1.2/1.8GHz Upgrade Projects

Maxcom Signal Generator for Plant Validation

Background on Product Development

- Traditional cable MSO's have a significant investment in existing plant architecture, using the DOCSIS platform.
- DOCSIS 3.1 has given the MSO's the platform for increased speeds (upstream and downstream) utilizing existing coax infrastructure.
- Development of DOCSIS 4.0 further enhances these capabilities:
  - DAA (RPHy, RMACPHy)
  - Full Duplex
- By combining a high split for return path (anywhere from 85MHz to 204MHz) with expanded bandwidth (currently 1.2GHz, but moving to 1.8GHz) allows even greater use of existing HFC network, significantly reducing upgrade costs.

Background on Product Development

- In current networks, many operators only have signals out to less than 860 MHz.
- Work is being done to change out amp/le modules, but typically the passive plant is left alone, unless a known change needs to be made.
- Some systems have the capability to send a single carrier at 990 MHz, but this one carrier would not pick up any suck outs, or other problems.
- Having an ***inexpensive*** hand held tool, that can be used in the field, allows quick and easy plant verification.

Product Applications

- For plant verification
- Used in conjunction with existing Meters:
  - Viavi ONX 620 and 630
  - XM2 meter
  - Devisor
  - Any other meter that will generate a peak hold to see full spectrum
- Use in spectrum analyzer mode
- Inject signals from 700 MHz up to 1800 MHz
  - Frequency Agile – user selects frequency range desired
- Used to identify potential problems in plant such as:
  - Old generation taps
  - Old generation splitters
  - Amplifier modules that have not been upgraded
  - Bad cable segments
  - Bad connectors

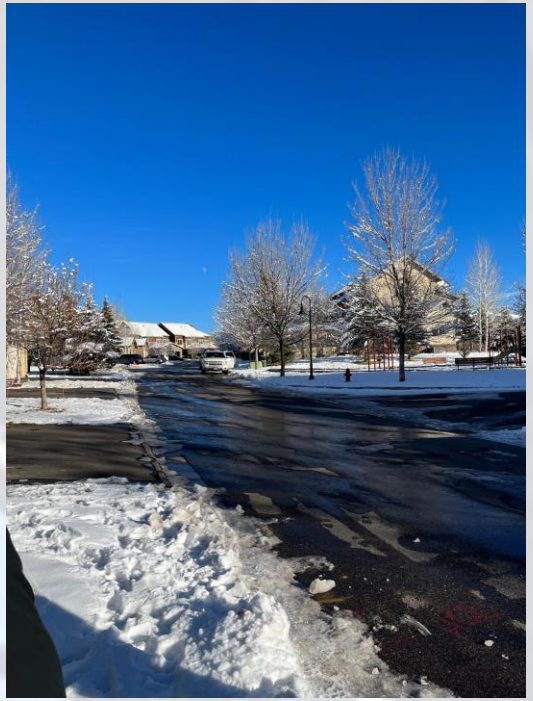
Product Applications

- Construction
  - New build or upgrade areas, where verification is needed that segments will pass the higher frequencies. Areas where cold splicing is involved as well.
- Fullfillment
  - Verification in newly acquired MDU's/Bulk agreement locations, to verify drop infrastructure
  - Verify MoCa filters in home. Only carry to 1050 MHz, if higher spectrum is needed to 1200 MHz, MoCa filter will need to be replaced.
- Maintenance
  - Trouble shooting problems, need either a single carrier, or multiple carriers at higher frequencies, to determine performance
- Business Partners (Contractors)
  - In all areas identified above, where they are doing the actual work
  - Provides operator with a verification, as screen shots of sweep are saved

Field Evaluations

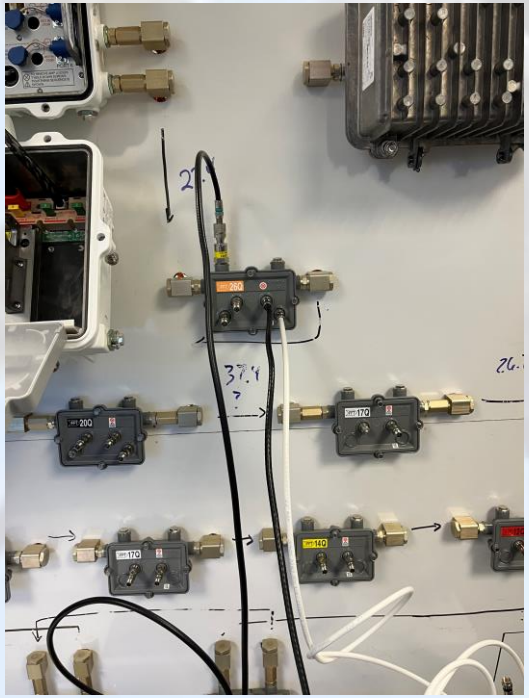
- Burns, OR
- Gypsum, CO
- Tampa, FL
- Sacramento, CA
- Lexington, KY
- Reno, NV
- Birmingham, AL
- Austin, TX
- Kansas City, MO

