RTU-4000 Remote Test Unit
RTU-4100+ Optical Test Module

Remote Fiber Test System (RFTS)

The RTU-4000 platform equipped with RTU-4100+ optical test module monitors optical fiber infrastructures in Core, Metro, Access and FTTx networks, improving workflow and reducing Mean Time to Repair (MTTR).

Key Platform Features

RTU-4000 Hardware

- Small 1U, 19" rackmount profile and construction
- Field serviceable modular design
  - CPU/Power supply
  - RTU-4100+ optical test module
  - Cooling fans
- Local alarm relay contacts on rear panel
- Compatible with VeEX's OXA-4000 optical switches
  - Scalable from 8 to 32 ports in a single 1U
- Connectivity via 10/100 Base-T Management interface
- Supports dual input AC/DC or -48V DC powering options
- Optional SD card up to 256Gbyte for data storage
- Optional 3G/LTE mobile modem for backup communication

RTU-4000 Software

- VeSion server integration compatibility
- OSS integration using SNMP
- Secure connection (HTTPS) support
- SMS, email alerting
- Web Browser access for standalone configuration/operation
- Software Programming and Application support
  - HTTP+JSON API (language and framework)
  - HTTP API configuration/operation using embedded HTTP server

Key Optical Performance

RTU-4100+ Optical Test Module

- Up to 500,000 sampling points with 3cm resolution
- OTDR test port equipped with live fiber detection for monitoring P2P or PON networks
- Out of service/dark fiber testing at 1310, 1550, 1625, or 1650 nm
- In-service testing using filtered 1625 nm or 1650 nm
- OTDR test ports fitted with fixed or universal connectors
- Up to 50 dB dynamic range
- Event dead zone < 1m, Attenuation dead zone < 4m typ.
- Telcordia SR-4731.sor trace format
- V-Scout fiber characterization using multiple acquisitions complete with link map and event tables
- Optional Optical Power Meter (OPM) for level measurement
- Proactively monitor network fibers in real-time, 24/7
- On demand OTDR testing can be automatically triggered by RF or Ethernet probes within VeSion system
  - DOCSIS UCD loss
  - OTN/Ethernet link loss event

Hardware Architecture

Remote Fiber Monitoring and On-Demand Testing

The Remote Test Unit (RTU) is a self-contained, scalable 1U rack mount solution. A state-of-the art modular design, ensures the RTU can be easily re-configured, upgraded or serviced in the field.

Connectivity and Powering Capabilities

Front Panel - The CPU/power supply module is equipped with RJ-45, USB-A, RS-232 and 3G/LTE modem Antenna interfaces.

- RJ45 network port is used for LAN/WAN communication between the RTU and the Server and/or Optical Switch. If communication between VeSion RTU server and RTU probe is disrupted for any reason, the RTU will continue to function in “offline” mode saving measurement results to the internal SD card until communication with server is restored at which time, the results will be uploaded to the server.
- RS-232 Control port supports local low level control of the RTU via special null-modem cable connected to PC.
- SMA connectors support dual antennas interfaces for optional, built-in 3G/LTE wireless modem

Rear Panel – Grounding, cooling fans, switch control port, alarm connector and power inputs are located on the rear panel.

- Grounding screw provides connection to an isolated DC return.
- Dual, cooling fans maximize heat extraction. Thumb screws allow the fans to be removed easily for servicing
- Alarm connector provides “dry contact” relay connection for local monitoring of power outage.
- Dual, 15 Volt DC power inputs provided via hot swappable external AC/DC adaptors
- Negative (-48 Volt) DC power input since most telecom/wireless networks typically operate from a -48 Volt DC power source.
- DB-25 style control port is used to power and communicate between RTU and OXA-4000 Optical Switch.

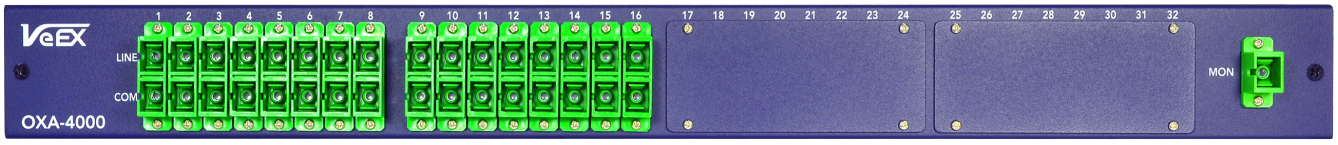
OXA-4000 Optical Switch series

Optical switches allow repeatable connection between the RTU-4100+ optical test module and the fiber under test. Optical switches are typically used to monitor multiple dark fibers or used in conjunction with external FWDM passive component devices or test matrixes for in-service fiber monitoring. Configurations from 1:8 up to 1:32 are available depending on the number of fibers to be monitored. The switch can be configured with an optional dual input ports for dual monitoring operation or application, e.g. Port A to OTDR, Port B to OPM/OSA.

Front panel mounted SC/APC or LC/APC connectors simplify connection, disconnection or inspection of optical fibers. The optical switch is controlled and powered by the RTU-4000 thus no additional power or network connection is required. Flush or 4" recess rack mounting brackets are available.

