RFTS-400

Remote Fiber Test System

The RFTS-400 modular platform design incorporates an Optical Control Module (OCM) and Optical Switching Modules (OSM) that support fiber monitoring expansion from 8 to 108 ports in the 1U rack. A fully expanded system can support up to 4608 monitoring ports.

Optical Control Module (OCM)

Key Features

- Up to 50 dB dynamic range excluding switch option
- Occupies 2 module slots in 1U tray; wall-mount option available
- Optional built-in switch up to 16 ports
- Simple installation and maintenance with front panel access
- Dual -48V DC inputs
- Dual Ethernet interface
- Dedicated management Ethernet interface for remote system diagnostic and recovery
- Low power consumption: 6W
- Secure HTTPS interface
- Solid state storage up to 10 TB
- Running ruggedized Linux® operating system (OS)
- Controls up to 4608 test ports
- Manage both serial and ethernet controlled optical switches
- OLS feature with tone generator for fast fiber identification and OLTS applications

Key Benefits & Applications

- Simple and intuitive installation and commissioning
- Serverless Remote Fiber Test System operation
- Continuously monitors fiber integrity
- Dark fiber and in-service monitoring up to 400 km using the bi-directional monitoring feature
- PON construction monitoring
- Out of band DWDM monitoring
- Improves failure detections to minute scale
- Supported by major GIS solutions
- Performs non-intrusive fiber characterization
- Proactive monitoring and machine learning-induced fiber degradation analysis
- Supports email notifications, SMS notifications, SNMP traps, relay outputs, and push notifications to the RFTS mobile app

Optical Switch Module (OSM)

Key Features

- MEMS based for high reliability and lifetime >1 billion cycles
- No external IP communication is required
- 1x8, 1x16, 1x32, 1x64 and 1x128,1x144,1x288 configurations available in 1U rack space
- Front access, high-quality LC/APC connectors
- Integrated FWDM option available
- No configuration required; OSM modules are controlled and powered by the OCM module

Key Benefits & Applications

- Low insertion loss
- Flat passband
- Fast switching time, <15ms for adjacent channels
- Protocol and bit-rate independent
- Single-mode fiber support
- Low reflectance and ORL

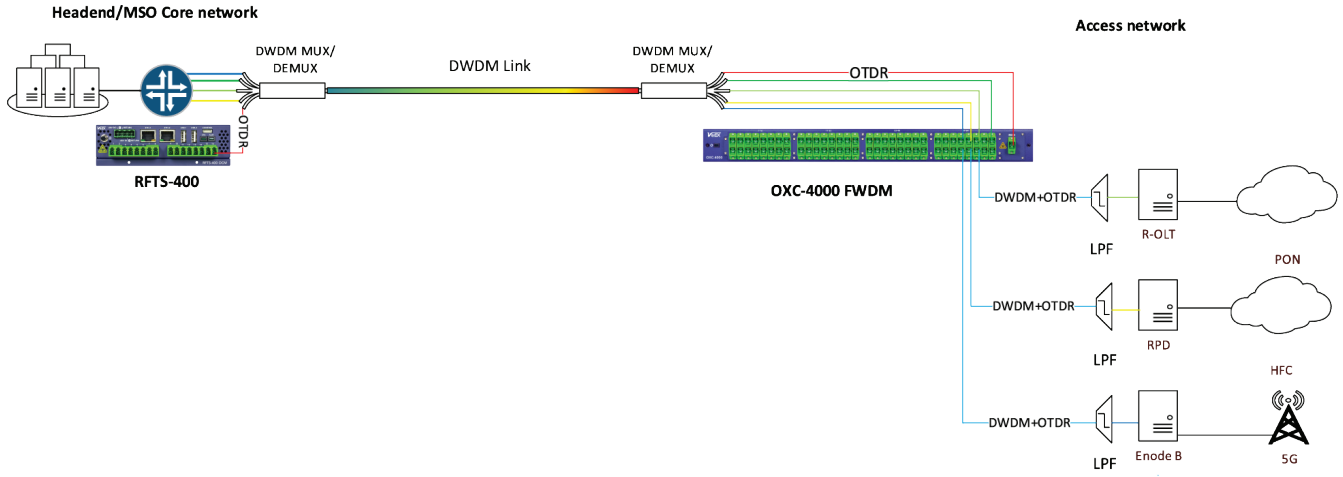
Key Platform Features

The RFTS-400 is VeEX's third generation optical remote fiber test unit. The RFTS-400 fits into a 1U tray which has six single width slots. The OCM requires two slots, leaving four remaining slots in the tray, allowing up to an additional 4 single slot OSM modules or additional OCM modules. The RFTS-400 is field serviceable, expandable, and upgradable. An unparalleled selection of OSM modules are available to support the many network type monitoring applications using the RFTS-400 such as dark fiber monitoring, in-service monitoring, PON construction and monitoring, infrastructure monitoring, and security monitoring.

