VIAVI

PathTrak™ Return Path Monitoring System

HFC Upstream Monitoring Solution

Key Benefits/Features

- Speed troubleshooting with essential spectrum and cable-modem upstream analysis and monitoring in one solution

- Improve network maintenance efficiency with a more accurate view of node health—evaluate both spectrum and upstream DOCSIS carrier quality

- Prioritize service calls based on customer-affecting issueswith real-time RF and data metrics related to the subscribers' DOCSIS® packets, not near-real-time CMTS data

- Reduce trouble tickets and customer churn by identifying problems before they impact customer experience

- Support field techs with DSAM FieldView™ and Field View QAM™ for one-man upstream troubleshooting

- Use a trusted solution – over 500,000 HFC nodes worldwide are monitored and maintained with PathTrak products

Applications

- View in-band and in-service faults that standard spectrum analysis tools frequently miss

- Troubleshoot linear and non-linear impairments such as laser clipping, group delay, microreflections in-band and in-service

- Use the MACTrak™ node performance index to prioritize repairs and maintenance according to customer-affecting issues

- Easily and quickly detect impairments such as impulse noise, ingress, CPD, and laser clipping on all nodes 24/7

- Identify modems experiencing codeword errors in real time to verify faults—and then fix

The PathTrak Solution

PathTrak, the Viavi Solutions platform for monitoring, maintaining, and troubleshooting the HFC return path, is the most advanced and extensively deployed system of its kind available today. It offers highly efficient, continuous, and automated return path/upstream RF and data performance monitoring and analysis. It is ideal for residential or business DOCSIS 3 service deployment and maintenance. PathTrak gives clear upstream plant health visibility and highlights nodes with service-impacting issues to enable more efficient cable modem upstream service troubleshooting with fewer tech hours and less equipment. The system delivers even more by supporting field techs in their day-to-day work.

Addresses the Network/Upstream Evolution

As the upstream spectrum becomes crowded with more active carriers, it leaves less free bandwidth for traditional spectrum monitoring. This, combined with the evolution to more sensitive and higher-order modulation schemes like QAM 64, means node performance assessment and troubleshooting techniques must be improved. Node upstream spectrum health is still important, but now monitoring must incorporate metrics for both RF carrier health and data health.

It is vital to look at live upstream carriers in-band in order to find linear impairments that are invisible to traditional spectrum analysis tools. The system evaluates this additional health information to rank node performance and efficiently target and prioritize maintenance efforts. Evaluating live subscriber-populated upstream carriers is essential for assessing node performance as the subscriber experiences it.

PathTrak supports this upstream evolution with innovative and unique solutions for RF carrier and data health assessment as well as overall node health. In addition, it provides advanced in-service and in-band DOCSIS carrier troubleshooting tools that let multiple system operators (MSOs) efficiently and proactively certify, monitor, and maintain their DOCSIS networks. In addition to conventional spectrum monitoring, the MACTrak analyzer can demodulate and monitor live, bursty DOCSIS upstream signals to expose linear and nonlinear impairments such as group delay, micro reflections, and laser clipping, in addition to simple ingress along with the affected CPE MAC address. Only PathTrak offers MACTrak technology capabilities on nodes monitored with RPM3000 or HCU200.

MACTrak Performance Monitoring

MACTrak node ranking calculates a node performance index (NPI) for each node. This provides an overall node performance assessment that takes into account the performance of individual upstream DOCSIS carriers during a 24-hour period. Once scored, node performance can be ranked and reported, allowing for dramatic improvements in maintenance targeting and prioritization. MACTrak node ranking also indicates which nodes are improving or degrading, letting you proactively address issues before they impact services.

MACTrak performance history lets you delve into the history of a node and its individual upstream carriers in order to find the cause of a poor node ranking. This historical analysis is vital for determining the root cause behind poor node or upstream performance, for spotting patterns of faults, and for verifying fixes. MACTrak node ranking assesses both RF and data health for your node and upstream signals with key metrics including carrier level, equalized and un-equalized MER, impulse noise and codeword errors, and the CPE MAC address.