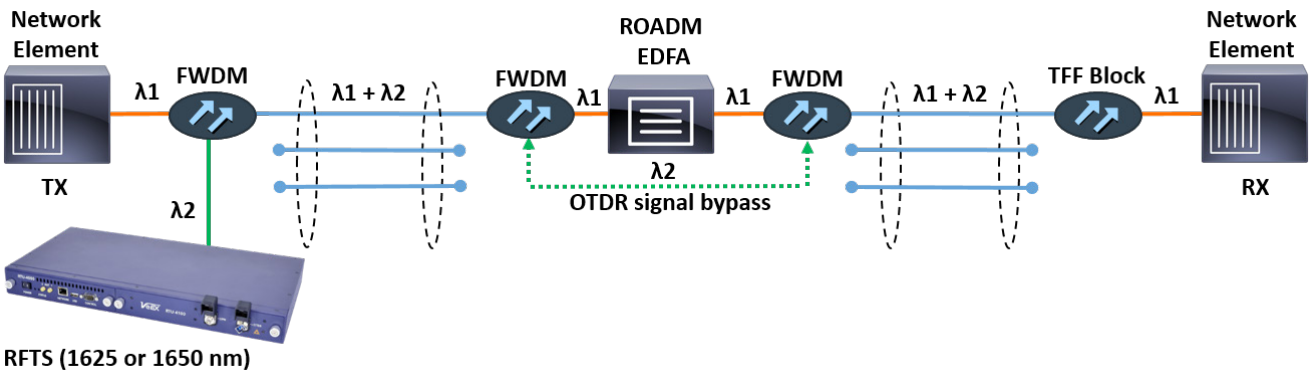
OXA-4000 Optical Switch + FWDM series

VeEX offers the industry's first optical switch with integrated FWDM to test fibers that are in-service or carrying live traffic. By combining the switch and FWDM in a single unit, up to 32 external optical patch cords can be eliminated thereby reducing cost and installation time. Fewer external optical connections reduces reflections and patch cords reducing potential failure and cabling mistakes. The out-of-band OTDR test signal (1625 or 1650 nm) is combined with the live traffic signal using a Filter Wavelength Division Multiplexer (FWDM). Since the optical switch and FWDM offer low insertion loss and a flat passband, both OTDR and live traffic signals traverse with little power penalty. Bypass versions of FWDM are available when the OTDR range covers more than one fiber span or when active devices such as Erbium-Doped Fiber Amplifier (EDFA) or Reconfigurable Optical Add-Drop Multiplexer (ROADM) are present on the fiber span.



RTU-4000 & OXA-4000

When used together, both RTU-4000 and OXA-4000 occupy only 2U of rack space. This form factor offers customers the highest density, 32 port RFTS system available since competitive solutions can require up to 5U space for the same configuration.