One RFTS-400 OSM module can be configured to support up to 288 ports in 1U for high fiber density monitoring applications. All OSM modules can also be configured with integrated FWDM filters without needing additional shelf space for in-service monitoring. By incorporating the FWDM into the OSM module, we also simplify the system installation and reduce the system commissioning time while eliminating the possibility of cross-over connection concerns. The RFTS-400 can operate as a serverless remote fiber test system or as part of a centralized server monitoring system powered by VeSion®, VeEX's state of the art monitoring software platform.

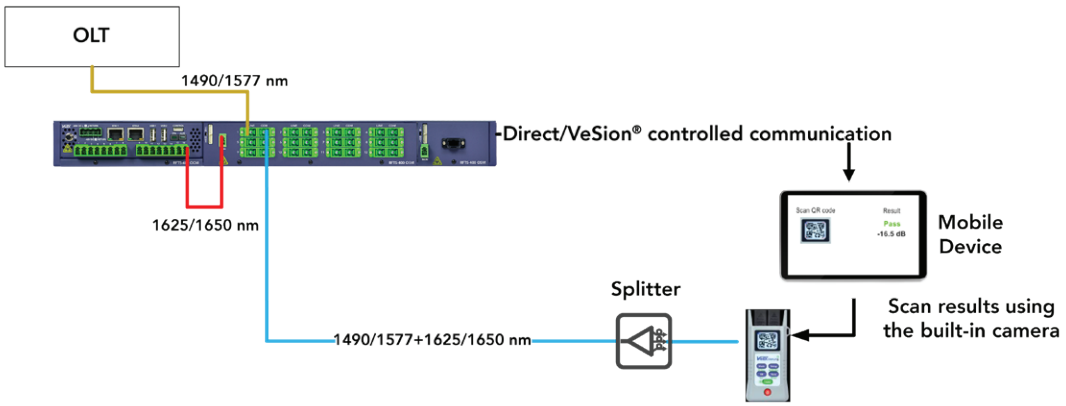
RFTS-400 and OXC-4000

In addition to the RFTS-400 OSM switch, the system can also interface with the VeEX OXC-4000 series MEMS-based switches. OXC switches are controlled over the Ethernet interface, which allows the switch to be strategically located at the edge of the access network even if the RFTS-400 is installed at the headend or central office. De-centralizing and cascading multiple switches avoid deploying additional RFTS-400 units deeper into the network, resulting in significant cost savings.



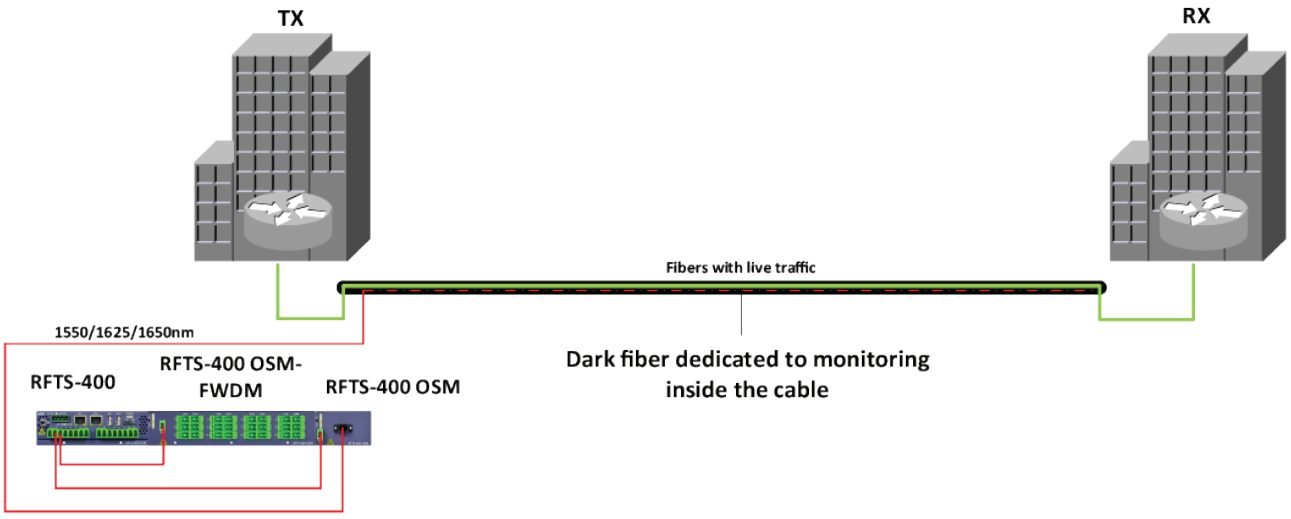
RFTS-400 OLS

The RFTS-400 optical light source can operate with CW or modulated 270, 330, 1000, or 2000 Hz signal. The modulated frequencies can be detected with an LFI (Live Fiber Identifier). Dark fiber providers can use this feature to identify the fiber in high-density fiber optic cables. The OLS feature is often used in PON construction and monitoring to measure the ODN loss before turning up service. The RFTS-400 OLS is controlled via a standard web interface using a mobile device eliminating the need for installing any dedicated application to control either a VeEX NoApp™-enabled Optical Power Meter (OPM) or the RFTS. All communication is based on NoApp-QR code-based technology, which doesn't require direct communication between the OPM and the mobile device.

