Troubleshooting Upstream RF Noise Issues at the Headend

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**Greater Chicago Chapter of the SCTE
Digital Troubleshooting Seminar**

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Agenda

- **Noise Classification**

- **Impulse Noise Measurement**

- **Instrumentation**

- **Survival Techniques**

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Noise Classification

- **AWGN** - **Additive Gaussian White Noise**
 - Amplitude Statistically Uniform over Time & Frequency

- **Ingress Noise** - **Varies over Frequency**
  - Amplitude Statistically Uniform over Time
  - Center Frequency
  - Width

- **Impulse Noise** - **Varies over Time**
  - Amplitude
  - Duration
  - Period

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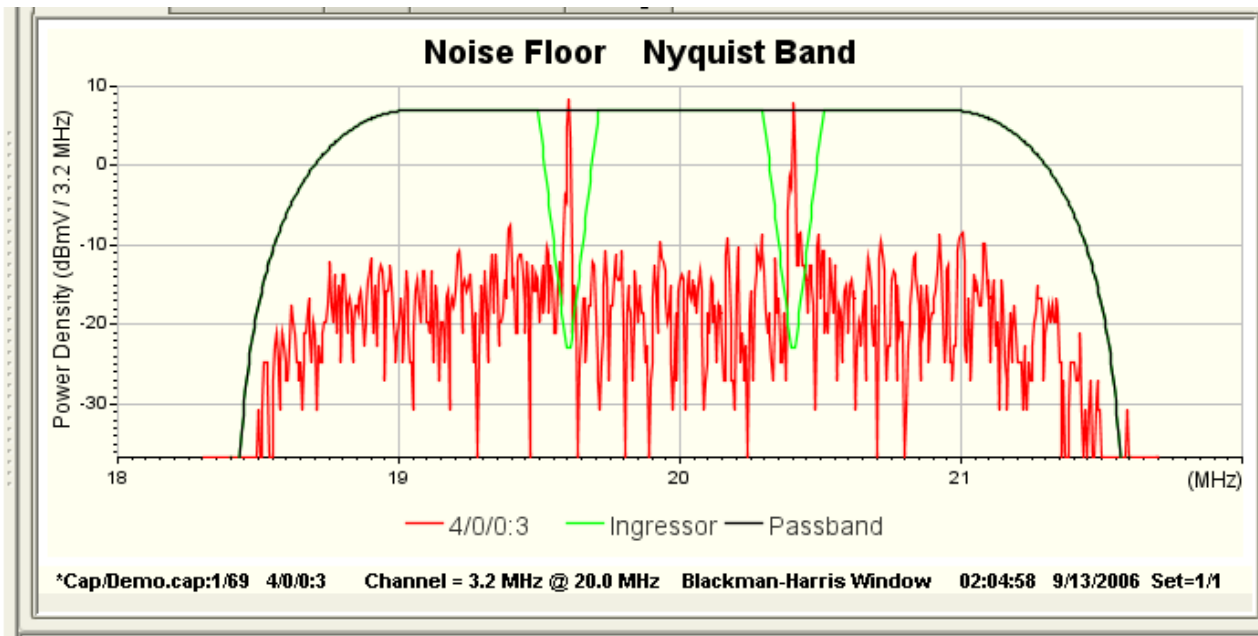# AWGN – Additive White Gaussian Noise

- Mitigated by:

  Reed-Solomon Forward Error Correction (FEC)
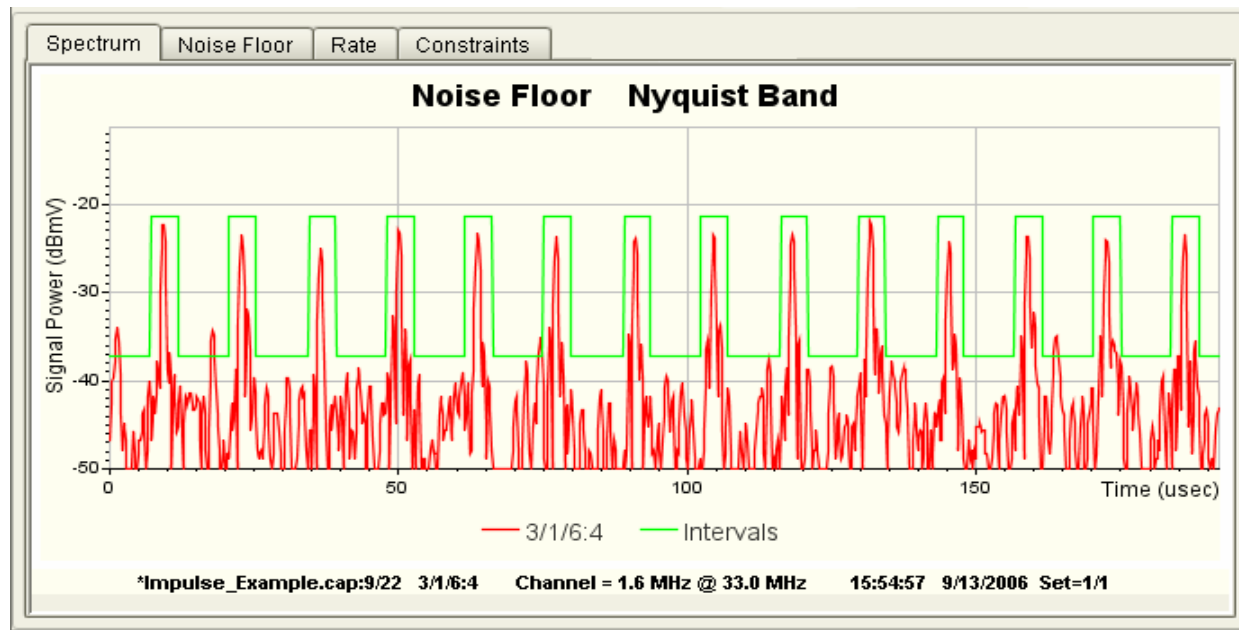 Choice of Modulation Type
  Increase CM Transmit Power

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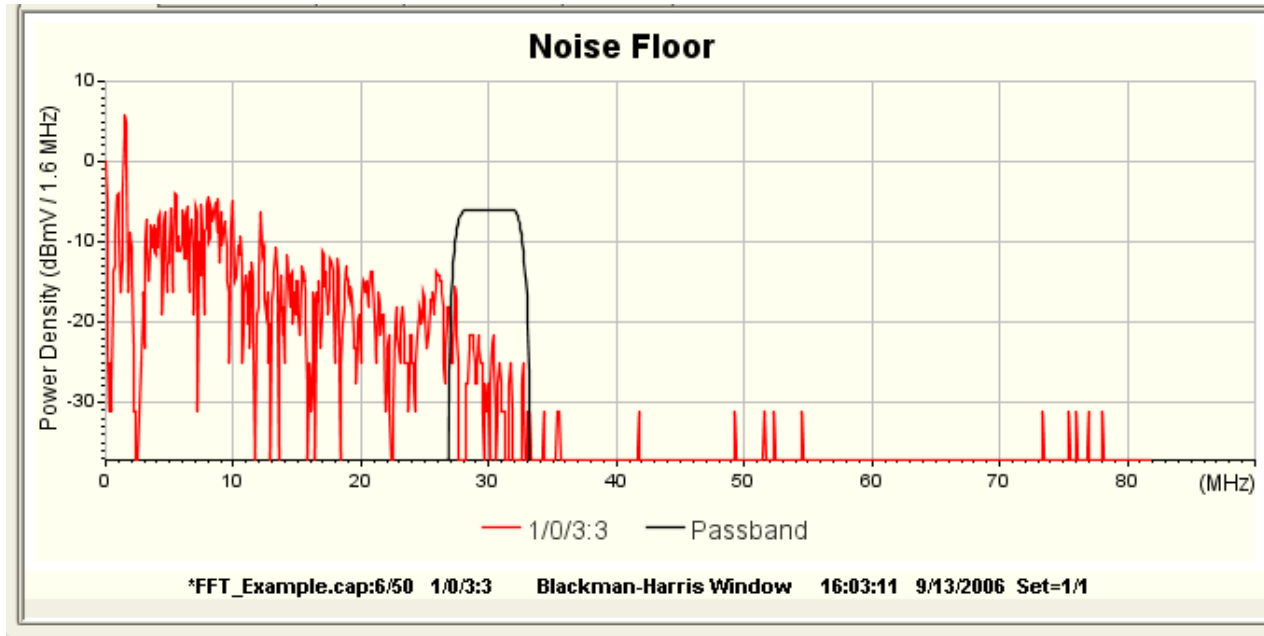
Ingress Noise

