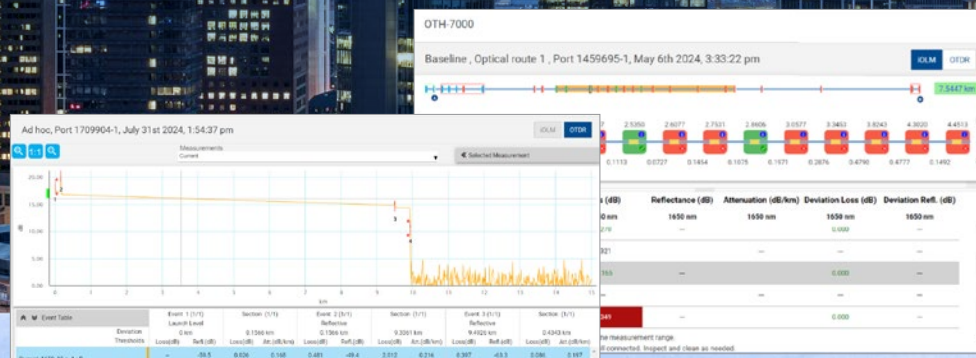


EXFO remote fiber testing and monitoring (RFTM)

SOLUTION OVERVIEW

SERVERLESS REMOTE OTDRS



FAST



ACCURATE



RELIABLE



SMART



COMPACT



ENERGY
EFFICIENT



AUTOMATED

Smarter
network
in sight.™

EXFO

EXFO develops smarter test, monitoring and analytics solutions for the global communications industry.

We are trusted advisers to fixed and mobile network operators, hyperscalers and leaders in the manufacturing, development, and research sector. Our customers count on us to deliver superior visibility and insights into network performance, service reliability and user experience. Building on decades of innovation, EXFO's unique blend of equipment, software and services enable faster, more confident transformations related to 5G, cloud-native and fiber-optic networks.

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1 EXFO REMOTE FIBER TESTING AND MONITORING (RFTM)

The EXFO RFTM solution provides end-to-end link testing, diagnostic and proactive monitoring for any type of fiber network. Its industry-acclaimed OTDR-based technology and automation empowers users to easily and efficiently trigger remote tests.

At the core of this solution is an OTDR engine, which directly influences the accuracy and speed of results. High-quality, reliable results are essential for any system; otherwise, it's simply 'rubbish in, rubbish out.' EXFO is a world leader in OTDR technology, supplying more OTDR technology than all our competitors combined. Over many years, we have tested nearly all major fiber networks worldwide, using that plethora of data to continuously refining our engine, technology, and algorithms.



Fast



Accurate



Reliable



Smart

Whether you operate a small network (e.g., municipality, private network, small MSO, etc.) or a countrywide network, EXFO can help you choose the right type of OTDR-based centralized testing and monitoring to meet your return-on-investment targets.

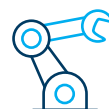
Looking for the highest performance and density together with the fastest testing? The **RTU-2** powerhouse is designed for you. Prefer an OTDR white box instead? The new **OTH-7000** is exactly that—it gives hyperscalers, NEMs and system integrators great value for the price without any compromise on the OTDR unit's ability to detect and monitor the optical infrastructure's weaknesses and degradations before they become critical and require urgent restoration. All this in a dense, compact form factor down to ½ RU with power consumption as low as 10 W.



Compact



Energy efficient



Automated

EXFO's solutions for remote fiber testing and monitoring deliver key functions and innovative capabilities that are unmatched:

- Automation of OTDR measurements using patented Link-Aware™ (iOLM) technology providing detailed end-to-end (E2E) fiber characterization without requiring effort nor OTDR expertise
- Capability to read and use fiber/cable documentation data, managed externally into alarm workflows
- Fully web-based application, including a GIS function for fault-on-map capability
- Denser solution (up to 1024 ports in 3U) for large FTTH central offices using MPO-type connectors on optical switches
- First and only RFTS solution with phone-home and event-based communication architecture enabling scalability, higher IT security and cloud operability

EXFO can also complement your remote fiber testing solution and boost technician efficiency in the field thanks to a large portfolio of intelligent and connected handheld test instruments.



2 FLEXIBLE DEPLOYMENT TO FIT YOUR IT REQUIREMENTS

From serverless use cases to FMS centralized management, EXFO's RFTM offers flexible solutions for the deployment and operation of our portfolio of remote OTDRs. This document covers serverless scenarios. For more information on FMS centralized management, consult the [RFTM technical brochure](#).

	TEST AGENT 2.0	CONNECTED TEST AGENT (API)	FMS-IN-A-BOX	FMS-AS-A-SERVICE	CUSTOMER MANAGED FMS HOSTING
Highlights	Test head UI accessible locally or remotely (no FMS)	Test heads configured as client API hardware (no FMS)	FMS deployed on pre-installed dedicated server	FMS deployment in the EXFO managed cloud	FMS deployed on-premises or in a customer-managed cloud
Applications supported	P2P ad-hoc test and deviation analysis	P2P ad-hoc test and deviation analysis	P2P test & monitoring	P2P test & monitoring: PON build, connect & assure	P2P test & monitoring: PON build, connect & assure
Key selection driver	Need OTDR capability for reactive maintenance (no monitoring/prevention) No connectivity on RTU site (can operate as a closed system) Low complexity	Need OTDR capability for direct integration with customer OSS (API) Complete end-to-end control Scalability	No connectivity on RTU site (can operate as a closed system) Complete end-to-end control with no IT maintenance Autonomous operation Simpler deployment than on-prem	No IT skills required Free up internal IT resources Faster deployment Scalability FMS integration with existing OSS	Complete end-to-end control Scalability FMS integration with existing OSS Can work in air-gapped environments
IT install skills required	Low (IP address config)	Low (IP address config)	Mid (Linux CLI)	Low	High
Test-acquisition mode	OTDR + iOLM	OTDR + iOLM	iOLM (+ ad hoc OTDR)	iOLM (+ ad hoc OTDR)	iOLM (+ ad hoc OTDR)
Mobile app support	NO	NO	NO	YES	YES
Local switch support	YES	YES	YES	YES	YES
Remote switch support	NO	NO	NO	YES	YES
Multiple test units centralized management	NO (access 1 at a time)	YES – Customer responsibility from their centralized solution	NO (1 per server)	YES (up to 1,000 in FMS)	YES (up to 1,000 in FMS)
Software – commercial model	No software fee	No software fee. API starter pack (for integration)	Perpetual license included	Annual subscription	Perpetual license

3 SERVERLESS APPLICATION: WEBUI WITH LOCAL OTDR TESTS AND SUPPORTED APIS FOR THIRD PARTY INTEGRATION

Instead of being controlled by EXFO FMS, remote test units can be configured to be controlled directly through its WEBUI or by your network management system (NMS) via open REST APIs on the unit.