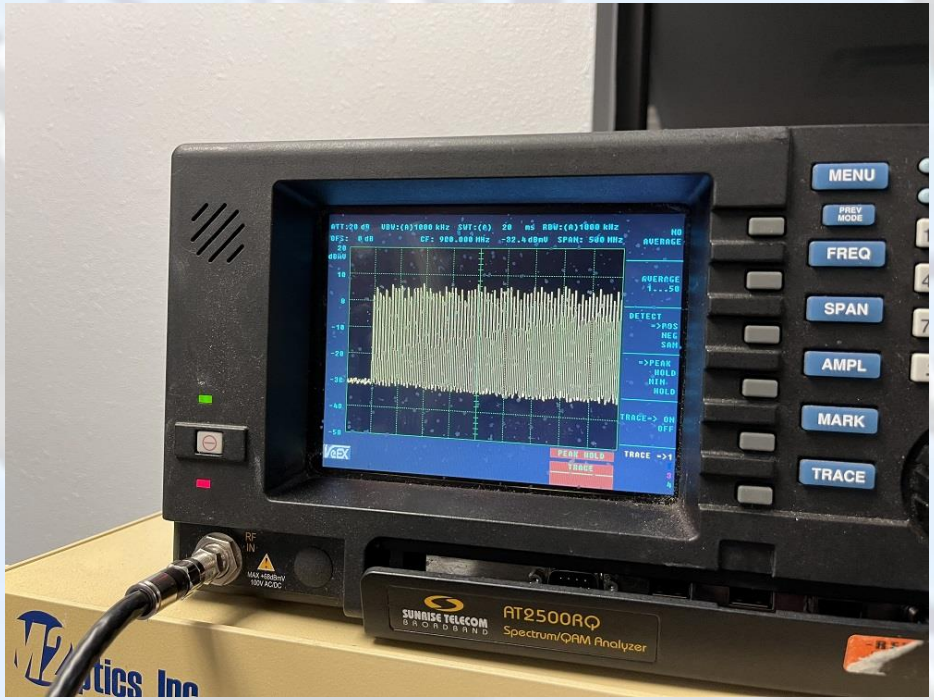
Gypsum, CO

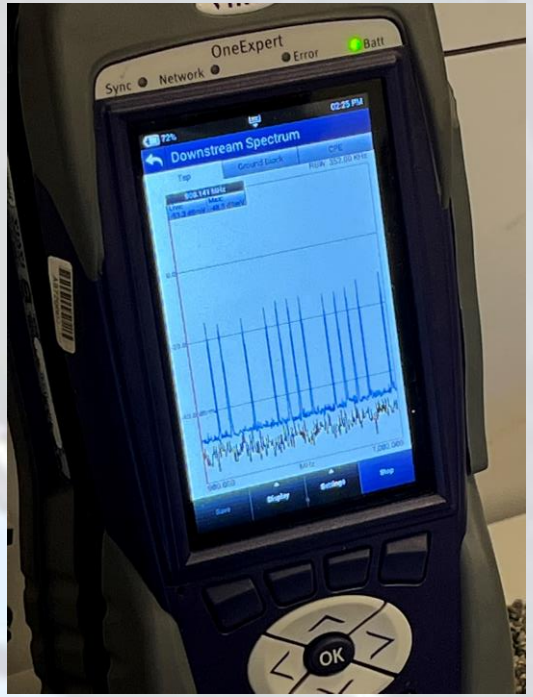


Very first field demo, injected at node test point, measured at tap 300 ft. down the road. Working with the XM2 meter. Validated results with and without carriers (plant powered, not powered). Team continued to use, and verified end of lines. All brand new plant.

