



# PathTrak™ Return Path Monitoring System



# Introduction



The PathTrak family of products includes the optional Field View feature on field meters to allow field technicians to view the return spectrum as received in the headend or hub site.

**PathTrak HFC Performance Monitoring**—PathTrak is the No. 1 selling Hybrid Fiber Copper (HFC) Return Path Monitoring System in the world and is the only system available that is powerful enough to simultaneously monitor and troubleshoot all nodes in a crowded DOCSIS®3.0 environment to support business and residential services.

- Unique LivePacket™ technology to troubleshoot active carriers
- The industry-leading return path monitoring and maintenance system
- Over 300,000 HFC nodes worldwide are monitored and maintained with PathTrak products

**LivePacket Technology**—Demodulates *live* bursty DOCSIS upstreams

- Reveals linear and nonlinear impairments such as group delay and laser clipping within the carrier versus simple ingress
- Provides consistency across enterprise versus CMTS data—values independent of CMTS hardware or firmware versions

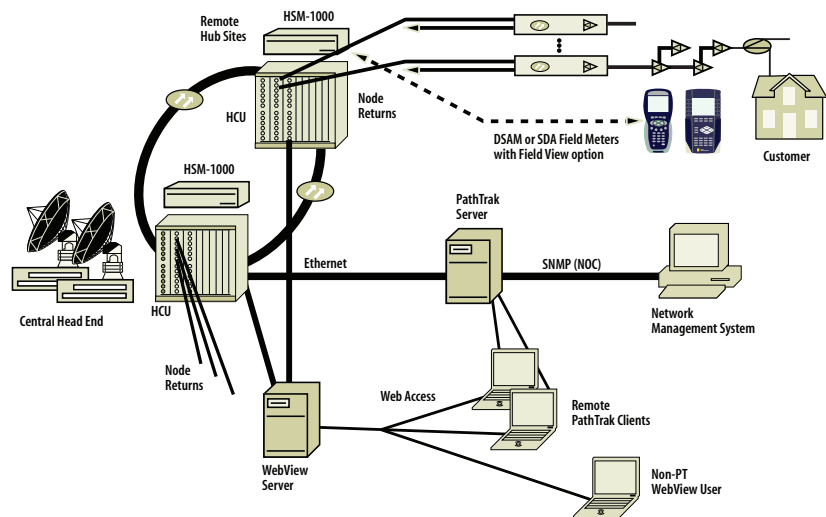
**QAMTrak™ QAM analyzer** (with embedded LivePacket)

- Determine root cause of impairments before rolling a truck using traditional spectrum and LivePacket technology
- Demodulate inserted out-of-band quadrature amplitude modulation (QAM) carriers from Digital Services Analysis Meter (DSAM) to troubleshoot adjacent carriers or test for new carriers
- Eliminates need for traditional stand-alone QAM/spectrum analyzer for troubleshooting return paths
- Updates in real-time for live troubleshooting, unlike stale CMTS data

The PathTrak Return Path Monitoring System offers a highly efficient, continuous, and automated method of monitoring and analyzing RF performance that is ideal for operators who currently deploy or who are planning to deploy DOCSIS 3.0 services. With the exclusive PathTrak LivePacket technology operators can demodulate live bursty DOCSIS upstream carriers and can measure node health on actual revenue-generating upstreams in real time, better than with stale cable modem termination system (CMTS) data and independent of CMTS hardware and firmware versions. Using QAMTrak to view modulation error ratio (MER), level, and constellation on in-service carriers can reveal impairments that spectrum-analyzer-based systems simply cannot see.

As DOCSIS 3.0 and increased business service penetration drive an increasingly crowded upstream, PathTrak has responded with features to mitigate the reduced open spectrum available for monitoring. Narrow 30-kHz resolution bandwidth filters (RBW) filters enable noise floor monitoring between tightly spaced carriers, expanding the frequency range to 500 kHz to 85 MHz allows detection of impairments outside of common carrier locations, and 50-dB dynamic range allows visibility deeper into reduced noise floors.

