

The slide features a blue header with a large, faint "CISCO" logo. Below the header is a white section containing the title "Advanced Spectrum Management" in a large, bold, black font. Underneath the title is the name "Jeffrey J. Forhan" in a smaller, bold, black font. At the bottom left, the text "Session Number" and "Presentation\_ID" are listed. At the bottom center, the copyright notice "© 2001, Cisco Systems, Inc. All rights reserved." is present. At the bottom right, the number "2" is displayed. The Cisco.com logo is visible in the top right corner of the white section.

## MC16S Spectrum Management Card

Cisco.com

- **First DOCSIS line card to offer an integrated spectrum analyzer**
- **Reduces the reliance on costly spectrum analyzers at every headend or hub**
- **Quickly provides spectrum views without the complicated setup time of a spectrum analyzer**



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## S Card Advantage

Cisco.com

- **Hardware-assist frequency hopping with software enhancements:**
  - Shift upstream (US) channel center frequency
  - Hop to new center frequency in clear spectrum
  - Change modulation mode
  - Reduce upstream channel bandwidth
- **Flexible configuration choices for proactive channel management**
  - The priority is frequency then channel width when using Dynamic Channel Widths
  - The priority is modulation, frequency, then channel width when using Dynamic Upstream Modulation

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## Frequency Hopping Pros

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- **Increase availability of upstream plant**
- **Run modems 3 dB hotter**
  - If you base your levels off of power/Hz
    - Additional spectrum allocated for redundancy
- **Can now hop based on time of day**
- **Can assign a different power based on the hop freq. or range of frequencies (32 ranges)**
- **Can increase availability even more**
  - Change the modulation and/or bandwidth in addition to frequency hopping

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## Dynamic Modulation Selection

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- **User-configurable criteria maintains highest**
  - Channel width & modulation rate
  - Bit rate
- **Revert to original channel when available (configurable)**
- **Applies to uBR-MCxxC, uBR-MC16E and uBR-MC16S line cards**

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## Frequency Hopping Cons

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- **Some people will rely on this for availability instead of cleaning their plant**
- **Ingress at 15 MHz will still affect modems at 28 MHz**

Laser clipping, harmonics,...

- **More bandwidth must be allocated for redundancy/hopping**
- **If it's a blind hop, you could spend more time hopping than actually transmitting useful data**

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## MC16S Benefits

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- **Improves response time to ingress and noise impairments**
- **Eliminates “blind” and unnecessary frequency hops**
- **Saves time and effort by MSO staff when troubleshooting cable plant impairments**
- **Increases cable plant availability**
- **Improves % of modems on-line**
- **Maximizes spectrum utilization**

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## Old Hopping Decisions

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- **Decision based on:**
  - Schedule**
  - % of missed station maintenance messages**
- **Clean band defined as:**
  - A signal-to-noise ratio (SNR) > 29 dB for 16-QAM**
  - An SNR > 19 dB for QPSK**
- **Channel width can vary to find a clean band**

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## Spectrum Management Enhancements

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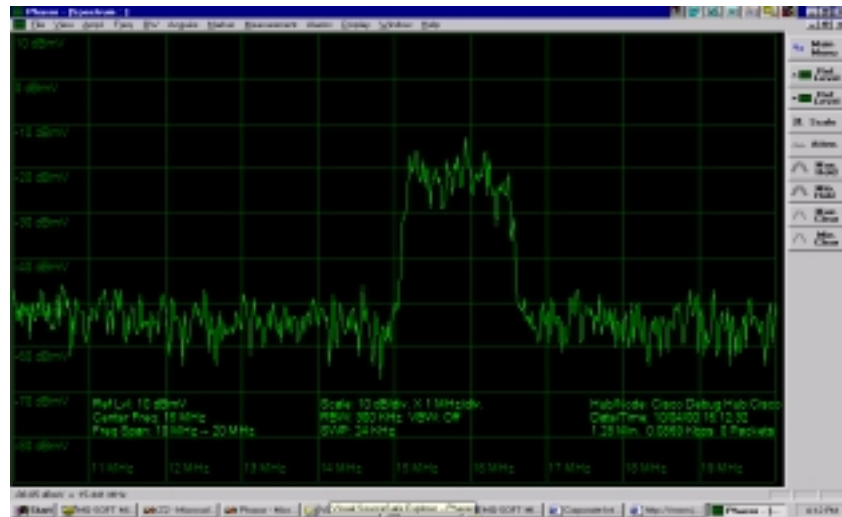
- **Hopping criteria based on C/N ratio**
- **Dynamic modulation selection**
- **How fast to hop? Ex. uBR7246<config-if>#**
  - cable spectrum group <n> hop period <1-3600sec> (25 second default)**
  - cable spectrum group <n> hop threshold <1-100%> (20% default)**
- **CNR measurements per service ID (SID)**
- **Interface for Real-Time Spectrum Display**

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## Real Time Spectrum Display



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## CNR-Based Hopping Criteria

- **Dual hop criteria:**
  - Modem performance
  - Correctable/uncorr Forward Error Correction (FEC)
  - CNR
- **User-configurable CNR threshold criteria**
- **Management information base (MIB) and command line interface (CLI) output of CNR readings**
- **Active channel measurements**
- **View spectrum band around single modem transmit**

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## Interface for Spectrum Data Output

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- **Server performs**
  - Collection/storage**
  - Trend analysis**
  - Graphical histograms/reporting**
  - Alarm generation/fault management**
- **Polling mechanism via MIB objects**
- **Cooperative marketing and referrals**

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## DOCSIS Cable Modem Test Analyzer (DCMTA)

