Gigaclear Documentation
Optical Time Domain Reflectometry (OTDR) Supplier Guide

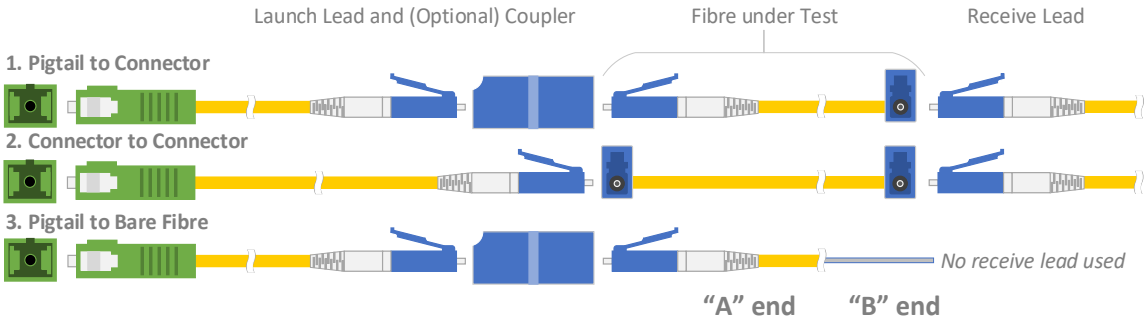
1. Scope and Introduction

This document is a quick reference guide for suppliers who have been asked to perform optical time-domain reflectometry (OTDR) testing on the Gigaclear network **on an ad-hoc basis** for special purposes. While the principles and guidance in this document is largely the same as our as-built standard, this document focuses on testing for activities such as:

- BT PIA installations overhead and underground
- Pre/post-installation cable tests
- Post-provision link and span tests

All testing done as part of "as-built" handover of *completed network segments* (e.g. active cabinet to drop cabinet) as part of network build should be done in accordance with the guidance in the Optical Build and Testing document contained in the main network specifications pack.

This document covers three test scenarios, outlined in the diagram below.



If EXFO's iOLM software is being used, then there is no need – unless explicitly requested – to perform bidirectional tests or insertion loss measurement tests. A single iOLM test will suffice.

2. Required Equipment

All testing must be performed with EXFO MaxTester OTDRs or EXFO FTBx modules in an EXFO FTB series chassis. Tests performed with other vendors' OTDRs *may* be accepted on a case-by-case basis if approved by the Chief Engineer.

The recommended test equipment is the most commonly found OTDR in use by many contractors, the EXFO MaxTester 730C with the SM8 optical configuration (1310/1550nm main port, 1650nm filtered port). Testing is only required at 1310/1550nm in most cases, but 1650nm tests are required for transport link testing.

Where tests are being performed to prove "connector to connector" performance, an automated inspection probe (microscope) image is also part of the evidence that must be provided; for this purpose, an EXFO FIP435B must be used. Other probes *may* be accepted on a case-by-case basis.

Tips must be the correct type for the connector being inspected. An inspection probe is required for all testing to ensure fibre cleanliness, even if the connector images are not required for evidence.

For pigtail tests commonly used to prove cables, a splicer, cleaver, and accessories will be required to attach the pigtail to the fibre. Bare fibre adapters are not recommended, but the Divot system and index matching gel may be used; a cleaver is still required to prepare the fibre to achieve an acceptable connection.

Cleaning supplies are required in all cases – Gigaclear recommends Sticklers CleanStixx and CleanWipes for connector and fibre cleaning. Isopropyl alcohol of at least 99.9% purity is required.