- Mitigated by: Vendor Proprietary Mechanisms
  (e.g., Digital Notch Filter)

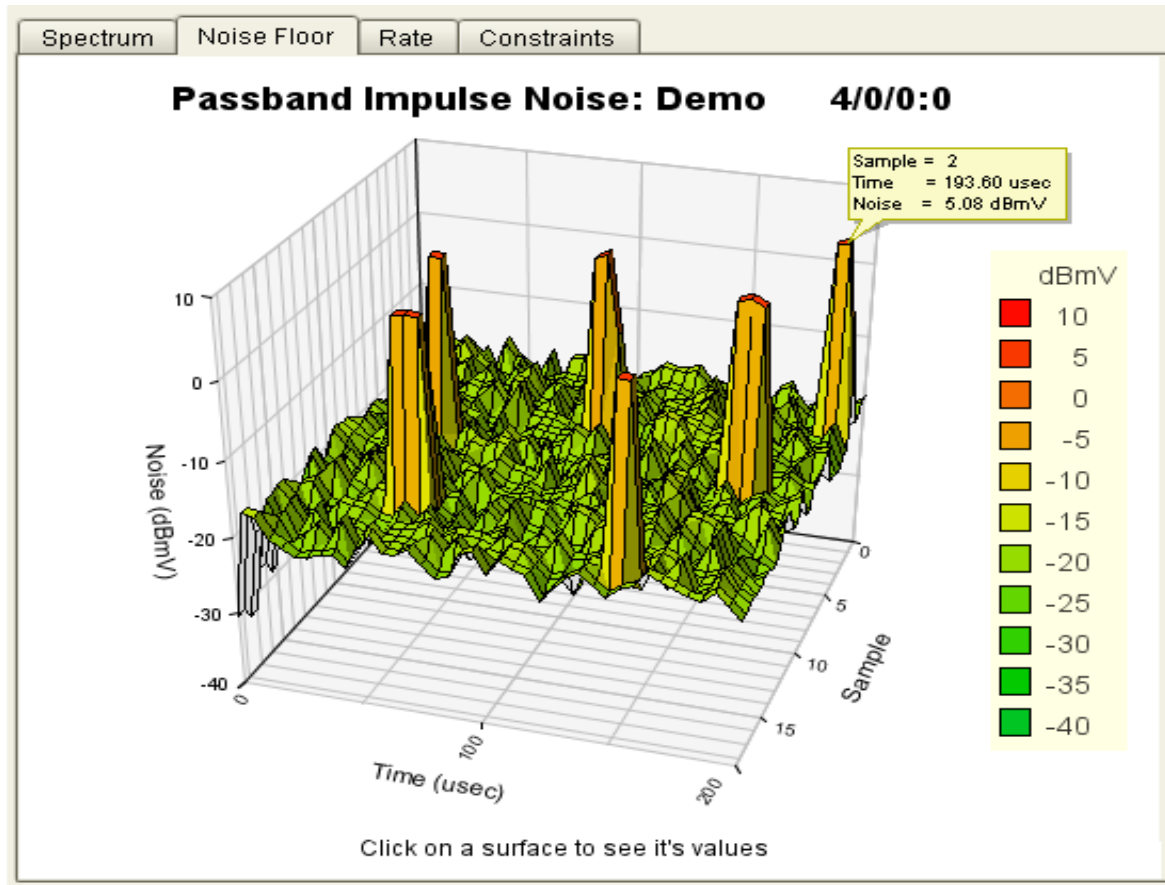**ARRIS**

Impulse Noise   (Short Period)

- Mitigated by: ~~ATDMA Interleaving~~   + FEC
  or: SCDMA Symbol Spreading + FEC

- DOCSIS 2.0 has paid much attention to Impulse Noise

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Impulse Noise   (Long Period)

- Mitigated by: ATDMA Interleaving   + FEC
             or: SCDMA Symbol Spreading + FEC

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Impulse Noise Measurement

- **Elements of Accurate Measurement**

  - Stop Return Path Data Transmission

  - Passband Filter Noise

  - Time-Domain Analysis

  - Statistical Sampling (Long Period)

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Instrumentation

- **Modulation Error Ratio (MER)**
  - Includes CM noise
  - Time-Averaged (Blind to Both Ingress and Impulse Noise)
  - Requires CM Traffic