Having this wealth of information helps identify which nodes/upstreams have problems, whether those problems are actually impacting subscriber services, and what is causing those issues. This lets you address the most relevant issue quickly and directly. It also provides node and upstream health information consistency across your network. Unlike CMTS data, MACTrak information is independent of CMTS vendor and CMTS hardware/firmware versions. It is real time and is available up to the minute.
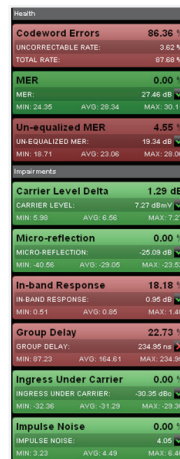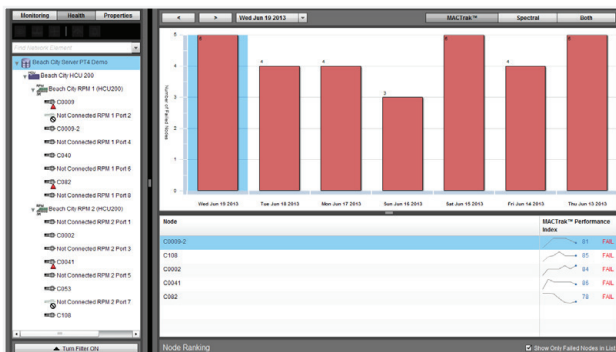
MACTrak data also complements CMTS-derived information by providing a carrier performance index (CPI), ranking the performance of each individual upstream carrier and not just the overall CMTS port (node). CPI is based on multiple in-band metrics, including automated impulse noise detection, and reflects the RF and data health of an upstream carrier. By identifying problem upstreams, operators can target maintenance efforts with greater accuracy.

Live MACTrak Displays

PathTrak supports the unique MACTrak analyzer for live troubleshooting of DOCSIS packets from subscribers or from a DSAM field meter. Again, these in-band and in-service measurements reveal impairments that are invisible to traditional spectrum analysis tools. The Impairments Dashboard allows you to see, at a glance, what is impacting RF and data performance, all in real-time.

The detailed metrics expose upstream packets with codeword errors and which impairment(s) are causing this. All key metrics including MER, un-equalized MER, codeword error rate, in-band response (ripple), group delay, ingress under the carrier, spectrum, micro-reflections, impulse noise and constellation diagram are provided in one comprehensive and easy-to-read display.

Pausing measurements enable packet-by-packet result reviews to identify corrupted packets and impacted MAC addresses.

Optimized for DOCSIS 3

PathTrak hardware covers the full DOCSIS 3.0 upstream frequency range from 500 kHz to 85 MHz. The dedicated spectrum analyzer has a wide variety of resolution bandwidth (RBW) and video bandwidth (VBW) filters optimized for measuring and monitoring in crowded upstreams. A 50 dB dynamic range accommodates the reduced noise floor commonly needed for QAM 64 upstreams.

Spectrum Analysis

Spectrum analysis is still an important aspect of upstream maintenance and troubleshooting. The PathTrak spectrum analyzer addresses the entire upstream band and more for future proofing against upstream expansion and identifying issues that either cause or are the result of laser clipping. Monitoring and analysis up to 85 MHz enables identification of spectral artifacts which are caused by laser clipping. Visibility down to 500 kHz enables identifying issues such as low end noise or AM radio signal ingress which can cause laser clipping.

Spectrum data also complements CMTS-derived data by providing information about upstream performance outside of those frequencies occupied by the DOCSIS carriers themselves (which is all that the CMTS data covers).

Supports the Field Tech

Effectively delivering PathTrak MACTrak capability to the DSAM, Field View QAM is the latest interactive development between PathTrak and DSAM. Its primary aim is to reduce modem upstream test/fault find times and convert upstream troubleshooting into a one-person task for techs or installers. By delivering live modem upstream measurements from hub sites to the field, it removes the need for an additional tech or additional test equipment at hub sites or support from NOC staff.