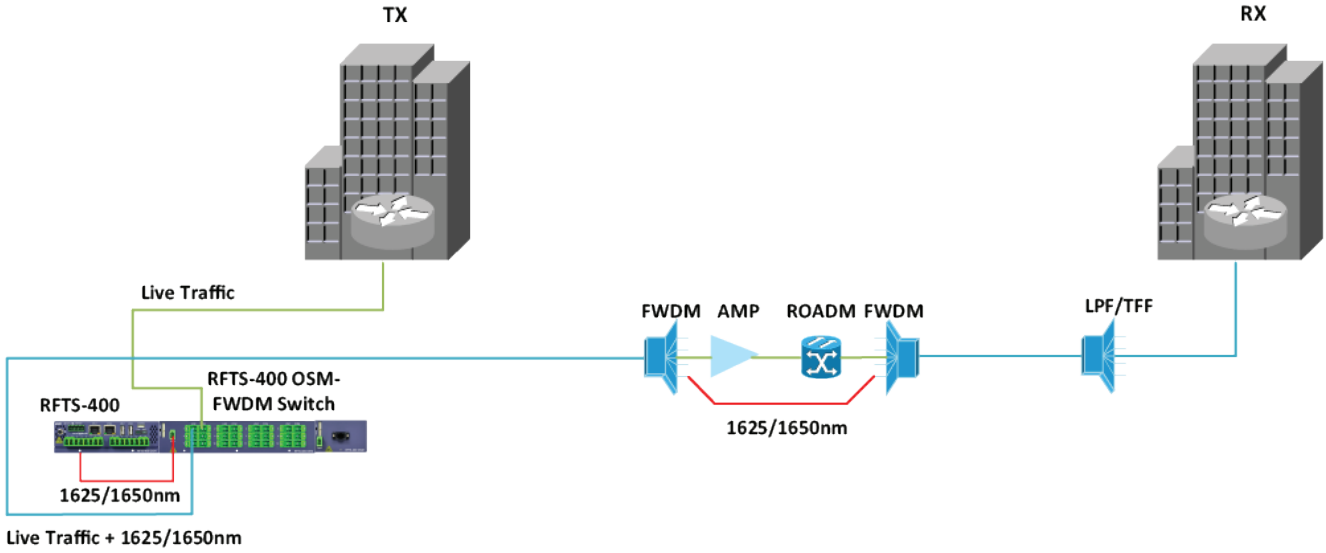


RFTS-400 Typical Applications

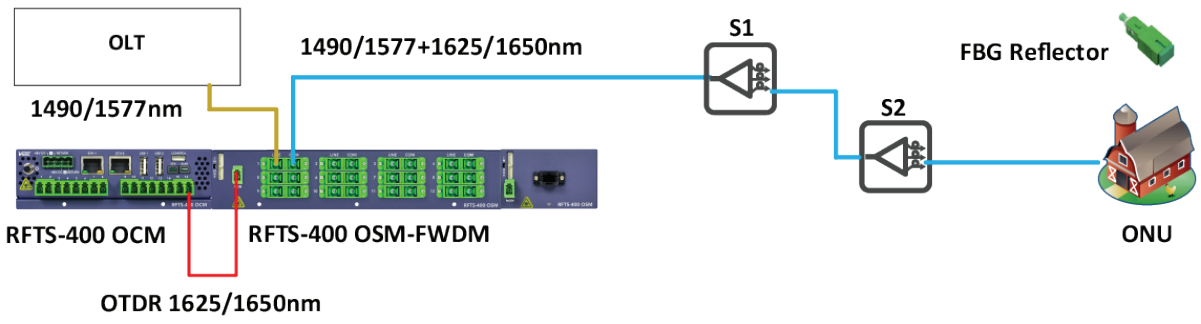
Dark Fiber Monitoring



In-Service Monitoring



PON Monitoring



Software Support

The RFTS-400 operates using a ruggedized Linux OS, which is secure, highly stable, and optimized for 24/7 monitoring and on-demand testing. The RFTS-400 can be operated in Serverless mode or controlled using a centralized VeSion RFTS monitoring platform.

Serverless Operation

The RFTS-400 OCM module includes the serverless point-to-point RFTS capability as a standard feature. It provides rich fiber integrity monitoring and reporting experience in environments where a traditional server-centric approach brings more challenges than benefits. It can be easily integrated into an existing cloud-native ecosystem for a CRM, GIS, metrics storage service, or cloud observability platform to reduce the time required to resolve an issue to a minute scale. Every serverless system is backward compatible with VeSion, VeEX's state-of-the-art centralized monitoring platform.