The web interface of the remote test units also allows the local creation of local routes and execution of different tests (baseline, test on-demand and ad hoc) which can be visualized in standard OTDR and in EXFO's proprietary iOLM format. Historical status of the tests and related measurements are kept locally on the remote test units.

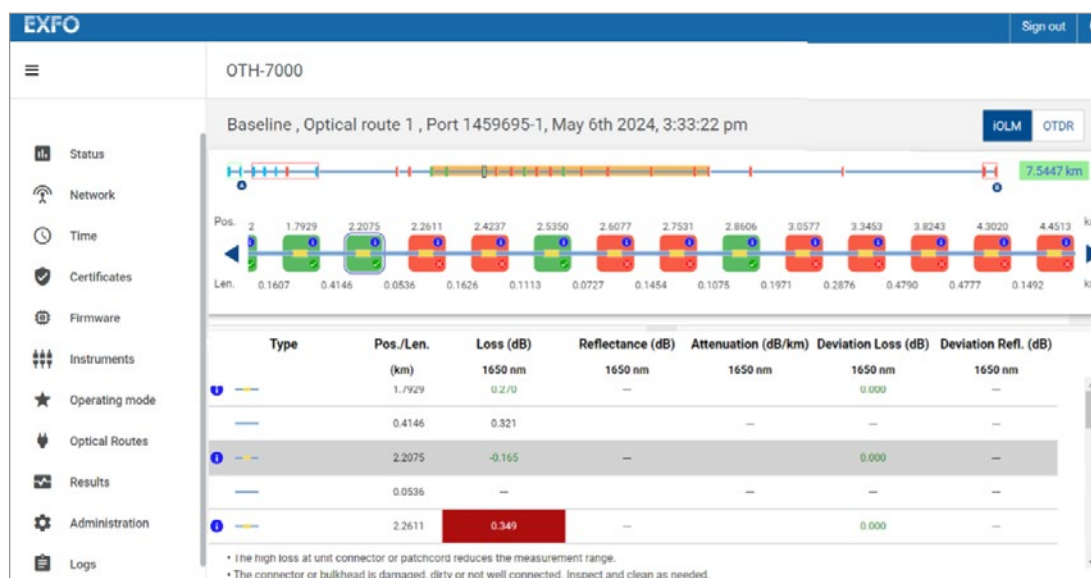


Figure 1. EXFO remote test units WebUI for serverless applications.

Integrate the remote test units client API to your corporate system to store OTDR measurements, perform analysis operations (such as fiber loss calculations) or create configuration files and templates for fiber breaks and degradations. The remote test unit client API removes fiber monitoring EMS requirements and bundles remote equipment control/management into fewer software instances within the corporate network.

Execute tests to detect and precisely locate any deviation from the initial condition with standard OTDR technology (Bellcore .sor). Testing can be programmed or launched on demand from your OSS or SDN controller to get OTDR measurements and perform further analysis. The remote test unit will return the fault status (dB loss and distance) from a simple API call.

Based on a known IP or machine name, you can easily query optical test inventory. For instance, if your NMS or OSS detects a device outage, you can integrate the remote test unit client API to determine if the root cause is related to the fiber, hence reducing mean time to understand (MTTU) when a lack of network communication occurs. This helps to create workflows between transport and test equipment.

The remote test unit as a client can be integrated into your development software through web API calls to test optical routes. This function is crucial for data centers, utility groups, TELCOs, network operators and so on.

Reduce OPEX/CAPEX with less cost and maintenance fees by using an integrated open API solution for your GIS, NMS, OSS or SDN controller.

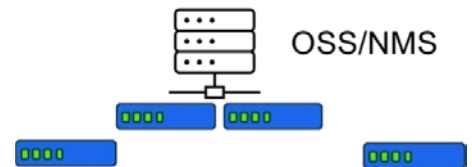


4 SERVERLESS USE CASES

4.1 OTDR probes for integrators

The OTH-7000 and RTU-2 units have a documented set of API commands. The device Swagger tool is available for software developers through its WebUI. API are available for the Baseline, Ad Hoc and Test On Demand (TOD), as well as the naming of the optical routes.

The units can be implemented in the customer NMS/OSS to confirm the optical nature (optical fiber break or degradation) of a root cause coming from an NMS/OSS trouble ticket.



4.2 Rack, stack and test

Most initial remote test unit deployments rely on the IT ports and connectivity with the FMS. Now the Field Tech can test the fiber right away without waiting for the FMS connection.

Once the IT connectivity is enabled, the remote test unit will connect directly to the FMS with its "phone home" feature.



4.3 Local/remote OTDR

Verify locally/remotely the state of the fiber (no FMS connectivity)

When the remote OTDR loses connectivity with the centralized FMS solution (if used with this configuration), the user can launch OTDR tests locally (or via the unit's WebUI) to verify the state of the fiber.



5 SERVERLESS OPERATION FEATURE SET (TEST AGENT)

5.1 Testing without optical route definition

5.1.1 Ad hoc testing

You can perform classic OTDR tests from optical ports on the OTH-7000 without creating optical routes. From the Instruments page, select a test port then configure the OTDR test settings manually (duration, pulse, range) or automatically. An ad hoc test will return the typical optical values one can expect from OTDR testing: link length, link loss, link optical return loss (ORL), and for each event its optical loss, reflectance, and distance.

