



Broadband Instruments and Systems



“Maintenance Activities on the Digital HFC Network”

for
CCTA Member Companies
August 16, 17, 18, 2011 San Juan, Puerto Rico

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Tony Holmes



think ahead.



Technical Session Overview

- Challenges faced by the technician
- The importance of the parameters which affects QoS
- Implementing a well planned maintenance program
- Understanding the Triple Play
- What tools are available to increase technician efficiency



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Session One

- Downstream/Upstream Testing
- Return Path Monitoring
- Certifying the Return Path
- Work Management Logging
- Generating Reports





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Downstream/Upstream Testing



think ahead.

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Aligning the Forward Path

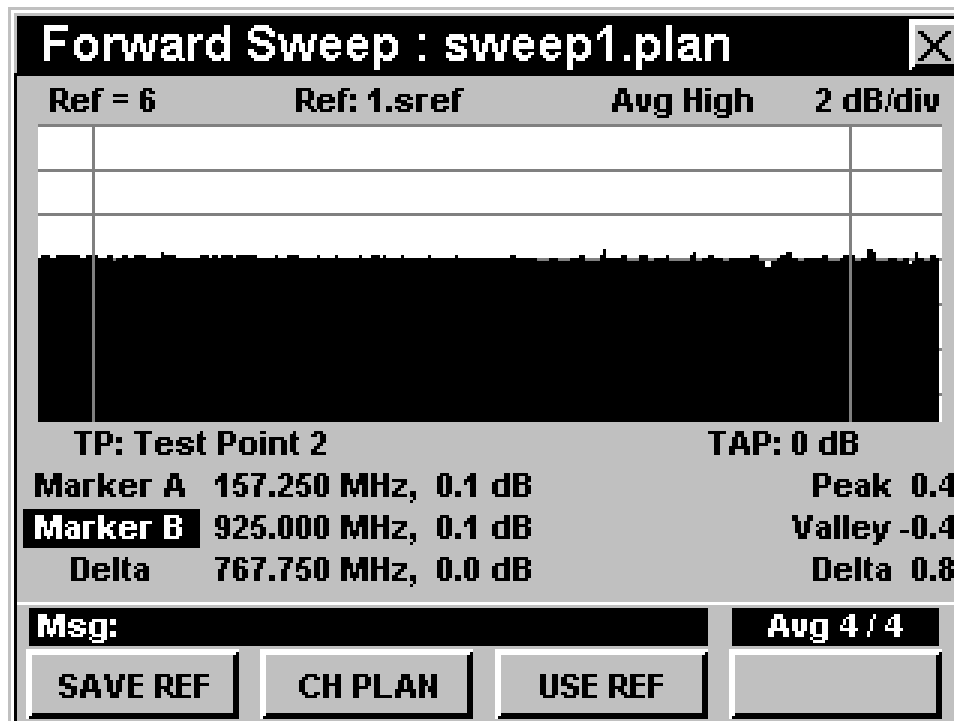


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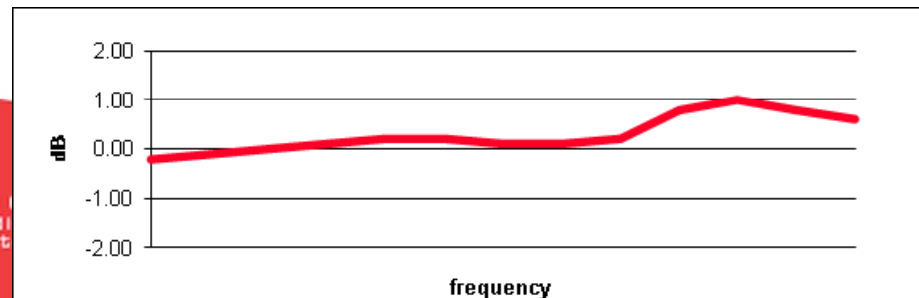
Forward Sweep





Frequency Response Definition

- System's ability to properly transmit signals from head-end to subscriber throughout the designed frequency range
- "Sweep" tests verify performance to design specifications
- Expected results: $n/10 + x = \text{max flatness variation}$
 - Where n = number of amplifiers in cascade
 - Where x = best case flatness figure (supplied by manufacturer)





Why Sweep?

- SpeedSweep makes it easier for technicians to find:
 - Reflections
 - Water Migration
 - Damaged cable
 - Suck-Outs
 - Cable Roll-Off
 - Loose or cracked connectors
 - Craftsmanship errors





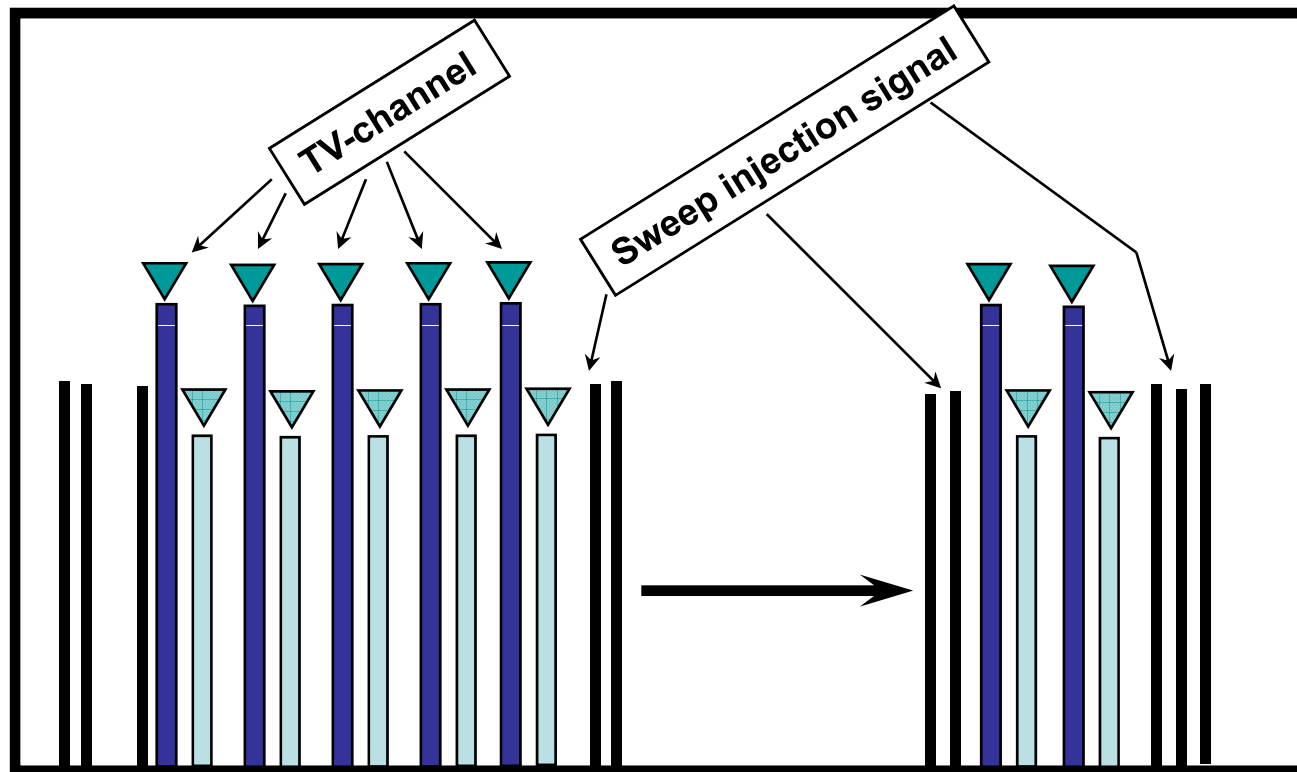
Why Sweep?

- Allows a reference to be stored
 - Sweep makes it possible to divide the HFC plant into network sections and test its performance against individual specifications
- Can measure in unused frequencies
 - This is most important during construction and system overbuilding





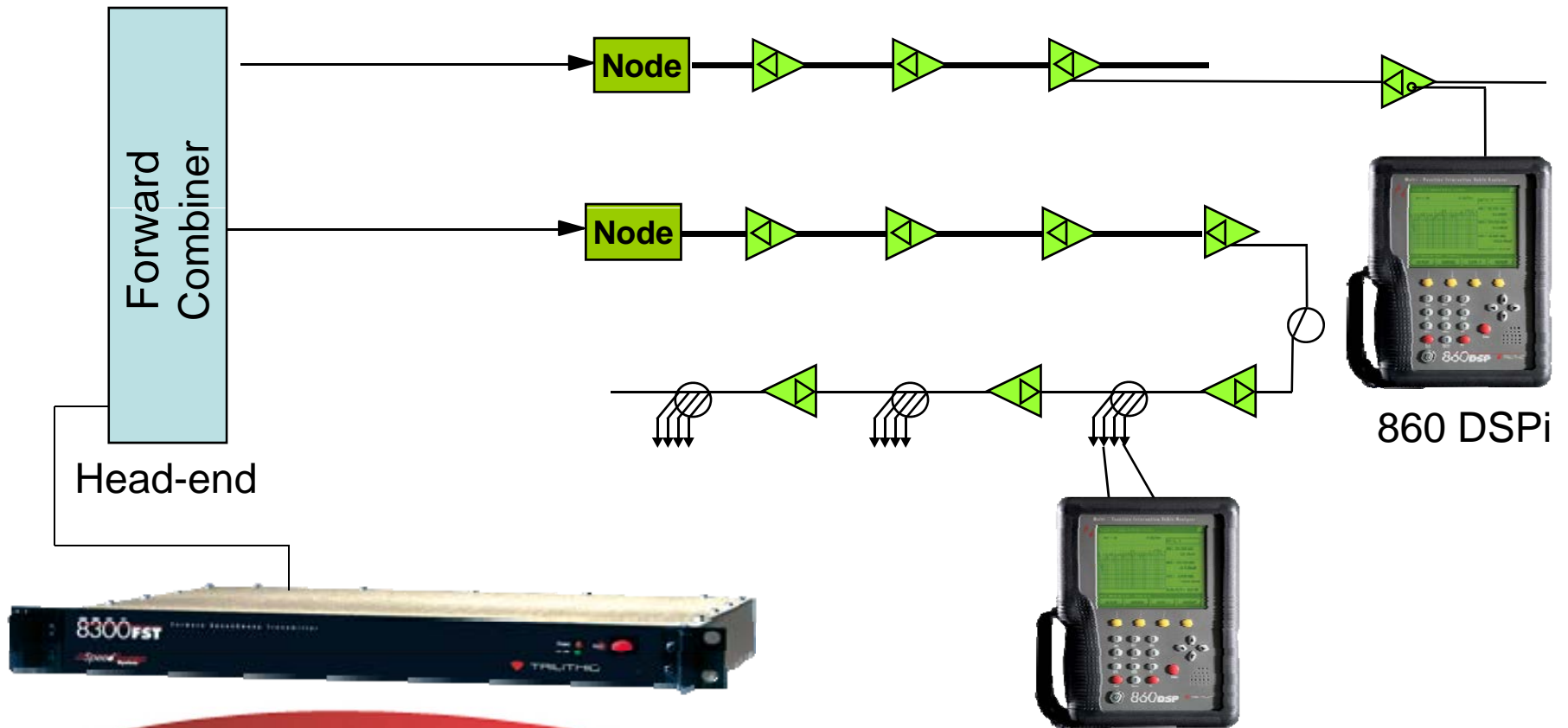
Maintenance Activities on the Digital HFC Network



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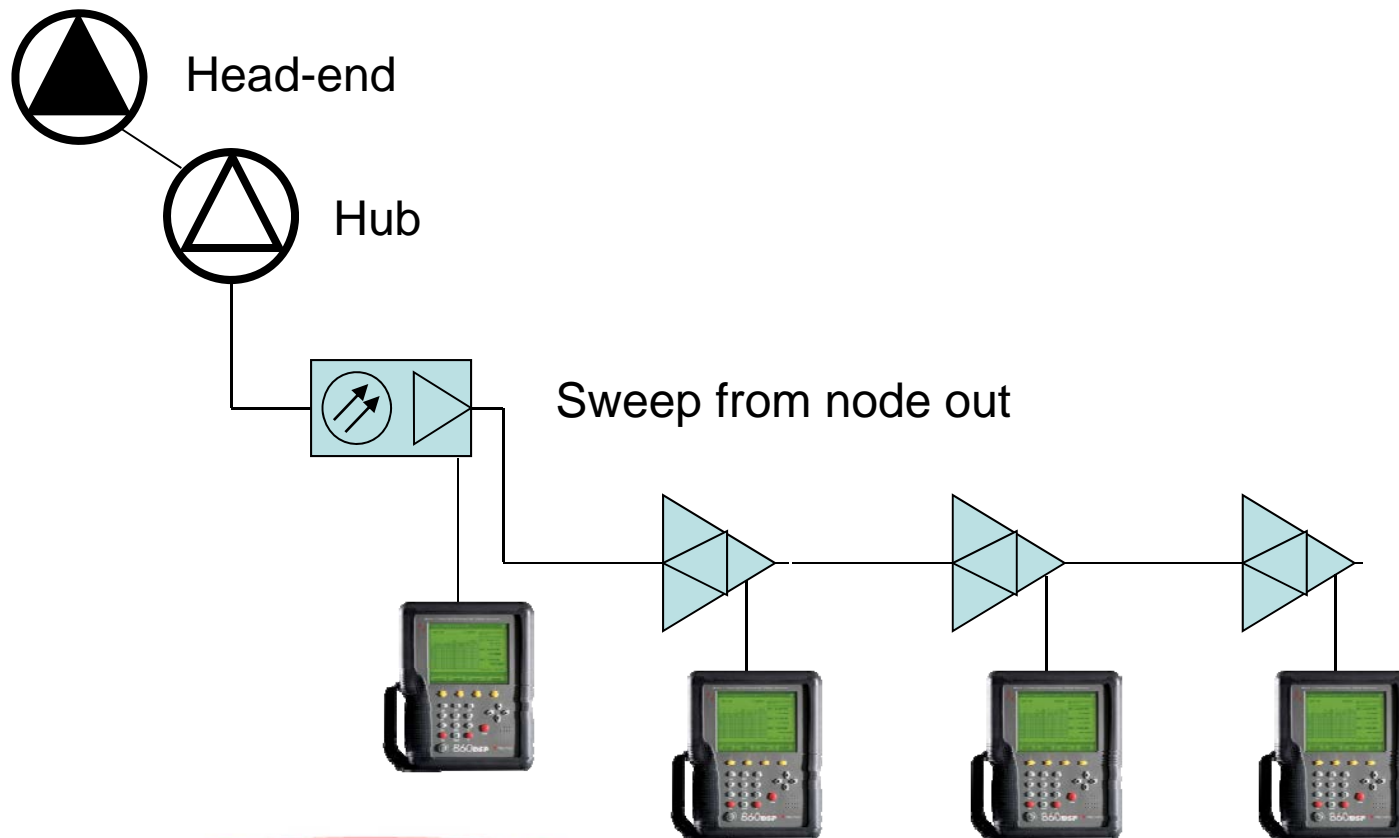


Insertion Diagram





Sweep Forward Path





Sweep Forward Path

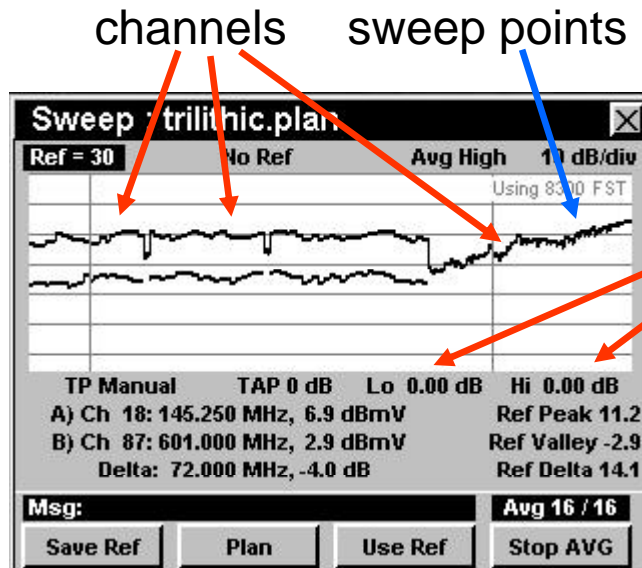
- Start at node
 - Verify unity gain
 - Align RF portion of node at test point
- Store a reference at the node
 - Balance trunk first
 - Then work out into the feeder