The architecture uses distributed scanning spectrum and QAM analyzers with advanced network-based software. Analysis tools allow cable operators to quickly troubleshoot issues before they impact the customer. Simultaneously, the ability of PathTrak to communicate with the stealth digital analyzer (SDA) and DSAM field meters (Field View option) lets technicians view the live headend return spectrum to quickly find and fix return ingress problems. PathTrak is the only Return Path Monitoring System available that is fast enough and powerful enough to simultaneously provide monitoring, live remote client spectrum views, constant performance history, and remote spectrum views on field meters (Patent No. 6,425,132).



Only a coordinated team effort armed with the JDSU PathTrak, the industry's most powerful, fastest scanning and most comprehensive return path monitoring system, can proactively maintain quality return performance, assuring that customers who subscribe to advanced two-way services do not have their service interrupted by poor return path performance.

# PathTrak provides something for everyone concerned with network quality.



Operations and Engineering Management

## Your principle focus...

- Improved efficiencies
- Plant reliability
- Integration of all systems
- Proactive processes
- Bandwidth management
- Vendor service support



Network Operations Center Administrator

## Your principle focus...

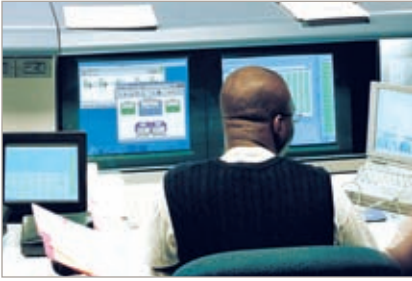
- Constant monitoring over entire network
- Useful alarms
- Operator management
- Ease of system expansion
- Monitor desired return carrier performance

## PathTrak delivers...

- Assign duties based on real-time node status and track progress and changes as work is being completed. Efficient node certification for voice over Internet Protocol (VoIP) services.
- One monitoring port per return provides 24/7 data collection for each node
- Integrate alarms with the Network Management System (NMS) through the use of simple network management protocol (SNMP) interface
- Correlate real-time and historical PathTrak data with other systems such as IP data layers
- Performance history tracks node RF performance
- Distributed digital signal processing (DSP) reduces network traffic to just alarms until detail is requested
- Training Services—customized to users and their system
- Optimization Services—get the most out of your investment
- On-Site Calibration Services—leave equipment in the rack

## PathTrak delivers...

- Use PathTrak to certify returns for advanced service deployments including DOCSIS 3.0
- Discover ingress under high-speed data carriers with Spectrum Analyzer Zero Span or QAMTrak analyzer
- Optimize monitoring plans based on node performance history
- Intelligent Alarm Filtering minimizes alarms of low importance
- Enhanced Alarms instantly displays detailed data before and after an event
- View Performance History for any node(s), stores up to a full month of data
- Assign client rights for ease of use and configuration control
- Scalable hardware and software
- Add or subtract system capacity on your schedule
- Set alarms for minimum and maximum levels, by frequency
- PathTrak Return Path is part of a comprehensive HFC monitoring and troubleshooting solution including field meters, forward path/video monitoring hardware, and all supporting software



Network Operations Analyst

**Your principle focus...**

- Alarm management
- Node health and trouble tickets
- Efficient node certification

**PathTrak delivers...**

- Multiple means to identify the importance of an alarm
- Enhanced Alarms to instantly view detailed data before and after an event
- Export detailed data or simple snapshot of a view
- Monitor multiple nodes simultaneously
- Monitor consistently the same way on all nodes
- Record results to support certification
- View any node, or collection of nodes, with the live Spectrum View or QAMTrak analyzer



Headend Technician

**Your principle focus...**

- Rapid resolution of customer-affecting return path impairments including outside plant technician support
- Proactively identify and address HFC issues which may become service affecting if left unattended
- Maintain and upgrade headend transmission and monitoring equipment

**PathTrak delivers...**

- Use live displays to quickly verify field fixes to HFC linear and non-linear impairments
- Wide variety of RBW filters to enable optimized monitoring plan coverage for crowded upstreams and coverage of entire carriers for DOCSIS measurements
- Expanded selection of user-configurable reports available via the web with optional PathTrak WebView server