Software Support

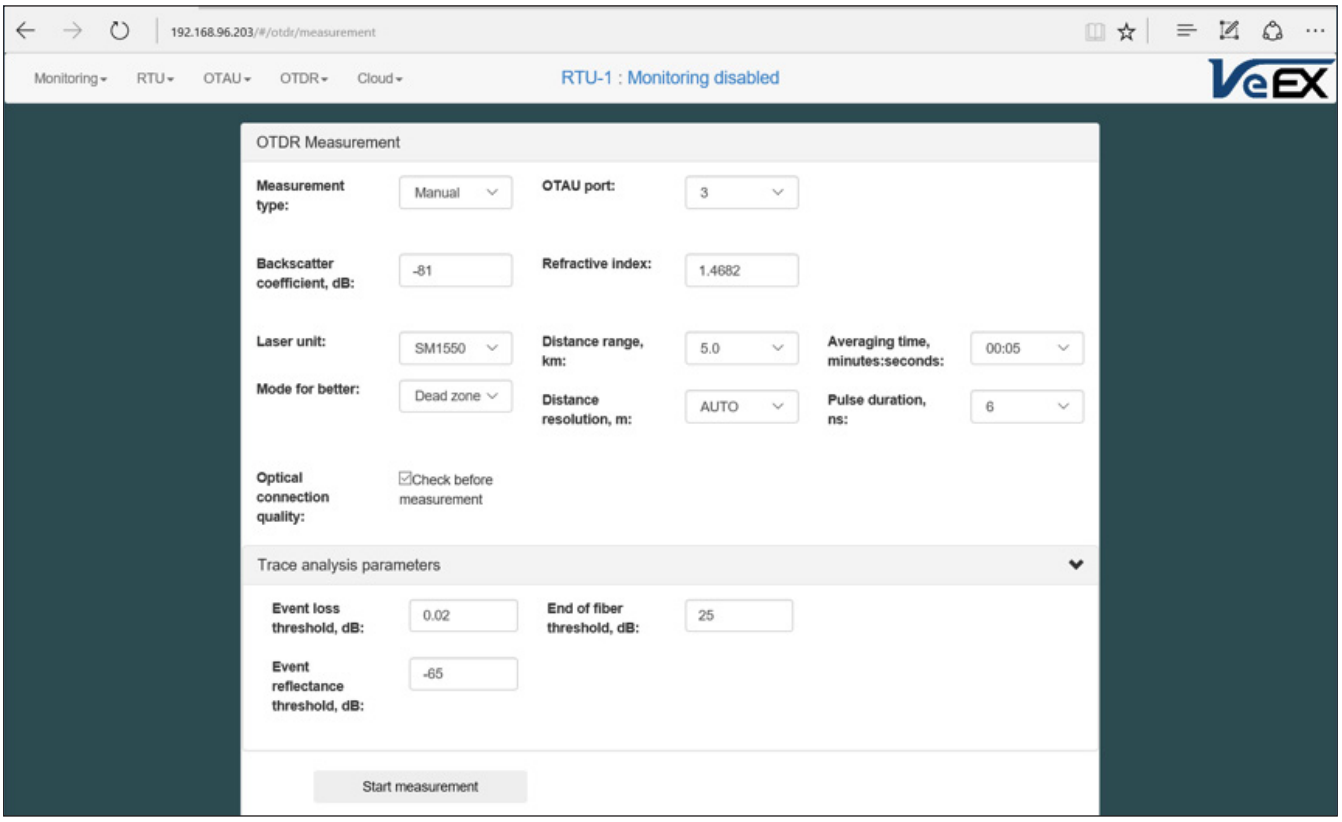
Overview

The RTU runs an embedded Linux Operating System which is highly stable and perfectly suited for 24/7 monitoring and on demand testing. The Remote Test Unit (RTU) can be operated in Standalone, VeSion or custom applications.

Standalone Operation

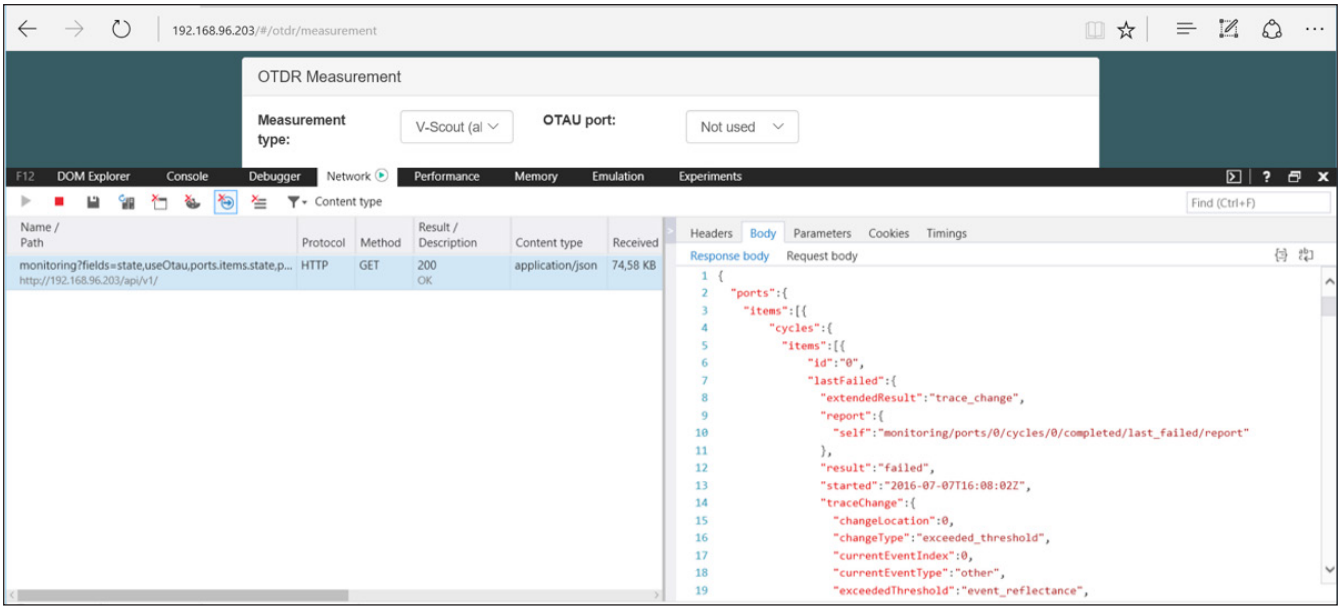
Web Access (HTTP)

The RTU-4000 platform comes with pre-installed software and built-in web server offering simple Out-the-Box, Plug-and-Play operation. Using a LAN/WAN connection and a PC web browser for access, Novice or Expert users can start to test almost immediately. The user simply points the browser to the RTU's IP address to configure, test and monitor a fiber. No RFTS client-server application is required.