Sweep on 860 DSPi

Reference name can have up to 8 alphanumeric characters



860 DSPi with no reference

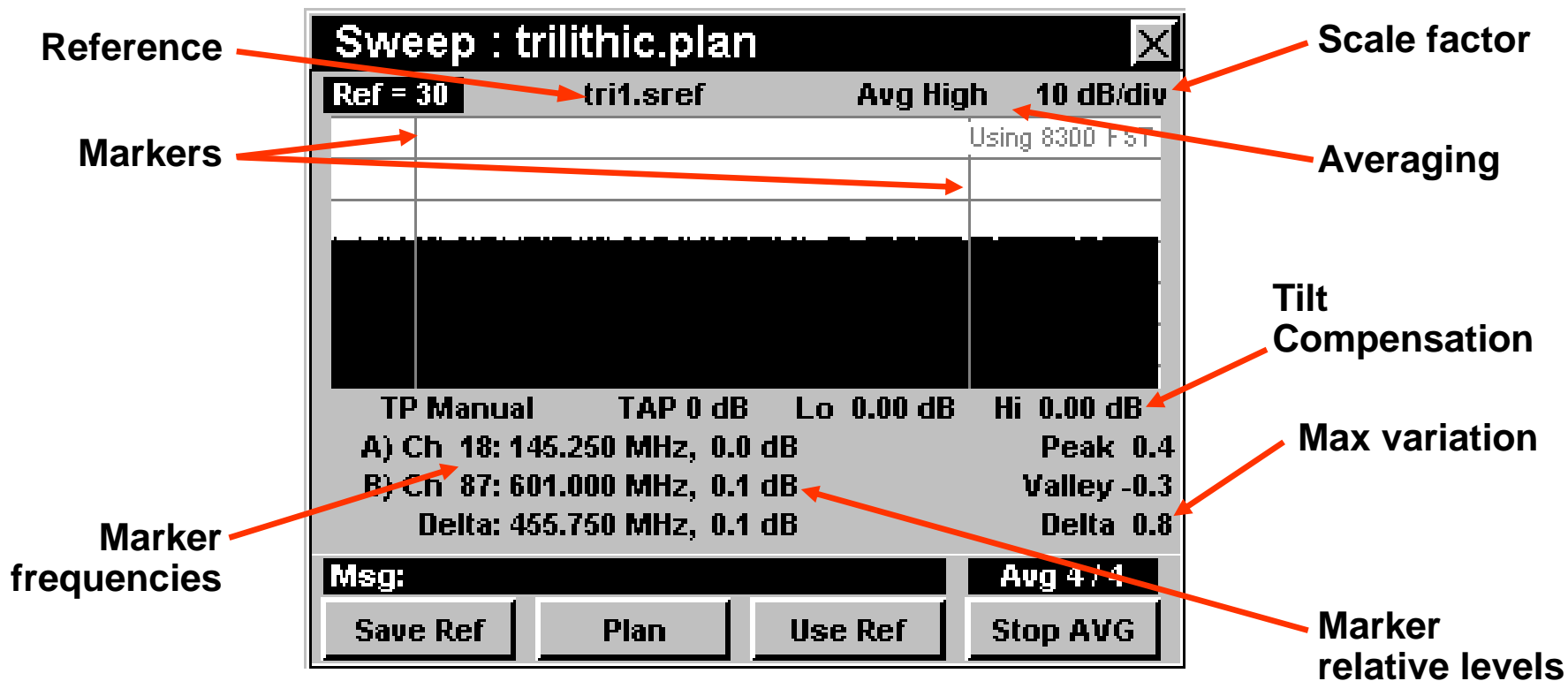


860 DSPi with reference





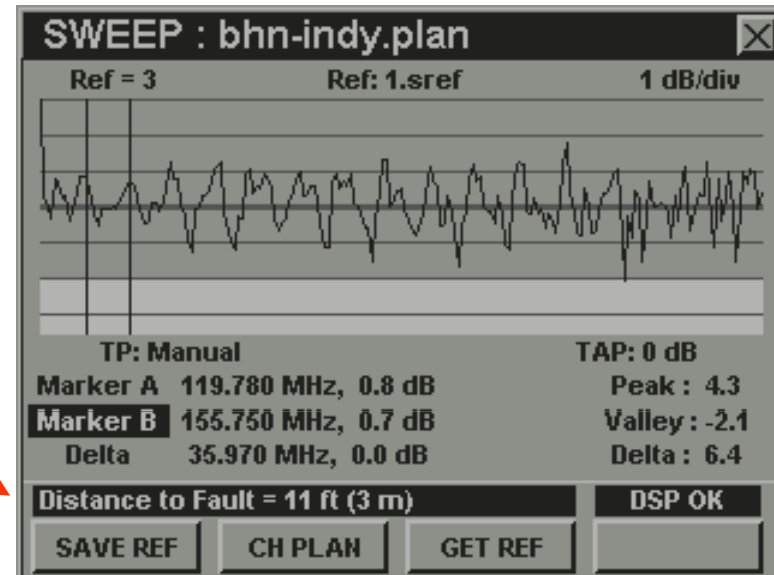
860 DSPi Sweep Display





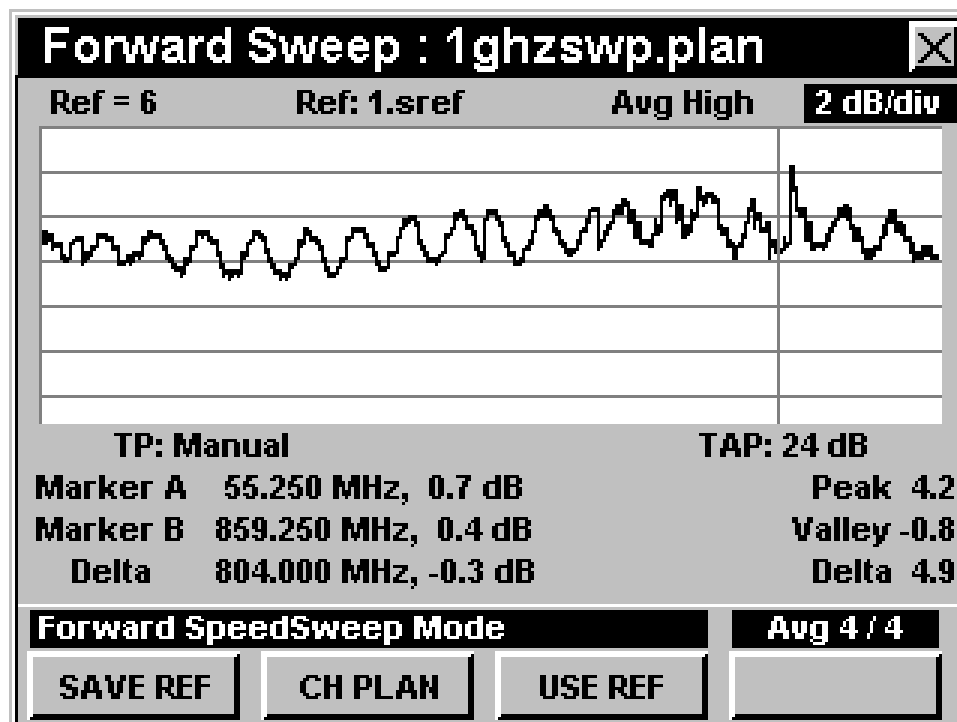
Standing Waves

- Automatic distance to fault



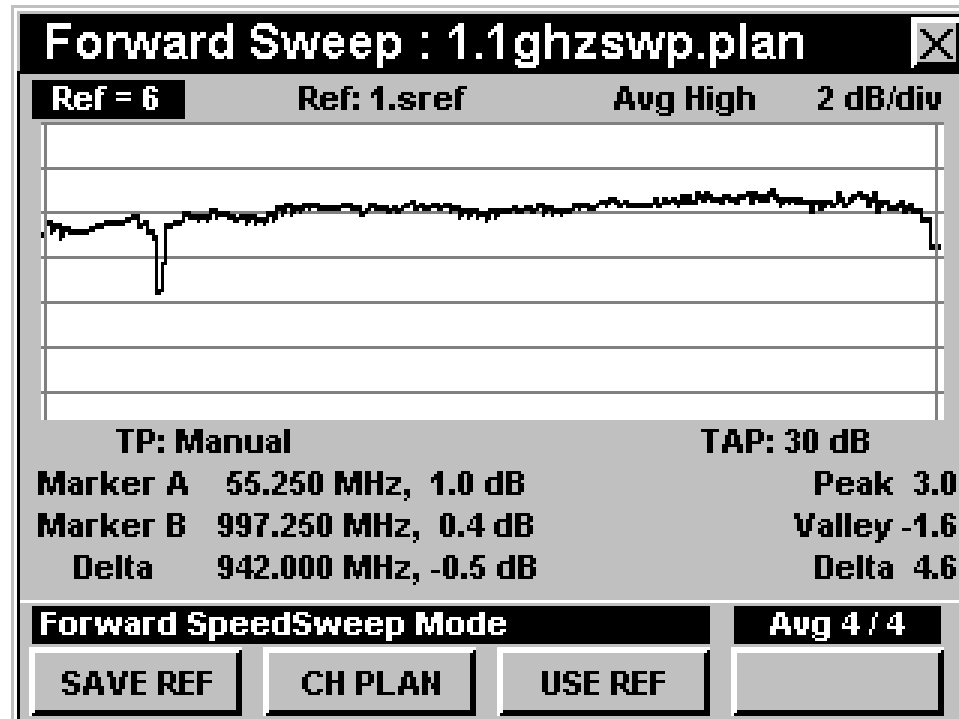


Standing Waves



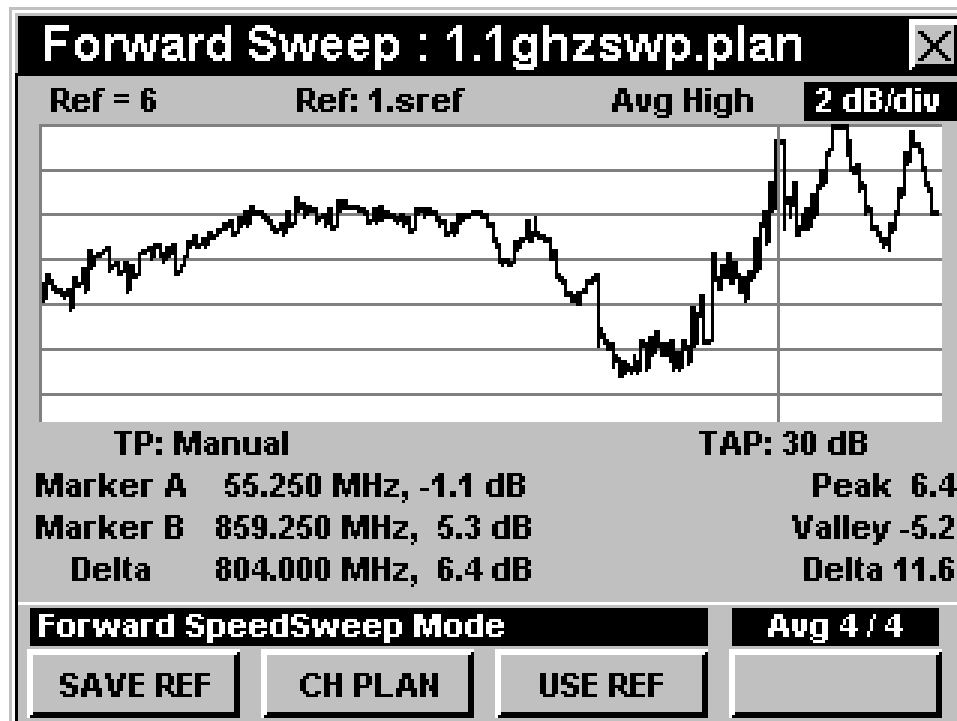


Suck-Out



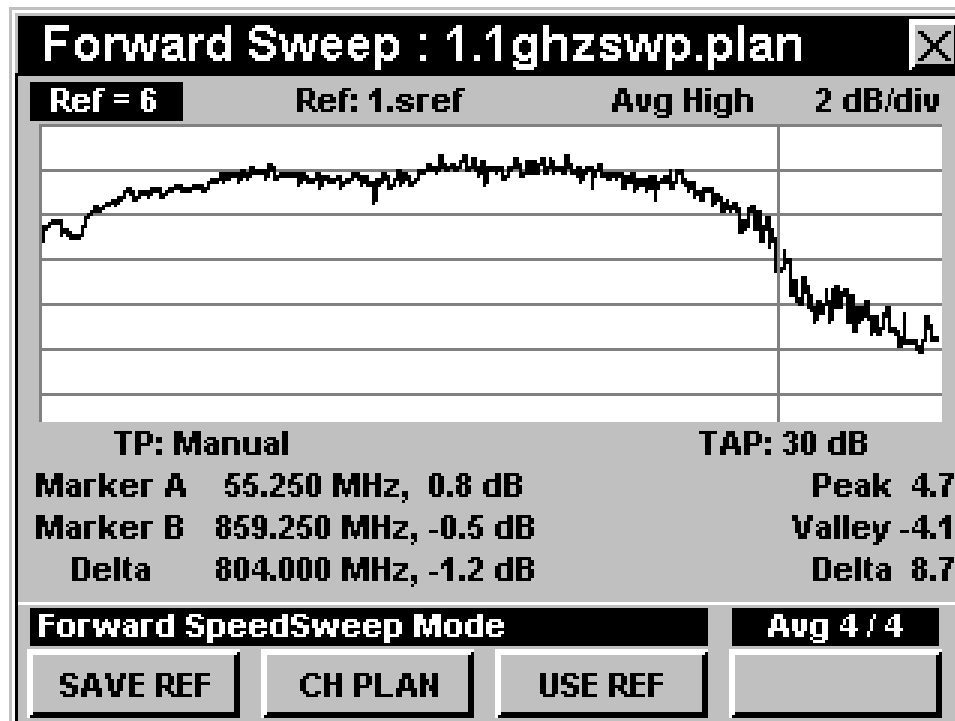


Suck-Out





Roll-Off





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Return Path Testing

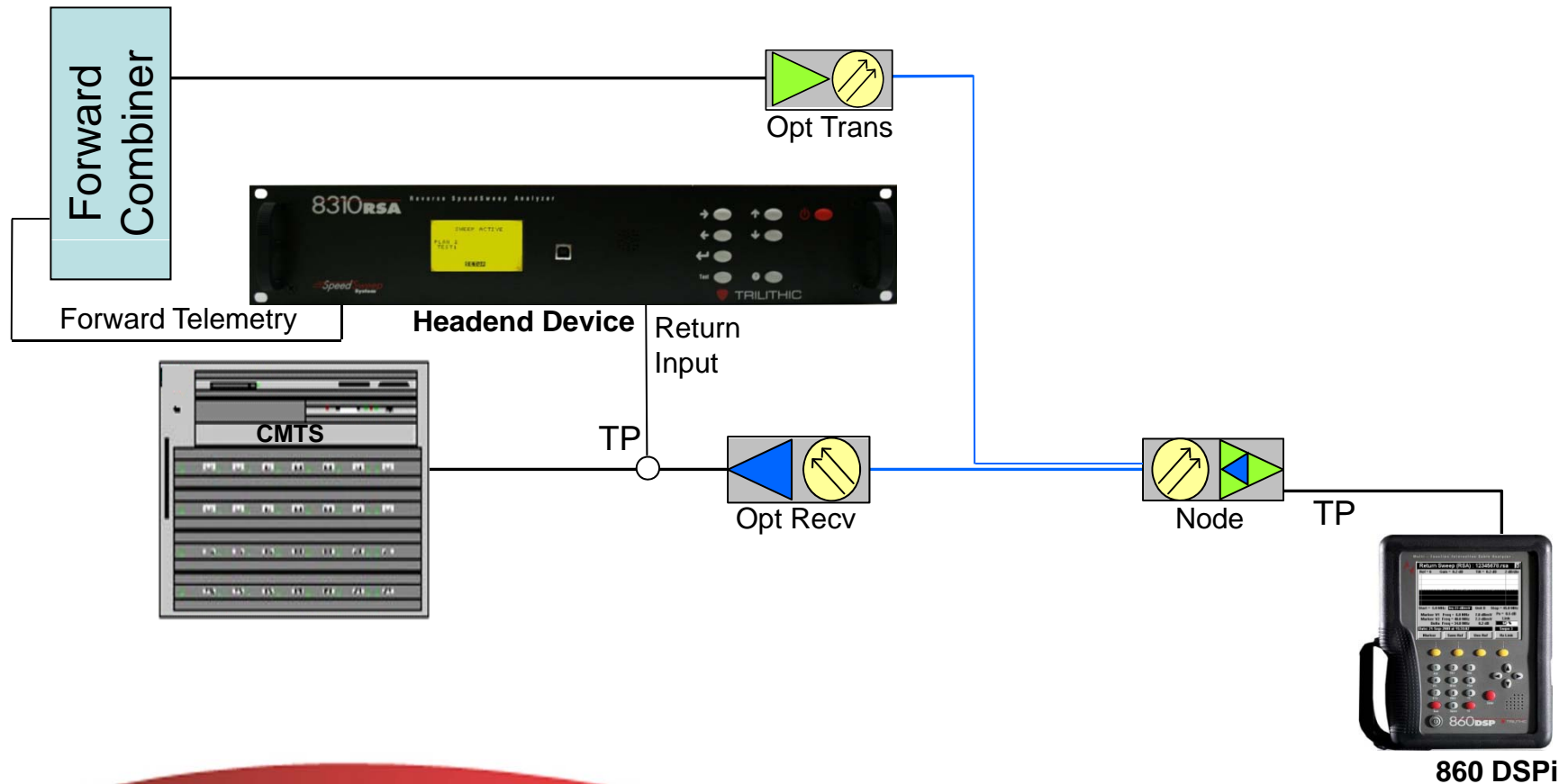
think ahead.





