confusing results**




| Standards | ITU-T G.652.D | ITU-T G.657.A/.B |
|---|---|---|
| Wavelength (nm) | 1310 | 1310 |
| MFD (µm) | 8.6 to 9.5 ±0.6 | 8.6 to 9.2 ±0.4 |
| Max. Diff. (µm) | 2.1 | 1.7 |

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# Zoom on
# Bi-Directional Tests

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# Zoom on Bi-Directional Tests

## Bi-directional OTDR Benefits

### A->B direction : Apparent gain (False Positive)


### B->A direction: Excessive loss (False Negative)


***True*** **splice loss is the average:**

**( Event loss A->B + Eventloss B->A ) / 2**

**@1550 nm : 0,049 dB**

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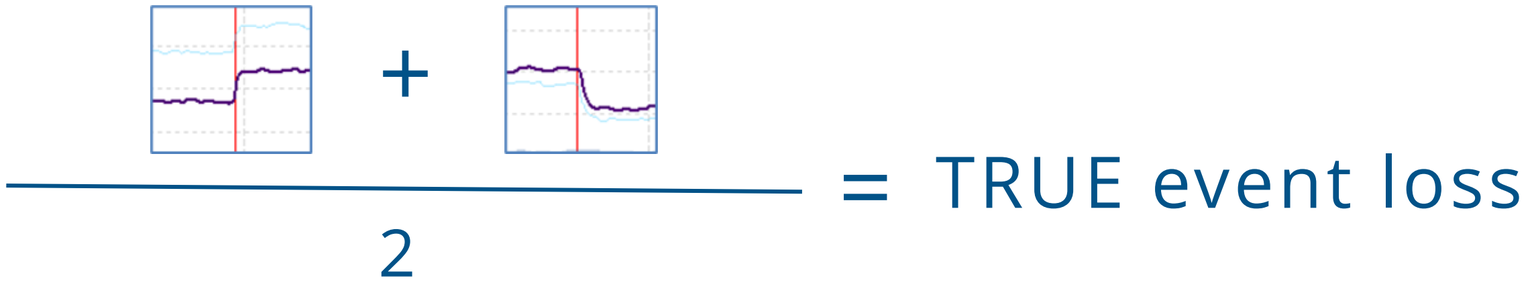
# Zoom on Bi-Directional Tests

## What Standards Say

### Bi-Directional OTDR Analysis




- The only method for accurate loss/event loss measurement per the international standards (IEC and TIA)
- Eliminate the effects of backscatter differences (≠ MFDs ) seen by the OTDR
- Commonly performed for acceptance testing of access feeders, metro and long-haul fiber cables
- Most accurate method to get the “TRUE” event loss
- Improves event detection and location accuracy

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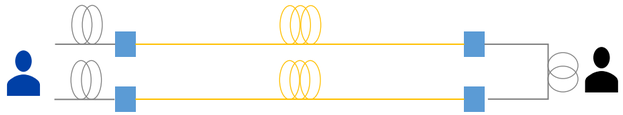
# Zoom on Bi-Directional Tests
## Test methods

| | Pro's | Limitations |
|---|---|---|
| **Manual End to End**  | • Closed events detected<br>• 1 instrument | 1. No proof of continuity<br>2. No total end to end loss<br>3. Averaging by Post processing off site |
| **Loopback**  | • Closed events detected<br>• 1 instrument | 1. No proof of continuity<br>2. Post processing off site<br>Short links only<br>Tests by pair<br>Mobile coverage for synchronisation |
| **Automatic End to End: TrueBIDIR**  | 1. Closed events detected<br>2. Proof of Continuity<br>3. Total end to end loss<br>4. Averaging automated on site, no post processing | • 2 instruments |

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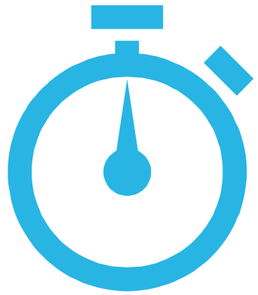
# Zoom on Bi-Directional Tests
## Time studies

| 576 fibers / 10 km | Manual End to End | Loopback | TrueBIDIR |
|---|---|---|---|
| No. of days | 2.9 | 1.9 | 1.3* |



- More than 2x faster than traditional methods
- Less than 1.5 days compare to almost 3 days for 576 fibers cable
- Only 3 days to payback the “extra” test set
- Contractor double its profit every year.

*Source of time optimization: instant continuity check, no calls required between techs at each end, parallel tasks, OTDR test time (Auto: 10s/wavelength)

# Zoom on Bi-Directional Tests

## Tier 2 Certification Summary – Key Points

**With Uni-Directional OTDR:**

- Precise events fault identification & location
- Permanent record of fiber link characteristics

**With Bi-Directional OTDR:**

- Better accuracy
- Compliancy and reliability

**With TrueBIDIR (Automated Bi-Directional + on site averaging):**

- Immediate corrective actions, reduced call backs
- Operational efficiency improved

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