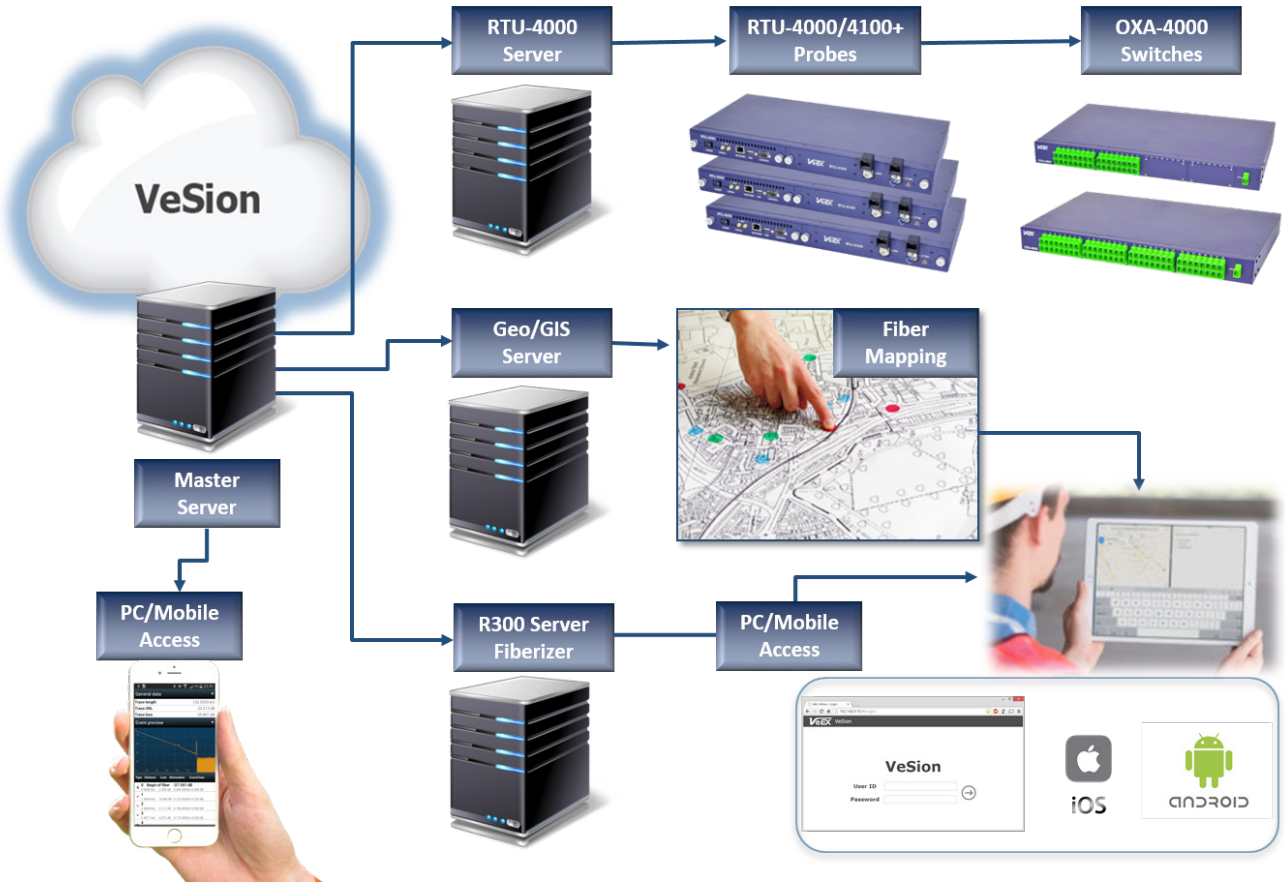
Application Programming Interface (HTTP API)

For custom monitoring applications, Users can configure, control and obtain measurements from the RTU using any programming language that supports sending HTTP requests and receiving HTTP responses. Since the API is already used by the RTU's Web User Interface, it is available simply by pointing the browser to the RTU's IP address. This functionality and flexibility is appreciated by developers who want to integrate the RTU into a 3rd party solution or eco-system using the on-board HTTP+JSON API.