Maintenance Activities on the Digital HFC Network

Headend Diagram



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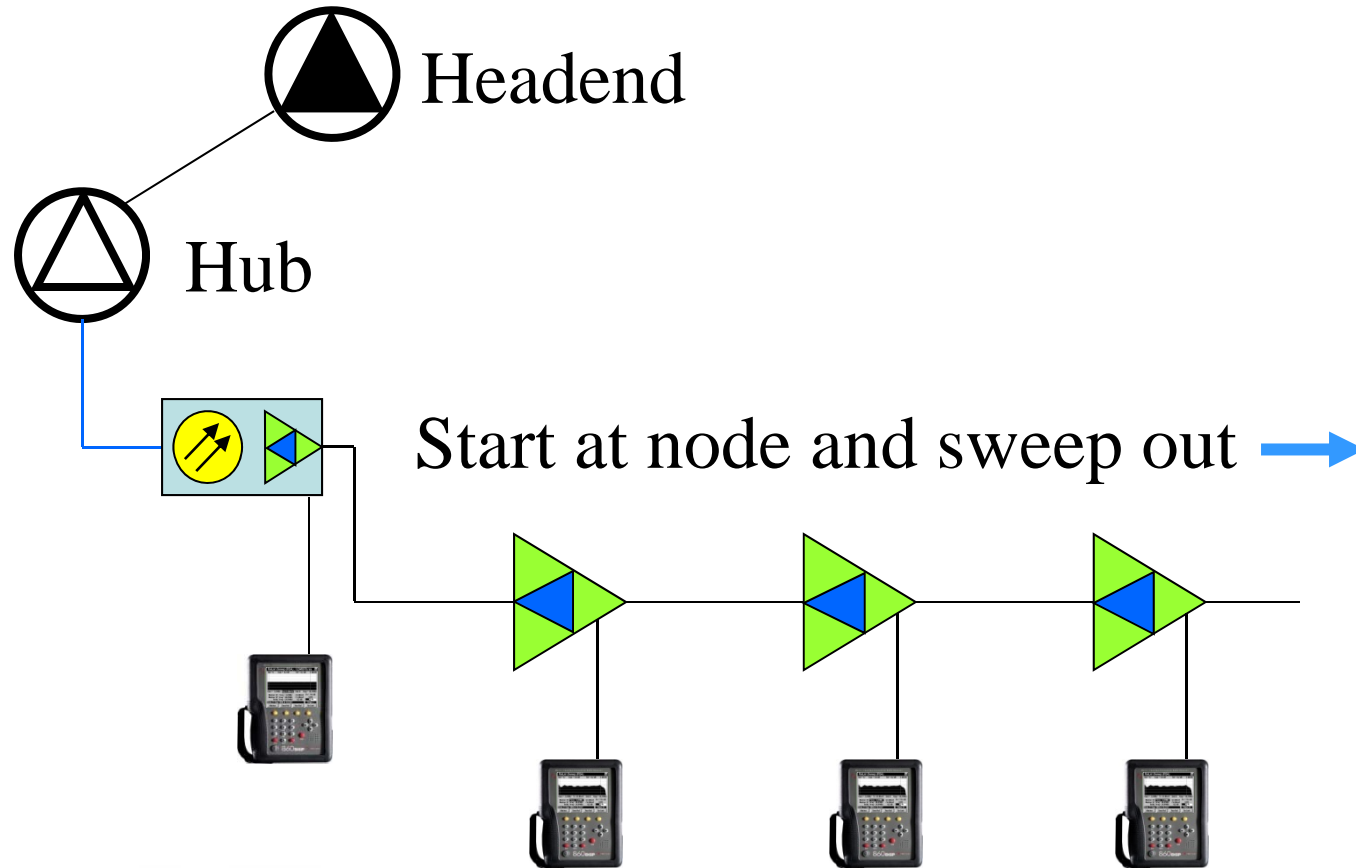
Return Sweep

- **Balancing of the System**
 - Sweep Signals transmitted by field unit are recovered and analyzed at headend
 - Gain, Tilt and Frequency Response of sweep carriers are returned to the field unit via a downstream telemetry carrier (50 MHz to 1 GHz)
 - Start at node
 - Store Reference trace
 - Proceed to amplifier



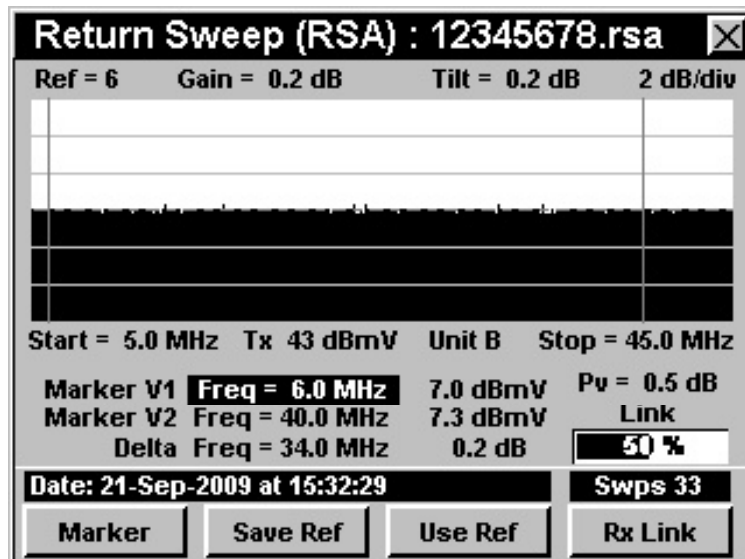


Sweep Return Path





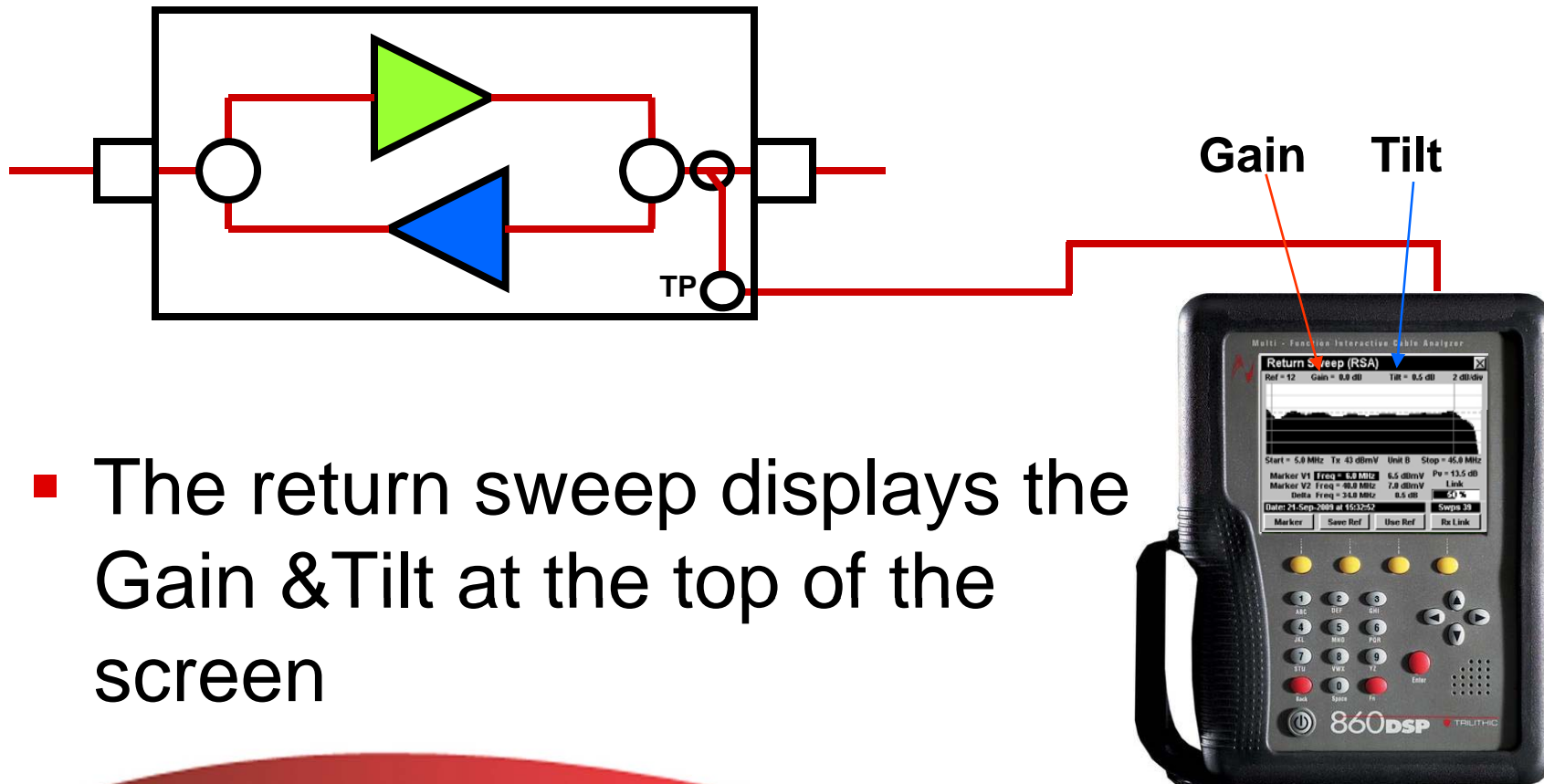
Return Sweep



- Sweep Screen
 - Plots received level in the Headend for each sweep carrier
 - Scale 1, 2, 5, & 10 dB per Division
 - Ideal Trace is a flat line
 - Gain Information
 - Difference between Headend nominal and sweep carrier level
 - Tilt Information
 - Difference between low and high pilot carrier levels
- Displays impairments to frequency response
 - Damaged cable, actives, or passives
 - Low or High end roll off



Return Sweep



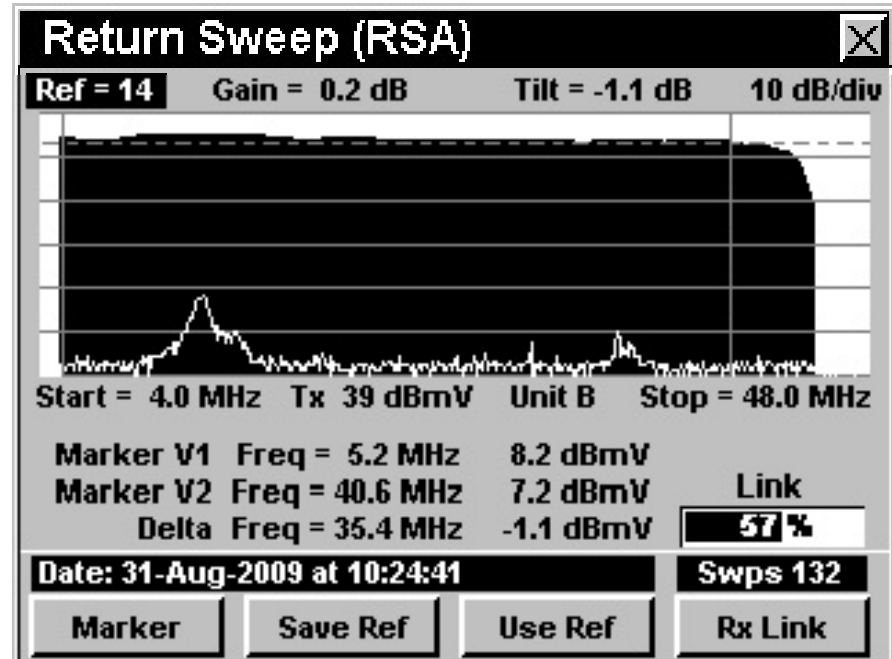
- The return sweep displays the Gain & Tilt at the top of the screen





Return Sweep

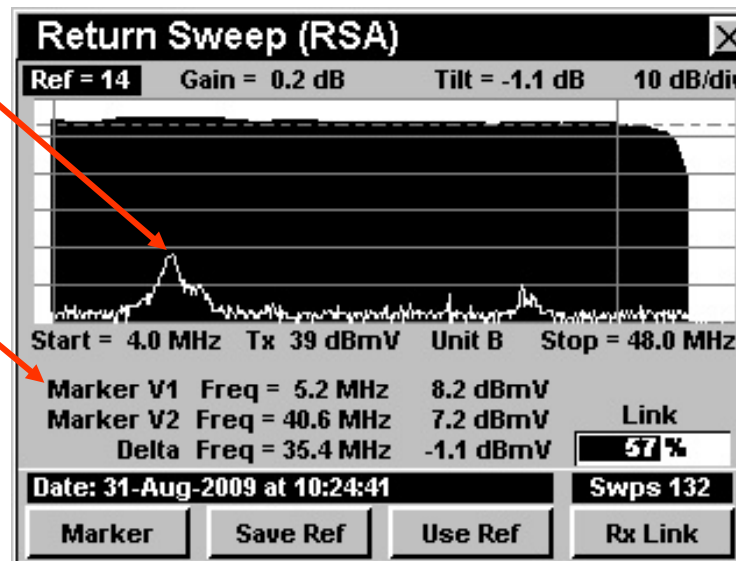
- Displays both sweep & ingress screen while sweeping
 - The Ingress can be turned
 - ON/OFF
 - Via the FN Key





Return Sweep

- Sweep & Ingress
- Move marker location until locate the frequency of the ingress





Return Sweep

- Possible causes of High Noise Levels
 - Excessive gain
 - System integrity
- Remedies:
 - Balance trunk first then work out into the feeder to adjust Pads & EQ's
 - Keep all fittings tight, fix all rodent chews & tree rubs, plus watch out for backhoes





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Return Path Certification and Monitoring

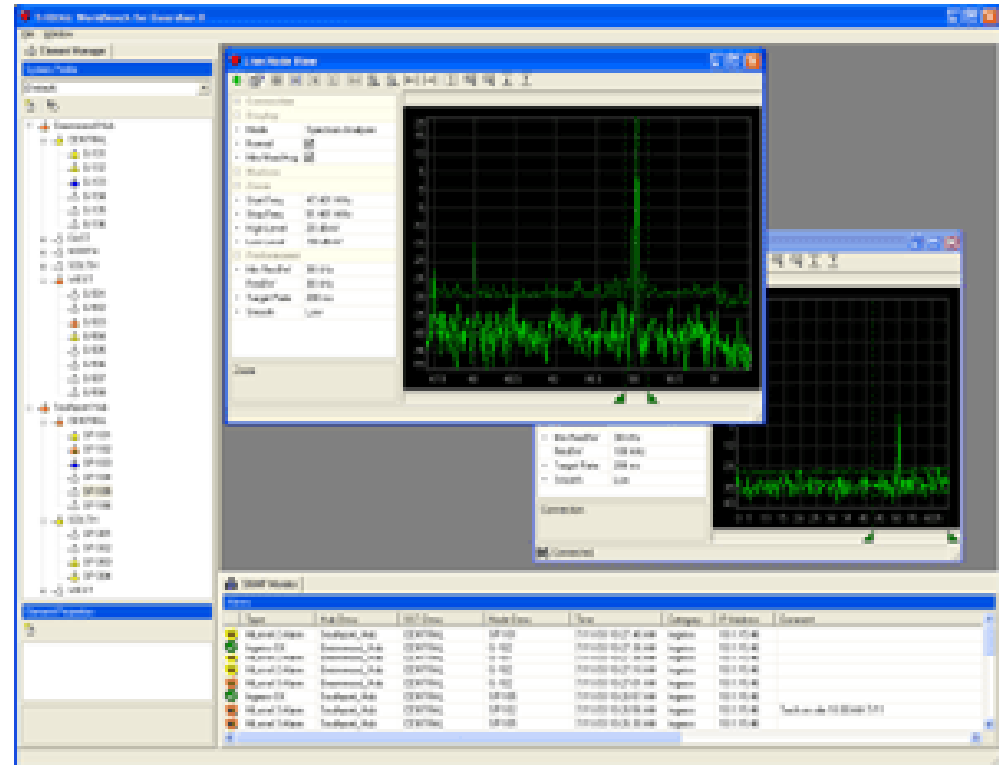
think ahead.





Certifying Return Path

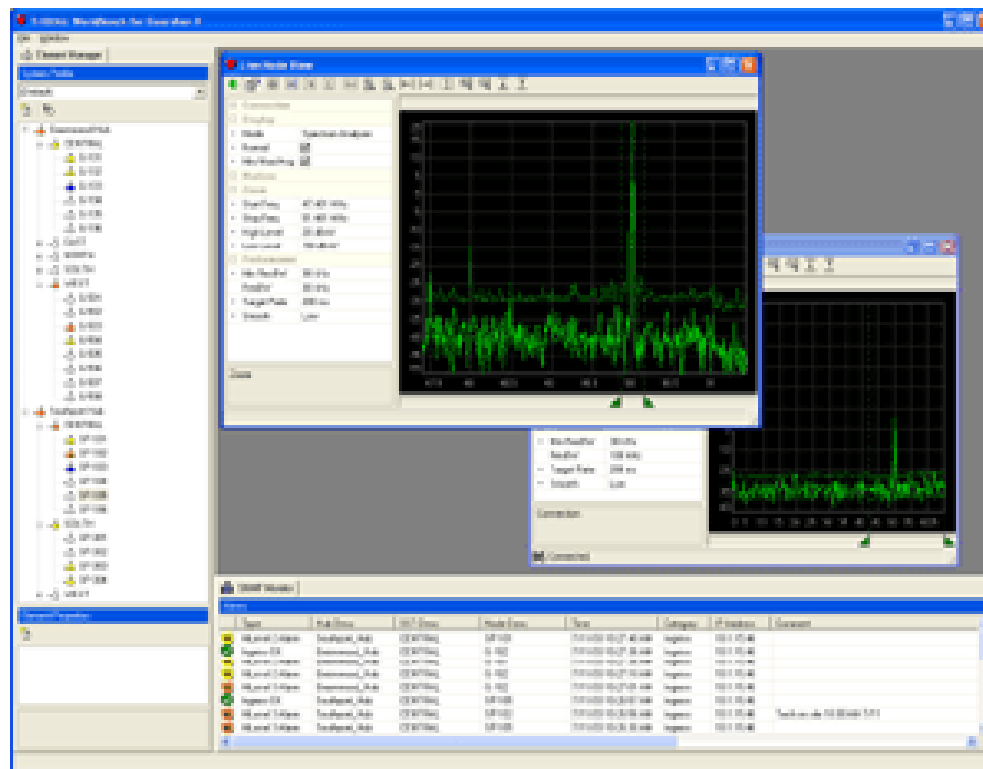
- There have been as many methods and specifications
- Examples include
 - a one-hour max hold
 - ten minutes max hold
- The results are considered to demonstrate that over this period the network would either pass or fail based on the amount of junk viewed





Certifying Return Path (cont.)

- Voip is not a 1 hour service
 - 24 hour
 - 7 days a week
- This maximum measurement is also not indicative of the true performance of the network
- The certification process should be at least a twenty-four hour certification
- Should be an on-going figure of merit.