Tampa, FL

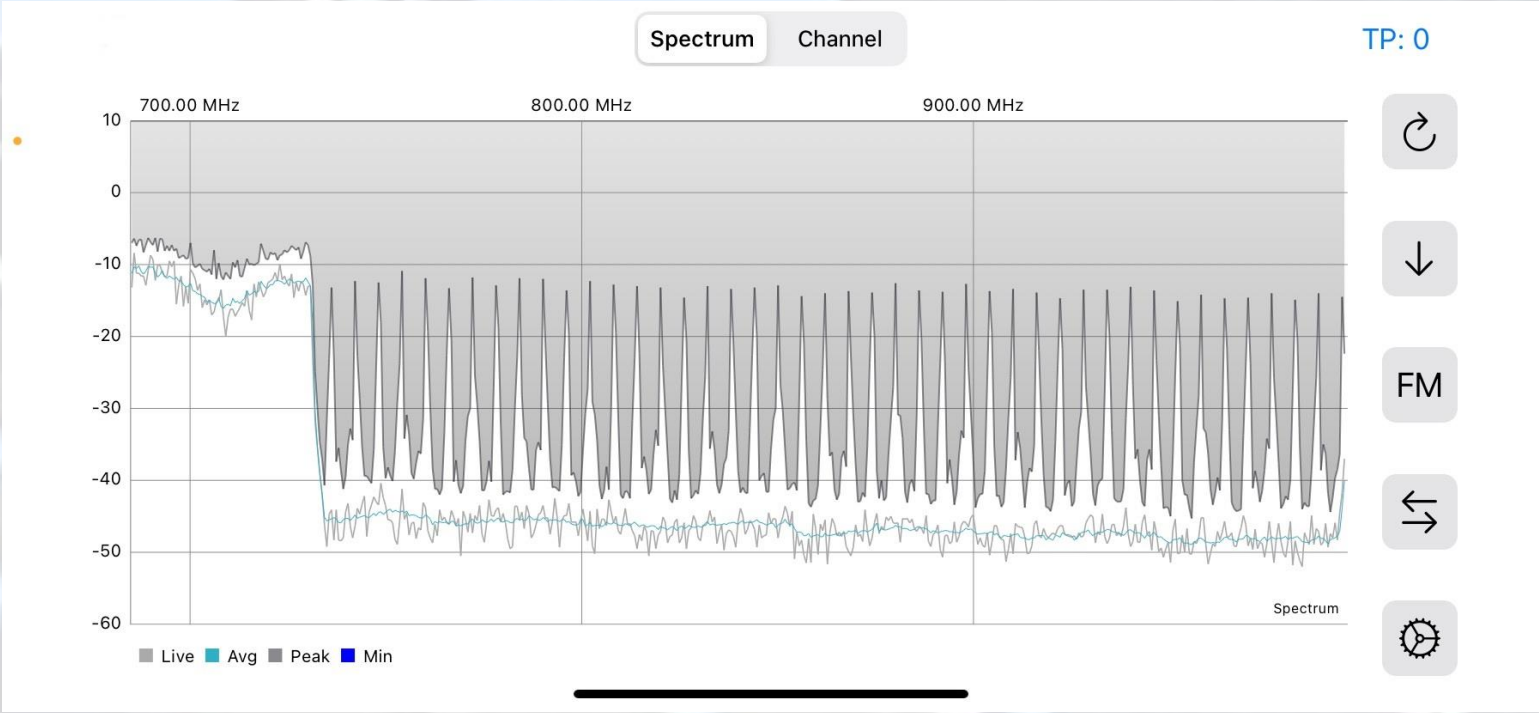






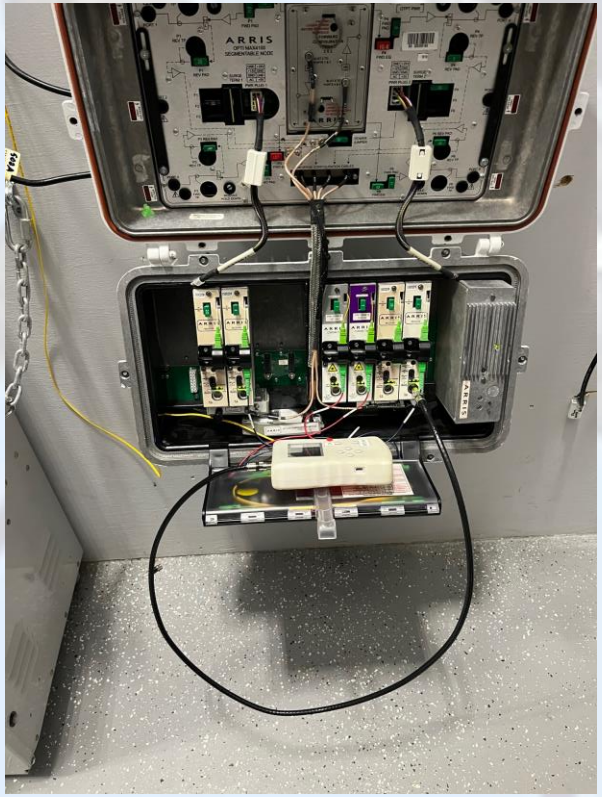
Worked with Field Engineering team in the lab to verify signal output levels, injection capabilities, and viewing signals on the Viavi meter, as well as a spectrum analyzer. Collected good data to share with other teams.

Sacramento, CA



Worked with MSO business partner, injected using 0dB probe at tap leg off Amp, measured output at tap downstream. Validated flat signals across spectrum. Upgrade project in a brownfield environment, switching out amp and LE modules to 1.2GHz, not replacing passives.

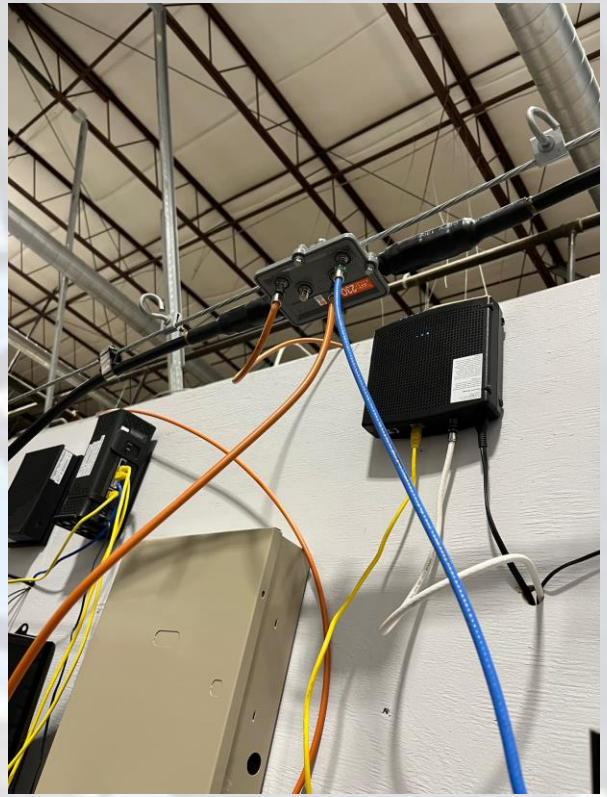
Lexington, KY



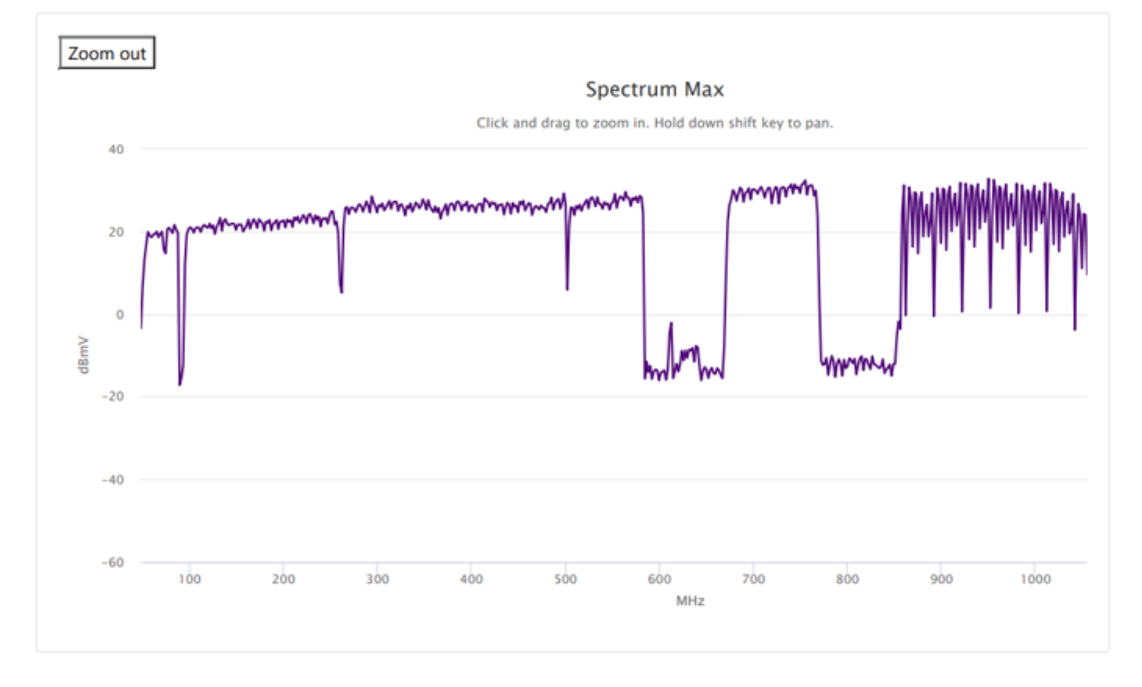
Worked with customer in training facility, did a variety of testing injecting at:

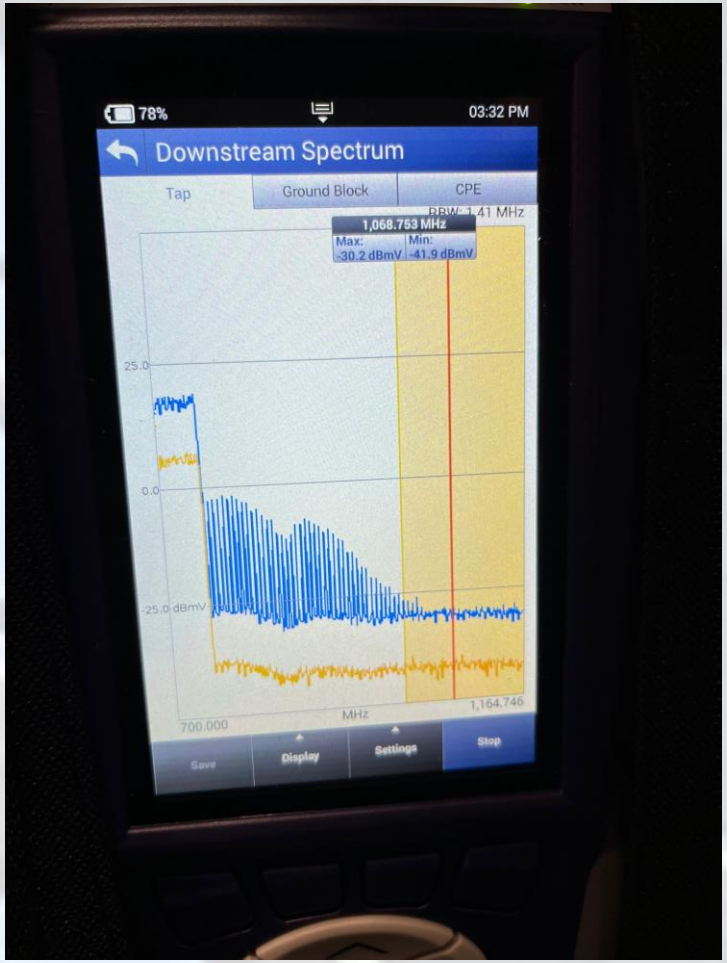
- Test point in node
- Directly in to node transmitter
- Tap off of node

Measurements were taken at various locations, including past an amplifier, at tap location pictured on right (which was also an injection spot), and at the end of line, running through 4 taps.



Lexington, KY

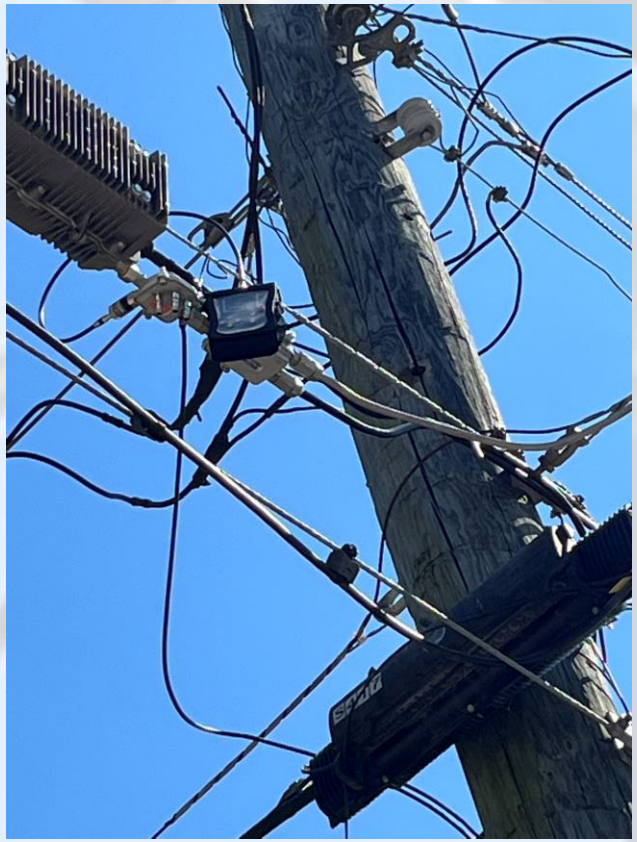




After completing testing in training facility, customer used the device in the field, and was able to document end of lines, as shown above. In the process, they also discovered a 750 MHz LE module, that had not been documented in system, and allowed immediate replacement. See slide on right showing roll off of signals past 800 MHz. This finding secured the business case, and proved the value of having this tool.