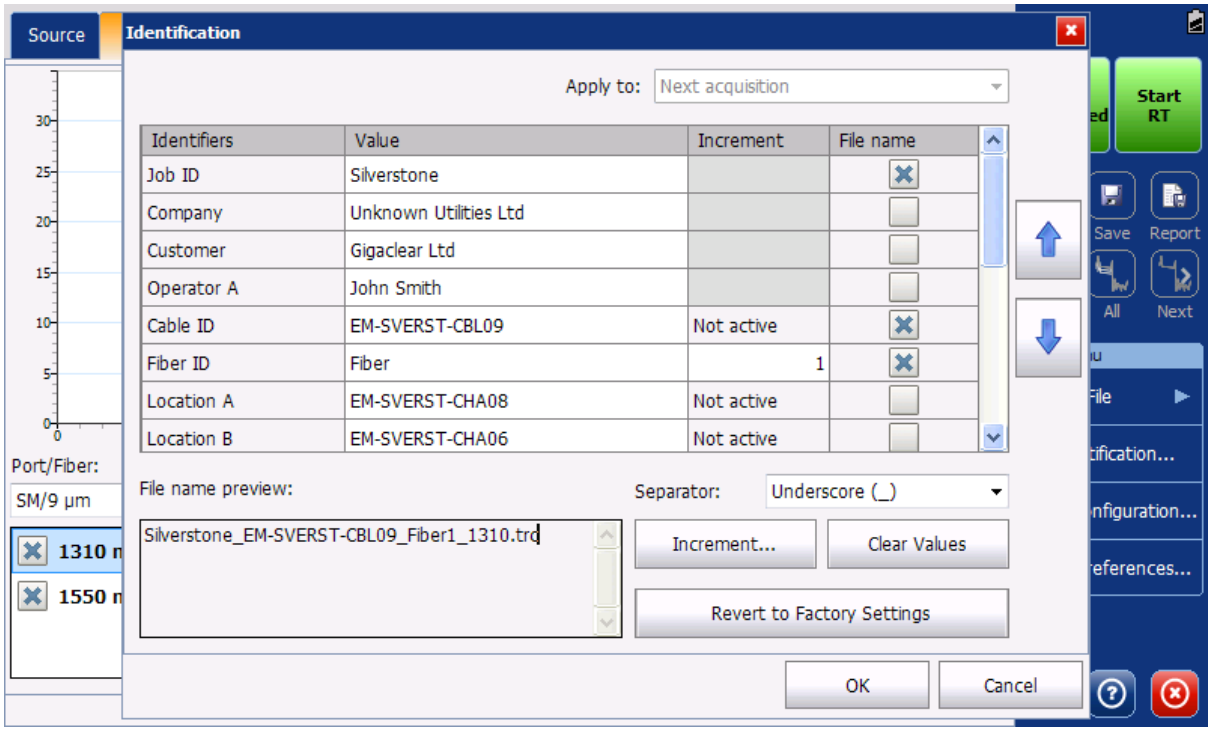
3. Test Labels and Identification

If you are a Gigaclear contractor with access to EXFO TestFlow, ask for the required tests to be issued to you through TestFlow; this allows Gigaclear staff to specify exactly the tests to be performed and pre-labels all of the tests, as well as providing you with an appropriate configuration.

Otherwise, the test labels will vary depending on the application. However, they must in all cases:

- Be clear and unambiguous as to what they are testing
- Identify the cable and fibre, or connector, where the test device was connected
- Make use of Gigaclear supplied identifiers (cable name, cabinet name, etc) in their “fully qualified” or long form (e.g. EM-SVERST-CBL09, not just CBL09) wherever possible
- Record the name of the company doing the work as well as the individual operator performing the tests
- Record the location of tests (chamber names for cable installation tests, cabinet names for cabinet-to-cabinet tests, etc)

Underscores should be used as separators in file names, and file names should include the key identifying information. An example of an OTDR configuration for a cable post-installation test is shown below.



4. Performing Tests

Best practice in fibre hygiene must be followed throughout testing – see the sidebar for a primer.

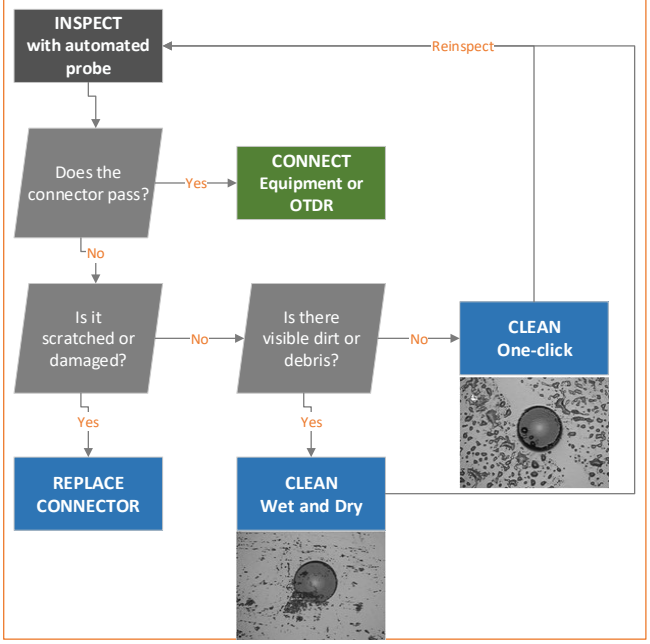
Connectors should be inspected and cleaned immediately before connection – dust caps should not be relied upon to protect connectors between inspection and use, as they cannot be guaranteed to be clean.