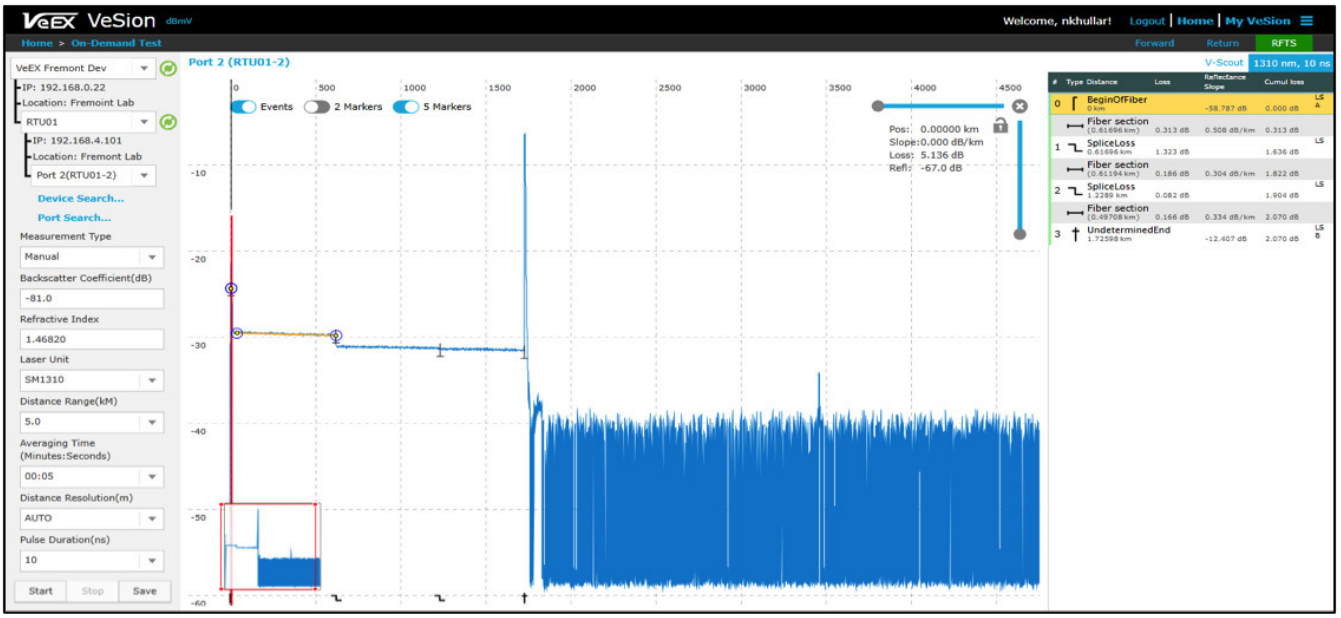
VeSion Server Operation

Depending on network complexity, organizations may prefer to deploy RTUs at strategic points throughout their optical network and have a central server store and manage system information. VeEX's VeSion server architecture is specifically designed for such applications – The Master server continuously polls measurements from the RTUs and compares live test data with baseline traces according to fiber records. Measurement deviations are flagged immediately, triggering powerful alarm management functions and alerts. Precise distance to fault information based on fiber plant documentation (mapping) is available to field engineers for troubleshooting and restoration purposes. VeSion improves network troubleshooting, streamlines workflow and reduces resolution time significantly.



Scalability and Connectivity

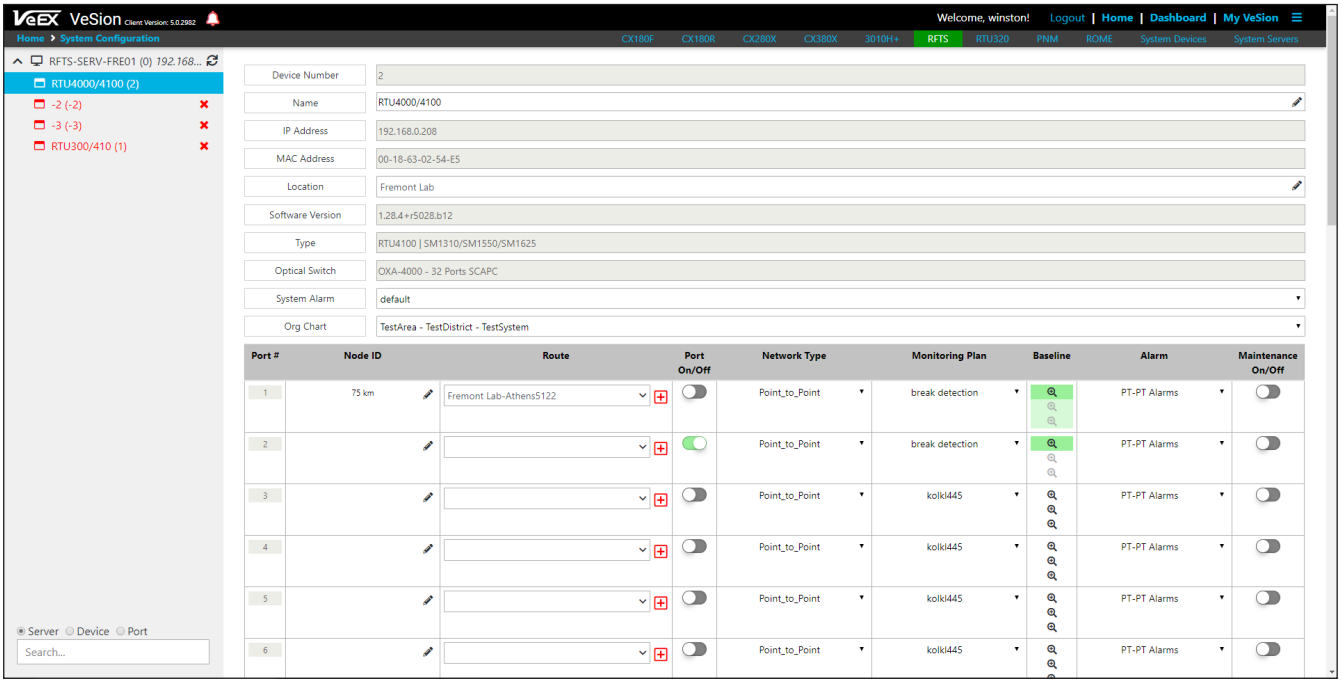
VeSion scales easily reducing initial startup cost and ongoing ownership. The system can start out with a few RTUs to monitor critical links and be expanded later to monitor an entire network. The system is accessible anytime, anywhere, using a common web browser on a PC or mobile device operating iOS or Android. Users can review uploaded test results, system alarms, live traces, and perform on demand tests as required.