Troubleshooting Summary

- Verify at the node
 - Determine which leg(s) are contributing to the problem
- Identify the span
 - Using amplifier test points “Get ahead” of the problem
- Isolate to the tap
 - Using a return path test probe isolate the problem
- Pinpoint the origin
 - To a tap (subscriber premise)
 - Damaged Cable





Node Certification Report

- Automates node certification testing
- Specify Locations and time span
- Returns Pass/Fail results based on ingress levels vs. user specified limits



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Node Certification Report

- Summary Report
 - Includes Header information
 - Summary of test results
 - Pass/Fail results by node

Node Certification Report

Report Settings

Report Name	Palmdale/Landcaster Training
Run Date Time	9/27/2006 1:00:00 AM to 9/27/2006 6:55:00 AM
Span (MHz)	0.375 - 65.25
Minute Interval	5
Limit Name	Training

Summary

25 Nodes
19 Passed
6 Failed

Detail

Node Name	Test Result
LN 297	Fail
PD 158	Fail
LN 144	Pass
PD 290	Fail
PD 013	Pass
LN 000	Pass





Historical Analysis

- Specifically designed for convenient and efficient historical analysis
 - Archives up to a year of data
- Displays both historical and live spectral views
- Calculates the average probability that a node will exceed its thresholds over time





Historical Analysis Tools

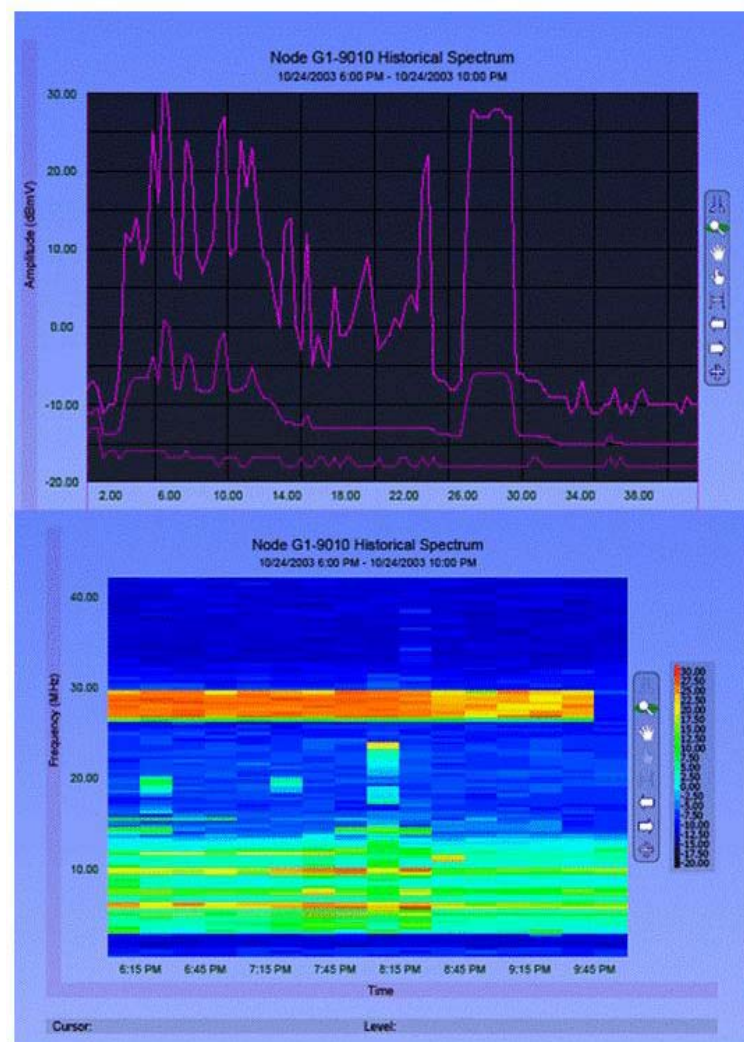
- Recall spectral information over selected time periods
- View frequency availability of the return path for new service launches
- Evaluate the impact of changes in modulation schemes on system services
- Verify existing services are meeting performance standards
- Generate figure of merit calculations for return performance





Spectral History

- Retrieve Spectral History
 - Both spectral and time based views
 - Evaluate the severity and duration of ingress related events
 - View the waterfall graph



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ADIA Node Service Report

Node	Events	Alarm State Time Span (h:m:s)					% Over Limit
		No Signal	Level 4	Level 3	Level 2	Level 1	
16 Nodes	145994						20.977%
16 Node(s)	145994						20.977%
ENGR 25	45		1478:10:35				99.934%
SST A Node 1	49		1478:02:40				99.926%
ENGR 18	145855		1020:38:05	13:40	04:32:59	118:30:00	77.336%
ENGR 26	45		864:21:18				58.436%
ENGR 27							00.000%





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Work Management Logging



think ahead.





Field Measurement Data Mgmt.

- Helps ensure that proper testing is done
- Leads to higher service quality
- Cuts down the number of truck rolls
- Provides data for effective management
 - Reports
 - Queries
- Saves \$\$\$





Maintenance Activities on the Digital HFC Network

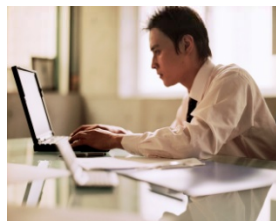


860 DSPi

- Work order retrieval
- Test macros/temp storage
- File transmission

WorkBench/TDM Component

- TDM user interface
- Data display and analysis
- Queries, Reports



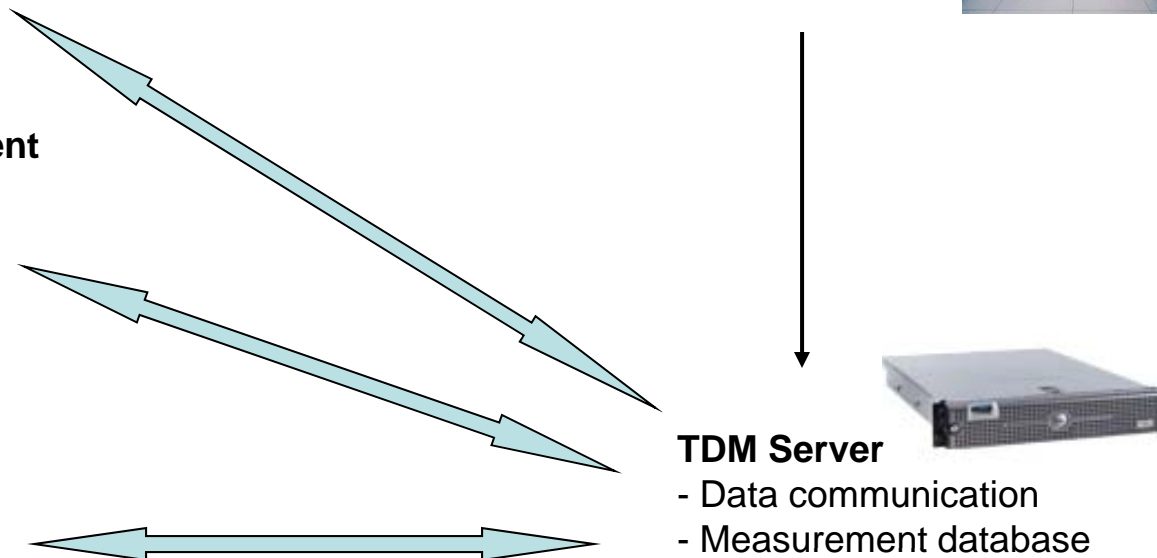
Microsoft IE Browser

- Manager/Supervisor access to reports

System Diagram

Billing/WFM System

- Data file generation



TDM Server

- Data communication
- Measurement database

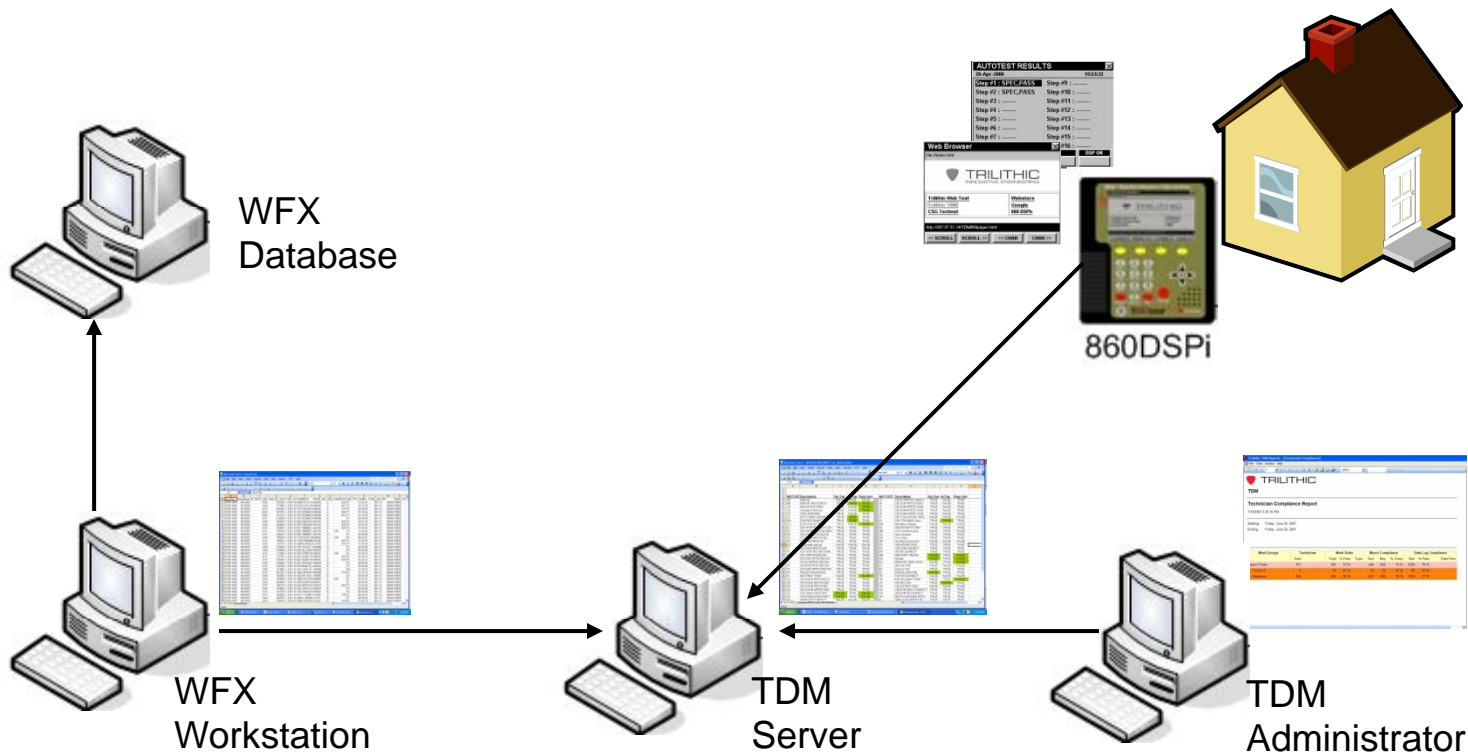


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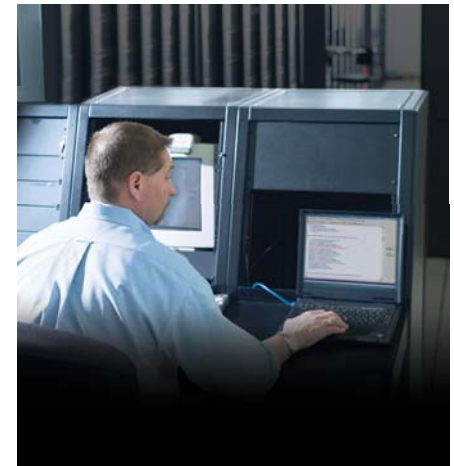
System Integration





Administrator Interaction

- Administrator (manager/supervisor)
 - Queues-up 860 DSPi configuration changes
 - Channel plans
 - Test macros
 - Firmware
 - Packages
 - Runs reports and queries data as desired





Technician Interaction

■ Morning

- Work order data is replenished daily with data through the use of an automated script – may be replenished at any time or frequency.
- Technician connects to TDM with 860
 - Gets configuration updates from queue
 - Downloads work orders for the day, or
 - Creates work orders directly on the meter





Technician Interaction

- Daily routine
 - At job site, technician performs tests with macros
 - Saves results to work order task ID (provided by TDM)
 - Technician accesses next job, which was downloaded from TDM this morning
 - Addresses for all queued jobs are viewable in 860 DSPi task folder
- Evening
 - Technician uploads all completed data logs to TDM



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Reports

- Macro summary
- At-tap node history
- Calibration check
- House history
- Meter inventory
- Set-top compliance
- Technician compliance
- All reports are storable, and can be emailed with expansion/contraction features intact





WorkBench Queries

- Queries enable a user to search for specific data
- They can be customized to find particular information
- They can be saved and repeated on demand
- This is a very flexible, powerful tool



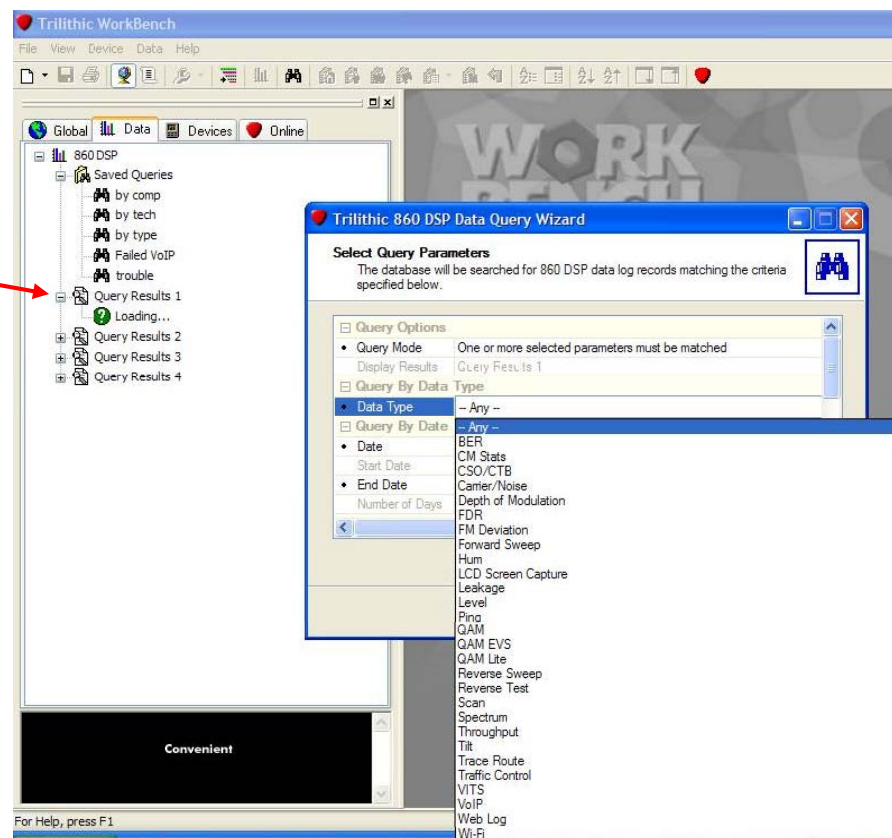
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WorkBench Queries

- Select a saved query or run custom query



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End of Session One Questions?



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Session Two

- Troubleshooting the QAM Carrier
- Ingress Troubleshooting Using Leakage Detection
- HSD Troubleshooting
- VoIP Services
- The Challenges and Diagnostic Tips
- Using the Tools and Test Equipment Properly



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QAM Measurements

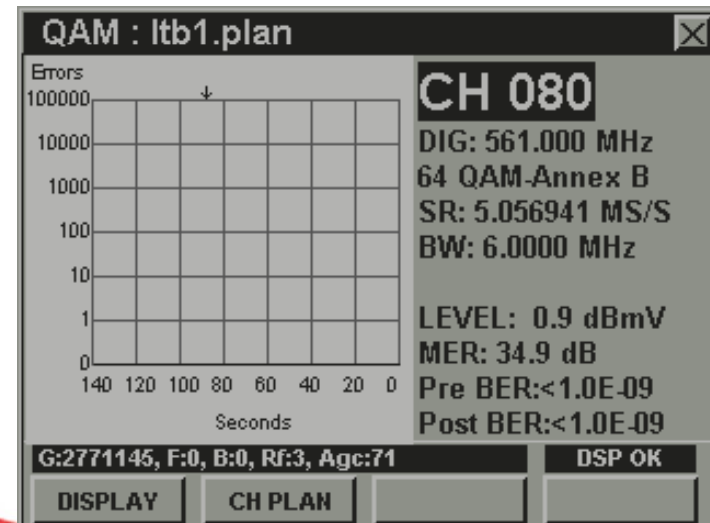
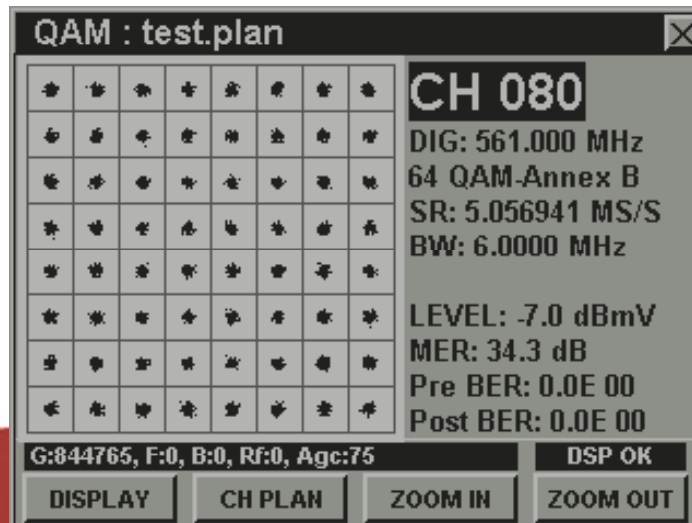
think ahead.