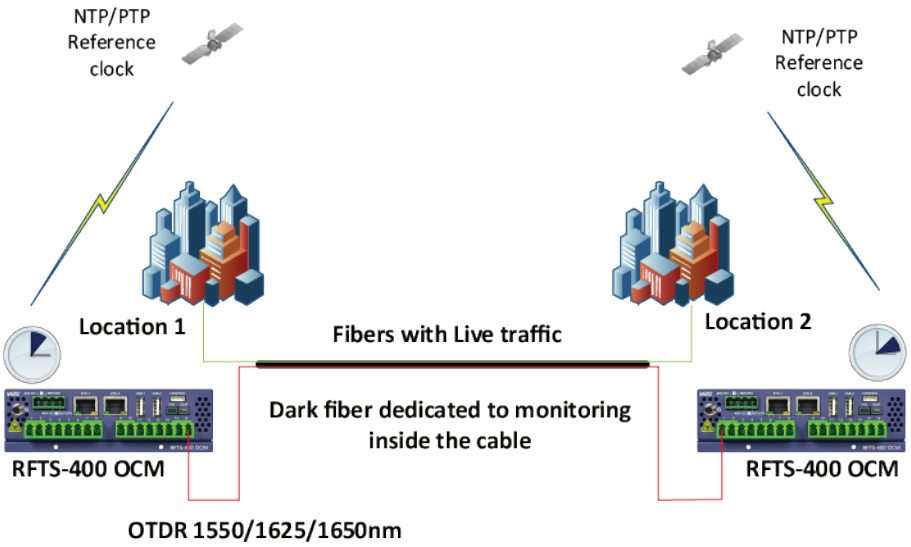
Key Features

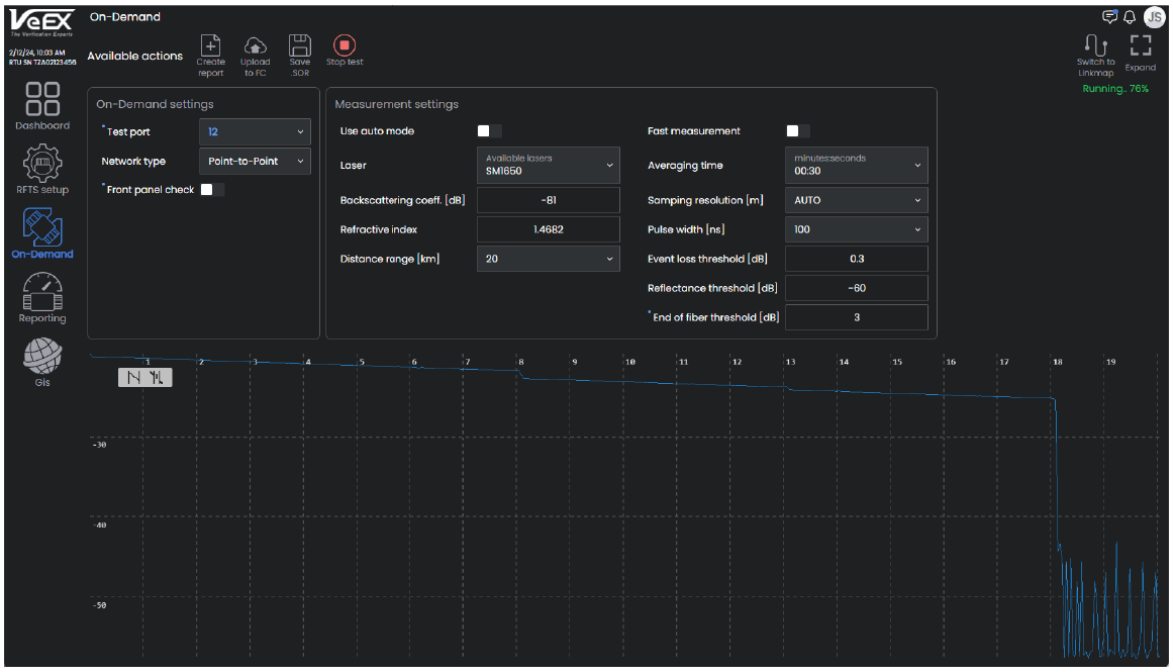
- Standard with every RFTS-400 OCM
- Supports RFTS-400 OSM and OXC-4000 switches
- Simple and intuitive installation and commissioning
- Reduces the time needed to pinpoint an issue from hours to minutes
- Continuously monitors fiber integrity
- Performs non-intrusive fiber characterization
- Provides detailed visibility over the fiber infrastructure
- Supports dark fiber and in-service monitoring
- Integrates with cloud-native monitoring tools like Prometheus or Grafana, SaaS-based GIS
- Works with VeEX GeoServer® and VeEX Flow™ cloud services
- Multi-user system: up to 5 users can operate the system simultaneously
- HTTPS interface
- Proactive monitoring and machine learning-induced fiber degradation analysis to identify a fault before it affects the network
- Wide range of notification options -- supports emails, SNMP Traps, relay contacts, Grafana alarms