Launch and receive leads must always be used. Gigaclear recommends 150m launch leads and 2.2km receive leads. The exception is cable testing, where the far end is a bare fibre; a launch lead must still be used but the receive cable may be omitted.

Gigaclear prefers and in all cases recommends the use of EXFO's iOLM software which performs a fully automated test sequence over multiple wavelengths. This should always be used where it is available unless there is evidence that iOLM is not able to operate on the fibre under test for some reason. iOLM tests should be taken in these scenarios to evidence the failure.

Fibre Cleanliness

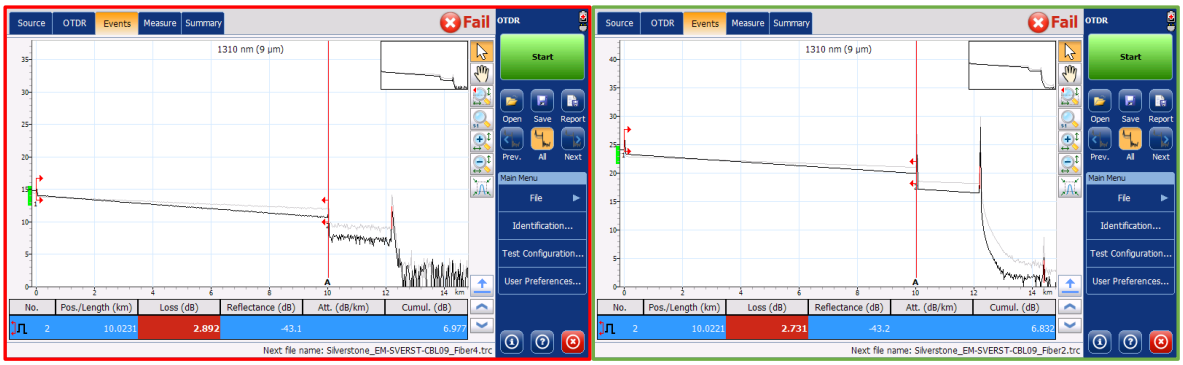
Fibre must be kept clean to prevent damage to the network and to produce valid test results. Dirty fibre connectors will not pass a test, and can damage test equipment or connectors in the network. Fibre must also be kept clean during splicing operations to prevent damage to splicers or poor splice performance. **Follow this process before connecting!**



Where manual OTDR tests are taken, multiple tests may be required to completely characterise a link. On short links such as <2km cable tests, a single short pulse and duration (such as $0.5\mu s/5ns$ for 30 seconds) may suffice – at least one OTDR trace must clearly show the end reflecting event, and the noise floor should be consistently $10dB$ below the end of the cable. Test durations of less than 15 seconds are not recommended on any length of cable.

It is recommended to use the "auto setting" mode of any OTDR that supports it, and to ensure that the test duration is sufficiently high to achieve the low noise floor and accurate measurement of all elements.

Below are shown two tests – the only distinction being that the left hand trace was captured with a 30ns pulse for 5 seconds, the right hand trace is a 30ns pulse for 15 seconds. The loss is much more accurately characterised in the 15 second trace, with a clear cable end event.



5. Pass/Fail Criteria

The exact pass/fail criteria for the link in question will depend on the application. However, the following general pass/fail criteria are always applied.

Cables and spans within a trace shall meet or exceed the following:

- Span reflectance: $< -40dB$ reflectance
- Span loss at 1310nm: $< 0.35dB/km$
- Span loss at 1550nm: $< 0.25dB/km$
- Span loss at 1650nm (if tested): $< 0.25dB/km$