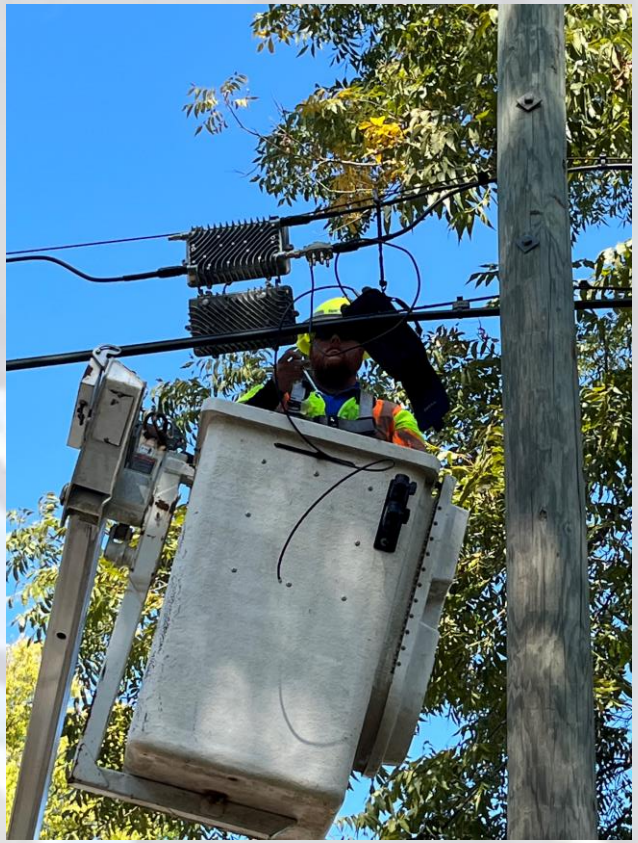
Birmingham, AL

Birmingham, AL



Picture 1: Injection site – tap off amp and splitter.

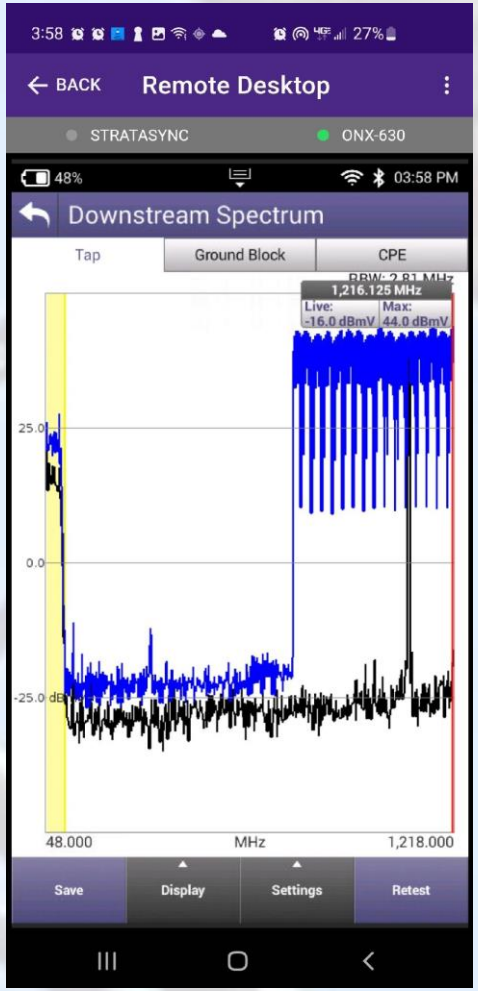
Picture 2: First Test location View back to Injection Site – Approx 3-4 pole spans



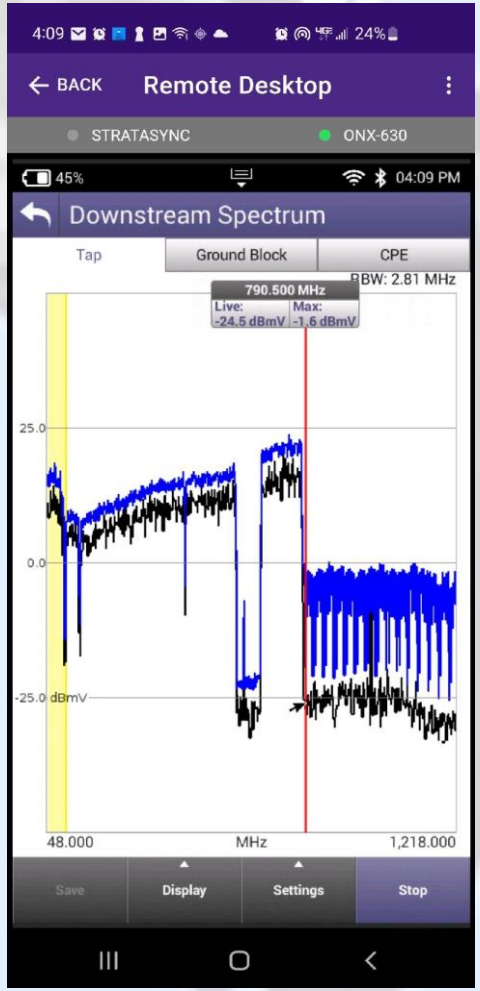
Picture 3: First test location, in/out of amp, and out of tap