Serverless Monitoring Applications

The web-based user interface only requires the user to open any web browser, so there is no need to involve your IT support team. Beginners will appreciate the machine learning-induced monitoring setup and thresholds to help them set up the system within minutes. Expert users will benefit from the system flexibility that can help with network planning or provide targeted, proactive maintenance in the network before an issue impacts any service. The system fully uses the capabilities of the RFTS-400 test probe. It supports dark fiber, in-service, and infrastructure monitoring using reflective sensors.

Although the system entirely relies on the decentralized/serverless architecture, it supports features usually implemented in centrally managed RFTS, like bidirectional monitoring, which allows monitoring of a fiber span if the span loss exceeds 43 dB. The two RFTS-400 systems that use the same OTDR wavelength are synchronized to the same time base, allowing them to monitor the same fiber from both ends in different time slots. This provides a cost-effective solution to monitor long-haul fiber spans.



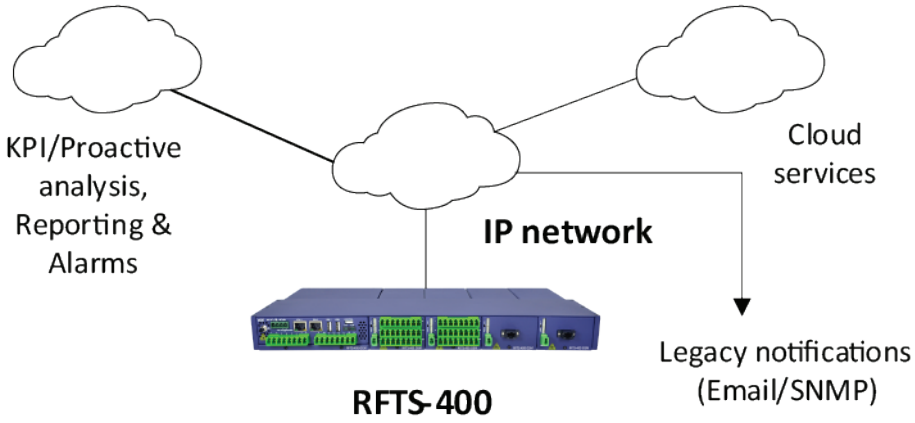


Integration Options

Serverless RFTS mode has fully adopted the cloud-native approach that helps organizations optimize their CAPEX by offloading resource-consuming features– like reporting or GIS-- to the cloud. The cloud-native approach has effectively removed the resource constraints of all standalone RFTS solutions. Users no longer need to rely on the limited resources of a single unit; the system will seamlessly stretch between the unit resources and the cloud when needed. NOC users can monitor the network through the standard Prometheus interface on the unit. Additionally, the system can offload historical data to a long-term metrics repository, enabling the system to track fiber degradation over multiple years.

The system can use Fiberizer® Cloud to offload and back up the datalog and the system configuration. Users don't need to worry about the capacity of the locally available storage or potential data loss.

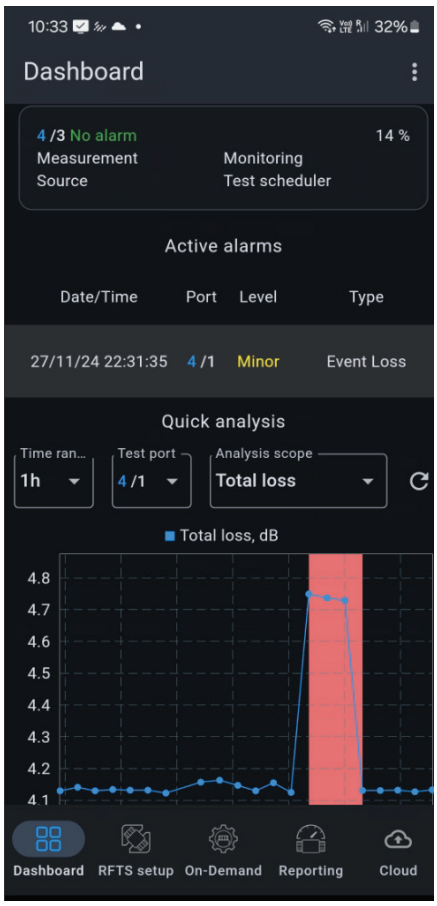
They can integrate the system with Flow™, VeEX's cloud-based workforce management system, to automatically convert alarms into trouble tickets and dispatch an available field crew to minimize the time needed to repair the issue.

