Beginner's guide to OTDR testing:

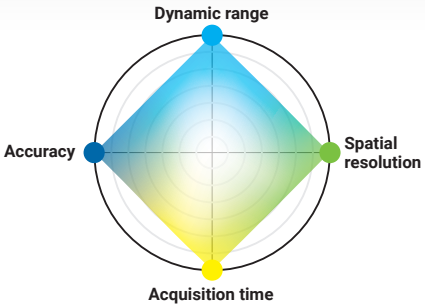
acquisition, trace analysis and intelligent automation

Smarter network in sight™

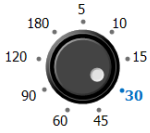
EXFO

Key test parameters

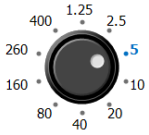
OTDR settings are a balance between dynamic range, acquisition time, spatial resolution and accuracy.



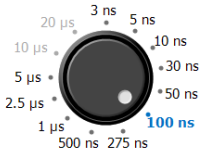
Three interacting parameters may influence test results:



Duration
Enables improvements in signal-to-noise ratio (SNR)

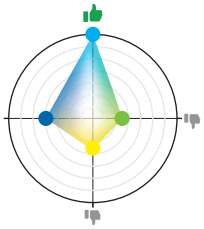


Distance range
Sets fiber length and sampling rate

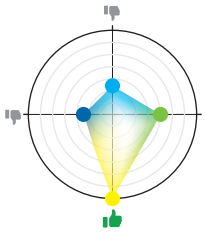


Pulse width
Determines acquisition power and resolution

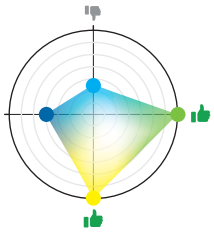
Optimizing one has an impact on the others:



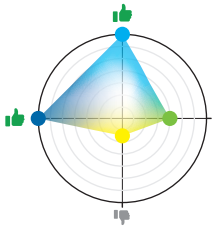
To maximize dynamic range (maximum distance), compromises must be made on testing time and spatial resolution.



To minimize testing time, compromises must be made on accuracy (detecting low loss elements).

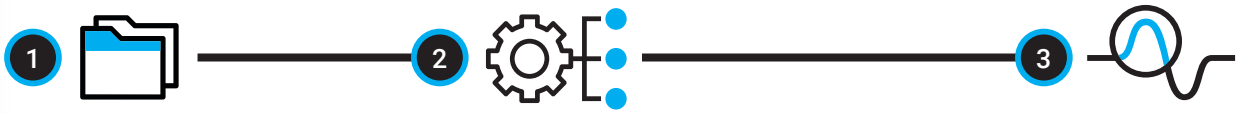


To maximize spatial resolution (detecting close elements), compromises must be made on maximum distance.



To maximize accuracy (detecting low loss elements), compromises must be made on testing time.

How to set up your OTDR



Define naming convention

Use the file naming and identification features.

Define optimal acquisition parameters using any one of these three options

Find any historical data available on link length/loss to set OTDR parameters accordingly.

or

Use **Automode** to discover the link under test. Based on the results, you may have to manually adjust some test parameters to detect more events.

or

You may also use **real-time mode** to adjust fiber range and pulse width.

Complete fiber characterization

Use **different pulse widths** to find any hidden event undetected by Automode.

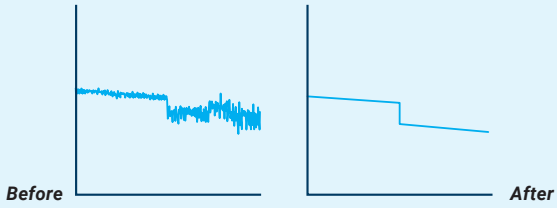
- Use the shortest pulse width to check the **front end** including the first connector of the link.
- Use larger pulse width to reach **longer distances** and/or to characterize optical splitter (for FTTH/PON).