QAM Measurements

- Constellation Display
- MER
- BER
 - True BER or Estimated



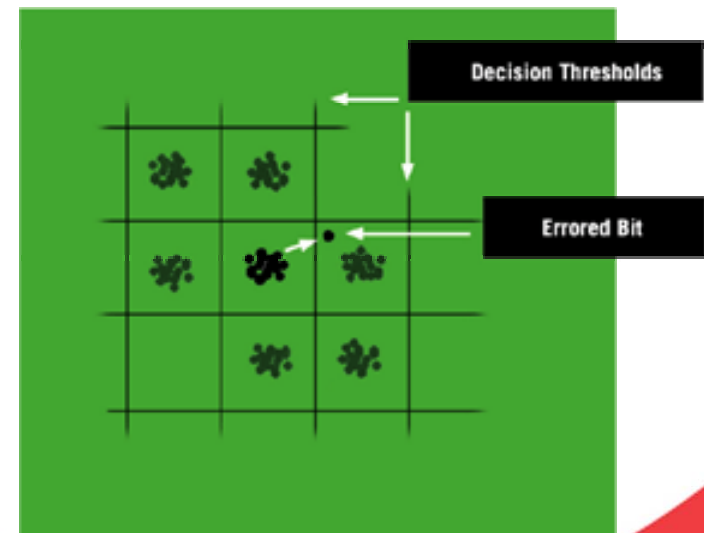
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Reading Constellation Diagrams

- The boundary is called the "Decision Threshold"
- If a signal disturbance pushes a symbol across the Threshold it is incorrectly interpreted as belonging in the neighboring box, and becomes a "bit error"
- Symbols that are not disturbed enough to be pushed across Thresholds are always interpreted correctly
- A constellation diagram is a good troubleshooting aid and can give clues concerning the source and nature of a disturbance

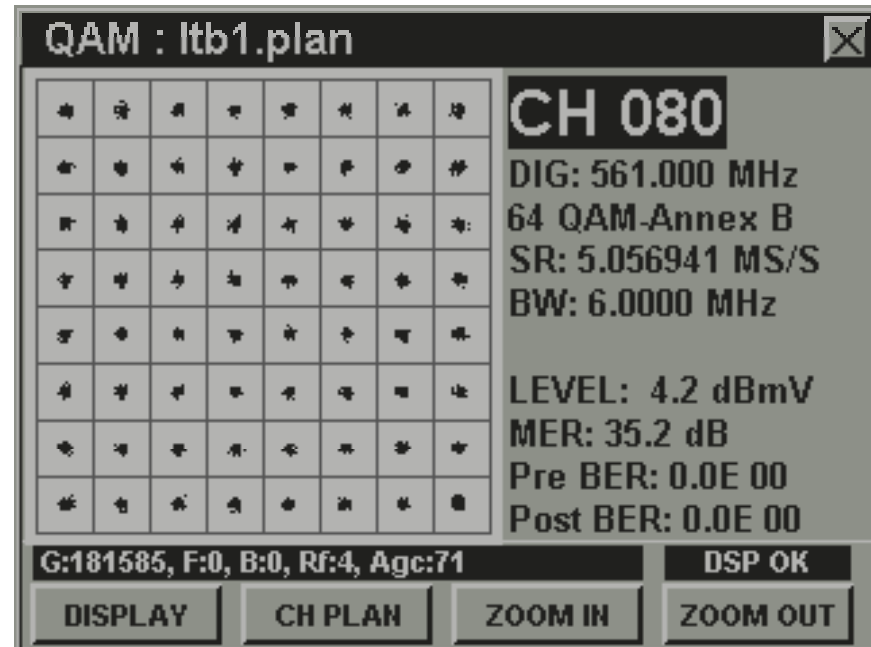




Constellation

- The constellation display shows both I and Q
- Helps determine modulation problems:

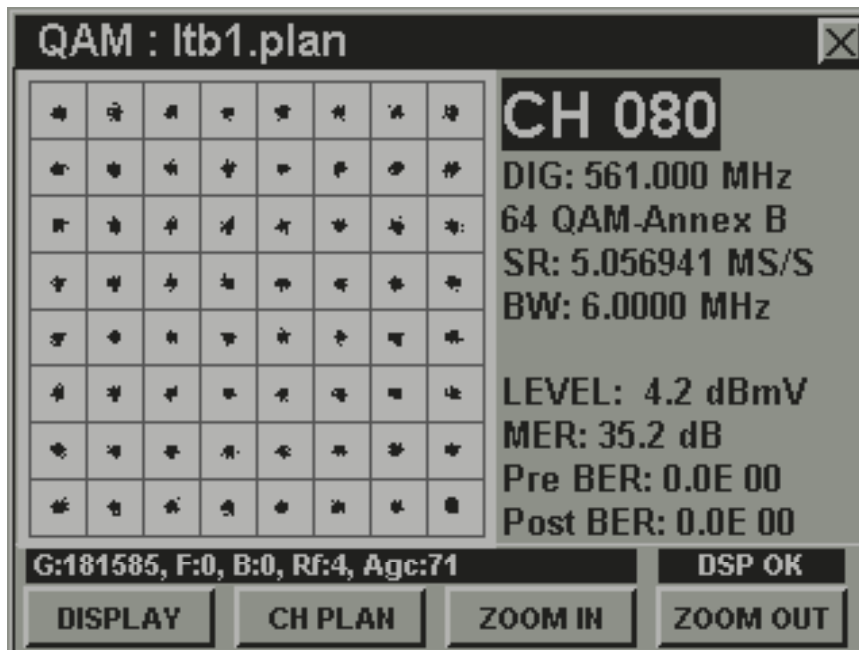
- Amplitude Imbalance
- Quadrature Error
- Phase Error
- MER



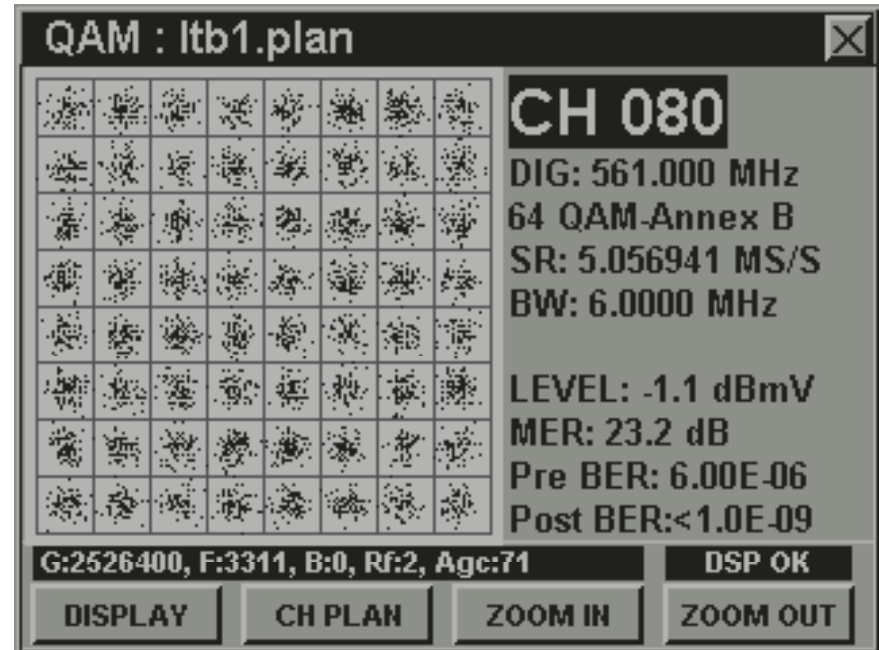


Constellation

Deviation from the ideal location



Good MER



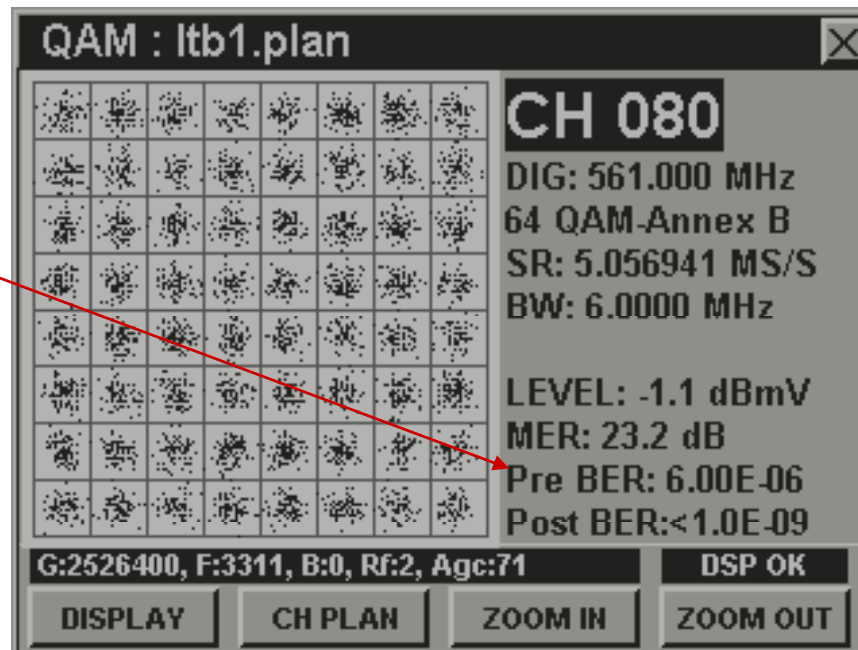
Poor MER





BER

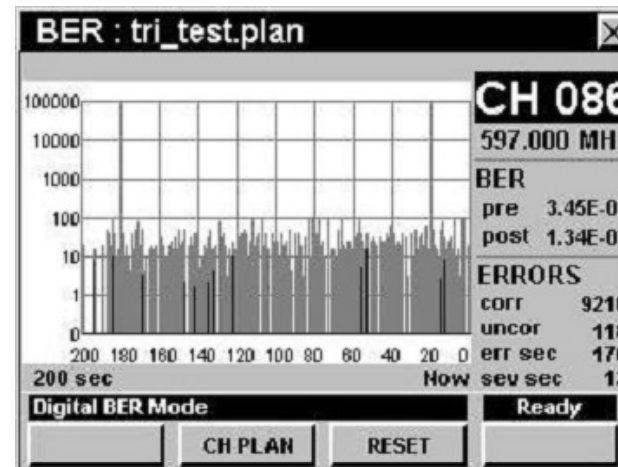
- Bit Error Rate is the number of bits in error divided by the total number of bits in the data transmission
- Pre BER
 - System Margin





BER

- Digital signals work well until very close to the point of failure
- Measurement of digital carriers critical to determine the system margin
 - Signal level
 - MER
 - BER



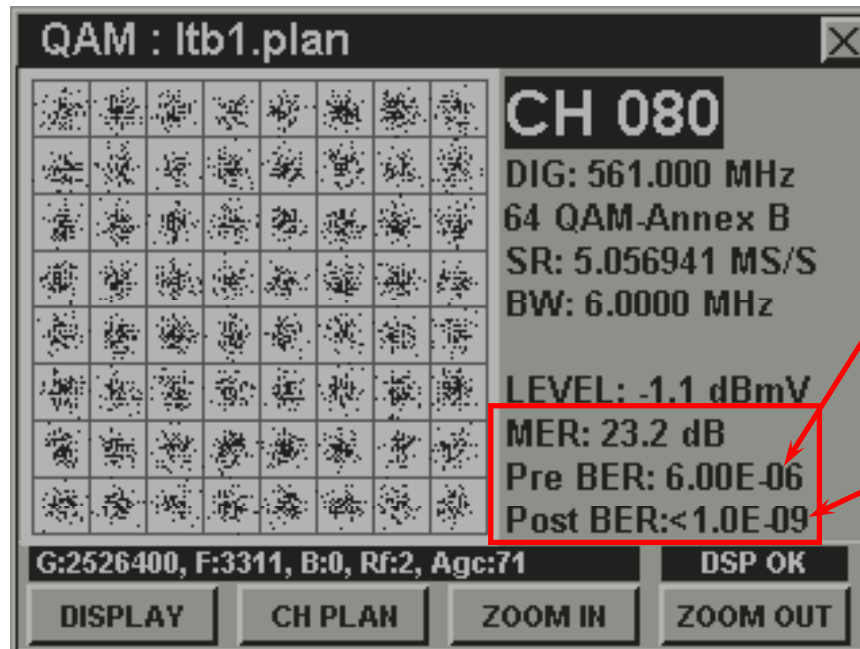
- The BER Mode helps to find problems





Forward Error Correction

- FEC
 - Corrects errors to a point



Pre FEC BER
(Before Correction)

Post FEC BER
(After Correction)





Digital Troubleshooting Tips

- Verify that the problem is happening before you troubleshoot
- Check
 - RF levels
 - MER
 - BER
 - Constellation
 - Signal Leakage



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Digital Troubleshooting Tips cont.

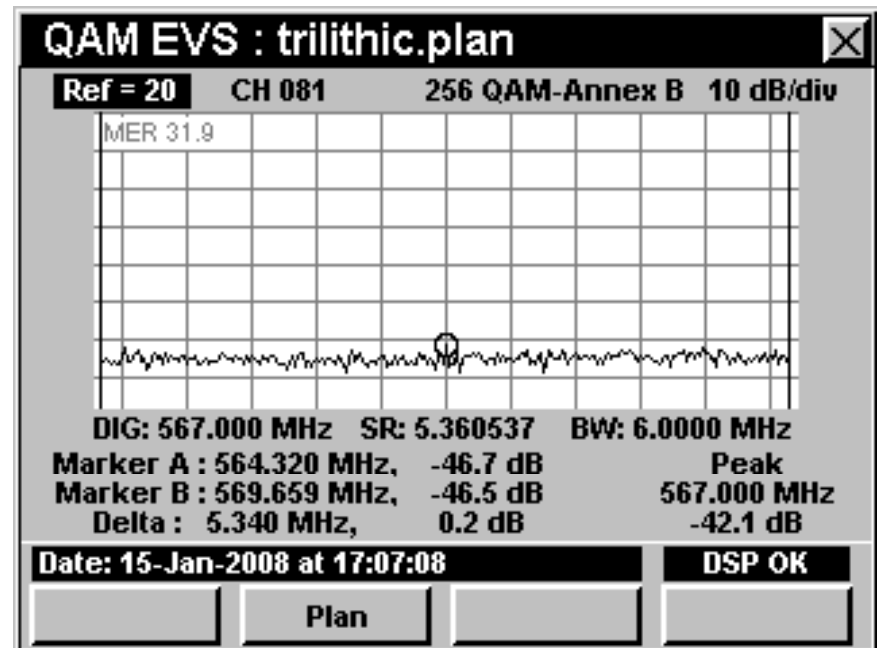
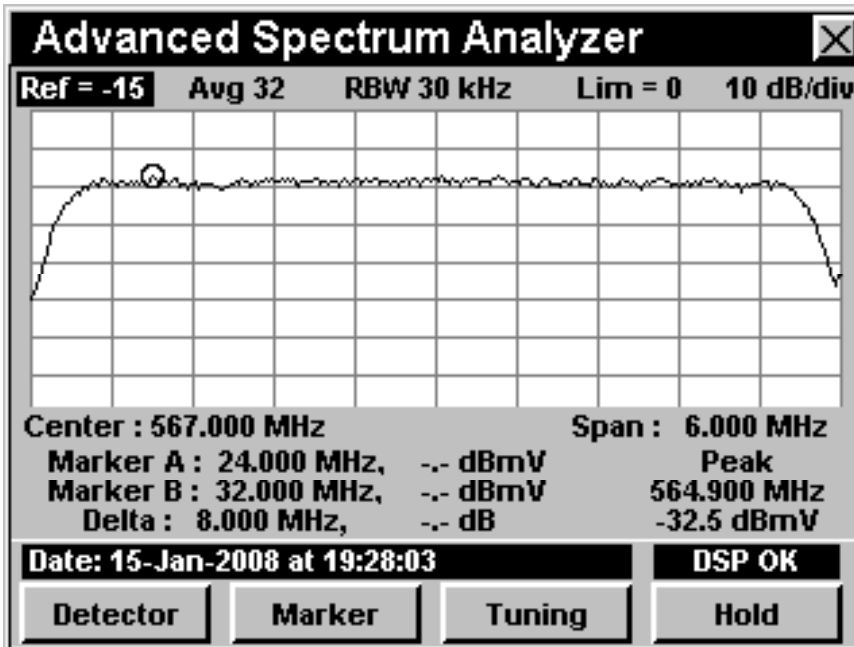
- The return spectrum for excessive noise
- What channels are being effective
- Adaptive Equalizer for reflections
- Connectors
- Wiring
- What time the problem occurs
- Diagnostic screens on the set top
- The noise floor under QAM





Error Vector Spectrum

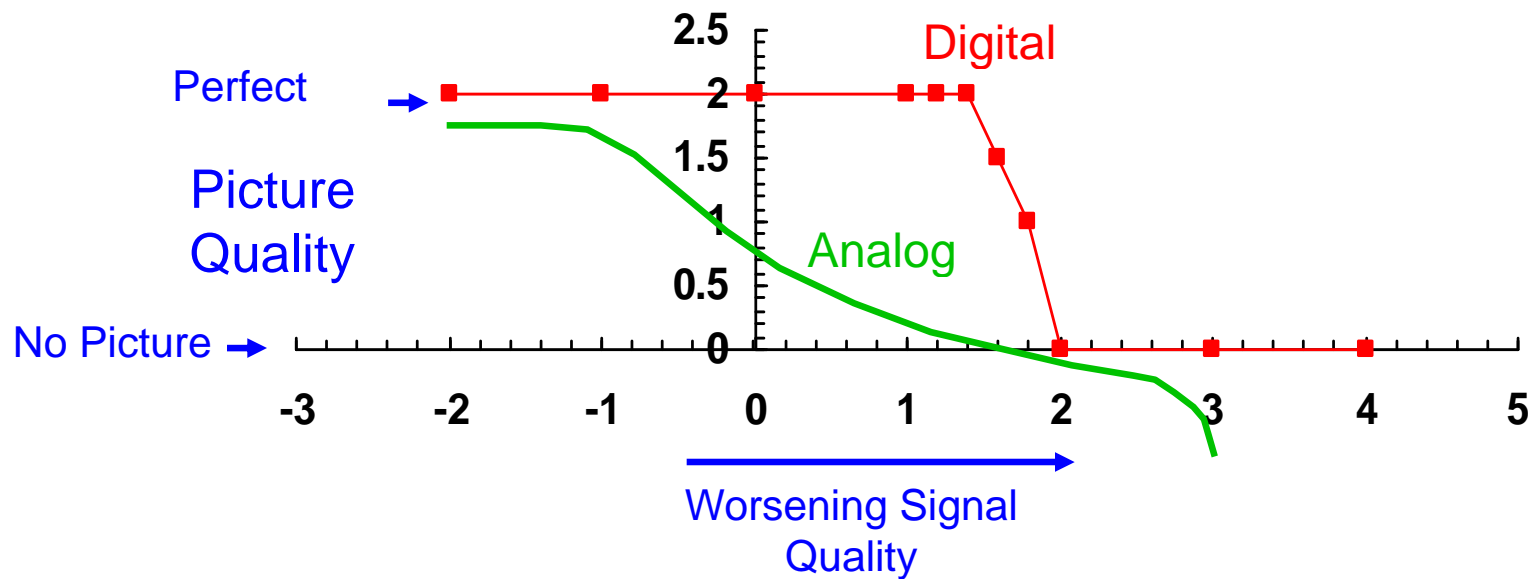
- To view the noise floor under QAM the carrier needs to be removed





Threshold and Margin

Signal Quality versus Picture Quality





MER TARGET - *THE “CLIFF” EFFECT*

- What is The “Cliff Effect”?