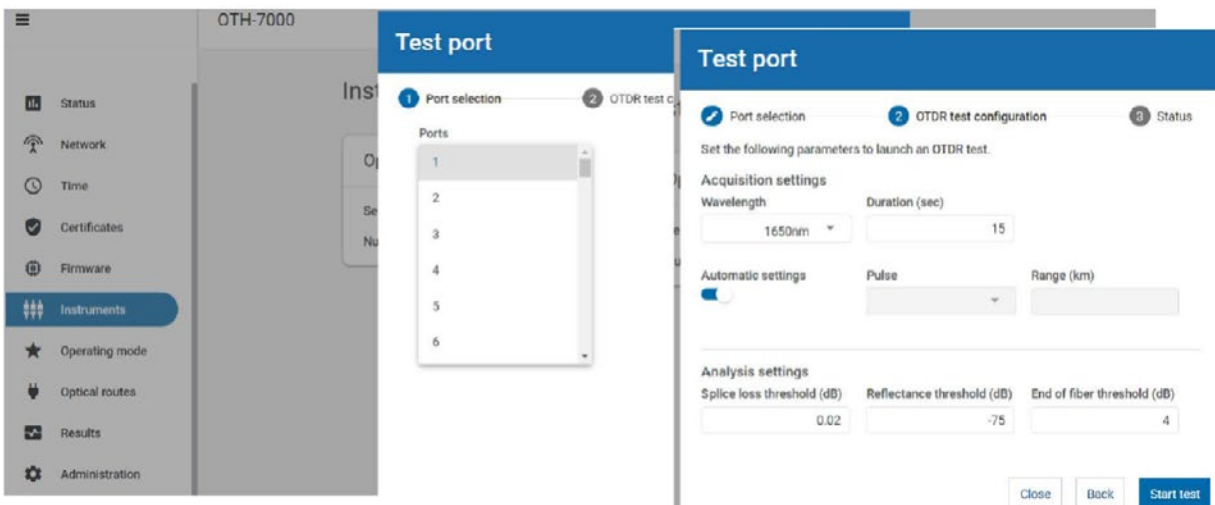


Figure 2. Viewing ad hoc OTDR test result.

Latest test results on a given port can be reviewed by opening the OTDR trace and displaying the Measurements and Event Table. Summary and Identification of the measurement can also be displayed, and .SOR results can be saved locally or exported for further analysis in a software like [EXFO's FastReporter](#).

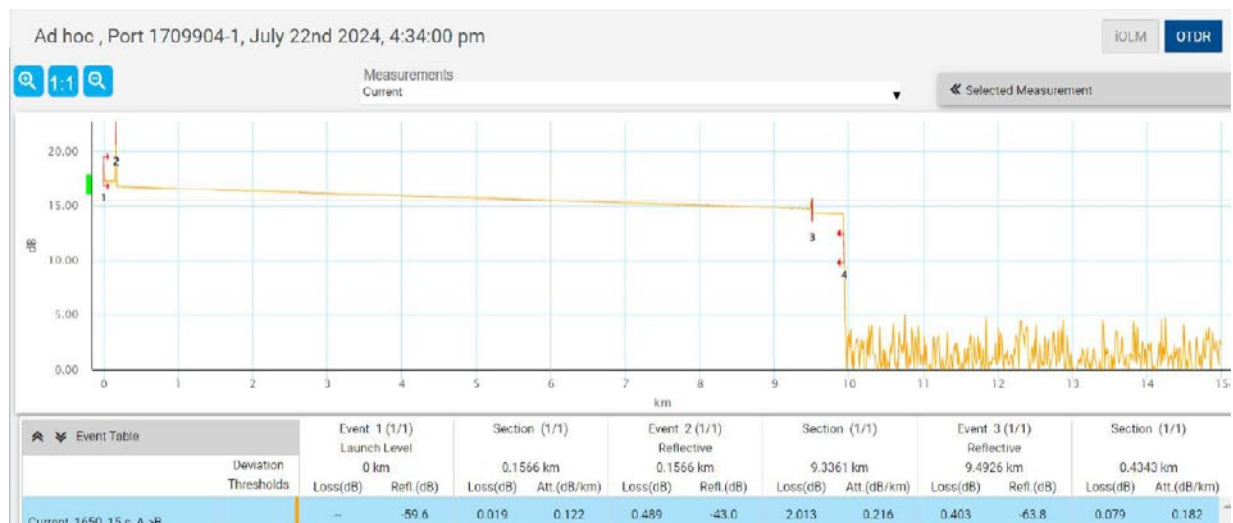


Figure 3. Viewing ad hoc OTDR test result.



5.2 Testing on optical routes

In the context of a remote fiber testing application, an "optical route" refers to the specific path or circuit that an optical signal follows through a fiber optic network from its source to its destination. This route includes all the optical fibers, connectors, and any intermediate devices that the signal encounters along its way.

The optical route is critical for understanding and analyzing the performance of the fiber network, as it impacts signal quality, attenuation, and overall system reliability. When conducting remote fiber tests, various parameters are assessed like signal loss, events reflectance and integrity along this route to ensure that the network is functioning correctly and to diagnose any issues that may arise.

5.2.1 Managing optical routes

You can add optical routes to quickly view results or trigger optical tests. Once routes are created and associated to a port, you can modify their name and description if necessary.

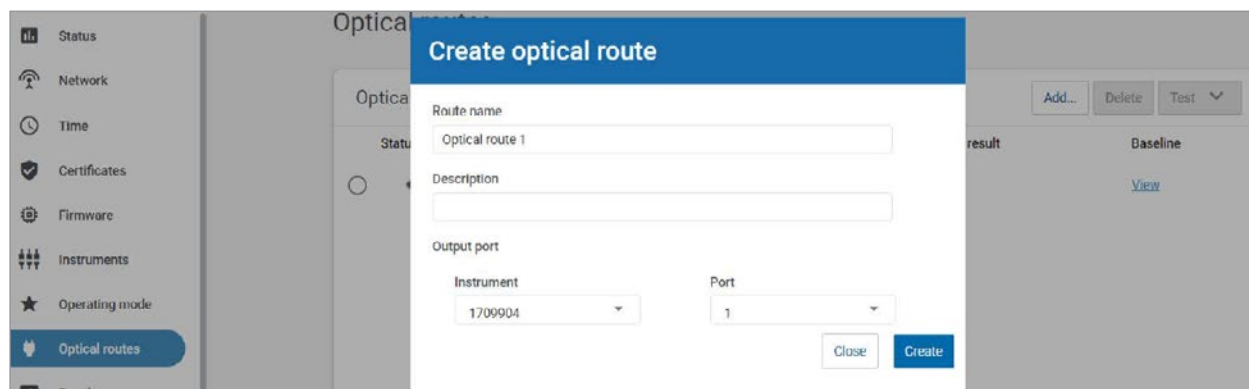


Figure 4. Creating an optical route.