- **Network-Embedded Spectrum Analyzers**
  - Multiple Nodes in Upstream Path (Fault Isolation)
  - Frequency Domain Measurements
  - May Require Moving CMs to Different Channel

- **CMTS-Embedded Spectrum Analyzers**
  - Scheduled Idle CM Traffic Intervals
  - Optional Passband Filtering
 - Time & Frequency Domain Measurements

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Survival Techniques

- **In General:**
  More Noise ➜ Lower Channel Capacity

- **But: Excess Channel Capacity may exist**
  - By design
  - Off-Peak Hours
  - Different Noise Type was Anticipated

- **Carefully Chosen Modulation Profile Change**
  - Based on Accurate Quantification of Noise Characteristics
  - Software Tools are Available for:
    - Matching Modulation Profile to Noise Characteristics
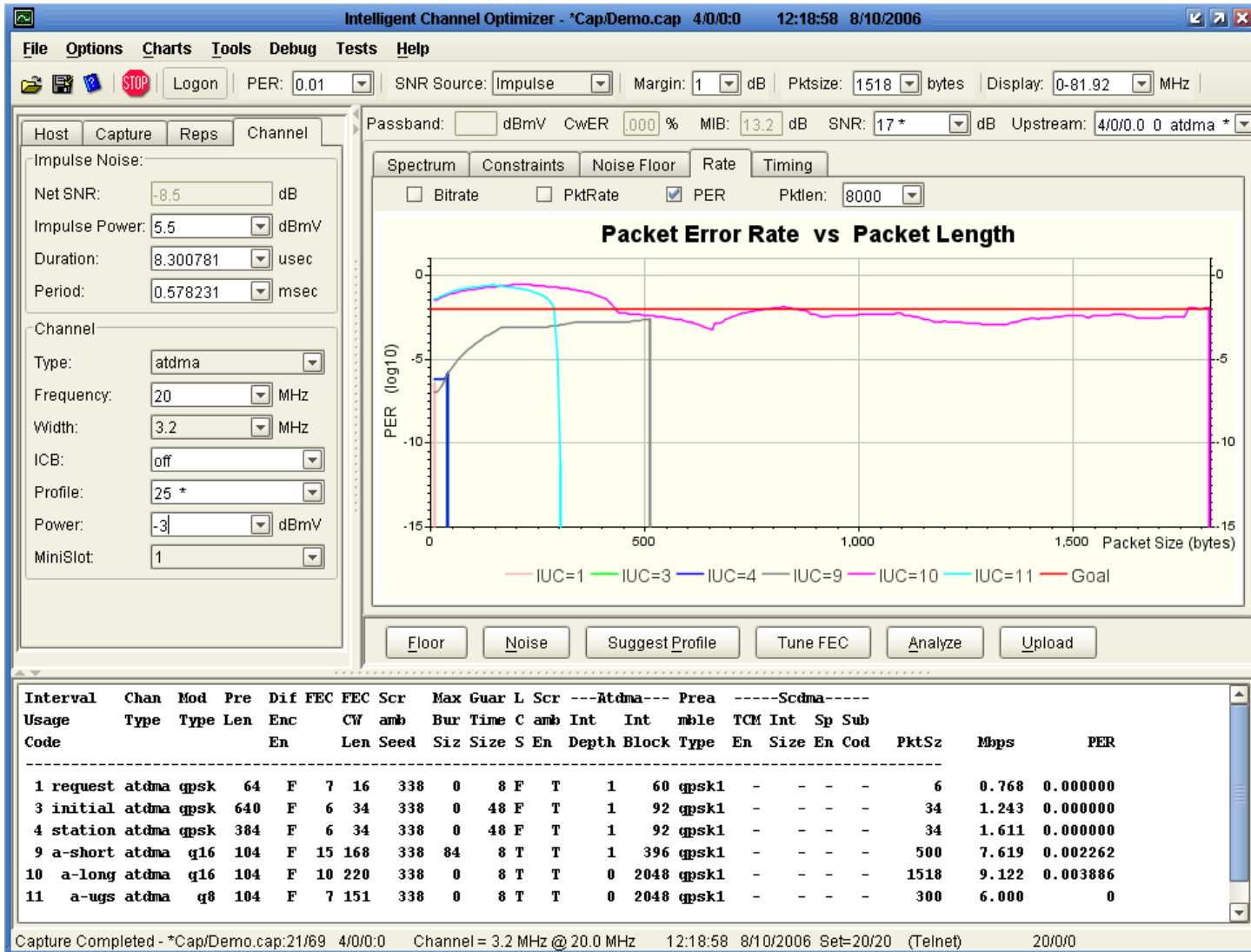   - Forecasting Resulting Packet Error Rate