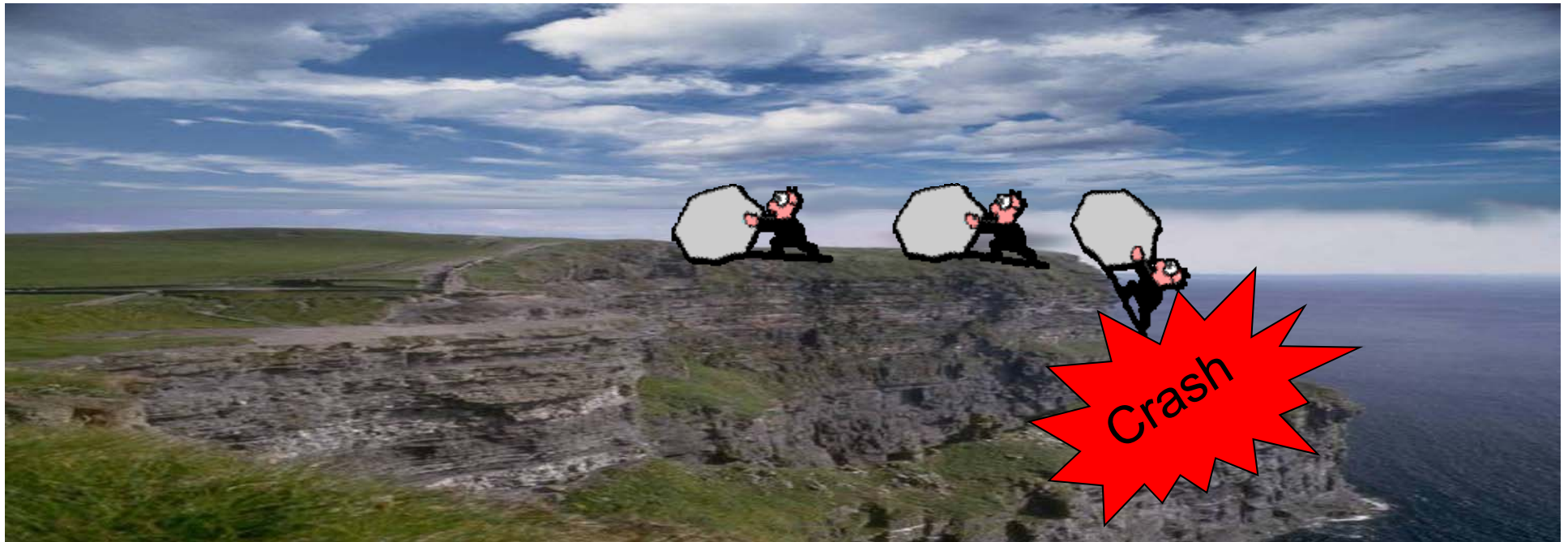


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Maintenance Activities on the Digital HFC Network



Operating margin
Zone

Risk
Zone

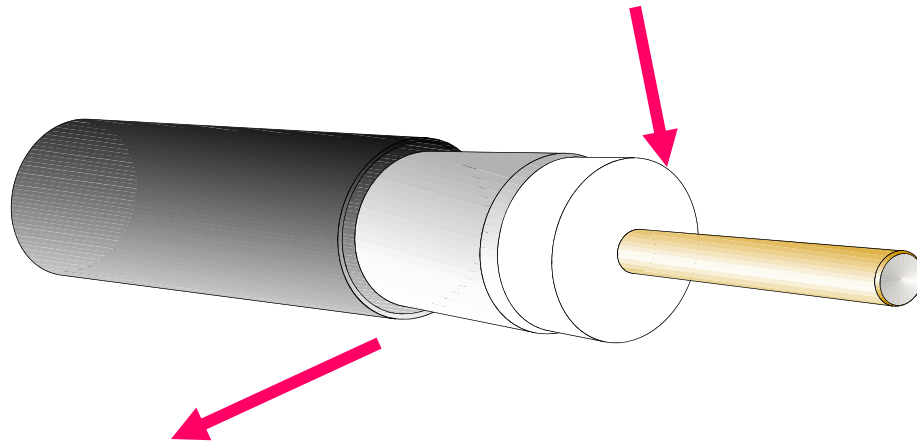
Crash
Zone



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Ingress & Egress



- Ingress

- RF or electrical energy that enters the coaxial environment

- Egress

- RF signal leaking out of the coaxial environment





Leakage Detection Benefits

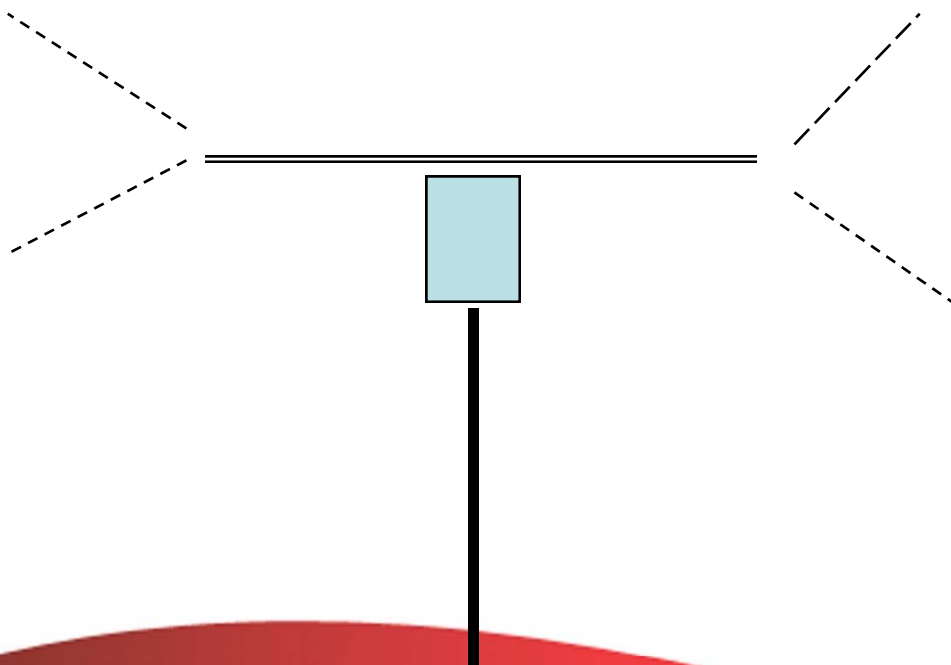
- Eliminates Ingress
- Improves System Performance
- Reduces Repeat Service Calls
- Locate Physical Problems within the network



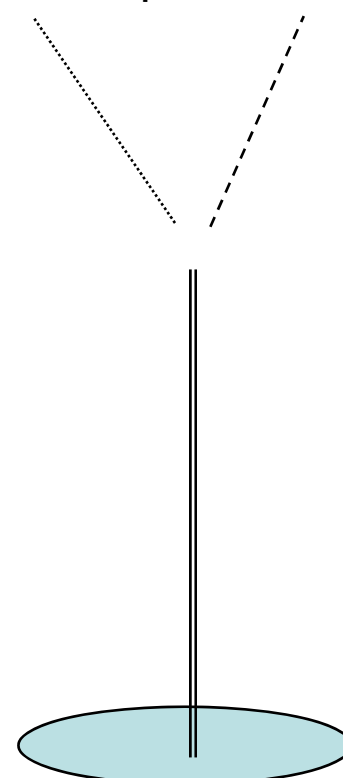


Polarization Angle

Dipole

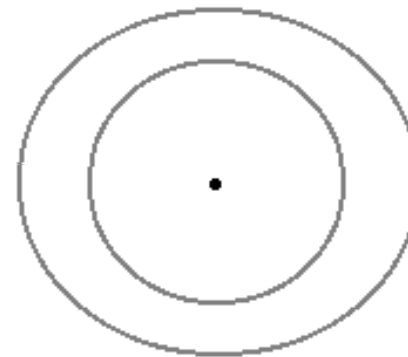
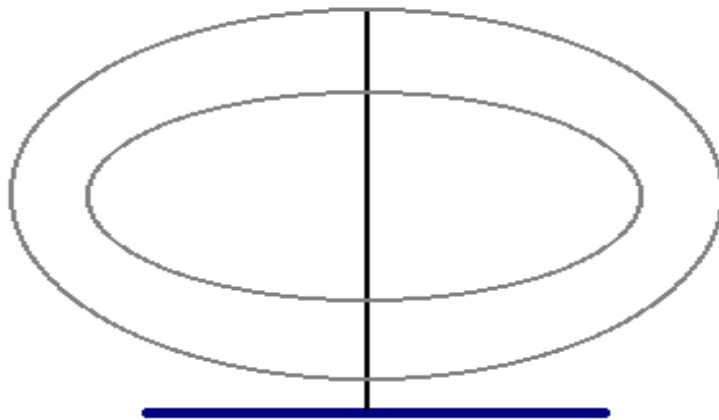


Monopole





Leakage Antennas-Whip

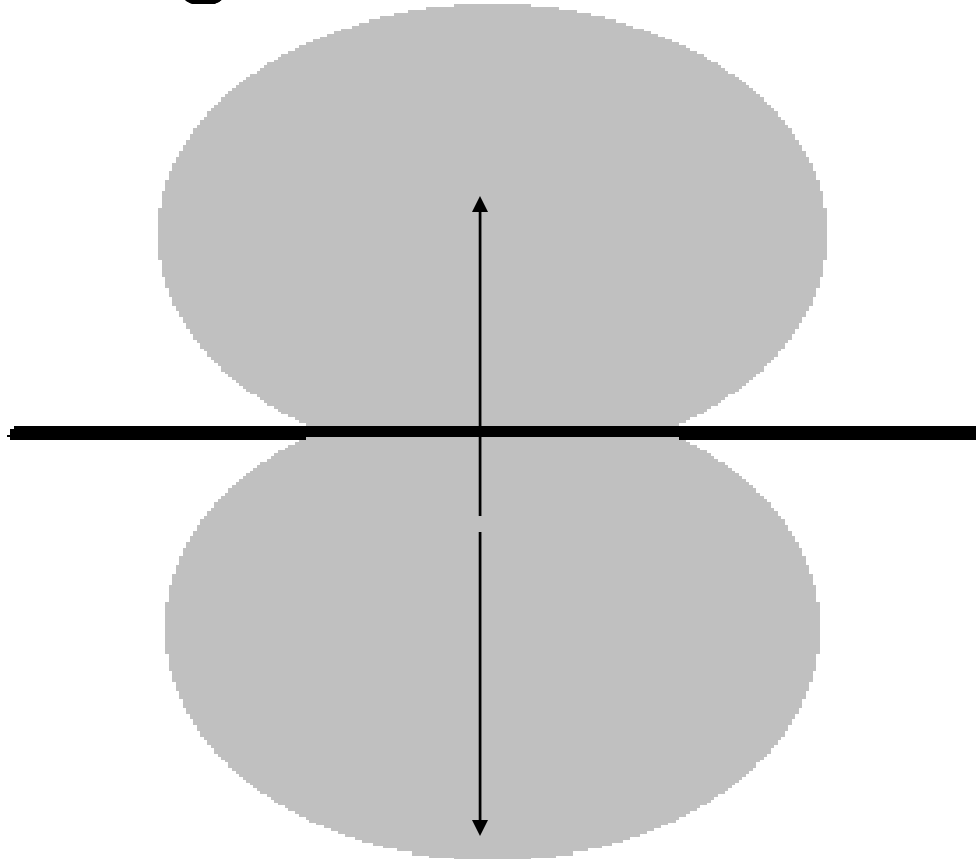


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Leakage Antennas-Dipole



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HSD Troubleshooting Tips



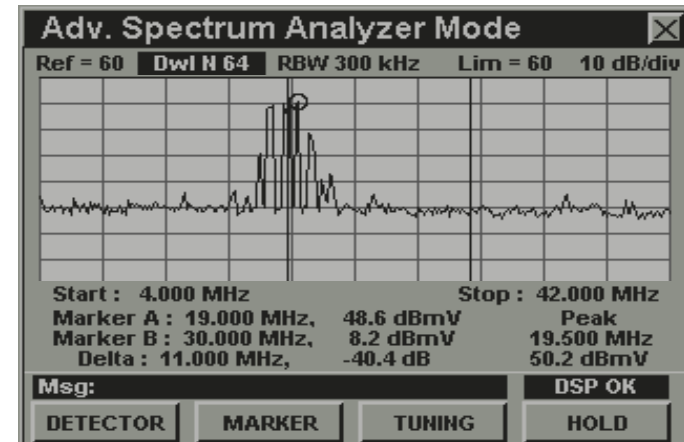
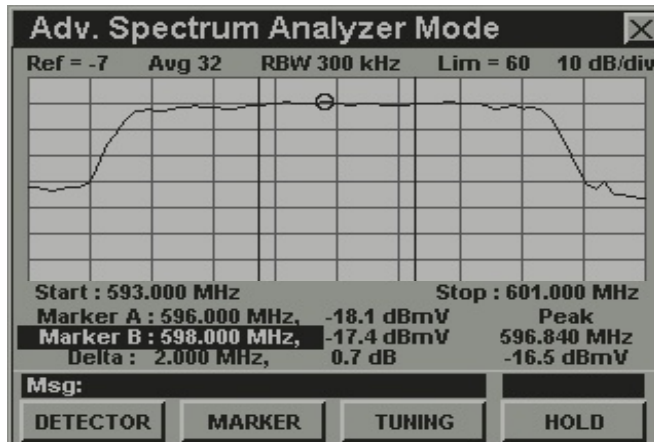
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High Speed Data

- Downstream is streaming data
 - Constant signal
- Upstream data signals are bursty





Network Ping

- Enter Host Name or Host IP
- Packet Delay (how often packets are transmitted)
- Packet Size (size of packets transmitted)
- Sent and Received Packets
- Lost Packets
- LPR (Loss Packet Rate)
- LPR(%) (Percentage of Loss Packets)

Network Ping (IP 10.1.31.98)			
Host Name	<input type="text"/>		
Host IP	<input type="text" value="10.1.70.92"/>		
Pkt Delay	<input type="text" value="100 msec"/>	Pkt Size	<input type="text" value="512 bytes"/>
Sent	<input type="text" value="269"/>	Min Time	<input type="text" value="5 msec"/>
Received	<input type="text" value="269"/>	Avg Time	<input type="text" value="12 msec"/>
Lost	<input type="text" value="0"/>	Max Time	<input type="text" value="160 msec"/>
LPR	<input type="text" value="0.00e+00"/>	Latency	<input type="text" value="67 msec"/>
LPR (%)	<input type="text" value="0.0 %"/>	Jitter	<input type="text" value="77 msec"/>
Date: 09-Dec-2008 at 09:51:09			
<input type="button" value="Favorites"/>	<input type="button" value="Start"/>	<input type="button" value="Stop"/>	<input type="button" value="Modem"/>





Ping from the PC

```
cmd Command Prompt
Microsoft Windows [Version 6.0.6001]
Copyright (c) 2006 Microsoft Corporation. All rights reserved.

X:\>PING WWW.YAHOO.COM -t

Pinging www-real.wa1.b.YAHOO.COM [209.191.93.52] with 32 bytes of data:
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58
Request timed out.
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58
Reply from 209.191.93.52: bytes=32 time=38ms TTL=58
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58
Reply from 209.191.93.52: bytes=32 time=34ms TTL=58

Ping statistics for 209.191.93.52:
    Packets: Sent = 10, Received = 9, Lost = 1 (10% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 34ms, Maximum = 38ms, Average = 34ms
Control-C
^C
X:\>PING WWW.YAHOO.COM -t
```



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Trace Route

Trace Route (IP = 10.1.33.58)

Host Name **WWW.YAHOO.COM**

Host IP **209.191.93.52**

1	10.1.1.1	10 msec : bem.trilithic.net
2	207.250.51.129	<10 msec : 207-250-51-129.static.twtelecom
3	66.192.244.20	10 msec : peer-02-so-0-0-0-0.chcg.twtelec
4	216.115.96.41	30 msec : vl151.bas2.dal.yahoo.com
5	216.115.104.89	50 msec : ge-1-1-0-p120.msrl.mud.yahoo.co
6	68.142.193.9	30 msec : te-9-1.bas-c1.mud.yahoo.com
7	209.191.93.52	30 msec : f1.www.vip.mud.yahoo.com
8		

Date: 06-Mar-2008 at 11:03:50

Start Stop

- Sometimes it's helpful to run a trace Route from the subscriber's PC
- This will show the routing point where the transmission stops
- Some devices can be configured not to respond to ping, as a security measure
 - firewalls for instance





Trace Route from the PC

```
Command Prompt
Microsoft Windows [Version 6.0.6001]
Copyright (c) 2006 Microsoft Corporation. All rights reserved.

X:\>TRACERT WWW.YAHOO.COM

Tracing route to www-real.wa1.b.YAHOO.COM [209.191.93.52]
over a maximum of 30 hops:

  1  <1 ms    <1 ms    <1 ms    bern.trilithic.net [10.1.1.1]
  2  18 ms     8 ms     5 ms     168-215-73-193.ilectris.com [168.215.73.193]
  3  10 ms     10 ms    10 ms    dist-02-ge-3-1-0-401.brfd.twtelecom.net [66.192.
254.70]
  4  40 ms     31 ms    36 ms    so-0-0-0.pat1.dax.yahoo.com [216.115.96.60]
  5  37 ms     31 ms    36 ms    ae2-p110.msr2.mud.yahoo.com [216.115.104.109]
  6  32 ms     33 ms    42 ms    te-9-1.has-c2.mud.yahoo.com [68.142.193.11]
  7  31 ms     38 ms    36 ms    f1.www.vip.mud.yahoo.com [209.191.93.52]

Trace complete.

X:\>TRACERT WWW.YAHOO.COM
```