Measurement Plans Adapt to User Preferences

PathTrak real-time troubleshooting and monitoring configuration is extremely flexible. For spectrum monitoring, users can implement a simple yet effective monitoring plan for node certification. Or, they can choose to set up multiple alarm levels with up to five different thresholds for each monitored frequency. Measurement parameters for individual ports can vary, with each port having a different measurement plan if desired. Users can also set the measurement parameters for an individual port by frequency, and can scan different spans of the upstream spectrum at different resolutions or skip certain spans of spectrum altogether. Various resolution bandwidth filters allow for effective monitoring between carriers in crowded upstreams. Thresholds and alarms can be set to detect and trigger on several different types of events: sustained noise floor shifts, impulse noise, common path distortion (CPD), laser clipping, etc. For upstream DOCSIS carrier monitoring (via MACTrak Performance Monitoring), users can choose standard (default) DOCSIS parameters or customize limits for level, equalized/un-equalized MER, impulse noise, and codeword error rate, including uncorrectable errors. Users can choose the level of complexity and usage of advanced features based entirely on their needs.
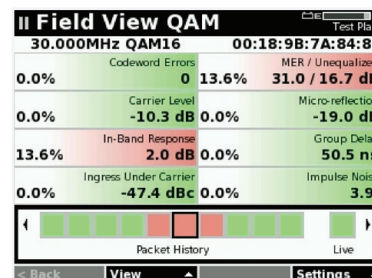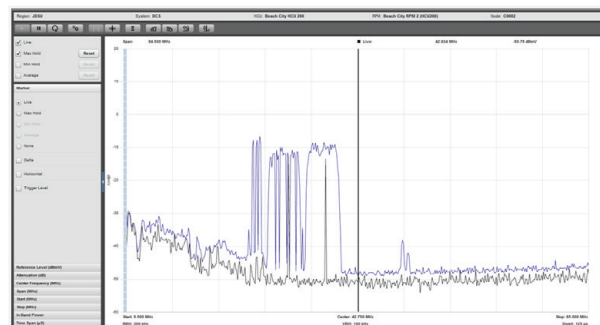
Alarm Notifications

Intelligent alarm generation and filtering minimizes the number of low importance alarms, while an enhanced alarm view displays data before and after an event for extra detail and clarity.

MACTrak Alarming

Until now, only alarms from PathTrak's spectrum-based measurements were available. However, operators also need to see alarms based on the DOCSIS carriers themselves in order to see service health and to better prioritize the daily workload of their technicians. This lets them respond faster to developing faults—before subscribers even become aware of an issue. MACTrak alarm events are based on the node performance index (NPI) built on individual DOCSIS upstream carrier metrics like codeword errors (data health) and equalized/un-equalized MER and impulse noise (RF health). These alarms reflect real customer experience and service-impacting events. Operators are now able to get alerts from PathTrak every 15 minutes as a proactive notification of deteriorating node/service health. They no longer need to wait 24 hours for the results of spectral node ranking (or other CMTS polling cycles and node ranking tools). MACTrak alarms also integrate with third-party OSS systems and link into the PathTrak Mobile app for remote verification/troubleshooting.