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ATDMA Interleaving Hazard
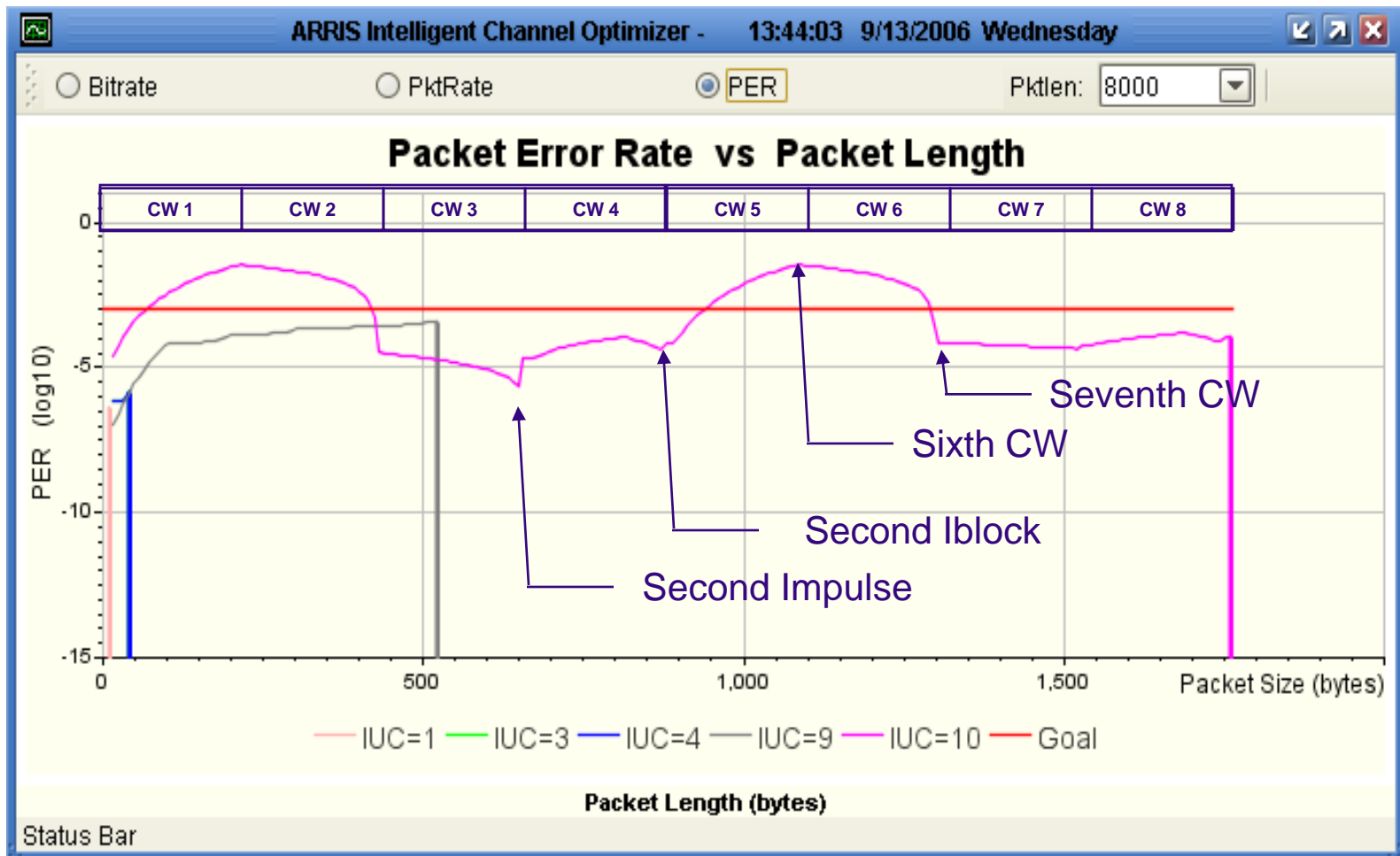
Analysis Tools are Valuable

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Thank You

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