How to set up your OTDR

Common issues

Solutions

Noisy trace

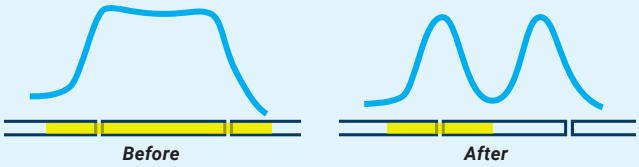


Increase averaging time (minimum 45 s).

or

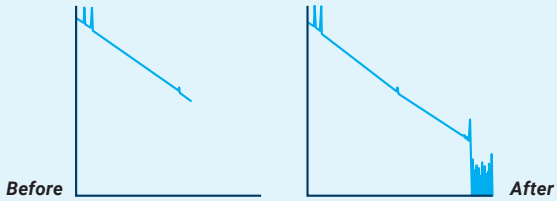
Increase to the next larger pulse width.

Events not visible or missing



Event might be located within the OTDR dead zone. Try reducing pulse width to heighten resolution and discriminate closely spaced events.

No fiber end

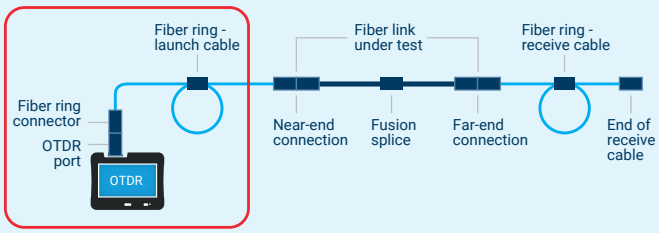


- Adjust distance range to approximately 120% of expected link length.
- Increase pulse width for more dynamic range.

OTDR connector fail

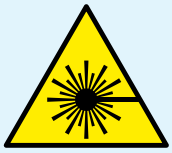
- Inspect OTDR port connector and clean if required.
- Use launch cable to measure the first connector of the link.
- Ensure OTDR port connector reflectance is < –45 dB.

Bad launch conditions



- Inspect launch cable connectors for dirt, damage or wrong connector type.
- Use a launch cable with the minimum length for the selected pulse width.

Live fiber detected (testing on a live network)