User Access

An intuitive user interface and web-browser access eliminates the need for a thick client. In addition, a smartphone and tablet app delivers easier field access to live spectrum traces for analysis, improving usability and enabling simpler troubleshooting. Assigning user rights and access customizes what nodes users can view and work with, easing navigation and usage.
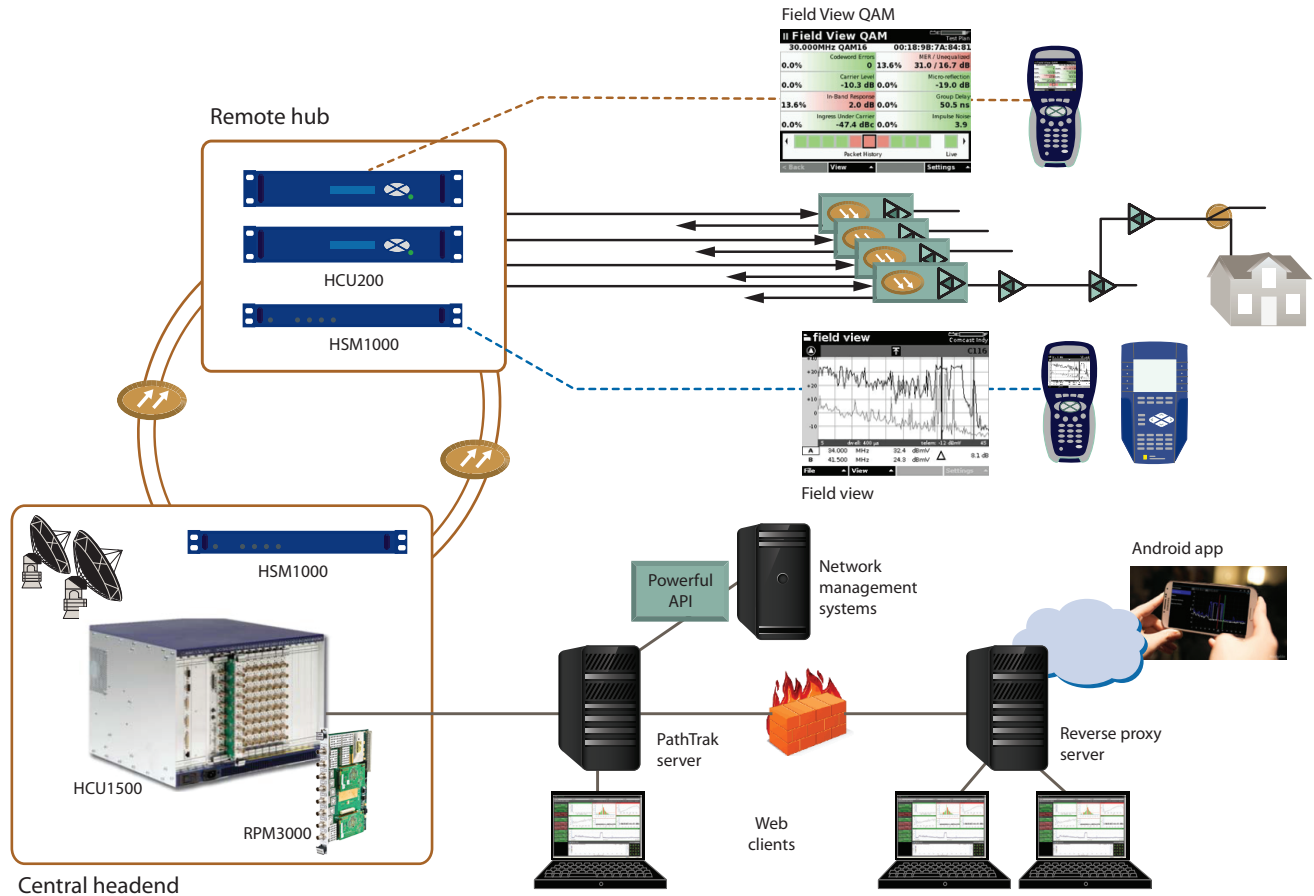
System Integration

PathTrak includes an open MySQL database and an improved API, simplifying third-party application access to PathTrak measurement data and enabling custom report generation built on multiple data sets. This enables correlating real-time and historical data with that from other systems to assess overall network and service performance—for example, enhancing data mined from CMTS with spectrum and MACTrak data with SNMP support for communicating actionable, real-time alarms to additional network management systems.
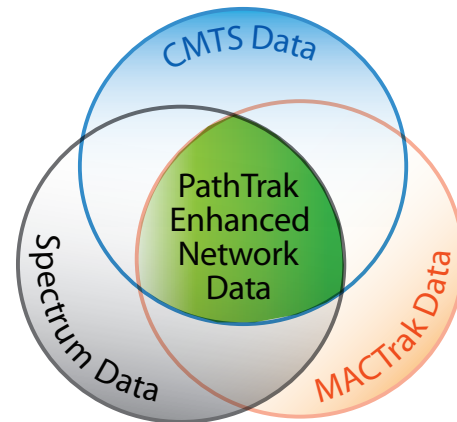
System Architecture and Components

The PathTrak system software communicates with the headend control unit (HCU), creating a distributed monitoring and troubleshooting solution with centralized management where a single system server can monitor more than 2000 nodes. The system continuously monitors upstream noise, ingress, carrier levels and carrier quality without sacrificing performance. Additionally, PathTrak works with Field View QAM™ to deliver spectrum information and upstream carrier information to DSAM field meters. This lets techs see upstream spectrum and carrier information, enabling faster find-and-fix for upstream problems. PathTrak is the only system powerful enough to support all of these capabilities simultaneously.

The system stores spectrum monitoring data for a full year in an open MySQL database and the data can be reviewed and reported in numerous graphical formats. Upstream DOCSIS carrier monitoring data is held for one week; more than a week is typically unnecessary as usually action has been (or should have been) taken by that point. Having both spectrum and DOCSIS history provides the information and detail necessary to certify new network or new upstream bandwidth for reliable DOCSIS services.

