Application Note

Sweeping in an Evolving Network

VIAVI Solutions

VIAVI helps operators build, deploy, and maintain an ever-evolving network. Using the fastest tools for alignment, balance, and sweep, networks can be expanded within tight time constraints. As networks evolve to a Remote PHY architecture, VIAVI is ready with full upstream sweep support. And as PNM tools evolve, XPERTrak and the ONX will help rapidly fix the issues and validate the network performance.

CONSTRUCT, EXPAND, AND FIX

- Test and align downstream network expansions to 1.2 GHz
- Pre-qualify upstream RF performance up to 204 MHz in < 2 seconds
- Validate networks prior to activating service flows in unused spectrum
- Fix network RF problems faster than other methods

SWEEP IN REMOTE PHY NETWORKS

- VIAVI upstream sweep is compatible with most Remote PHY network equipment manufacturers
- Use the same procedures for return sweep and amp alignment in Remote PHY and legacy networks
- Sweepless Sweep provides fast, full lineup analysis for sweeping forward path without the need for telemetry

SUPPLEMENT PNM SYSTEMS

- Use active sweep to quickly fix plant issues identified by PNM tools
- Locate, correlate, and fix problems with DOCSIS EQ and ICFR comparison to PNM
- Don't waste time sweeping "clean plant"- sweep to fix where needed as identified by PNM tools like XPERTrak

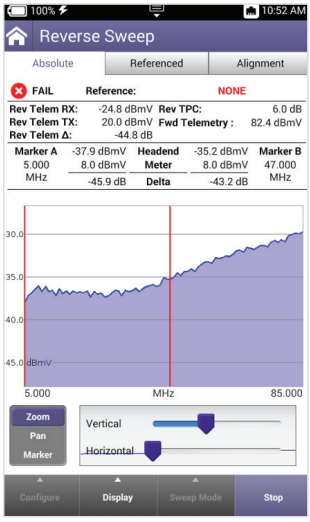
Highlights

- Upstream sweep works seamlessly between legacy networks and DAA networks
- Active return alignment and sweep takes only seconds and is the best way to turn up and fix the outside plant.
- DOCSIS® testing is a recommended supplement for final network validation when a technician can afford to take minutes to test.
- VIAVI sweep on the ONX is fast and clean enough to sweep OFDM-A carriers with little to no impact to customer services
- Sweepless Sweep™ is the recommended and accepted R-PHY downstream validation method
- Active forward sweep is recommended for frequency extension testing
- Challenges with using DOCSIS carriers for return alignment:
  - Changing power levels with OFDM-A and with variable bonding count
  - Is not full band
  - Is slow due to range response time

Active Sweep - Fastest Amp Turn-up, Balance, and Alignment

Time to resolution is important:

- Active return alignment and sweep are the fastest performance validation methods
- Results available in just seconds
- Response time to amp changes (tilt, gain, EQ) is <1 second
- DOCSIS-based alignment can take 2–8 minutes. Level changes often take 2+ minutes to respond via DOCSIS
- Downstream active sweep – necessary for proving out frequency expansions



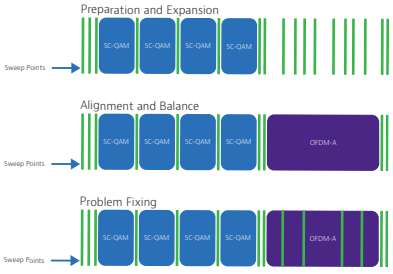
Sweep OFDM and OFDM-A with No Service Impact

Upstream Sweep with OFDM-A

- 2 points or 200 points – provides fast, stable results in seconds
- When preparing for new carriers, sweep with tightly spaced carriers to get best frequency response results
- Balance and align with points adjacent to OFDM-A carriers – fast and effective

Downstream Sweep with OFDM

- VIAVI sweep references the OFDM carrier at multiple points within the carrier band



Sweeping Through OFDM-A Carriers:

Extensive research has been completed assessing potential service impact of sweeping through OFDM-A carriers. While there can be negligible packet loss under a small minority of network loading and sweep configuration conditions, under no circumstances did VoIP MOS scores drop below 4.0. Upstream sweep pulses are only present while a tech is actually testing, and sweeping through carriers is generally performed while repairing critical plant faults and is considerably less intrusive than most other common plant troubleshooting practices.

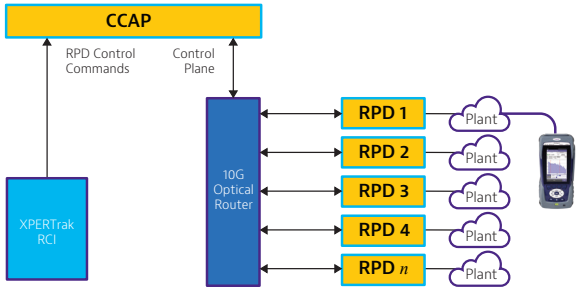
Sweep on Remote PHY is a Reality

Reverse Sweep on Remote PHY

- Virtualization enables identical meter and process for DAA vs. legacy nodes
- Same active reverse sweep injection from ONX in the field
- Telemetry and sweep interaction enabled by XPERTrak orchestration and capabilities of Remote PHY

Forward Sweep on Remote PHY

- Sweepless Sweep uses the active downstream carriers generated by PHY
- Sweepless Sweep requires no telemetry

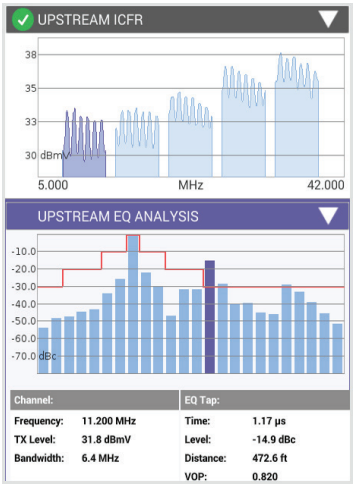


DOCSIS Tests with ICFR for Final Validation and Troubleshooting

ONX DOCSIS testing with integrated modem provides fastest complete service verification

Pros of DOCSIS-based validation:

- Downstream bonding – ensure all carriers are bonding
- Upstream power levels
- Upstream ICFR and EQ correlates to PNM



Cons of using DOCSIS for alignment/sweep:

- Slow or ineffective for Alignment. Relies on Station Maintenance messages – can take 2–5 minutes to settle
- Power levels can vary with OFDM-A traffic or SC-QAM bonding count

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