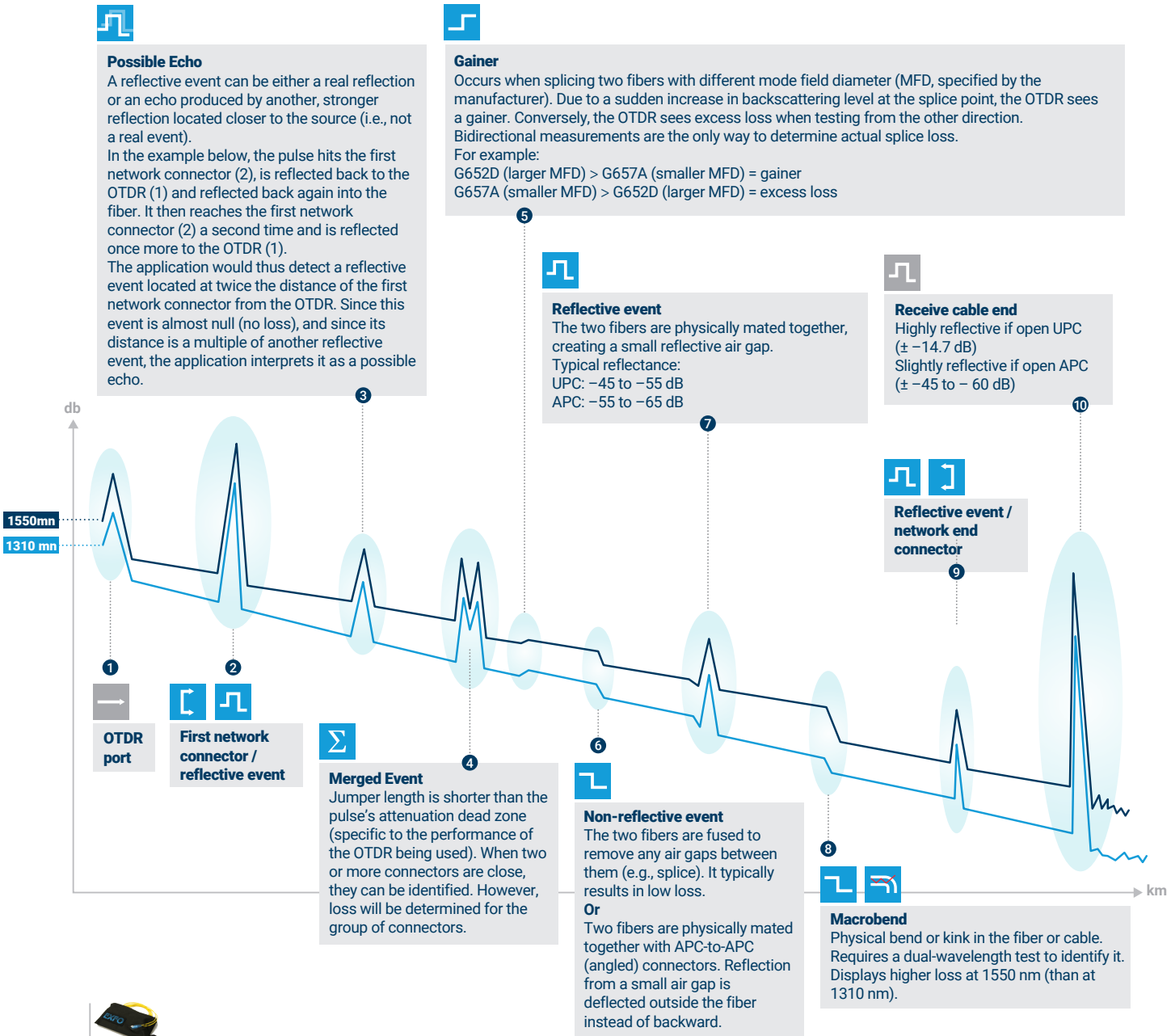


Use an out-of-band test wavelength (1625 nm or 1650 nm) on a filtered port.

or

Use an out-of-band test wavelength (1625 nm or 1650 nm) and external filter excluding incoming signal wavelength.

How to read an OTDR trace



Possible Echo
A reflective event can be either a real reflection or an echo produced by another, stronger reflection located closer to the source (i.e., not a real event).
In the example below, the pulse hits the first network connector (2), is reflected back to the OTDR (1) and reflected back again into the fiber. It then reaches the first network connector (2) a second time and is reflected once more to the OTDR (1).
The application would thus detect a reflective event located at twice the distance of the first network connector from the OTDR. Since this event is almost null (no loss), and since its distance is a multiple of another reflective event, the application interprets it as a possible echo.

Gainer
Occurs when splicing two fibers with different mode field diameter (MFD, specified by the manufacturer). Due to a sudden increase in backscattering level at the splice point, the OTDR sees a gainer. Conversely, the OTDR sees excess loss when testing from the other direction. Bidirectional measurements are the only way to determine actual splice loss.
For example:
G652D (larger MFD) > G657A (smaller MFD) = gainer
G657A (smaller MFD) > G652D (larger MFD) = excess loss

Reflective event
The two fibers are physically mated together, creating a small reflective air gap.
Typical reflectance:
UPC: −45 to −55 dB
APC: −55 to −65 dB

Receive cable end
Highly reflective if open UPC (± −14.7 dB)
Slightly reflective if open APC (± −45 to − 60 dB)