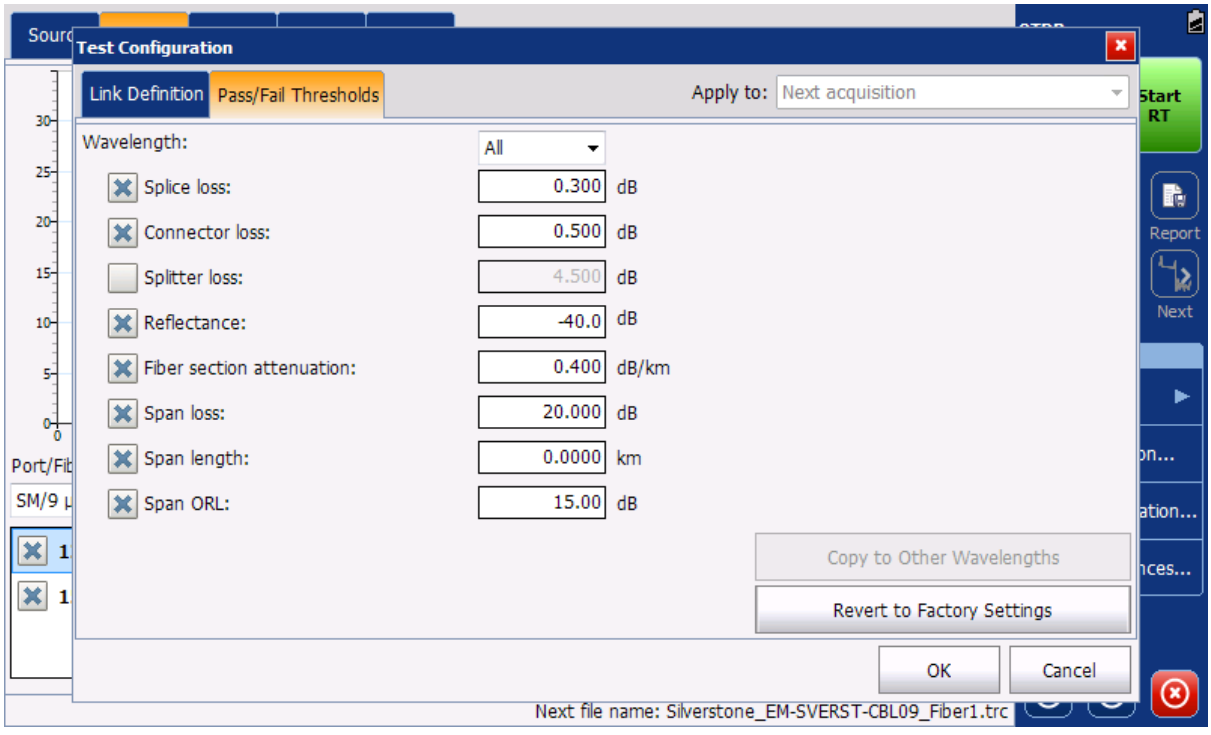
Splices and connectors shall meet or exceed the following:

- Splice: $< 0.3dB$ unidirectional loss, $< 0.1dB$ bidirectional loss (if tested)
- UPC connector: $< 0.5dB$ unidirectional loss, $< -40dB$ reflectance
- APC connector: $< 0.5dB$ unidirectional loss, $< -55dB$ reflectance