5.2.2 Performing tests on optical routes

You can trigger 3 types of tests: ad hoc testing (simple OTDR test), baseline definition (reference for future deviation analysis) and test on demand (test to identify faults from deviation from baseline)

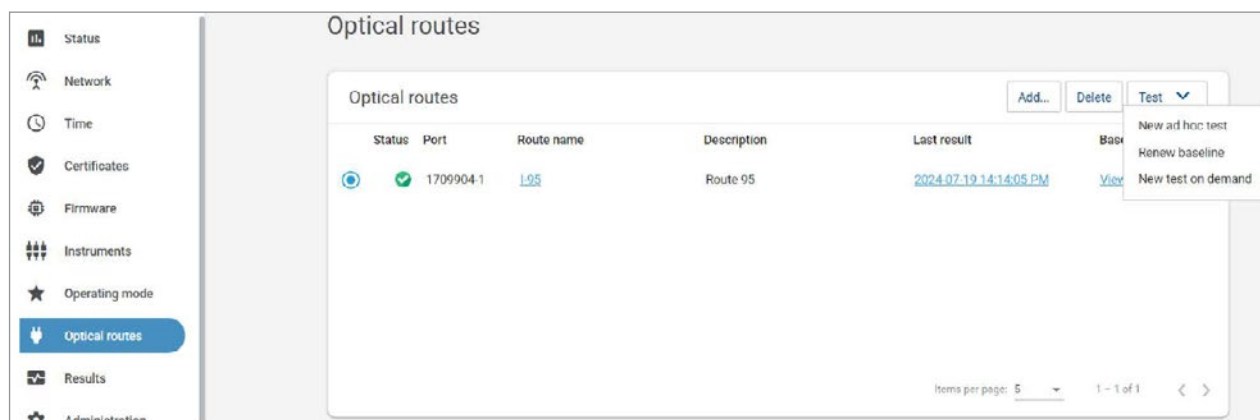


Figure 5. Performing tests on an optical route.

5.2.2.1 Ad hoc testing

An ad hoc test will return the typical optical values one can expect from OTDR testing: link length, link loss, link optical return loss (ORL), and for each event its optical loss, reflectance, and distance.

Ad hoc testing on optical routes is performed using a classic single pulse OTDR approach with automated parameters or user-defined parameters (pulse, duration, range).



Figure 6. Ad hoc test result on an optical route.

5.2.2.2 Baseline definition (new or renew)

A baseline is an iOLM test used as a reference measurement taken under standard or normal operating conditions. The test will return the typical optical values one can expect from OTDR testing: link length, link loss, link optical return loss (ORL), and for each event its optical loss, reflectance, and distance. The result analysis is based on “absolute” values that can be compared to a set of predefined thresholds for quality and fault assessment.

This benchmark will serve as a standard for comparison when assessing the performance of a given optical route. By comparing current test results against this baseline, deviations or anomalies will be able to be identified, allowing for the detection of potential issues such as increased signal attenuation or performance degradation within the network. A new baseline of an optical route is performed at first deployment of the remote test unit on this link. It can be renewed later on to account for accepted changes in the optical route. This typically happens after a repair on the link changes the link conditions (e.g., overall length, shifted positions, updated reference loss where the fiber was repaired).

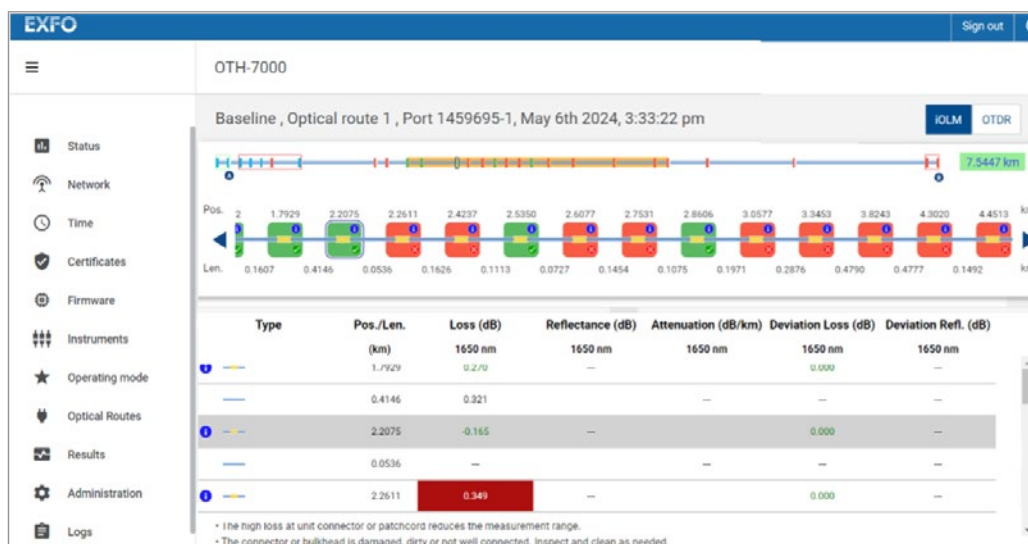


Figure 7. An example of baseline test results.



5.2.2.3 Test on demand (TOD)

A TOD is an iOLM test to identify faults by analyzing deviation from a baseline (or reference). It also provides absolute optical values of the fiber link under test and those are compared to the historical data from the baseline. Hence a relative analysis is performed to identify and quantify deviations, and those deviations are compared to a set of predefined thresholds.

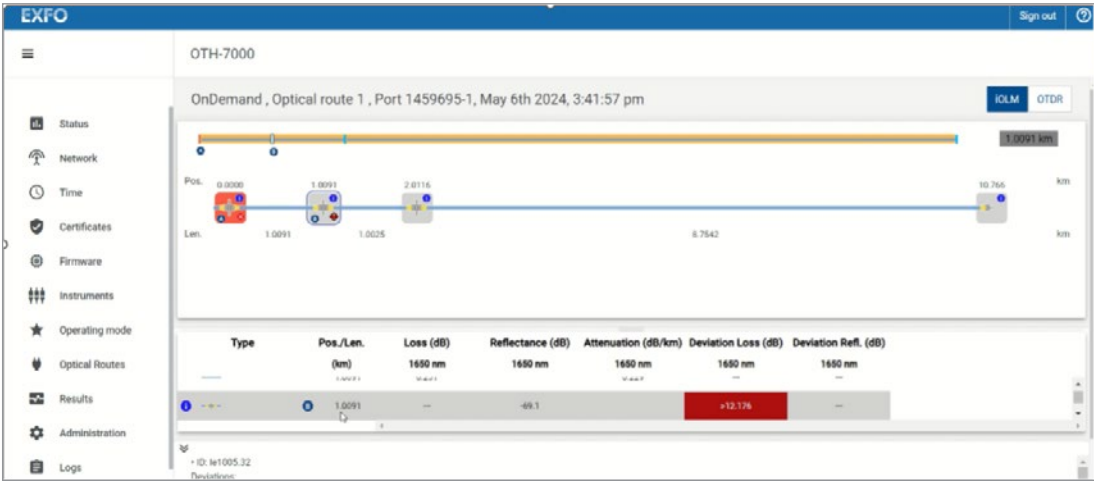


Figure 8. An example of a test-on-demand result.