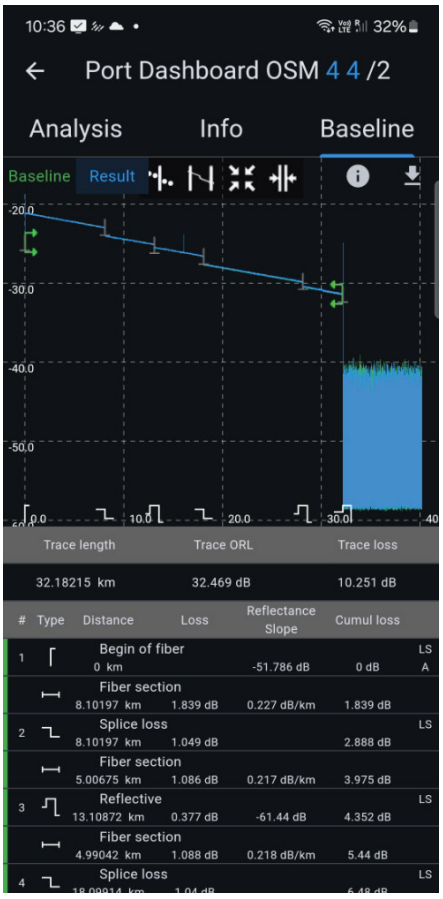


Network Construction and Monitoring

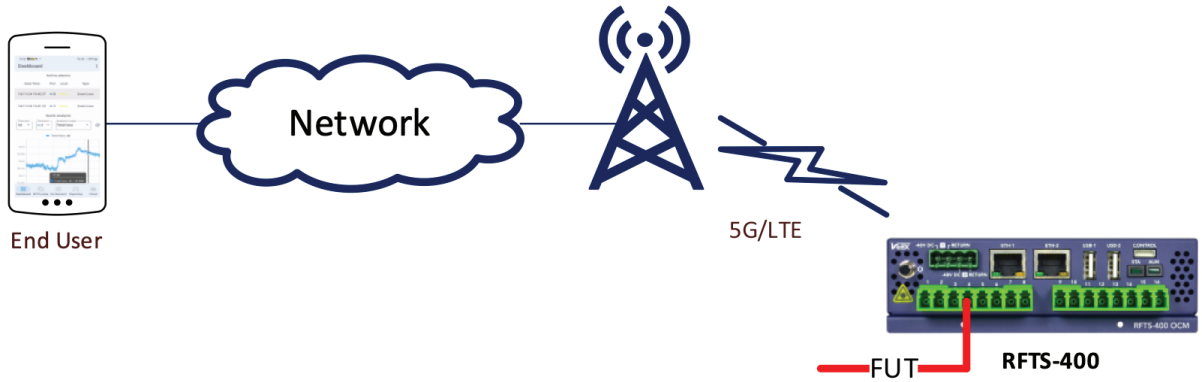
The serverless RFTS includes the VX-RFTS mobile application available for both Google Android and Apple iOS. This application serves as a tool for maintenance teams to maintain visibility over a fiber network. It supports Network Construction and maintenance features, allowing users to trigger the On-Demand Realtime mode to verify fiber continuity during splicing.

Network construction teams can utilize the Bulk Test Mode feature to verify up to 4608 fibers with a single click. The On-Demand test supports a wide range of Pass/Fail thresholds to enhance productivity and reduce the number of revisits.
Users can upload and share their measurements via the Fiberizer Cloud directly from their mobile devices, thereby maximizing work efficiency and minimizing the risk of data loss.