Field Techs and Installers

**Your principle focus...**

- Quality control at install
- Isolation of ingress source

**PathTrak delivers...**

- Use live displays to quickly verify field fixes to HFC linear and non-linear impairments
- Remotely enable node broadcasts via WebView, eliminates calling the headend to turn on broadcast for a node
- With Field View option toggle between Local and Remote Spectrum View to see the immediate impact of field work on return noise levels (Patent No. 6,425,132)
- Field View option on JDSU SDA and DSAM field meters (Patent No. 6,425,132) checks that work performed at install does not add to return noise
- Move between nodes and select appropriate node remote view at the meter

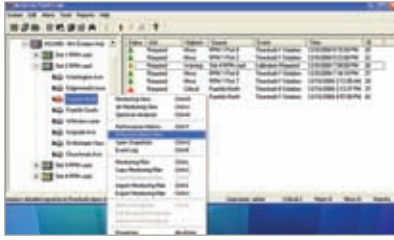


“Chasing return ingress” is a key to proactive network maintenance. The optional Field View feature on JDSU SDA and DSAM field meters places a view of selected return node spectrums in the hands of the field technician without requiring personnel at the headend or hub site.

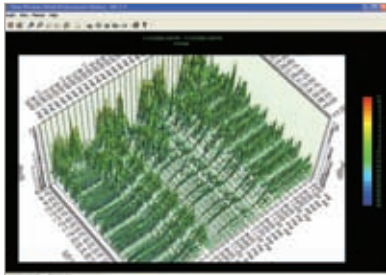
The PathTrak Return Path Monitoring System continuously monitors the upstream noise and carrier levels returning from multiple nodes. As many as 1500 or more nodes may be monitored on a single PathTrak server without any sacrifice in performance. Each PathTrak server can be scaled to handle up to 30 remote clients simultaneously. The management of all nodes on a single system is greatly simplified with highly sophisticated alarm parameters that can be placed on four different thresholds and configurable on each of 250 frequency points within the defined return spectrum. Data captured is stored up to a full month and can be reviewed instantaneously at anytime. With the addition of the optional PathTrak WebView, performance history up to a year can be reviewed in numerous graphical formats. The 250 frequency points can be individually programmed for frequency and threshold levels. Each threshold level may have an alarm assigned to it. There are multiple trigger criteria that are configured to define what activates the alarm. Alarms may be set to trigger off of several different types of changes on the return RF path such as a sustained increase in noise floor level, absence or presence of a carrier level and common path distortion. Logical combinations may be defined to minimize false alarms.

The typical PathTrak system comprises of these principal components:

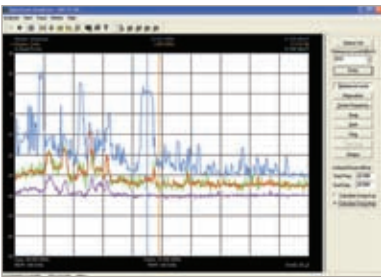
- PathTrak System Software, with a valid central system license file, running on a dedicated server machine provided by the customer
- A quantity of up to 30 Floating Clients per server as enabled in central system license file on server and installed on remote, network connected, workstations provided by the customer
- A quantity of Return Path Modules (RPMs), analyzer cards which capture and process the return path RF activity
- Multiple Remote Headend Control Units (HCU) as enabled in central system license file on the server. The HCU house multiple RPM analyzer cards and are remotely located in the HFC network at headends and hubs.
- The PathTrak server machine, all HCU, and the client workstations are all connected on the private local area network (LAN).
- Optional Headend Stealth Modem (HSM) is used to transmit specific return path spectrum(s) simultaneously to multiple JDSU field instruments that have the Field View option installed



Intelligent alarm capabilities of PathTrak assure that critical issues are alerted to network personnel immediately. Every node may have its own optimized monitoring plan complete with filter and logic settings specific for the monitored frequency point. The use of color and "right-click" shortcuts direct users to alarm source instantly.



Display of performance history over multiple days reveals network characteristics that are cyclical in nature. This 4-day display clearly shows consistent shortwave ingress at the lower frequencies and intermittent CPD fluctuates across several hours. These views help supervisors to identify ingress sources and efficiently schedule maintenance crews.



PathTrak spectrum analyzer views on client workstations are similar to views seen on general purpose analyzers. Familiar measurement settings are available and multiple nodes may be viewed simultaneously. Return spectrums that are needed in the field to compare with local spectrums on either the JDSU SDA or DSAM meters are easily selected for broadcast for field viewing (Patent No. 6,425,132). PathTrak Field View option is required on the field meter.