Comprehensive Monitoring Modes

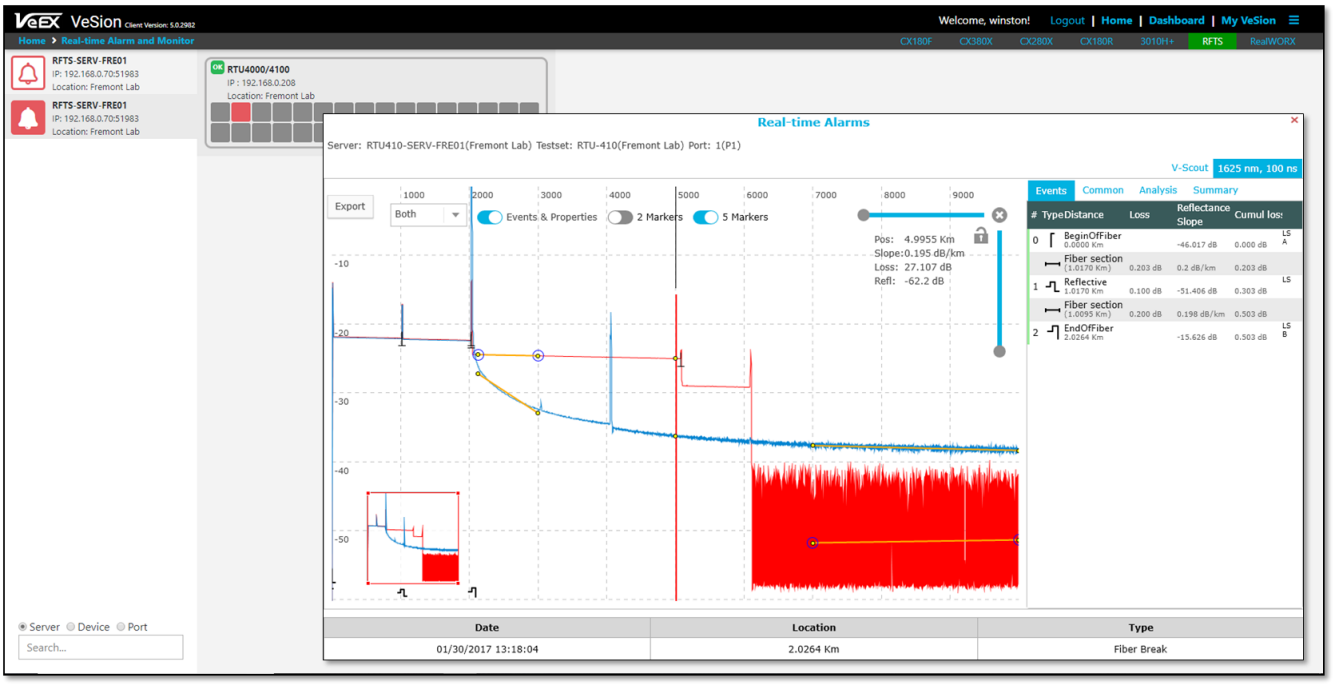
VeSion collects and saves reference trace for each fiber connected to the system. The RTU uses this baseline data to identify critical failures as it routinely cycles through fibers. User defined thresholds identify minor and major deviations from initial test conditions. The types of test modes that can be scheduled and performed include:

- 24/7 monitoring: Continuous test cycles to detect breaks or any other critical deviations. Short-Message Service (SMS) or email is used to notify remote users as to the type of fault and exact location.
- Scheduled testing: Tests predefined at specific times and intervals. Each port can be assigned with up to 3 separate test cycles depending upon SLA requirements.
- On-Demand testing: Tests can be initiated manually via the web UI, or automatically triggered by alarms from companion probes in the VeSion system e.g. RF UCD loss or OTN/Ethernet link loss event. Upon completion or termination of the On-Demand test, the system resumes regular monitoring.