5.3 Working with results

5.3.1 Viewing the results locally

The results browser will show past results by date, route name, port as well as the deviation loss (dB) and deviation position (km) if any. A clear icon is presented to display the results status.

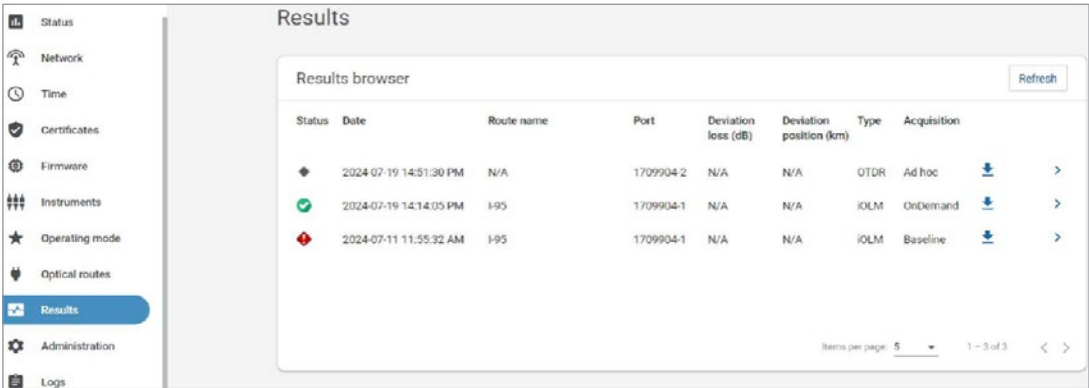


Figure 9. Results browser tab.

5.3.2 Exporting the results

Any result saved on the remote test unit can be exported to the computer connected to the remote test unit, either manually through the Web UI or through API calls. Classic OTDR tests (i.e., ad hoc OTDR testing) are exported in .SOR format while iOLM tests (i.e., baseline, TOD) are exported in .iOLM format. .SOR and .iOLM file formats can be opened and further analyzed if needed in a post-processing software like EXFO's FastReporter available at:

www.EXFO.com/en/products/field-network-testing/otdr-iolm/fastreporter-3

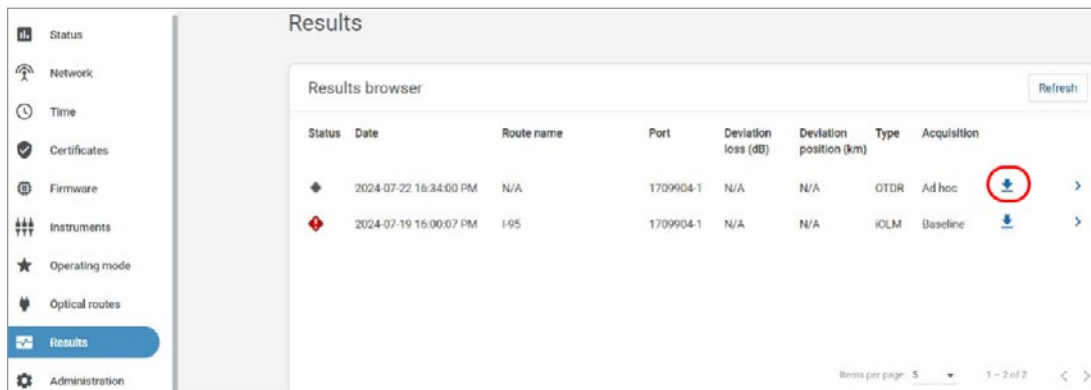


Figure 10. Manually exporting results from results browser tab.

5.4 Remote test unit management

5.4.1 User local access

EXFO's remote test units can be accessed locally by connecting a computer to the unit RJ45 management port and opening a web browser page pointing to the unit address (169.254.10.10). A default username and password are defined and can be modified.



Figure 11. OTH-7000 management Ethernet port (10/100/1000 Base-T) for local access.

5.4.2 User remote access

By default, the management of EXFO's remote test units is done locally by connecting a laptop to the unit. However, if you prefer to be able to manage your unit remotely (via LAN or WAN) after the first connection, you can enable a feature allowing you to do so. The remote test unit will then need to be connected to the LAN or WAN from its RJ45 LAN/WAN connection port or from the SFP port.

Once enabled, if the unit is reachable by your computer, its IP address can be type in a web browser to access the unit WebUI.



5.4.3 Operation through APIs

You can configure and operate your remote test unit using an API available on the LAN/WAN interface(s). A complete list of commands allowing you to remotely control your unit is available from the remote test unit or upon demand. It details the commands with examples and appropriate syntax.

Measurements	
GET	/api/measurements Returns all the measurements.
POST	/api/measurements Requests a measurement.
GET	/api/measurements/{measurementId} Returns a specific measurement.
GET	/api/measurements/{measurementId}/error Returns the error details of a measurement.
Optical routes	
POST	/api/optical/routes/{opticalRouteId} Creates an optical route.
GET	/api/optical/routes/{opticalRouteId} Gets a specific optical route.
PUT	/api/optical/routes/{opticalRouteId} Updates an optical route.
GET	/api/optical/routes Lists all the optical routes on the device.
POST	/api/optical/routes Creates a new optical route.
Results	
GET	/api/results Gets all the results stored on the device.
GET	/api/results/{resultId} Get a specific result.
GET	/api/results/{resultId}/dump

Figure 12. Examples of APIs available.