## PathTrak System Software

All functionality of the PathTrak Return Path Monitoring System is contained in the PathTrak System Software CD, which includes PathTrak Server software that is installed on the customer's server machine (a dedicated PC for the PathTrak system that meets minimum suggested requirements).

Client software for installation workstations, as well as software that is pushed from the server to all remote PathTrak elements, is included on the CD. Electronic versions of all manuals are included.

Separate from the physical package shipped to the customer is a central system license file that represents the purchased system configuration (single server with a quantity of floating clients and single or multiple remote HCUs). The central system license file is attached to the primary MAC address in the PathTrak server machine as recognized by the LAN.

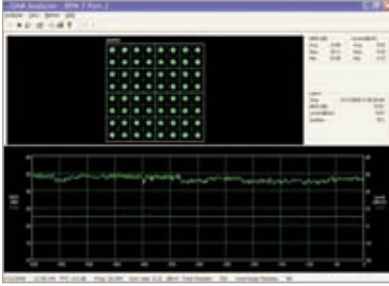
## Client Software

The client provides a user interface to the PathTrak server. Client software is typically installed on the server machine as well as remote workstations connected to the network. Because the software is controlled by "floating licenses," it may be liberally distributed to anyone requiring access to the PathTrak system. The system administrator sets up user accounts to control who has client access to the system as well as assigning various user privileges. The central license file installed on the PathTrak server controls the quantity of clients actively logged into the system at any one time. Users may view return spectrums as well as live monitoring views and performance history.

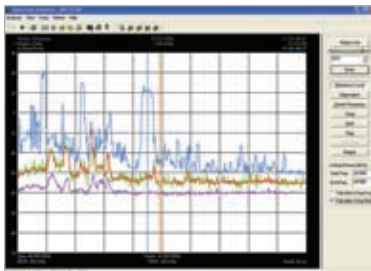
## Return Path Module

The RPM provides ultra-fast scanning of 1 to 8 input ports, each connected to a return path. For purpose of isolating noise and ingress issues to specific nodes, JDSU recommends that a separate RPM port be connected to each return node. Each RPM module is an independent spectrum analyzer with measurement settings and functions such as resolution bandwidth, video bandwidth, dwell time, span, marker control, max hold, min hold, peak search, and zero span. In Monitoring mode, the measurement speed at 300 kHz resolution, monitoring all eight ports, reaches five times per second for each port. Measurement settings can be varied by individual port, allowing users to program each of the eight ports on a single RPM with different monitoring plans.

The RPM provides flexibility to adjust these parameters in monitoring plans, or as a live spectrum analyzer for interactive analysis according to individual preferences. In addition, the RPM is designed with a fast detector for measuring very fast transient noise, ingress, and bursty signals. The RPM can reliably detect and measure bursts of noise as short as one microsecond in duration.



PathTrak QAMTrak featuring LivePacket Technology enables users to demodulate bursty upstream DOCSIS packets from live carriers and view MER, level, and constellation display. QAMTrak enables users to detect and identify both non-linear and linear impairments like group delay and laser clipping which are invisible to spectrum analyzer based systems. QAMTrak can also demodulate and display the same information for carriers injected out of band using a DSAM field meter.



Zero Span in the spectrum analyzer mode is a powerful troubleshooting tool. With the triggered Zero Span mode, PathTrak can capture time domain characteristics of a signal at a specific frequency, including intermittent signals. This capability helps identify undesired ingress under the desired DOCSIS high-speed data carrier returning from subscriber modems.



The Headend Control Unit (HCU)

The entire return spectrum is covered and each test port is scanned several times per second in the 24/7 monitoring mode. In the live Spectrum Analyzer mode, 500 points frequency resolution is used with multiple measurement scans made per second on the port of interest. Each broadcast spectrum of a node return may be viewed simultaneously by any number of field meters that have the Field View option.

### Headend Control Unit

The HCU provides the housing for PathTrak RPM analyzer modules, memory for data storage, and an on-board processor for intelligent analysis and control of monitored data.