Reflective event / network end connector

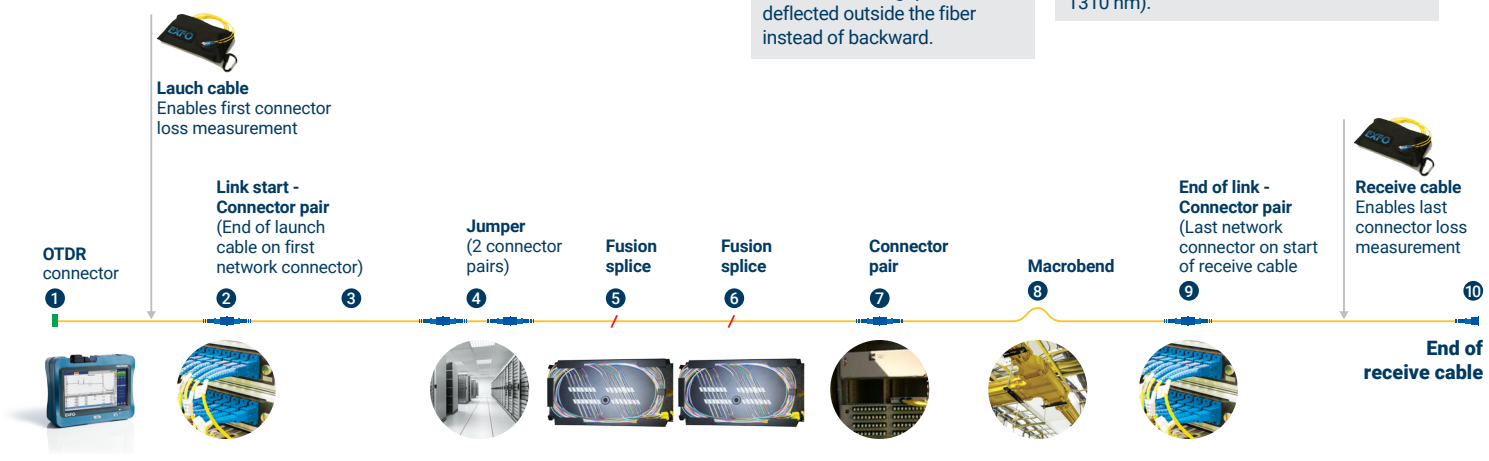
OTDR port

First network connector / reflective event

Merged Event
Jumper length is shorter than the pulse's attenuation dead zone (specific to the performance of the OTDR being used). When two or more connectors are close, they can be identified. However, loss will be determined for the group of connectors.

Non-reflective event
The two fibers are fused to remove any air gaps between them (e.g., splice). It typically results in low loss.
Or
Two fibers are physically mated together with APC-to-APC (angled) connectors. Reflection from a small air gap is deflected outside the fiber instead of backward.

Macrobend
Physical bend or kink in the fiber or cable. Requires a dual-wavelength test to identify it. Displays higher loss at 1550 nm (than at 1310 nm).



A smarter way to do OTDR tests

iOLM

intelligent Optical Link Mapper

iOLM is an EXFO OTDR-based application designed to simplify OTDR testing by eliminating the need to analyze and interpret multiple complex OTDR traces. Its advanced algorithms dynamically define the testing parameters, as well as the number of acquisitions that best fit the network under test. By correlating multipulse widths on multiple wavelengths, iOLM locates and identifies faults with maximum resolution—all at the push of a single button.

How it works

Dynamic multipulse acquisition

iOLM algorithms dynamically define test parameters as the acquisition progresses to automatically adapt to different fiber conditions. The iOLM can perform numerous acquisitions with various parameters (pulse width, averaging time, resolution) at several wavelengths.

Intelligent trace analysis

Based on multiple acquisitions and using advanced algorithms, iOLM can detect more events with maximum resolution.

A single pulse width might not provide optimal information to determine all of an event's characteristics. For maximum accuracy, measure each event and each characteristic using data from multiple acquisitions to precisely determine their loss, location and reflectance.

Combine all results in a single link view

Results are visually displayed in an icon-based fiber-link view to quickly assess each event's pass/fail status per standard selected, eliminating any risk of misinterpretation.