Birmingham, AL

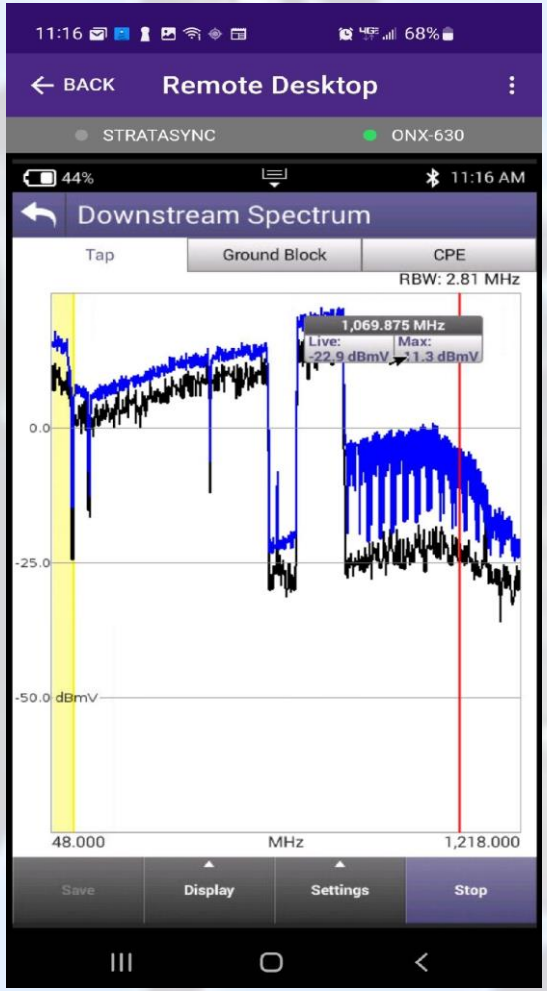
Reference Trace – Directly in to meter



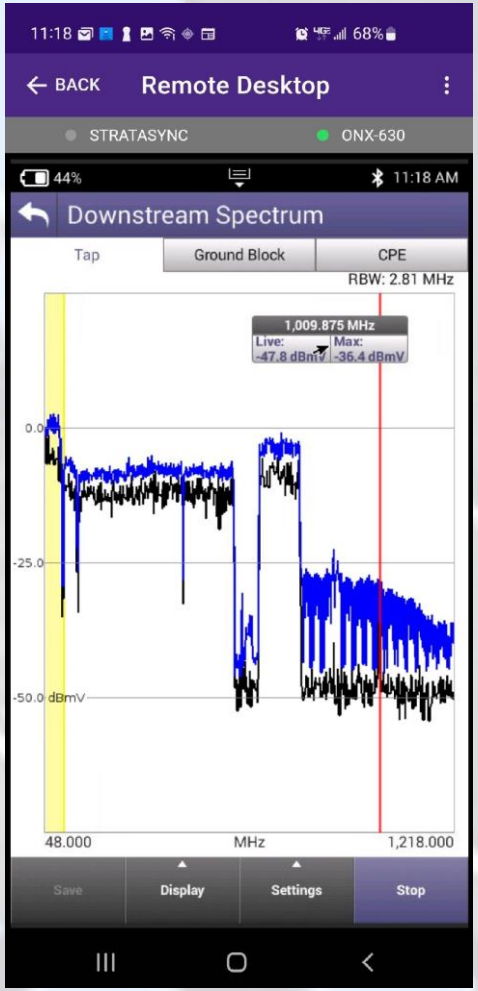
Reference Trace – Out of input tap (injection Site)