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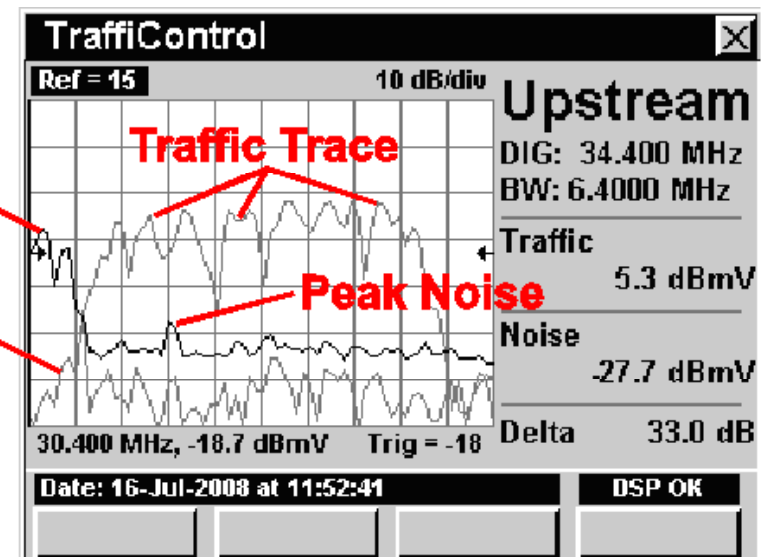
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Traffic Mode

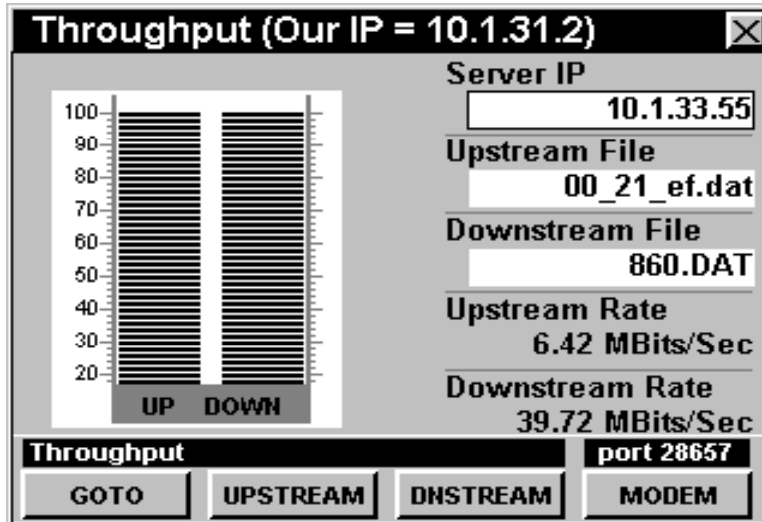
- Traffic mode can be used to see the ingress that is present “underneath” an upstream cable modem carrier, VoIP carrier, or any bursty signal
- Troubleshooting made easy
 - Divide & Conquer
 - Source typically a home

Adjacent Return Channel
Live Noise





Throughput Test



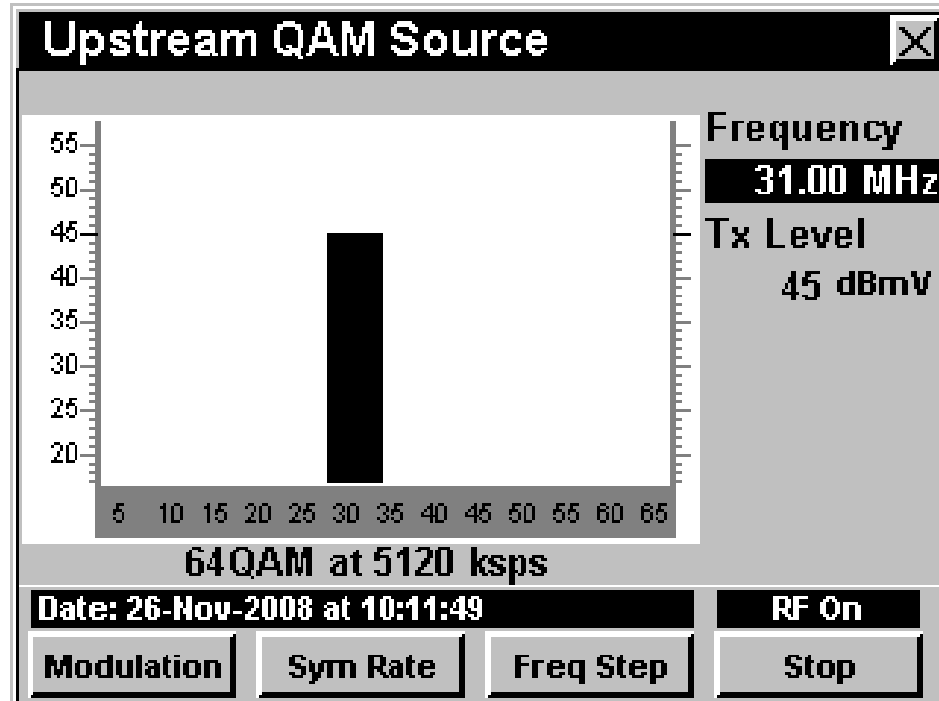
- Throughput rates up to 40Mbps
- Select test at fixed throughput rates, such as 5 Mbps, 10 Mbps, 15 Mbps, 30 Mbps, and 40 Mbps to test various tiered services
- Test at both the desired speed and one speed higher to prove that the cable modem is provisioned correctly





QAM Source

- Upstream QAM source verifies the transmission capability of the network for higher order QAM signals
 - QPSK
 - 16 QAM
 - 64 QAM
- Adjustable
 - Symbol Rate
 - Level
 - Frequency





Maintenance Activities on the Digital HFC Network

VoIP Troubleshooting



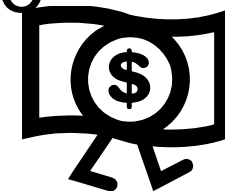
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How Testing Helps

- Must be quick to identify, isolate, and solve problems – know system health
- Recruiting customers is expensive, and long-term retention is critical to ROI
- Loss of voice customer may also mean loss of the rest of the triple-play revenue



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Broadband Instruments and Systems



VoIP Tests,
Pre-Activation

think ahead.





Pre-Infrastructure VoIP Testing

- Prepares system for VoIP service offering by pre-testing
- RTP (Real-time Transport Protocol) tests for packet loss, jitter, and delay, with MOS
- Inexpensive solution, with low-cost headend based server



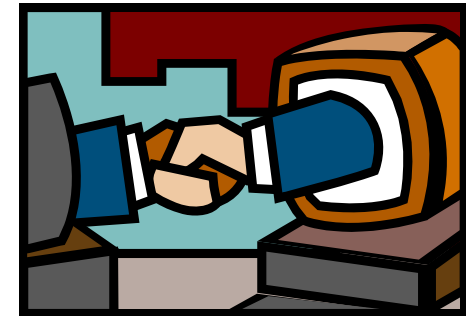
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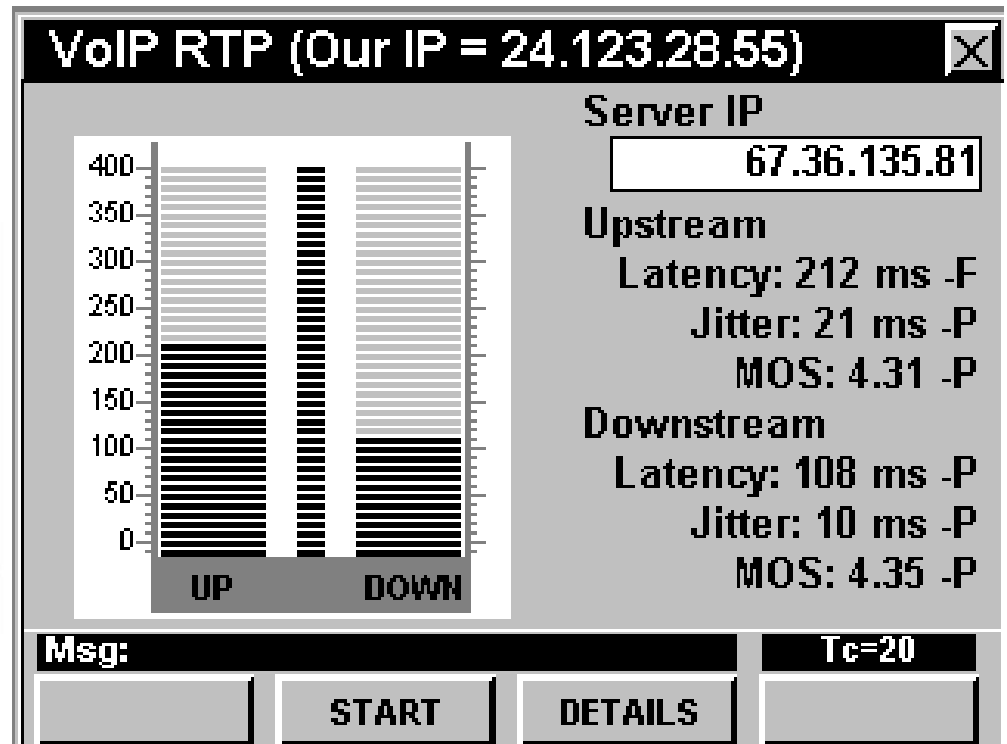
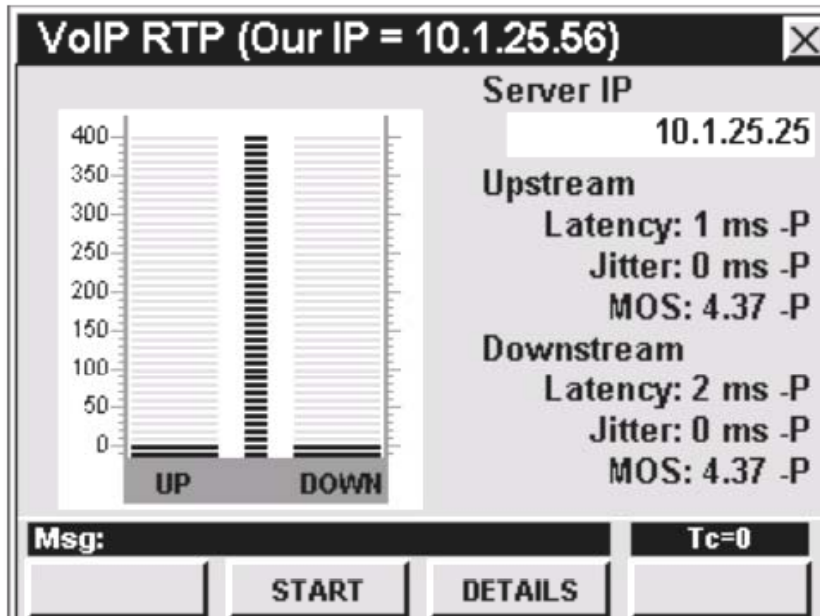
RTP Test

- Communication established
- Server and analyzer synchronize test parameters and clocks
- Communication occurs using RTP over UDP (User Datagram Protocol) at pre-negotiated port
- Results are calculated and compared to limits – Pass/Fail results





Sample Results





Sample Results – Drill Down

VoIP RTP (Our IP = 10.1.25.56)
Server IP

RESULTS [X]

VoIP RTP Local Results
(Downstream Packet Data)
1000 Packets, 0 Discarded, 0 Lost, 0 OutofOrder
Loss Periods: Min 0, Max 0, Avg 0, Number 0
Latency: Min 0, Max 2, Avg 1
Jitter: Min 0, Max 0, Avg 0
R = 91.37, MOS = 4.37

Press ENTER to Continue

Msg: [] Tc=0 []

[] START [] DETAILS []

Downstream

VoIP RTP (Our IP = 10.1.25.56)
Server IP

RESULTS [X]

VoIP RTP Remote Results
(Upstream Packet Data)
998 Packets, 0 Discarded, 0 Lost, 0 OutofOrder
Loss Periods: Min 0, Max 0, Avg 0, Number 0
Latency: Min 0, Max 1, Avg 0
Jitter: Min 0, Max 0, Avg 0
R = 91.40, MOS = 4.37

Press ENTER to Continue

Msg: [] Tc=0 []

[] START [] DETAILS []

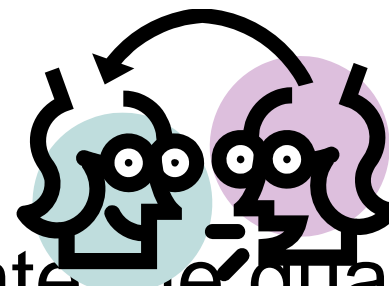
Upstream





Mean Opinion Score (MOS)

- Subjective voice quality score based on the perception of a random group of people listening to speech over a communication system.
- Group of males and females rate the quality of test sentences read
- Each person rates from 1 to 5
- MOS is average: 1 (worst), 5 (best)



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Mean Opinion Score (MOS)

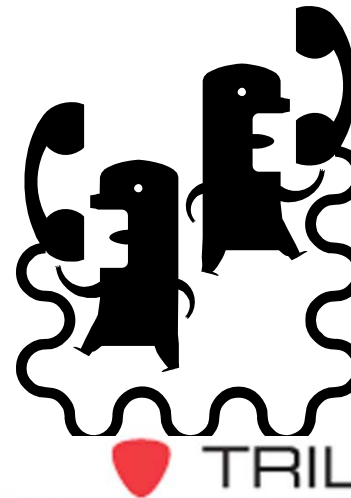
Rating	Definition	Description
5	Excellent	A perfect speech signal recorded in a quiet booth
4	Good	Intelligent and natural like long distance telephone quality
3	Fair	Communication quality, but requires some hearing effort
2	Poor	Low quality and hard to understand the speech
1	Bad	Unclear speech, breakdown





Latency (Delay)

- Causes Echo and Talker Overlap
- When delay is > 50 msec, echo becomes a problem; echo cancellation is required
- Talker overlap is significant when one-way delay is > 250 msec



TRILITHIC

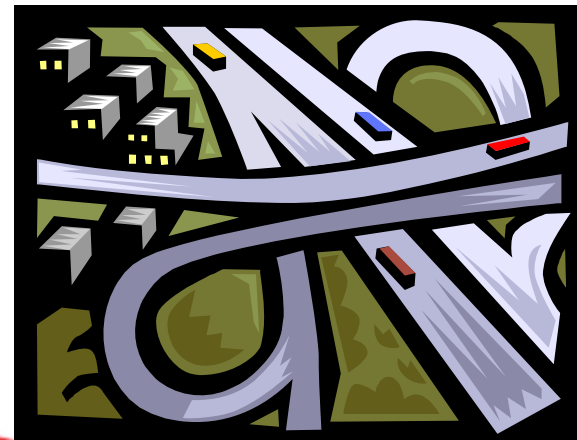
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Latency (Delay)

- Can seriously impair communication
- Usually a by-product of switching and routing
- Must be less than 300 msec. round trip



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Jitter

- Packets arrive at destination out of timing or sequence
- Jitter buffer is used to enable re-ordering of packets
- Increasing size of jitter buffer threatens delay
- Should be less than twice packetization rate
- Jitter buffer overflow causes packet loss



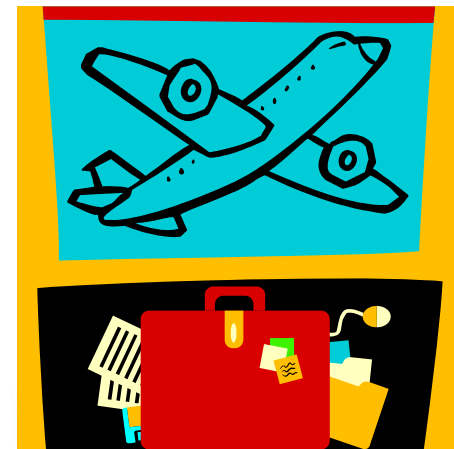
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Packet Loss

- Can be caused by network congestion, jitter buffer overflow, or ingress
- Random packet loss is less noticeable than “bursty” packet loss
- Target <1%, which is less noticeable when loss is random; >4% renders service unusable





Task for Headend, Maintenance and Service techs



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Maintenance Activities on the Digital HFC Network

- Verifies that the home network will support extended service (HSD, VoIP, VOD, Digital, etc)
- To detect faults at the premise
- Why clean it up?
 - The Issues
 - Home wiring architectures
 - Component Requirements
- Testing & Troubleshooting
 - Recommendations
 - Suggestions for a more available service



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Broadband Instruments and Systems



What checks should we make to ensure a good install

think ahead.





Broadband Instruments and Systems



Ingress Concerns

think ahead.