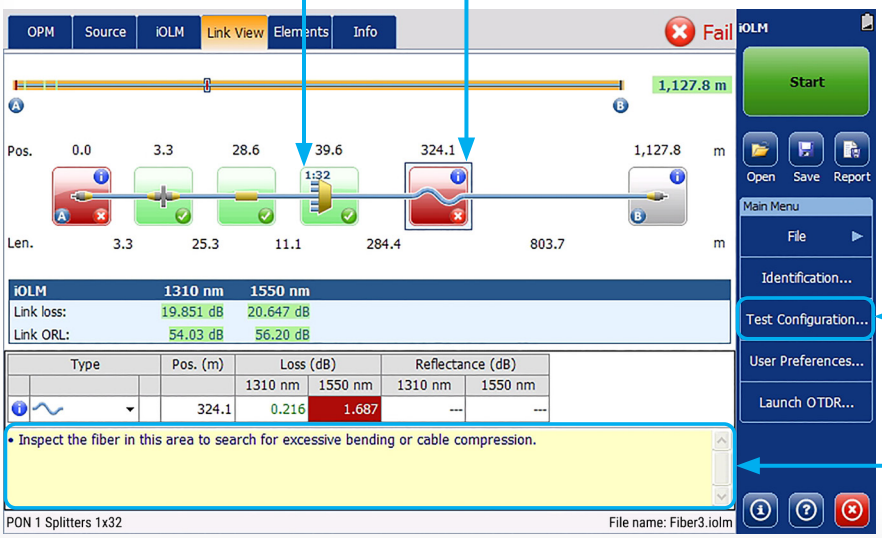
Comprehensive diagnosis

Delivers an analysis of failed events and suggests solutions, guiding technicians in fixing faults quickly and successfully.

Turning traditional OTDR testing into clear, automatized, first-time-right results for any technician, regardless of experience.

Automatic splitter ratio recognition for FTTH/PON testing.

Automatic macrobend identification.



Test Configuration...

Create and share with your peers as many test configurations as needed for specific jobs or network types. Test configurations define pass/fail criteria and network type (i.e., point-to-point [P2P] or with PON splitters).

Actionable insights and guidance to fix the link.

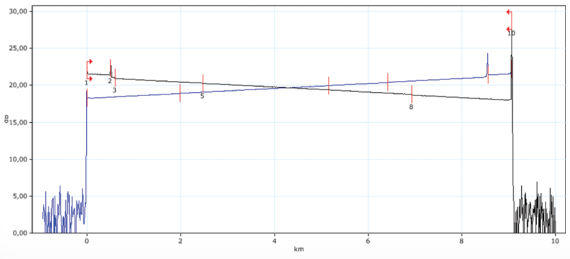
iOLM testing methodologies

Bidirectional testing

Bidirectional averaging testing is used for accurate splice loss measurement and is recommended in any type of application with singlemode point-to-point fiber links. Software applications, such as EXFO's FastReporter, will make the distinction between fibers in the reporting of bidirectional testing results, no need for post-processing.

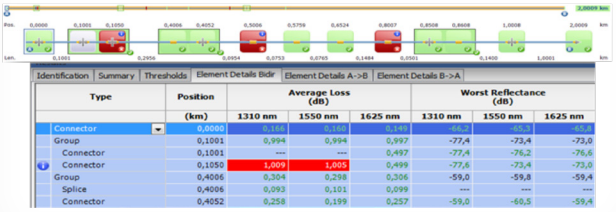
Traditional bidirectional OTDR view

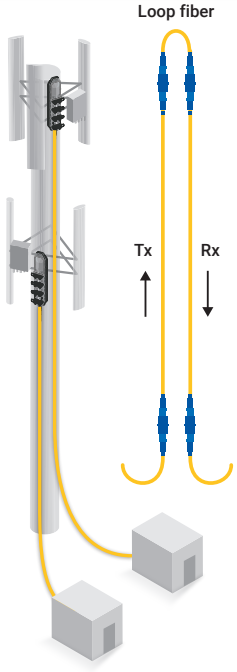
Single OTDR pulse with A to B and B to A directions



Single iOLM bidirectional view

Combining multipulses, multiwavelengths and multidirections
Patented (US9134197B2)





Loopback testing (iOLM)

Loopback testing

- Loops two fibers together at one end to test both fibers at once
- Software application will distinguish between the fibers in the reporting
- Particularly efficient in short- to medium-range fiber deployments
- Allows to test both upstream and downstream links with a single port—ideal for FTTA or DAS applications

Benefits of loopback testing

- 50% less testing time
- Single-ended test: less test equipment is required
- Performing loopback testing with two technicians requires minimal expertise from the second technician
- Distinct results for each fiber tested in loop (both OTDR and iOLM)
- Intuitive link view (iOLM) or traditional graphical view (OTDR) to identify loop section easily
- Easier and faster bidirectional acquisition with no post-processing required

We are here to help.
For more information, visit **EXFO.com**.