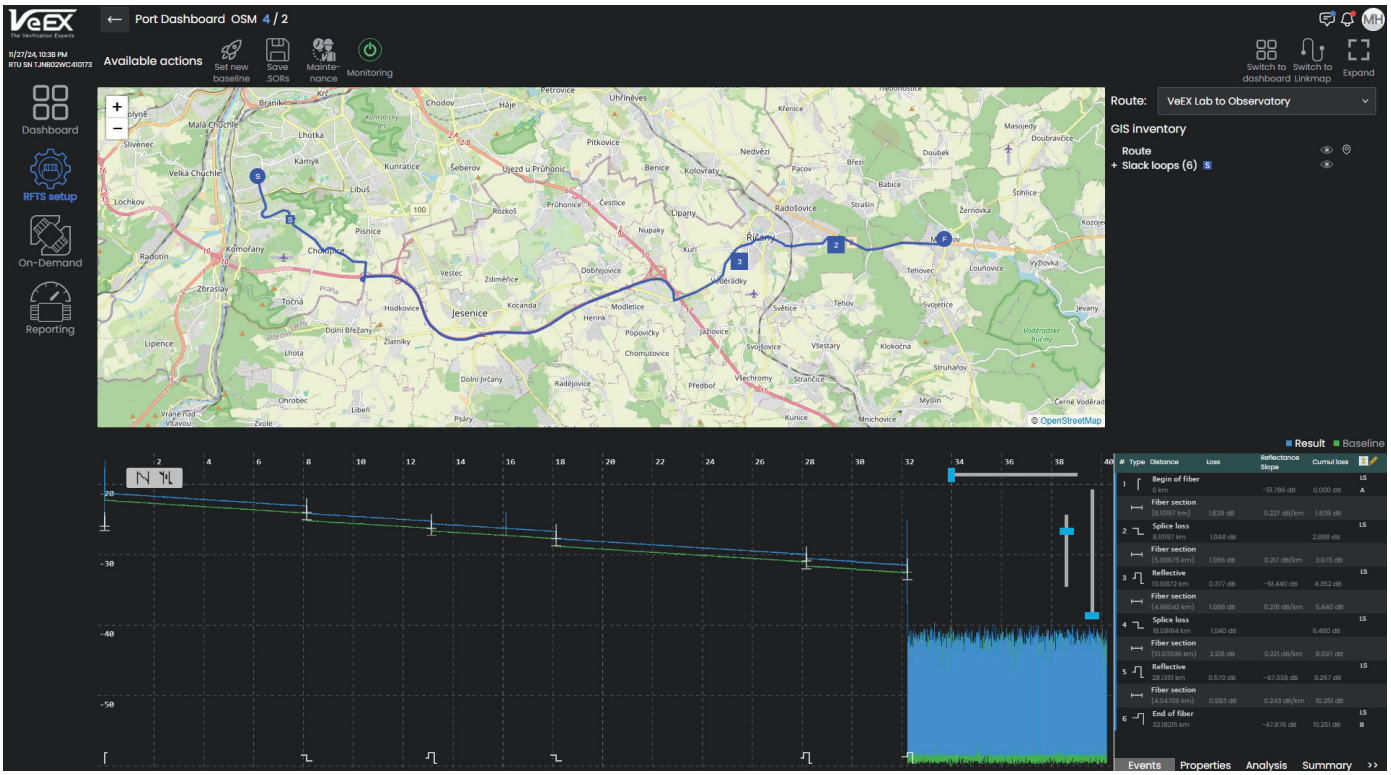
The system also includes a Mobility feature, enabling connections to the unit from the field without requiring a public IP address. This is useful for LTE/5G connections where individual CPEs are connected behind cascade firewalls or CG-NAT gateways, which prevent direct connections. Users don't need to use any special software, and they can connect directly from the field with the VX-RFTS mobile app or using any standard web browser. The connection between the unit and a client is end-to-end encrypted using the TLS encryption.



GIS Integration

The Serverless RFTS supports integration with any GIS system by importing the KML/KMZ files or through the VeEX® GeoServer service. Once a user assigns a GIS route to a test port, the system will automatically facilitate all the locations, splice points, and Slack loops related to the route to provide precise geo-correlated fault locations. The system also bundles the KMZ file that contains all the data associated with the alarm to minimize the Mean Time To Repair (MTTR).

Users can correlate the GIS inventory related to a test port with the port baseline. This allows the system to provide Geo-Enhanced Loss and attenuation reports and use the GIS locations as the demarcation points, which helps RFTS-400 users provide the right response if any alarm occurs.



OCM-OTDR Specifications[1,11,12]

OTDR		Singlemode
Wavelength	±20 nm	1550
	±5 nm	1625/1650[2]
Filter passband (nm)		1625: 1610-1680/1650: 1650 ± 10
Filter isolation (dB)		~50 dB (1625: 1260-1590/1650: 1260 to 1620)
Laser safety class		Class 1, 21 CFR 1040.10
Display range (dB)		0.1 to 54.165
Dynamic range (dB)[3]		Refer to ordering guide
Event dead zone (m)[4]		Refer to ordering guide
Attenuation dead zone (m)[5]		Refer to ordering guide
Reflectance accuracy (dB)		±2.0
Pulse width (ns)		3, 10, 25, 30, 100, 300, 500, 1000, 3000, 10000, 20000 (where applicable)
Distance range (km)[6]		0.1 to 400
Distance units		Kilometer, Meter, Mile, Kilofeet, or Feet
Readout resolution (m)		0.01
Sampling resolution (m)		Auto, High, or Low (0.03 to 16 depending on module and distance range)
Sampling points		Up to 500,000
Distance uncertainty (m)[7]		±(0.5 + resolution + $3x10^{-5}$ x L)
Group index range		1.2000 to 1.8000 in 0.0001 steps
Linearity (dB/dB)		0.03
Loss threshold (dB)		0.001 to 100.000 in 0.001 step
Loss resolution (dB)		0.001
Measurement time		Auto or user defined presets (5s, 15s, 30s, 1 min, 2 min, 3 min, 10 min)
Measurement modes		Loss (2-PT or LSA, dB/km), Reflectance
Reflectance threshold (dB)		-0.10 to -99.9 dB in 0.1 dB step
Optical interface		LC/APC
Power (V)[9]		-36 to -60
Communication Interface[10]		10/100/1000Base-T Ethernet