The HCU communicates to the PathTrak Server (server PC) via 10/100 BaseT Ethernet connection to notify users of system alarms and status. The housing is an industry standard VME chassis. Each HCU has either 15 slots (HCU1500) or 4 slots (HCU400) for RPM spectrum analyzer modules. The HCU1500 can be configured with RPM modules to monitor from 8 to 120 ports. The HCU400 handles up to 4 RPMs equating to 8 to 32 monitoring ports. Additional HCUs and RPMs may be added to the system at anytime. PathTrak Return Monitoring System is a highly scalable system that maintains high performance in large deployments.

Each HCU contains a multi-gigabyte hard drive module for storage of monitored performance data and a powerful single-board computer module for intelligent analysis. With on-board processing power close to monitoring modules, data storage and analysis is much faster, and more extensive. Communication to the PathTrak Server (server PC) is only required to communicate system status and alarms. Thus, multiple HCUs deployed in multiple remote sites can all perform at equally high speed and are unrestricted by communication links to a central PC controller, which minimizes network traffic over a user's LAN or data communications network. PathTrak does not require a dedicated high-bandwidth LAN to monitor peak performance.

After proper setup, the HCU is a completely self-managed, stand-alone unit. It works independent from the LAN. If the LAN has a temporary outage, the monitoring process still continues. The on-board computer supports all local processing power. Because the computer is a VME industry type, the mean time between failures (MTBF) is much greater than standard PCs.

## Headend Stealth Modem

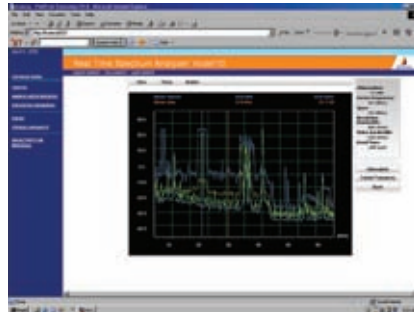
The optional HSM is used in combination with the PathTrak HCU to transport data from the PathTrak system to SDA-5000/4040D and DSAM field meters. The HSM is a required component with the Field View feature. It lets the field technicians observe and compare real-time headend return spectrum graphs from their meter against the local spectrum graph.

Data is transmitted to the field meter via an FSK-modulated (100 kHz) telemetry carrier. The telemetry is inserted into unoccupied bandwidth on the forward path up to 1000 MHz and has an adjustable output level from +20 to +50 dBmV. All telemetry parameters are programmable via PathTrak software. The HSM is located at the data collection point and is connected to the PathTrak HCU with standard RS232 communication. A rear panel RF output port allows for easy coupling to the cable system forward path.



The Headend Stealth Modem (HSM)

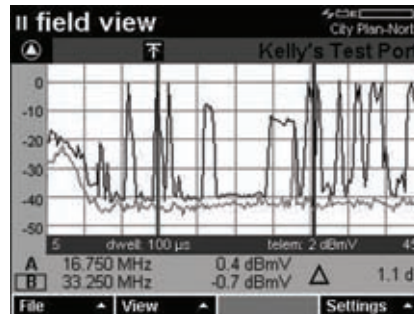
## Additional JDSU Products that Complement the PathTrak System



PathTrak WebView—Uses a separate server to provide browser interface to allow users to remotely access the spectrum analyzer and to create reports used to deploy VoIP.



DA-3400 and PVA-1000—The DA-3400 monitors VoIP traffic and feeds alarm information to OSS systems via SNMP. The PVA-1000 software takes a capture file and lists all of the VoIP calls, the MOS score in each direction, plots the jitter and packet loss, and plays back audio.



The PathTrak Field View option—available on SDA and DSAM meters—allows instant feedback of fixes performed in the field. Eliminates the second person needed to communicate spectrum view at headend. The DSAM PathTrak Field View option also provides a programmable CW carrier with user defined frequency and level up to +58 dBmV.



RSAM—Feeds forward path analog and digital carrier alarm information to the OSS via SNMP. It lets users see both desired and undesired forward path signals from the headend or hubsite in the field or through PC browsers via the DSAM Browser option. Measurements and views include full channel scan, forward spectrum, and individual channel parameters, including level, MER, BER, and constellation.



## Test & Measurement Regional Sales

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