The main tasks that can be performed through APIs are:

- Remote test unit remote management: certificate management, NTP server settings, IP settings, software updates, etc.
- Remote test unit firmware management: checking and installing updates
- Associate a port to an optical route name
- Performing OTDR tests: perform ad hoc, baseline and test-on-demand (TOD), check their status, retrieve test results
- Troubleshooting the remote test unit: retrieve log files and set log verbosity

5.4.4 Software updates

EXFO's remote test unit allows you to check for updates, download these updates (internet connection required) and install them. This task can be performed through either local or remote access by a user on the Web UI or through API calls. Additionally, the updates can be uploaded from a local computer through the WebUI

Firmware

Current firmware

Current firmware version	3.0.0.24207.4
Current update source	Default
Update from EXFO cloud	Check for updates Update
	Yes - 3.0.0.24212.4
Update from local firmware	Upload .LIF and .LIS files

Figure 13. Firmware update through WebUI.

7 REMOTE TEST UNITS AND ACCESSORIES

Remote test units are OTDR-based test heads. Combined with local or remote switches, they scale up for testing from a few ports to thousands. OTH-7000 and RTU-2 units run EXFO's patented Link-Aware™ technology and are thus referred to as iOLM test units.

7.1 OTH-7000

The OTH-7000 is only ½U in rack height. Combined with an external high-density optical switching unit that is also ½U in rack height, one can provision up to 256 optical testing and/or monitoring ports in only 1U of space with fanless operation, low-power consumption and all-in-front access.



Figure 14. OTH-7000

The OTH-7000 is shipped with a standard test agent configuration, i.e., connectable through RESTful APIs to the client management tool as a multiple-port OTDR unit. Within minutes, OTDR testing capability can be added to the client software or management suite at a very competitive price compared to all the low-end OTDRs for remote troubleshooting. It can easily scale from the 4-port typical configuration (2 west and 2 east live fibers) to larger fiber nodes typically found in metro and access networks. The unit can test dark or live fibers through a high-performance OTDR and provides a dynamic range of 42 dB, meeting all core-to-access network requirements based on P2P-type links.

In-service testing and monitoring of P2P is possible thanks to a filtered OTDR port at 1650 nm coupled with a compact test access module coupler (up to 64 ports per ½U rackmount space).

OTH-7000 is available with a choice of 1, 4, 16, 32, 48 or 64 ports. OTH-7000 family is expanding with the UBRD model featuring narrower laser and filtering, optimal on P2P live networks when the upper L Band is used by traffic or supervisory.

GENERAL SPECIFICATIONS

Operating system	Linux
USB interfaces	USB 2.0 (4)
Wired network interfaces	2x 10/100/1000 Base-T Ethernet IP-V4 and V6 (network and management interfaces), 1x SFP (network interface)
Unit status front LEDs	Power, system and laser status
Storage	16 GB
Dual feed power supply	–48VDC 2A (ordering option: external AC-DC adapter for AC operation)
Power consumption	10 W (typical), over entire operating temperature range
Dimensions (for 19 in or ETSI racks) (H × W × D)	22 mm (½ U) × 440 mm × 220 mm (7/8 in × 17 5/16 in × 8 11/16 in) Compatible with ETSI 300 mm deep racks
Weight (includes brackets)	1.4 kg (3.1 lb)
Temperature	Operating: 0 °C to 55 °C (32 °F to 131 °F) Storage: –40 °C to 70 °C (–40 °F to 158 °F)
Relative humidity	< 95 % non-condensing
Heat management	No fan

Complete and latest specifications available at:

www.EXFO.com/en/resources/technical-documentation/spec-sheets/oth-7000

7.2 RTU-2

The RTU-2 is a 1U-rack-size remote test unit. It is modular (two module slots) and compatible with EXFO's FTBx modules used in portable and manufacturing test applications. The unit provides fast on-board analysis and large local storage. The unit can also support up to four RTUe-9120s switches, scaling the number of test ports up to 1024. An optional junction panel is available so that all connections are available at the front of the unit (see Figure 10 with the ½U shelf underneath the RTU-2 unit).

The unit can be connected to P2P links (either backhaul or access type) to provide both build and connect testing, as well as 24/7 monitoring. With the FTBx-750C-SM3, a 3-wavelength OTDR module for dark fiber characterization and monitoring, RTU-2 can test links ranging from short to long haul owing to its 45 dB dynamic range.

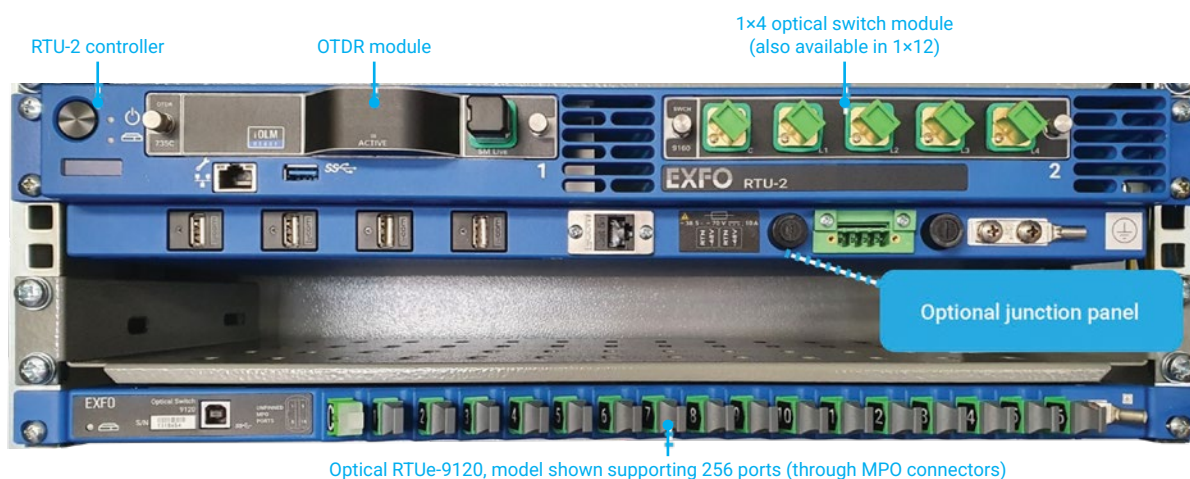


Figure 15. RTU-2 with OTDR module, first stage 1x4 switch and optional junction panel and second stage switch to support 256 ports.