OTDR Configurations			Deadzone (m)	
Order #	**Wavelength (nm)**	**Dynamic Range (dB)**	**Event**	**Attenuation**
Point-to-Point Singlemode - 1 Wavelength				
1315	1310/1550	38/36	0.85 typ.	3.5 typ.
1550	1550	50	0.85 typ.	3.5 typ.
1641	1625 (F)	41	0.85 typ.	3.5 typ.
6539	1650 (F)	39	0.85 typ.	3.5 typ.
6542	1650 (F)	42	0.85 typ.	3.5 typ.
1650	1625 (F)	50	0.85 typ.	3.5 typ.
6545	1650 (F)	45	0.85 typ.	3.5 typ.
6548	1650 (F)	48	0.85 typ.	3.5 typ.

Notes

1. Unless noted, all specifications are valid at 23°C ± 2°C (73.4°F ± 3.6°F), up to 95% humidity using LC-APC or SC/APC connectors
2. 1625/1650 nm SM live-port built-in filter isolation >50 dB
3. Typical dynamic range with longest pulse and three-minute averaging is the difference between extrapolated backscatter level at the start of test fiber to SNR=1
4. Typical SM 1310nm using shortest pulse measured 1.5 dB down from either side of the unsaturated reflective peak
5. Typical SM 1310nm @ Refl =-55dB; add 1m for Refl = -45dB
6. Distance display auto-scale setting for FUT
7. Does not include uncertainty due to fiber index; ±(0.5 + resolution + 3x10-5 x L) over full operating temperature
8. Insertion loss does not include the connector loss, which can be up to 0.75 dB per mated pair
9. 100-250V 50-60Hz AC power option available with external AC/DC adapter, consult factory
10. 10/100/1000Base-T USB-Ethernet available to provide redundant connectivity, consult factory
11. The optional built-in switch has the same performance as the RFTS-400 OSM
12. RFTS-400 OCM has the same operation and storage temperature as the RFTS-400 OSM

OSM Specifications

		Optical Switch	1625 nm FWDM Switch		1650 nm FWDM Switch	
Number of ports		8, 16, 24, 32, 48, 128, 144, 288				
Input port		1				
Wavelength range		1260 to 1670 nm	1260 to 1590 nm (Line)	1610 to 1680 nm (Mon)	1260 to 1620 nm (Line)	1640 to 1680 nm (Mon)
Insertion loss[8] (excluding connectors)	up to 16 ports	≤1 dB max.	≤0.4 dB max. (Line)	≤1.7 dB max. (Mon)	≤0.4 dB max. (Line)	≤1.7 dB max. (Mon)
	up to 64 ports	≤1.8 dB max.	≤0.4 dB max. (Line)	≤2.5 dB max. (Mon)	≤0.4 dB max. (Line)	≤2.5 dB max. (Mon)
	up to 288 ports	≤2.8 dB max.	**Consult Factory**			
Isolation		n/a	>15 dB	>30 dB	>15 dB	>30 dB
PDL, dB		≤0.15	≤0.25		≤0.25	
Back reflection, dB		>50				
Repeatability, dB		≤±0.05				
Lifetime		>1 billion cycles				
Switching time, ms		≤15				
Fiber type		SMF 28e+				
Connector type		MPO/APC,SC/APC,SC/UPC or LC/APC				
Power		Provided by OCM; <3 Watts				
Operating temperature (°C)		-20 to +70				
Storage temperature (°C)		-40 to +85				

Ordering Configuration*

OCM-XX-XXXX-X

OCM Port Count (LC/APC default)
01: 1 port
04: 4 ports
08: 8 ports
16: 16 ports

OTDR Test Module
1315: 1310/1550 nm 38/36 dB
1550: 1550 nm 50 dB
1641: 1625 nm (F) 41 dB
1650: 1625 nm (F) 50 dB
6542: 1650 nm (F) 42 dB
6545: 1650 nm (F) 45 dB
6548: 1650 nm (F) 48 dB

Mounting Type
0: Rack Mount
1: Wall Mount

OSM-XXXX-XXXX

OSM Port Count
Module sizes below apply to none built-in FWDM units only.

LC/APC
L008: 8 ports (1 slot)
L016: 16 ports (1 slot)
L024: 24 ports (1 slot)
L032: 32 ports (2 slots)
L064: 64 ports (3 slots)
L096: 96 ports (4 slots)
L128: 128 ports (6 slots)
L144: 144 ports (6 slots)

Built-in FWDM
Module size may vary with built-in FWDM

0000: N/a
1625: Passband 1260-1590 nm for 1625 nm (F)
1650: Passband 1260-1620 nm for 1650 nm (F)

**Consult factory for additional configurations*

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