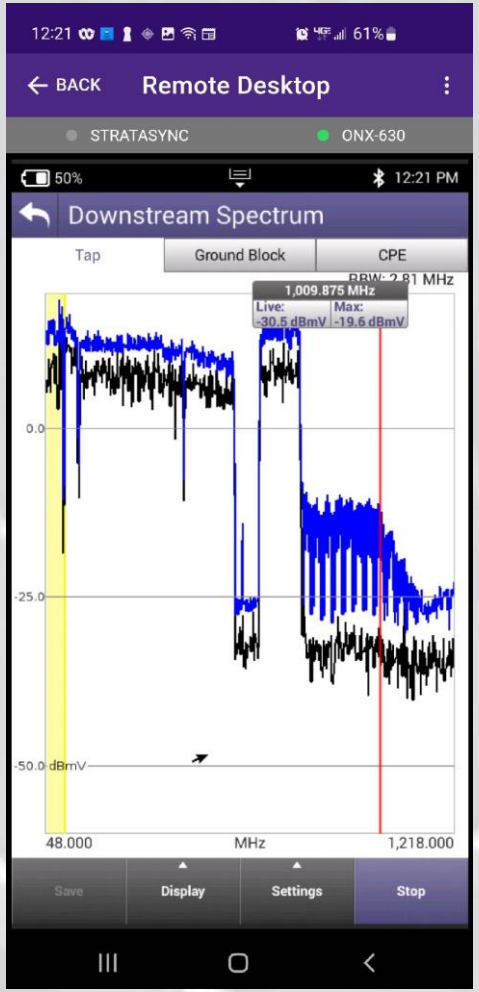
Amp output



First End of Line



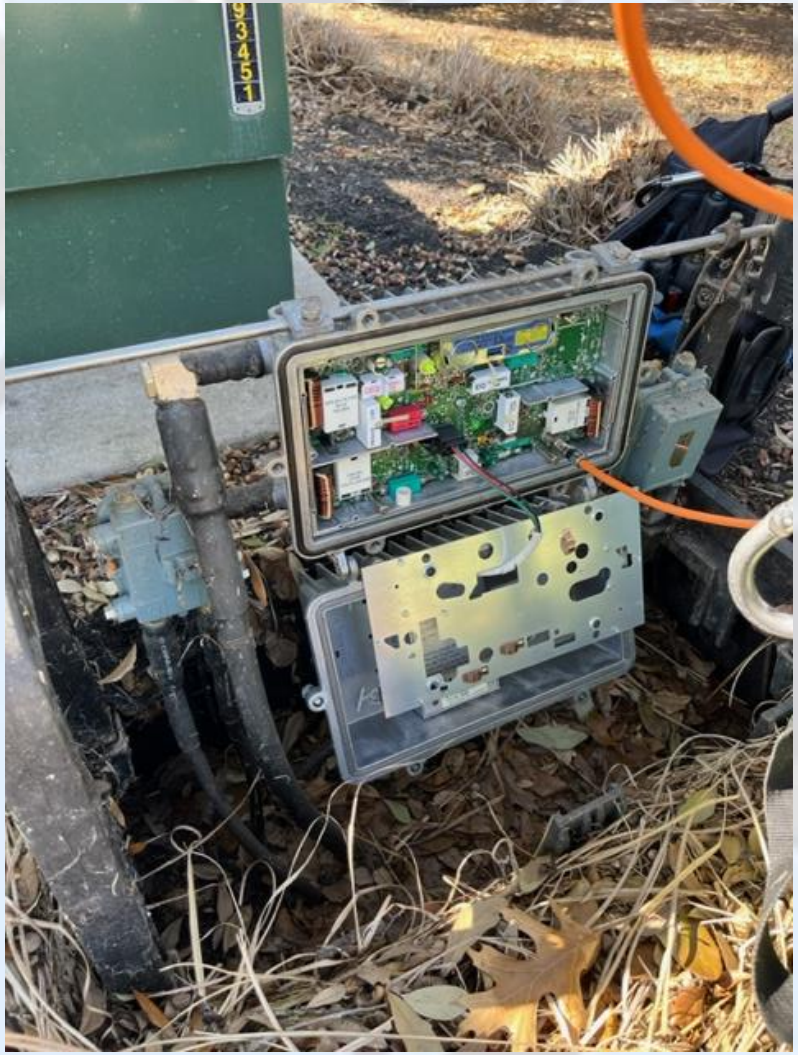
Second EOL – tap leg

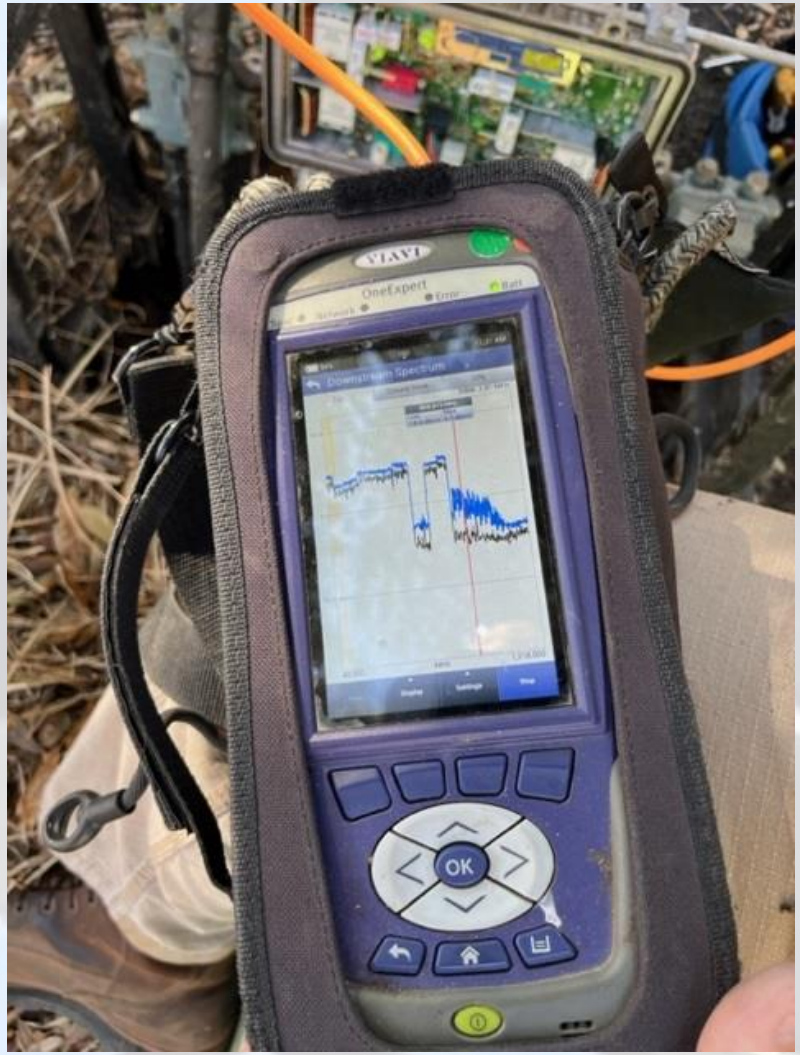


Austin, TX
Injection Site at the node – Test point

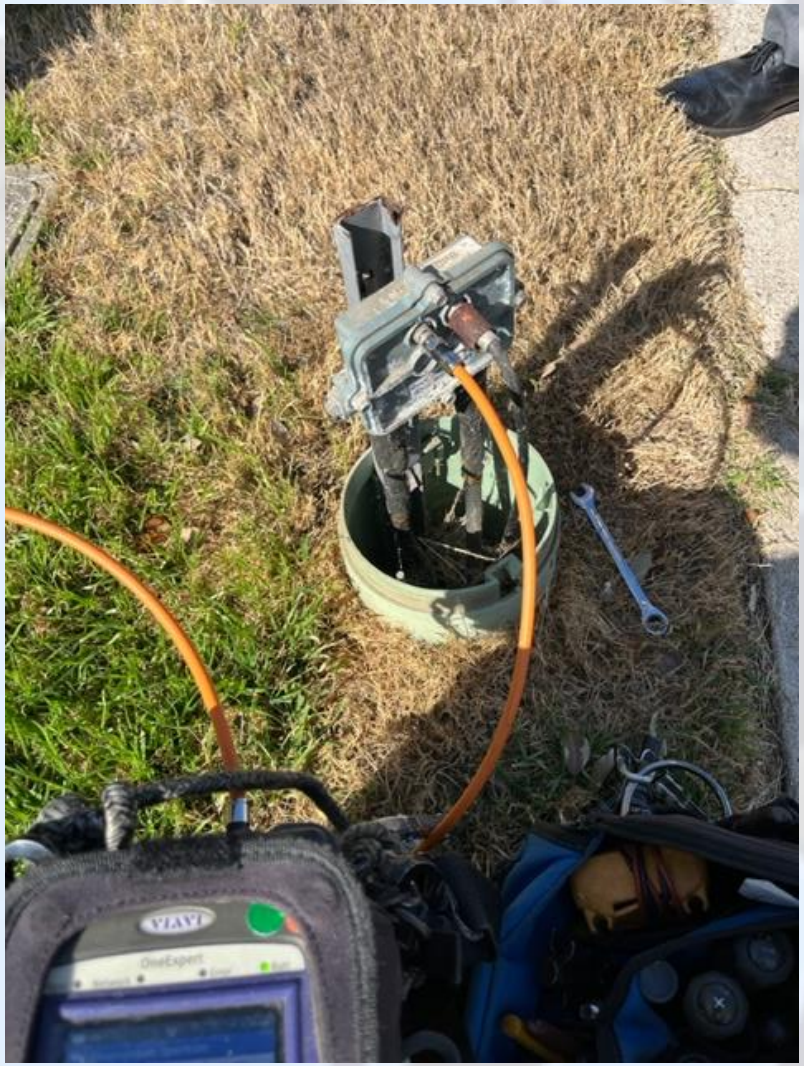
Austin, TX
First measurement – End of Line