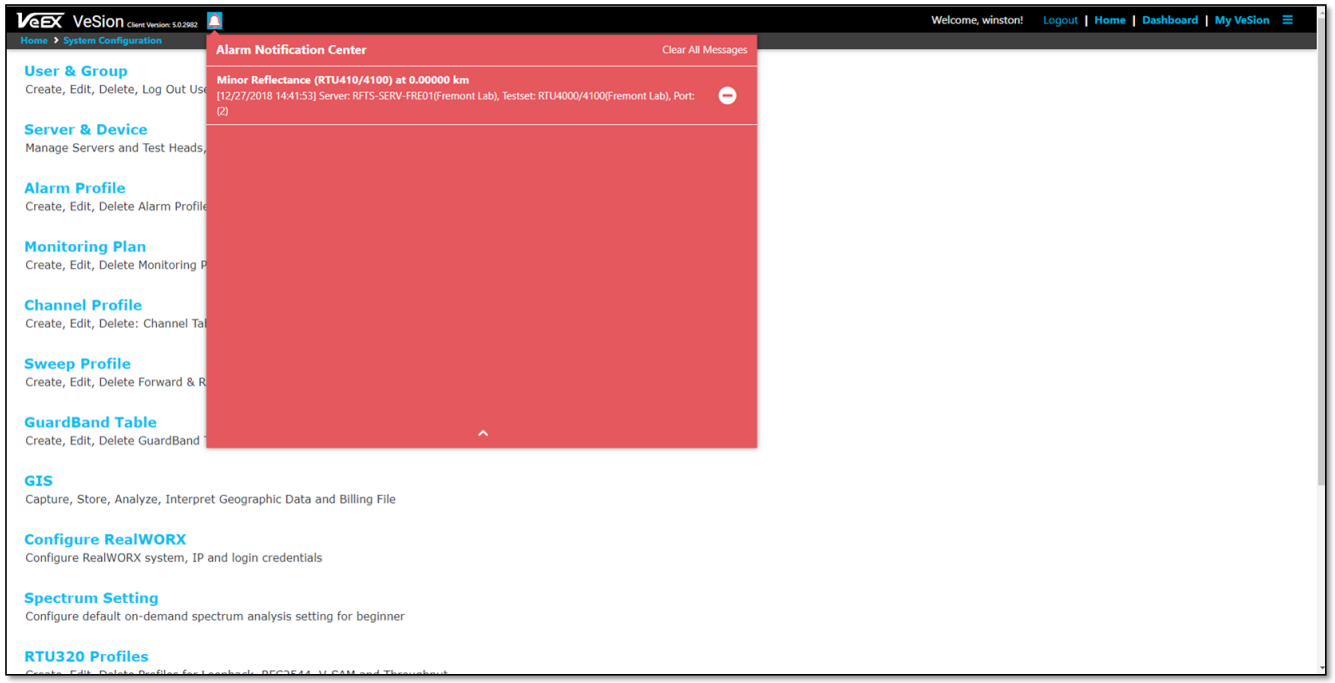
Intuitive Alarm Indication

When a fiber fault is detected, the event is date and time stamped and the exact location (metric or imperial) is displayed in both trace and table format. This information can be integrated with existing trouble-ticket or mapping systems.



Fault Localization & Notification

VeSion provides detailed information about the RTU and port where the fiber failure occurred. Multiple dashboards simplify fault location and diagnostics. Alarm notifications can be sent by e-mail, SMS, Web Services or via SNMP traps for escalation and follow up. RTUs can be segmented by geography or user defined groups, so technicians only see and respond to alarms that apply to them.

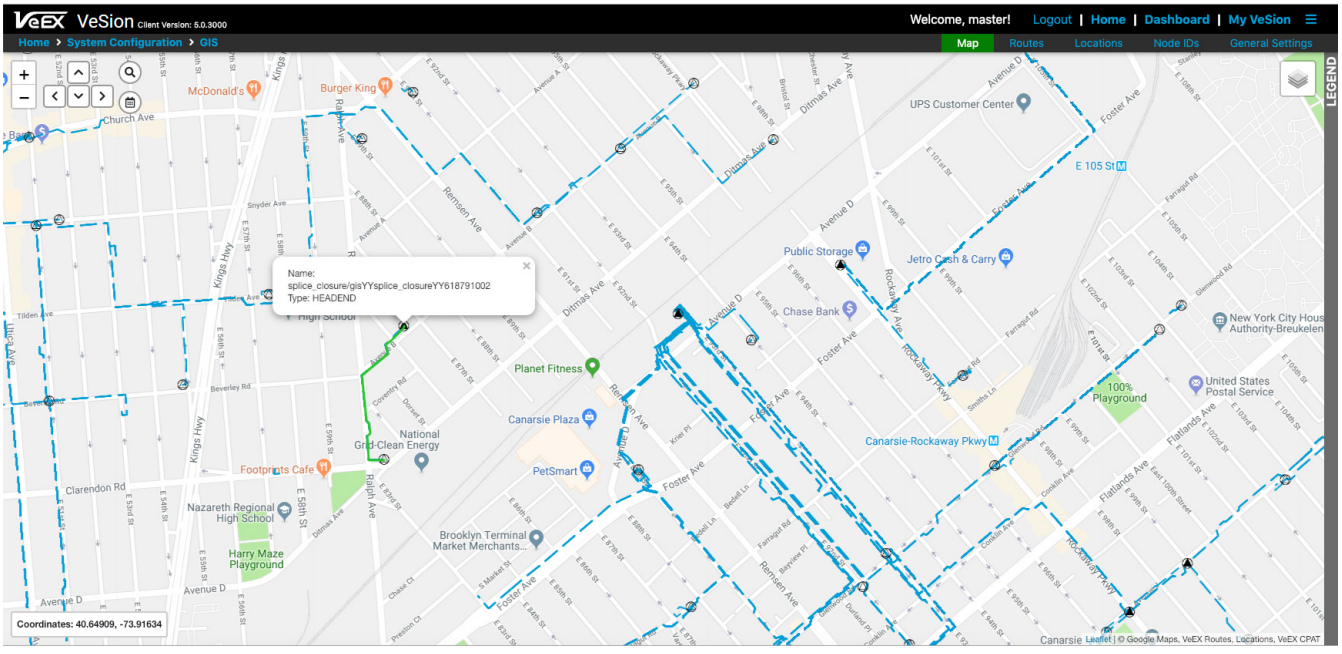


Fiber and Cable Mapping

Geo-Mapping is a valuable software tool to analyze/monitor point-2-point networks or when building new FTTx fiber networks. In either application, GIS fiber planning and mapping provides a powerful geo-based operations platform helping to visualize cable routes, workforce, operational ecosystem, and related resources.