PLATFORM SPECIFICATIONS

Mainframe		Quad-core Intel i7 processor / 8 GB / Linux embedded
Front interfaces		RJ45 10/100/1000 Mbit/s (management port), USB 3.0
Rear interfaces		RJ45 10/100/1000 Mbit/s (management + Ethernet ports) (2), USB 3.0 (5), relay contact: 3 (power, system and user configurable)
Storage		128 GB SSD internal memory
Power supply		–48VDC DC, 10A (ordering option: external AC-DC adapter for AC operation)
Power consumption	Idle state	25 W
	OTDR measuring	40 W (typical)
Dimensions (H × W × D) (includes brackets)		44 mm (1U) × 482 mm × 262 mm (1 3/4 in × 19 in × 10 5/16 in)
Weight (includes brackets)		5.1 kg (11.2 lb)
Temperature	Operating	–5 °C to 50 °C (23 °F to 122 °F)
	Storage	–40 °C to 70 °C (–40 °F to 158 °F)
Relative humidity		< 95 % non-condensing

Complete and latest specifications available at:

www.EXFO.com/en/resources/technical-documentation/spec-sheets/rftm-rtu2



7.3 RTUe switches

Based on reliable and cost-effective MEMS technology, the RTUe-9120 units are external optical switches for connecting an OTH-7000 or an RTU-2 to large quantity of fibers terminating in the same hub. It features low power consumption (typically 1W per unit) and is very dense (up to 1×256 in ½ U). It uses MPO connectors to interface with the fiber route to be tested/monitored. Models are available in 1×32, 1×64, 1×128 and 1×256 fitting most OLT port configurations, both being based on multiples of 16. Each MPO connector based on standard MPO 24-fiber ferrule, exits 16 ports (2×8 on the middle rows) and is therefore compatible with most MPO cleaning and inspection tools.

Unpinned
MPO ports



Figure 16. MPO-24 port configuration with 16 unpinned ports

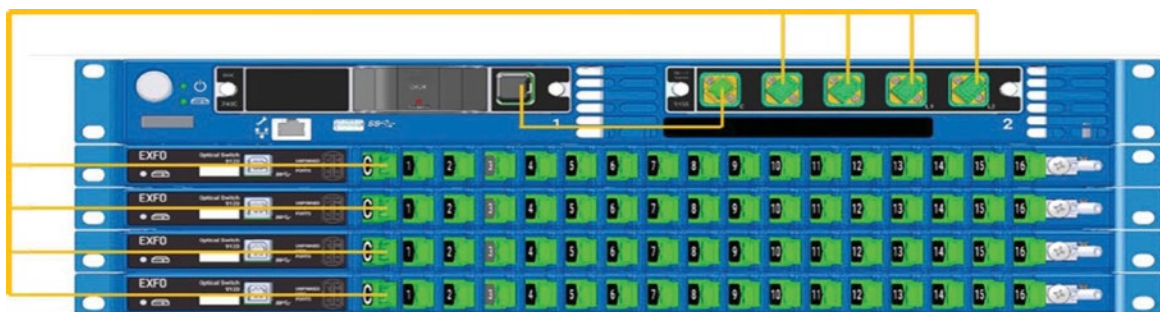


Figure 17. Four MPO-based RTUe-9120s with 256 test ports each in ½ U size for 1024 ports in 2 U height. First stage 1×4 optical switch connects to the 1×256 external optical switch. Excess loss caused by first and second level optical switching is typically 3 dB. Each unit is powered and controlled from the RTU-2 or OTH-7000 chassis (no need for more DC circuits).

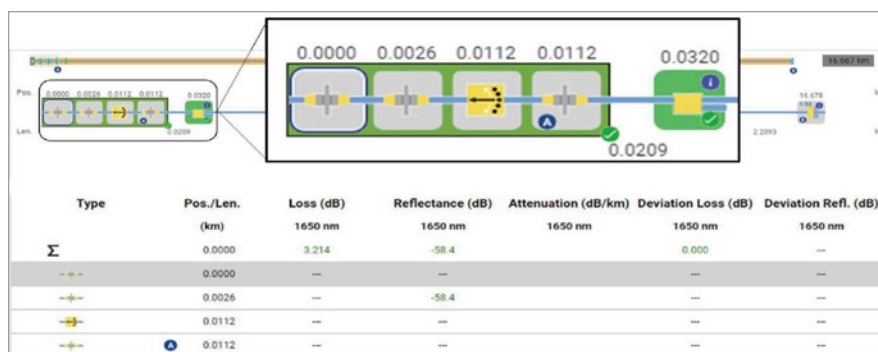


Figure 18. Thanks to iOLM's patented multipulse technology, even on a 17-km PON with high loss, last stage optical switch port on the front end is properly detected, allowing to set link start accordingly (A) at the output of the last connector, part of the injection.

ELECTRICAL SPECIFICATIONS

Latching type	Non-latching
Supply type	USB 2.0
Operating power consumption	~1 W

GENERAL SPECIFICATIONS

Chassis size	½U, rackmount chassis (19")
Size (H x W x D)	22 mm x 440 mm x 220 mm (7/8 in x 17 5/16 in x 8 11/16 in)
Weight	1.2 kg (2.6 lb)
Temperature	-5 °C to 50 °C (23 °F to 122 °F)
Operating Storage	-40 °C to 70 °C (-40 °F to 158 °F)
Optical connector location	Front panel

Complete and latest specifications available at:

www.EXFO.com/en/resources/technical-documentation/spec-sheets/rtue-9120

7.4 Test access module kits and FWDMs for testing on live fibers

When testing on a live fiber link, the OTDR signals needs to be injected with live traffic and then extracted on its way back. For that, the OTDR uses an out-of-band wavelength which is multiplexed with the traffic wavelength(s). The multiplexing, as seen in Figure 19, is handled by a test access module kit (TAMK), offered in ½U or 1U full-wide rack units. Typical out-of-band wavelength(s) used for OTDR in this implementation are 1610 nm, 1625 nm or 1650 nm (depending on applications). EXFO's remote fiber testing and monitoring offers a wide variety of configurations aligned with optical ports on EXFO and network equipment.

Optical transport equipment from network equipment manufacturers (NEMs) now often integrate an OTDR port. Although great in theory, these ports have to let the entire OTDR emitting power pass through and must present high-enough directivity, low reflectance (APC recommended) and enough isolation so that the return loss from the fiber and connectors hit by a strong OTDR signal are filtered out by the WDMs before they could reach a receiver. In comparison, EXFO WDMs typically provide:

- Low loss for traffic and OTDR—less than 0.8 dB for the device itself
- Isolation larger than 30 dB on the line port at the OTDR wavelength
- Directivity larger than 50 dB
- Various cut-off wavelengths between traffic and OTDR to ensure specifications are optimized for the application

7.4.1 Test access module kit (TAMK)

A TAMK is ½U or 1U full-size rack, in typical configurations of 16 to 64 WDMs, with spectral profiles aligned with EXFO's OTDR lasers and with your network constraints.