Ingress on Analog and Digital Channels

- Lines in picture
- High speed data problems
- Interference with two-way radio services using the same frequencies
- Macro Blocking
- Freeze Frame
- Loss of Picture and Sound





Alternative Maintenance Techniques

- High Pass Filters
 - Attenuate Return Path Noise and Ingress coming from the subscriber premise
 - Isolate entertain services from data services
- Return Path Attenuators
 - Increase the tap loss in the return path only
 - Equalize the loss for subscriber devices and increase isolation between subscriber premise and cable system
- Drop Testing
 - Testing the integrity of the subscriber wiring





Broadband Instruments and Systems



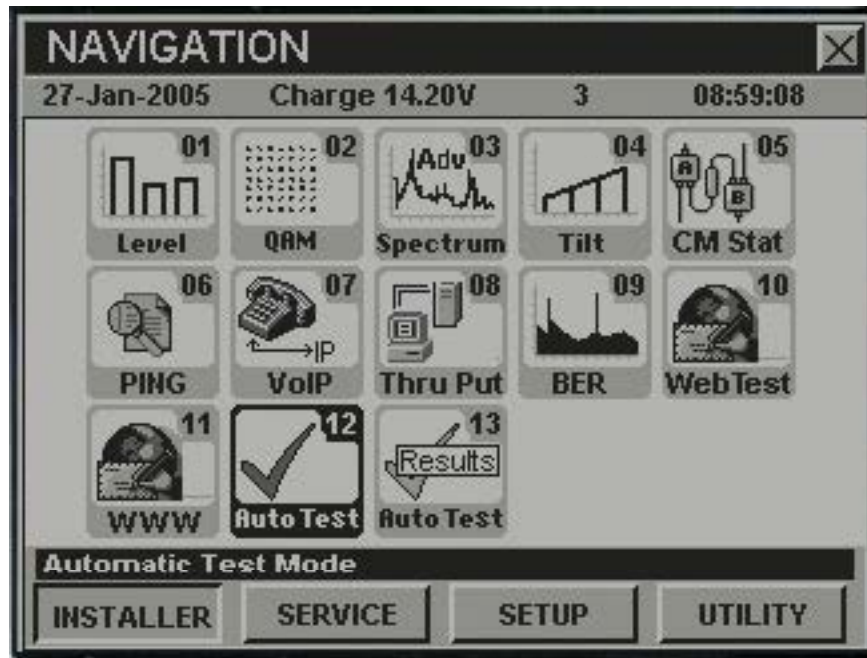
Autotest Macros

think ahead.





Auto Test Functions



- Automated Testing of...
 - Level (Single or Scan)
 - Hum
 - VoIP
 - Ping
 - QAM
 - Reverse Levels, Ingress
- Selectable Timing, Channel Plan, Label
- Test to Limits
- Results Labeled, Displayed and Stored





Broadband Instruments and Systems



Remote Signal Monitoring & Analysis

think ahead.





Scheduled Reporting Challenge

- Common task – report test signal analysis results
 - all signals
 - on regular schedule
- Techs required to visit remote locations
 - to verify and report signal quality
- Time consuming and expensive process, begging for automation



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Eliminate Unnecessary Travel

- Trips to remote sites no longer required to perform a wide variety of signal quality tests
- Automate measurements
- Access for “live” measurements using browser



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Applications

- Monitor forward signal quality
 - User definable limits
 - Management application software
 - Manages traps from
 - E-mail alarm notification
 - Designated technician/engineer/manager
- Check current status
 - Similar to 860 DSPi browser access/control





Alarm Analysis

- Display current alarm status
 - Based on traps received
- Provide easy access to remote devices
- Activate email notification of specified user



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Maintenance Activities on the Digital HFC Network

Trilithic Console - [860 DSPh Live View on 10.1.70.99]

860 DSPh

TRILITHIC

Alarms Channel Plan Channel Scan Limits Recent Traps Live Mode Information

Digital Level

DIG: 819.00 MHz
-44.36 dBmV
BW: 6.00 MHz
SR: 5.36 MSPS

Video

08-Feb-2010 19:44:27 Live Mode Testing

Channel	Hub	Unit	Input	Event	Time
4 - CH4	Number 1	Apps Test	3	Video Level	2/8/2010 2:34:11 PM
201 - CW	Number 1	Apps Test	3	Video Level	2/8/2010 2:34:11 PM
131	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
130	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
129	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
128	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
127	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
116	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
115	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
114	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
113	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM
112	Number 1	Apps Test	2	Digital Level	2/8/2010 2:34:09 PM

Channel Event Details

- Channel 128 Digital Level Event
 - Hub = Number 1
 - Unit = Apps Test
 - Input = 2
 - Event Date/Time = 2/8/2010 2:34:09 PM
- Channel 128
 - Limits
 - Digital Level
 - Digital MER
 - Digital Pre-BER
 - Digital Post-BER

Channel Events

Displays channel alarms received from devices.

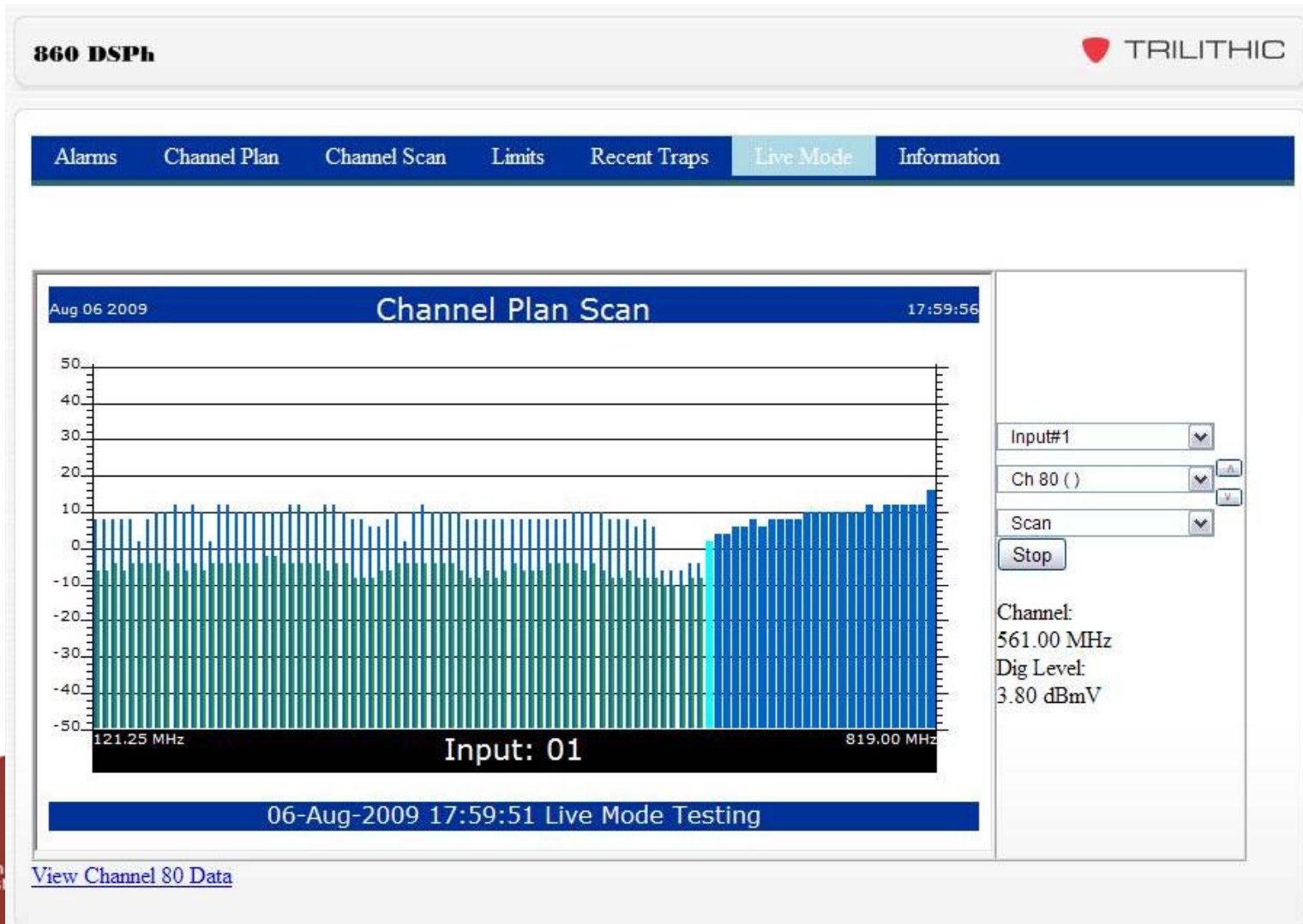
Click once on a channel event to see the Channel Event details.

Double-click on a channel event to bring up a live view mode to monitor current channel measurements.





Channel Scan (Live Mode)





Maintenance Activities on the Digital HFC Network

Spectrum Analyzer (Live Mode)

860 DSPh TRILITHIC

Alarms Channel Plan Channel Scan Limits Recent Traps **Live Mode** Information

Aug 06 2009 **Advanced Spectrum Analyzer** 18:05:04

06-Aug-2009 18:05:04 Spectrum Live Mode

Marker A: 530.00 MHz 19 dBmV Delta: 0 MHz
Marker B: 530.00 MHz -19 dBmV Level: 0 dB

[View Channel 80 Data](#)

Input#1

Ch 80 ()

Spectrum

Stop

Start: 510.00 MHz
Stop: 530.00 MHz

Ref: 21 dBmV Auto:

RBW: 30 kHz

Hold: None

Avg: Avg 16

Submit



Maintenance Activities on the Digital HFC Network

Constellation Diagram (Live Mode)

860 DSPh TRILITHIC

Alarms Channel Plan Channel Scan Limits Recent Traps **Live Mode** Information

Aug 06 2009 **QAM MER / Constellation** 18:18:00

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

DIG: 645.00 MHz
Level: 11.14^{dBmV}
MER: 34.46 dB

BW: 6.00 MHz
SR: 5.361 MS/S
Pre BER: 1.00e-9
Post BER: 1.00e-9
Modulation type:
256 QAM

Input#1
Ch 94 ()
QAM / MER
Zoom IN Zoom Out
Stop

06-Aug-2009 18:16:59 Live Mode Testing

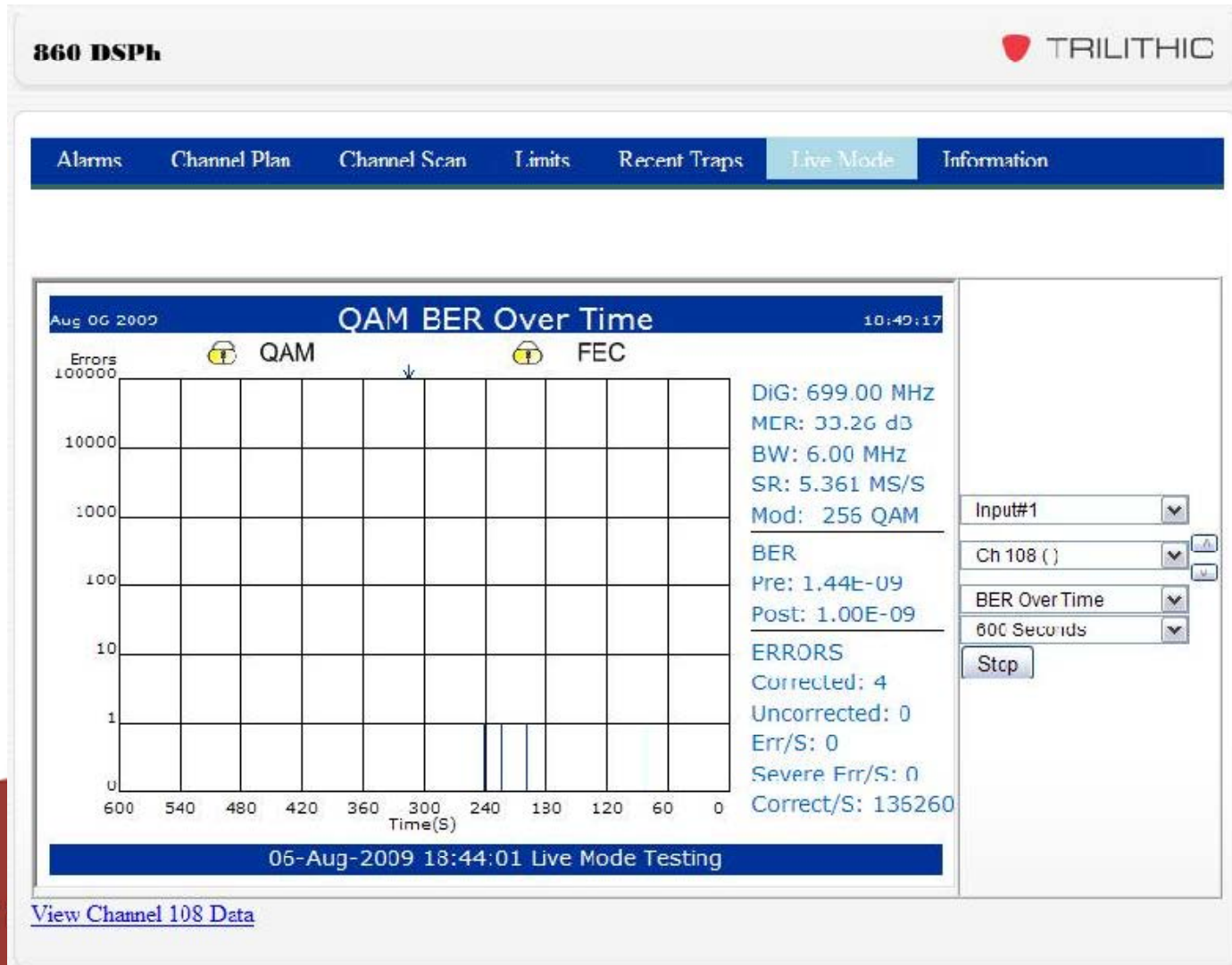
[View Channel 94 Data](#)

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Maintenance Activities on the Digital HFC Network


BER Over Time (Live Mode)





Channel Scan

860 DSP Remote Mini View

860DSP  TRILITHIC

Scan : default.plan Input 2

Ref = 20 dBmV 10 dB/div

CH : 074
DIG: 525.000 MHz
5.0
BW: 6.000 MHz

Total Power 43.1 Avg 4

Channel Plan Scan **DSP OK**

Goto Plan Drop Limits

1 ABC 2 DEF 3 GHI ↑

4 JKL 5 MNO 6 PQR ← →

7 STU 8 VWX 9 YZ ↓

Bk Esc 0 Space Fn . Enter

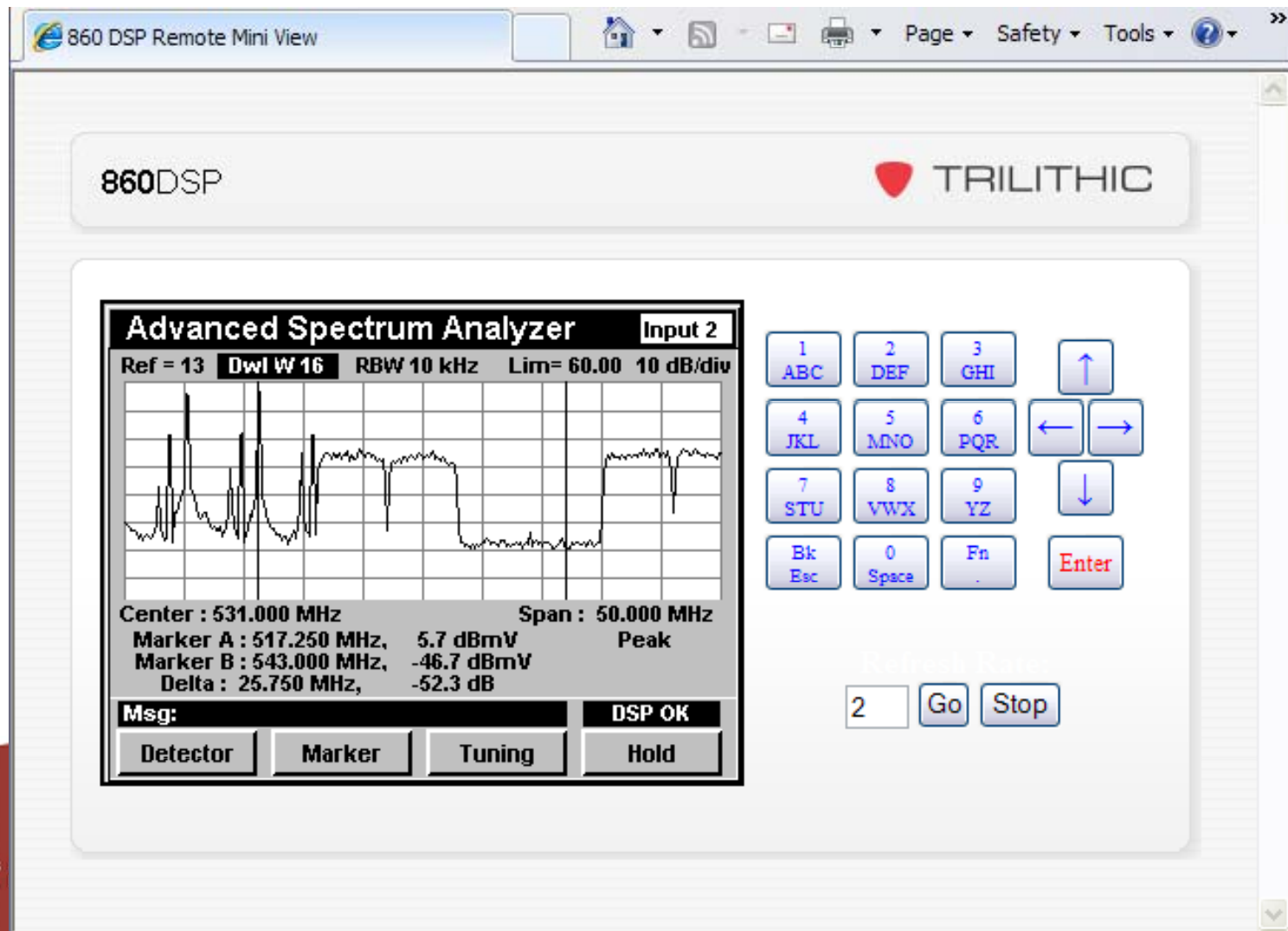
Refresh Rate

2 Go Stop

This document Trilithic



Spectrum Analyzer





Tools of the Trade

- Return Sweep and Balance
- Forward Sweep and Balance
- Ingress Monitoring
- Work Management
- Leakage





Tools of the Trade

- Digital Measurement
- HSD
- VoIP
- Remote Monitoring



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Maintenance Activities on the Digital HFC Network

End of Session Two Questions?



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Maintenance Activities on the Digital HFC Network

Thank you-Gracias-Merci-Masha Danki...

Trilithic Applications Engineering

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