GIS mapping in a remote fiber test monitoring application is typically used to correlate fiber alarms to physical locations so technicians and managers can access a mapping system online using web-enabled smart devices for faster and more effective follow up.

VeSion employs a GeoServer which acts as a gateway to provide bi-directional communication with 3rd party GIS and fiber mapping software. The API comprises a rich collection JSON/Rest resources for interfacing with 3rd party software.



RTU-4100+ Optical Specifications[1]

OTDR Parameters	Singlemode
Wavelength (±20 nm)	1310/1550/1625/1650[2,3]
Laser safety class (21 CFR)	Class 1/1M
Dynamic range[4] (dB)	Refer to ordering guide
Display range (dB)	0.1 to 54.165
Event dead zone[5] (m)	<1
Attenuation dead zone[6] (m)	<4 typical
PON dead zone[7] (m)	<15
Distance range[8] (km)	1 to 400
Distance units	Meter, Kilometer, Feet, Kilofeet or Mile
Readout resolution (m)	0.01
Sampling resolution (m)	0.03 to 16
Sampling points	Up to 500,000
Distance uncertainty[9] (m)	±(0.5 + resolution +5x10-5 xL)
Group index range	1.2000 to 1.8000 in 0.0001 steps
Linearity (dB/dB)	0.03
Loss threshold (dB)	0.0001 to 100.0000 in 0.0001 step
Loss resolution (dB)	0.01
Measurement time (sec)	Realtime, auto or user defined presets (5, 15, 30, 60, 120, 180, 600)
Measurement modes	Loss (2-PT or LSA, dB/km), Reflectance, ORL, Latency
Reflectance accuracy (dB)	±2.0
Reflectance display resolution (dB)	0.1
Reflectance threshold (dB)	-0.10 to -99.9 dB in 0.1 dB step
Typical real-time referesh (sec)	0.2
Optical interface	UPC or APC
Optical connector	Fixed or optional universal interface with interchangeable adaptors
Test Options	**Singlemode**
Optical Power Meter (OPM)	Optional
-Calibrated wavelengths (nm)	650, 850, 1300, 1310, 1490, 1550, 1625, 1650
-Power level range (dBm)	-65 to +10 (PM1) or -50 to +25 (PM2)
-Accuracy, % (dB)	± 5 (0.22 dB)
-Linearity, % (dB)	± 2.5 (0.11 dB)
Optical adaptors	Universal FC, SC, ST, or LC

Notes:

1. Unless noted, all specifications are valid at 23°C ± 2°C (73.4°F ± 3.6°F).
2. Wavelength accuracy ±20 nm or ±2 nm for selected models.
3. 1625/1650 nm SM live-port built-in filter highpass > isolation > 30 dB from 1270 nm to 1585 nm.
4. 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.
5. Typical, for reflection -45 to -55 dB in singlemode and -45 dB to -30dB in multimode, using 3 ns pulse measured 1.5 dB down from either side of the peak of an unsaturated reflective event.
6. Typical 1310 nm attenuation deadzone < 4m; reflectance below -45 dB at 1310 nm and 0.5 dB above linear regression for dynamic range <45 dB; 4.5 dB for dynamic range 45 dB or higher (module dependent).
7. Non-reflective Fiber Under Test (FUT), non-reflective splitter, 13-dB loss, 25-nsec pulse, typical value using 39 dB OTDR.
8. Distance Display auto-scale setting for FUT.
9. Does not include uncertainty due to fiber index.

Ordering Information - Optical Test Functions

Optical Specifications				Test Application		
Single Mode OTDR						
Wavelength (nm)	**Range (dB)**	**Event Dead Zone (m)**	**Attn. Dead Zone (m)**	**Dark Fiber**	**Live Fiber [P2P]**	**FTTX/PON**
Medium Range						
1625 nm (F)	41	<1	<5	●	●	●
1650 nm (F)	41	<1	<5	●	●	●
1310/1550	36/34	<1	<4	●		
1310/1550	39/36	<1	<4	●		
Long Range						
1550 nm	50	<1	<5	●		
1625 nm(F)	50	<1	<5		●	●
1650 nm(F)	48	<1	<5		●	●

Note: Additional optical configuration available. Consult factory for more details.

General Specifications

Size:	483 x 300 x 38 mm (W x D x H) 19.00 x 11.81 x 1.49 in
Rackmount	1U, 19 inch
Weight	>3 kg (less than 6.6 lbs.)
Power Options	
-AC Adaptor (parallel supply)	Input: 100-240 VAC, 50-60 Hz Output: +15 VDC, 5.33 A
-DC	-48 VDC terminal
Operating Temperature	-10˚C to 50˚C (14˚F to 113˚F)
Storage Temperature	-20˚C to 70˚C (-4˚F to 158˚F)
Humidity	5% to 95% non-condensing
Interfaces	RJ45, 10/100-T Ethernet, RS-232, DB-25, USB
Languages	Multiple languages supported/on demand
System Memory	Optional microSD card, up to 256 Gbyte

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