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- **Acterna software**
  - Based on Cheetah's Phasor DSP technology**
  - Simple network management protocol (SNMP) communication**
- **Interactive CD with Cisco S card purchases**
- **30 day free trial with Acterna license for all CMTSs**
- **Real-time spectrum analysis from 5-42 MHz**
- **Software resides on any pc w/ a link to the uBR**
- **Supports MC16S cards: uBR7223, uBR7246, VXR**

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## Fast Trouble Isolation

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- **Simple installation**

Spend time  
troubleshooting  
instead of  
installing

- **Enter CMTS IP address and SNMP RW community string**



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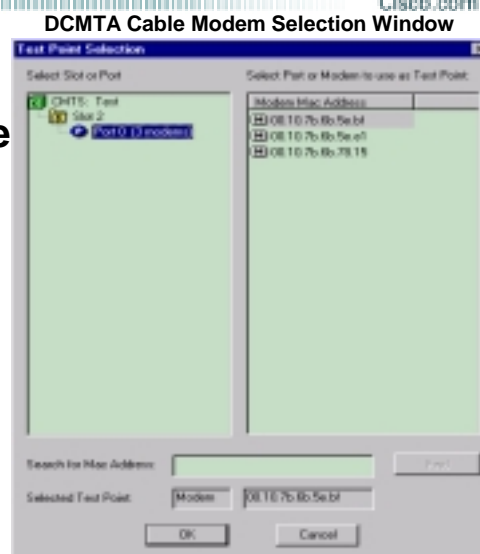
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## Fast Trouble Isolation (con't)

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- **Select CMTS to test**
- **Provides simple tree display of**
  - Downstream slots
  - Upstream ports
  - Modem MAC addresses
- **Network tree automatically populated via MIBs**



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## Test Analyzer Benefits

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- **Automatically populated network tree ensures you're always viewing accurate data from the CMTS**
  - Newly provisioned modems
  - Even self installs!
- **Easily and quickly choose the US port or modem to analyze and launch the spectrum analyzer view immediately**
  - Live troubleshooting of an US port or single modem
- **Proactively address ingress before affecting customers**
- **Measure ingress on the uBR port (under the carrier!)**
- **Easily troubleshoot cable modems in real-time**
  - Identify low/high modem transmit signal levels
- **No re-cabling or test points required to support diagnostics**

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## Individual Cable Modem Analysis

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Spectrum from an Individual Modem

- **Full spectrum view**
- **Can request an instantaneous CNR calculation as listed in the MIBs**
- **Also allows view of an CNR log for the active session**



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## Upstream Port Analysis

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- Provides a quick and simple mechanism to gauge the noise status on an individual US
- Select the corresponding US port in the tree, immediately taken to the spectrum analyzer view of that upstream port



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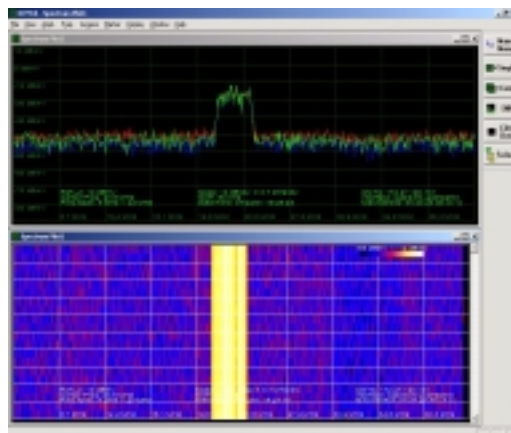
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## 3 Modes of Operation

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- **Spectrum Analyzer**
  - Single
  - Continuous
- **Amplitude vs Time**
  - Similar to zero-span
- **Spectrogram**
  - Color coded interpretation of time vs freq vs amplitude



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## Single or Continuous Mode

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- **Single mode captures single snapshot of spectrum**  
Used when a single trace, at a single point in time, is required for analysis
- **Continuous mode presents spectrum trace updates as received from the MIBs**
- **These are displayed as a live dynamic traces on the screen**  
Used for watching changes in the spectrum over time  
Update rate is approximately once per second

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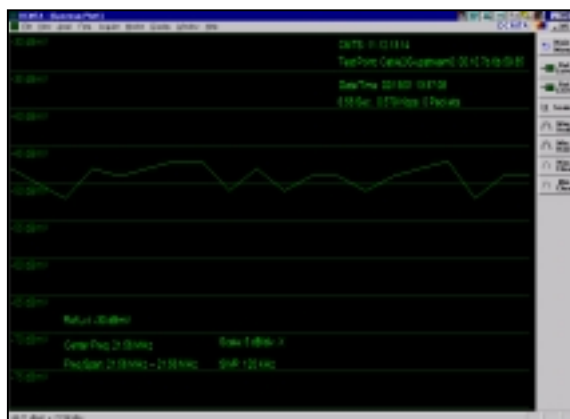
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## Amplitude vs. Time

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- **Monitors an individual frequency over time**
- **Similar to zero span**
- **Helpful when you need to monitor changes on a specific frequency**



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## Amplitude vs. Time Display Option from Spectrogram



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## Setup Information

- **Software tied to the MAC address of the PC's NIC**
- **Windows 98, 2000, NT4.0 with SP6a support**
- **Network tree fully populated from MIBs**
- **Displays blade slot, US port, and modem MAC addresses**

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## Summary

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- **Proactive maintenance**
- **Increased availability**
- **Efficient troubleshooting**  
Time and money savings
- **Happy customers!**  
“Word of mouth” advertising

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