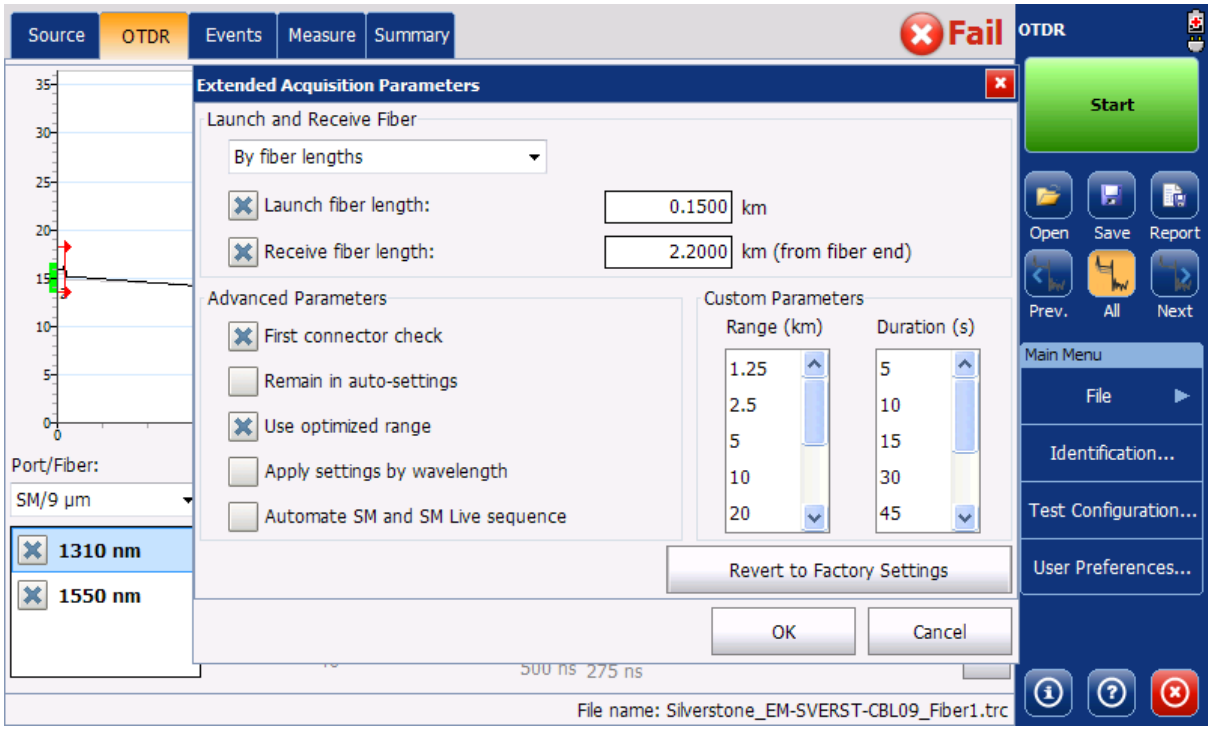
6. Tester Configuration

Generally, Gigaclear-supplied configuration files should be used. However, pass/fail criteria should be configured manually if these files are not used.

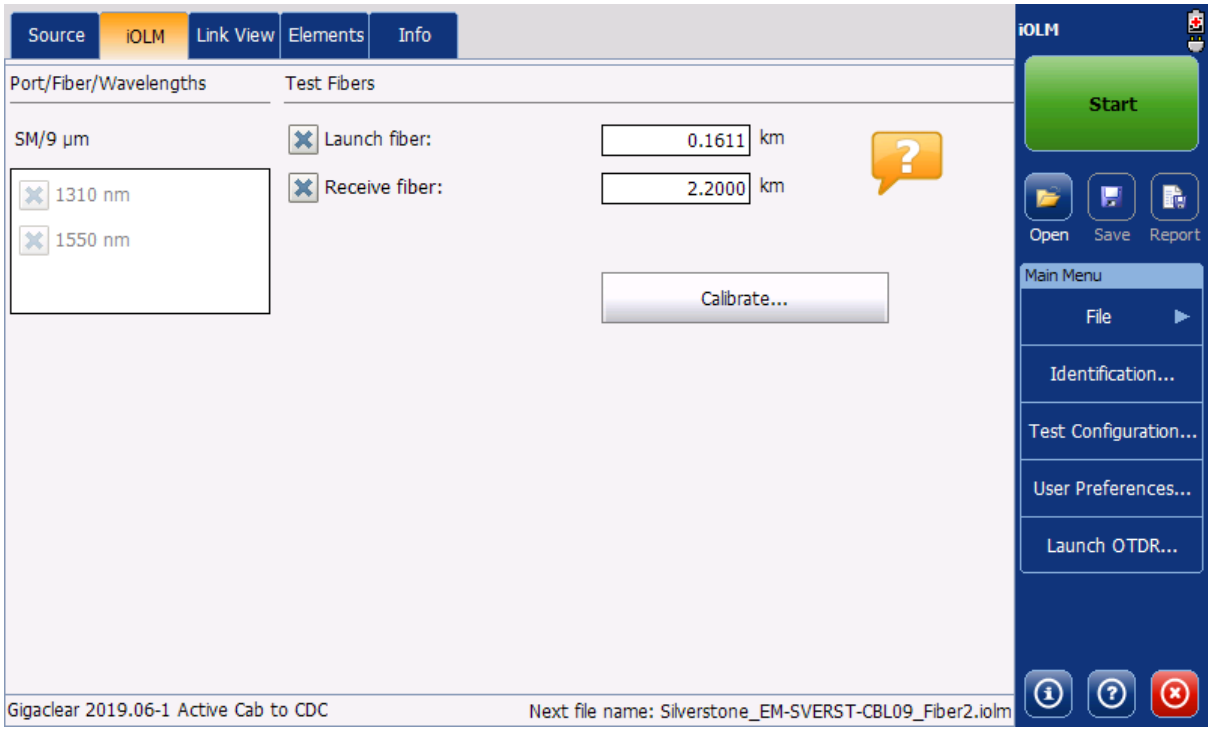
An example of an OTDR test configuration showing this specification is:



Other than setting thresholds, test identification, and acquisition parameters correctly, launch and receive leads must be used and configured in the acquisition settings. First connector checks and optimized range settings should be checked in the OTDR mode.



iOLM configuration follows a similar but simpler process – use the calibration function to accurately set launch and receive fibre lengths if possible. The configuration file for iOLM may be manually configured in accordance with the pass/fail criteria, or a Gigaclear supplied configuration file for ad-hoc testing may be used.



7. Version History

Version	Date	Notes
1.0	2019-07-02	First issue