Field View QAM

Remote hub

HCU200

HSM1000

Field view

HSM1000

Network management systems

Powerful API

Android app

HCU1500

RPM3000

PathTrak server

Reverse proxy server
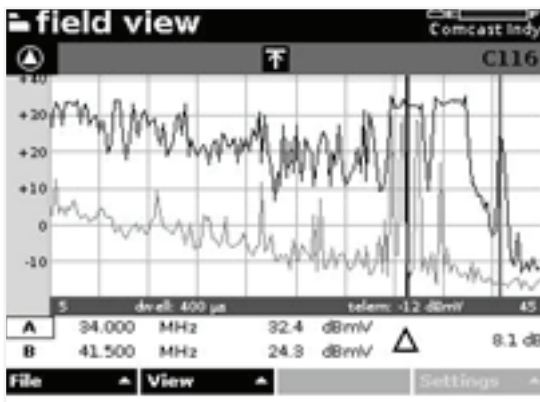
Web clients

Central headend

The HCU200 is a 16-port, high-speed return-path QAM and spectrum analyzer optimized for the PathTrak QAM and ingress analysis and monitoring functions. It is a self-contained probe with on-board data processing and solid-state memory for storage, with a small footprint requiring only 1 RU of rack space. Each monitoring port is an independent, isolated test port between which the HCU200 automatically switches to individually measure both upstream QAM and spectrum performance. The measurement settings and functions consist of all typical spectrum analyzer settings including resolution bandwidth, video bandwidth, dwell time, span, marker control, maximum hold, minimum hold, peak search, and zero span.

In addition, the HCU200 supports unique MACTrak analyzer settings for troubleshooting live DOCSIS packets from subscriber modems or from a DSAM field meter. Each HCU200 operates independently, so adding units will not adversely affect overall system performance. HCU200 quickly and easily integrates with current PathTrak systems and is fully compatible with existing HCUs and other components. A simple field upgrade solution is available for units deployed without MACTrak software options.

The return path module (RPM3000) is an eight-port module with the same high-speed upstream QAM and spectrum analyzer capabilities for analysis and monitoring functions. Each of the eight ports is an independent, isolated test port between which the RPM3000 module automatically switches to individually measure both upstream QAM and spectrum performance. The RPM3000 works in conjunction with the HCU1500 chassis (and older HCU400 chassis) and serves as an enterprise solution for monitoring a larger number of nodes with a single chassis. Each HCU1500 holds up to fifteen RPM cards totaling 120 monitoring ports. Each RPM3000 supports the same features and capabilities as the HCU200 and operates independently—adding modules to HCU chassis will not adversely affect overall system performance. A field upgrade solution is available for RPM3000s deployed without MACTrak software options.

Expands and Scales Without Performance Degradation

A PathTrak system can be designed to serve today's existing test points and then easily expand to add additional RPM3000 modules or HCU200 at a later date. Furthermore, because each RPM3000 module or HCU200 is independent, adding modules will not adversely affect overall system speed or performance.

All monitoring and historical information is processed and stored locally in the HCU. If network connectivity to the PathTrak server is temporarily lost, the monitoring process will continue, leaving no gaps in any alarm or performance history. Local processing and storage means less network traffic as a consequence of the regular monitoring process. HCU data is backed up to the server at specified times in order to take advantage of periods with low network usage.

The headend stealth modem (HSM1000) works in combination with the HCU200 and HCU1500 chassis to deliver upstream spectrum traces captured by PathTrak to SDA and DSAM users out on the HFC plant. This lets field techs observe and compare local return-spectrum traces with head-end or hub-site traces for troubleshooting purposes. The HSM is a required component for the SDA and DSAM FieldView feature (not Field View QAM). A single HSM can support a fully populated HCU1500 or up to 8 HCU200s.

Backward Compatibility

RPM3000 modules and HCU200 units are quickly and easily integrated with current PathTrak systems and are fully compatible with existing RPM1000/2000 cards, HCUs, and other components. A flexible upgrade by exchange program is available for older RPM1000/2000 hardware that lacks DOCSIS 3.0 support and MACTrak™ capabilities.

For more information, please call your local Viavi representative.