Figure 20. TAMK: ½U, 64 WDMs all in front.

Models

TAMK-WDM-GA-64-MPO16-104	½U, 64 WDMs all in front. LC-APC ports for common, MPO-24/16f (4) ports for line and 1.5 m pigtailed MPO-24/16f (4) terminated for OTDR. Also available in 48 WDM (TAMK-NS3244) and 32 WDM (TAMK-NS3293) versions.
TAMK-WDM-GA-48-MPOC-104	1U, 48 WDMs LC-APC for line and common (front) with MPO -24/16f (3) for OTDR (rear)
TAMK-NS3316	½U, 16 WDMs all in front. LC-APC ports for common and for line, and 3 m pigtailed MPO-24/16f (1) terminated for OTDR.
TAMK-NS2264	½U, 16 WDMs all in front. LC-APC ports for common and for line, and 3 m pigtailed LC/APC (16) terminated for OTDR.

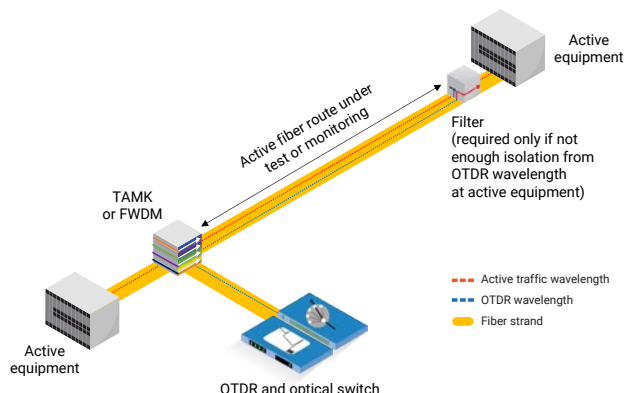


Figure 19. Use of a test access module kit and a blocking filter on a P2P schematic example.

7.4.2 Low-density FWDM cassettes

Ideal companion for OTH-7000, for EAST-WEST TX/RX live fiber monitoring



Figure 21. Rackmount RMK-HD3S-RK19 with FWDM-HD3191-1 cassettes

Models

FWDM-HD3191-1	½U cassette, 1/3U width, all ports in front. 4 WDMs for the monitoring of up to 4 live fibers. 2x duplex LC/APC connector for "line" ports, 2x duplex LC/APC connector for "common" ports, 2x duplex LC/APC connector for "monitor" ports.
FWDM-NS3314	½U cassette, 1/3U width, all ports in front. 1 WDM for the monitoring of 1 live fiber. 1x SC/APC connector for "line" ports, 1x SC/APC connector for "common" ports, 1x SC/APC connector for "monitor" ports.
RMK-HD3S-RK19	½U holder module hosting up to 3x FWDM cassettes

7.4.3 High-density FWDM cassettes

MPO 24f APC ferrules are used to terminate more fiber ports into high-density fiber racks. These cassettes can replace single-fiber connector patch panels already used to link up OLTs to ODFs, while offering an OTDR test access without a larger footprint.



Figure 22. MPO-based high-density FWDMs.

Models

FWDM-NS3093	64 WDMs, front/rear MPO24(16f), maximum 384 WDMs per 1U in scaling steps of 64x
FWDM-NS3193	48 WDMs, all in front MPO24(16f), maximum 288 WDMs per 1U in scaling steps of 64x
FWDM-NS2944	16 WDMs, front/rear MPOs, maximum 96 WDMs per 1U in scaling steps of 16x
RMK-HD3S-RK19	½U holder module hosting up to 3x FWDM cassettes



7.4.4 FWDM: Bypass assembly – single path

To enable the OTDR signal to bypass or jump over an active equipment (e.g., a traffic re-gen) or an optical add-drop multiplexer (OADM) site, EXFO offers a similar FWDM configuration but with the monitor ports of two WDMs spliced together so that it bypasses a transmission gear, an amplification equipment, or an OADM with minimal loss added to the link.

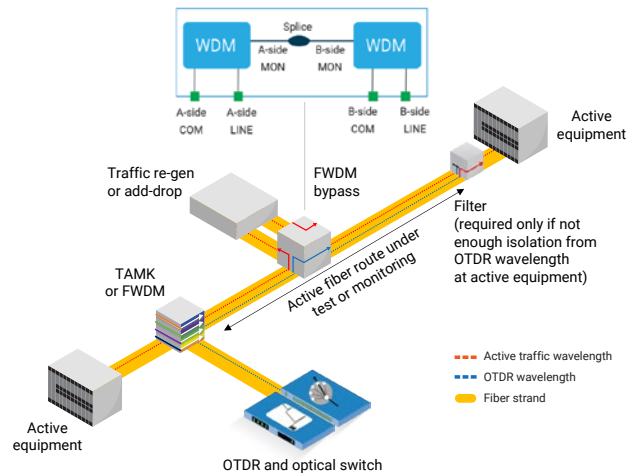


Figure 22. Schematic example using an FWDM bypass to monitor a fiber route including traffic regen or add/drop module.

7.4.5 Other passives

- Rejection filters for P2P fibers in jumpers or bulkhead adapters
- WDM in small and ruggedized package with various jumper lengths and connector types

Additional references

[OTH-7000 spec sheet](#)

[RTU-2 spec sheet](#)

[RTUe-9120 spec sheet](#)

[Assuring data center interconnectivity with the OTH-7000 use case](#)

[5G and fronthaul monitoring with the OTH-7000 use case](#)

[RFTM technical brochure](#)

A nighttime photograph of a city skyline, featuring several tall skyscrapers with illuminated windows. The sky is dark blue with some clouds. In the foreground, there are lower-rise buildings, some with lit-up facades. A semi-transparent dark blue rectangle is overlaid on the left side of the image, containing white text. In the top right corner, there are several white, stylized, overlapping 'V' or chevron shapes. In the bottom left corner, there is a yellow rectangle with black text. In the bottom right corner, the EXFO logo is displayed in white.

CONTACT AND MORE INFORMATION

Useful links

[EXFO.com](https://www.exfo.com)

[Contact a sales representative](#)

[Schedule a demo](#)

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[Support services and SLAs](#)

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