Austin, TX
Measurement – Amplifier (has 750MHz EQ's)





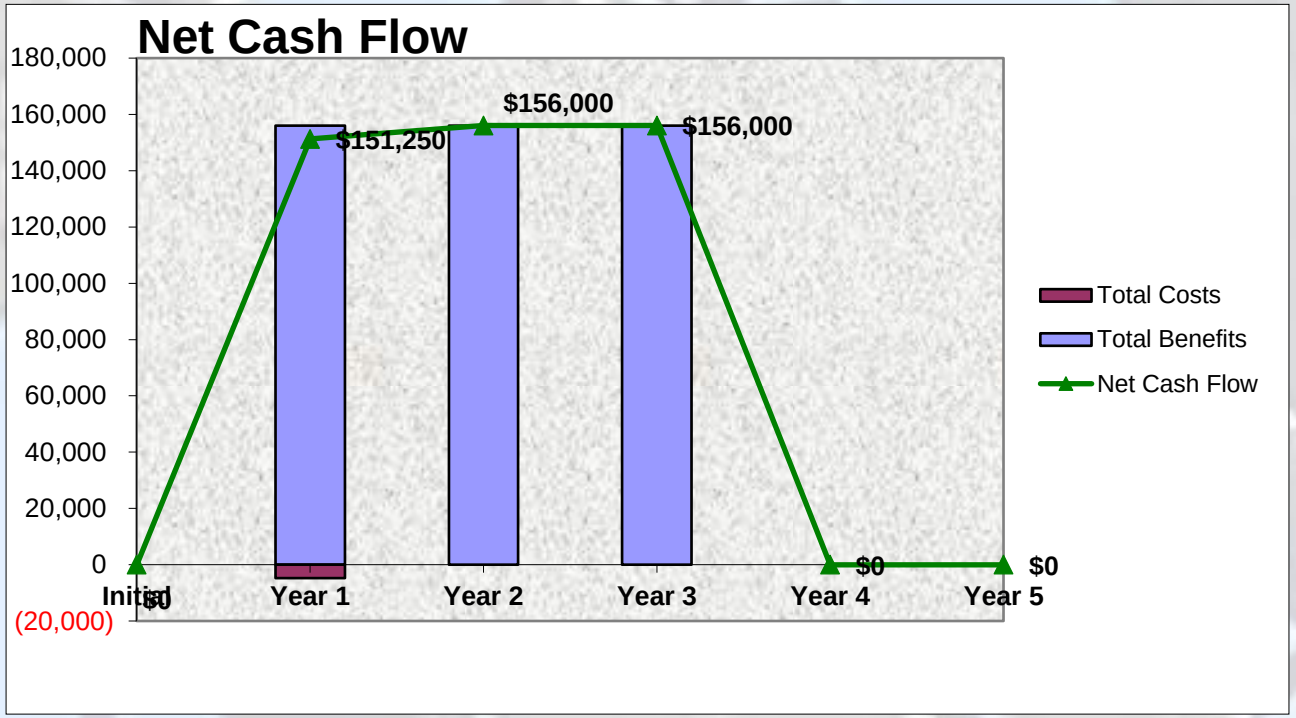
Austin, TX
Measurement – First Tap



Return on Investment

- Working with the team in Reno, they identified several locations, where this tool was not used, and had to go back to replace modules that were missed. These were discovered after activation, which had customer impact.
- The unit cost is $475. If one return to a location costs $300 (assuming two truck roles at $150 ea.), then two instances more than pays for the signal generator.
- Assuming you have 10 returns a week, then over the course of a year, it would be 520 locations x $300, which is $156,000 in potential savings, the return on investment for 10 devices is over 4000%
- Based on conversation, this is a low estimate, and actual savings will be greater!

Return on Investment



Over the course of the three year project, the use of 10 signal generators ($4,750.00) will provide a return on investment of over $400,000.00

Summary

- Initial field testing is providing very positive feedback with respect to applications for the signal generator
- As decisions are made to increase bandwidth, having carriers available to determine the quality of the plant will offer time savings for deployment
- Some current procedures may need to change to use the tool. For example, one location typically used the sweep function on the meter, but these carriers are only picked up using the spectrum analyzer mode
- As highlighted previously in Lexington, finding the 750MHz module with the device offered ***significant cost savings***, eliminating future trouble calls
- Having a ***low cost*** tool available for technicians to be proactive in finding trouble spots in the network will save significant future trouble calls and reduce negative customer impact.
- Full production units are IN STOCK! Available for shipment today!

Viavi Meter Diplex settings