



Impulse Noise Impact on 2.5Gb/s , 5Gb/s Operation in Enterprise Environment

AQUANTIA®

Ramin Shirani

1/13/2015

AQUANTIA®

Supporters

Peter Jones – Cisco

David Chalupsky - Intel

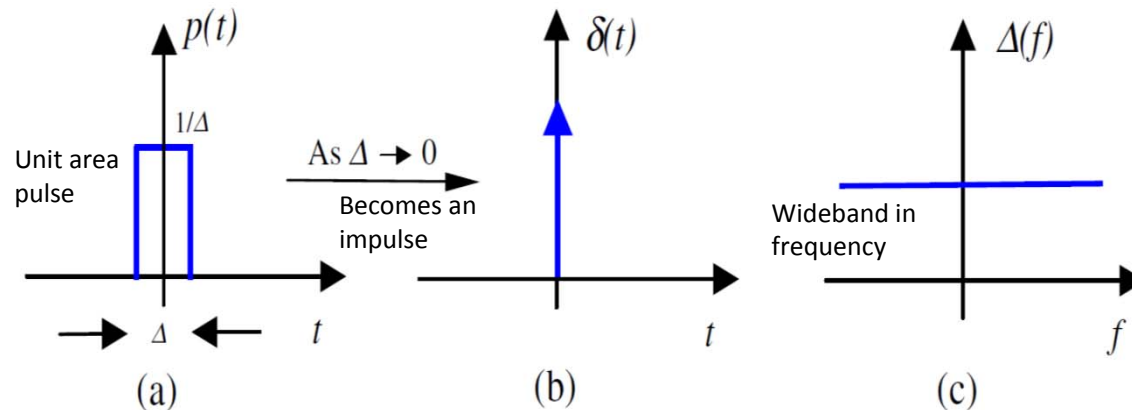
Jacky Chang & Keng Hua Chuang – HP

Richard Mei - Commscope

Tom Brown – Vitesse

George Zimmerman – CME Consulting

Impulse Noise and Enterprise Sources



- An isolated transient interference signal like:
 - Power (switch) contact make/break transitions (e.g. lighting, HVAC, office equipment)
 - Motorized equipment (e.g. fans, paper shredders) can generate periodic impulse noise events from motor brush make/break transitions
 - Desk chairs where ESD is generated internally within the chair and cannot be eliminated with standard ESD countermeasures (i.e. grounding chain)
 - ESD from movement of metal objects in a plastic bin
 - CDE and connection/disconnection of nearby PoE equipment
- Not the same as narrowband RF interference caused by intentional transmitters (e.g. cell phones)

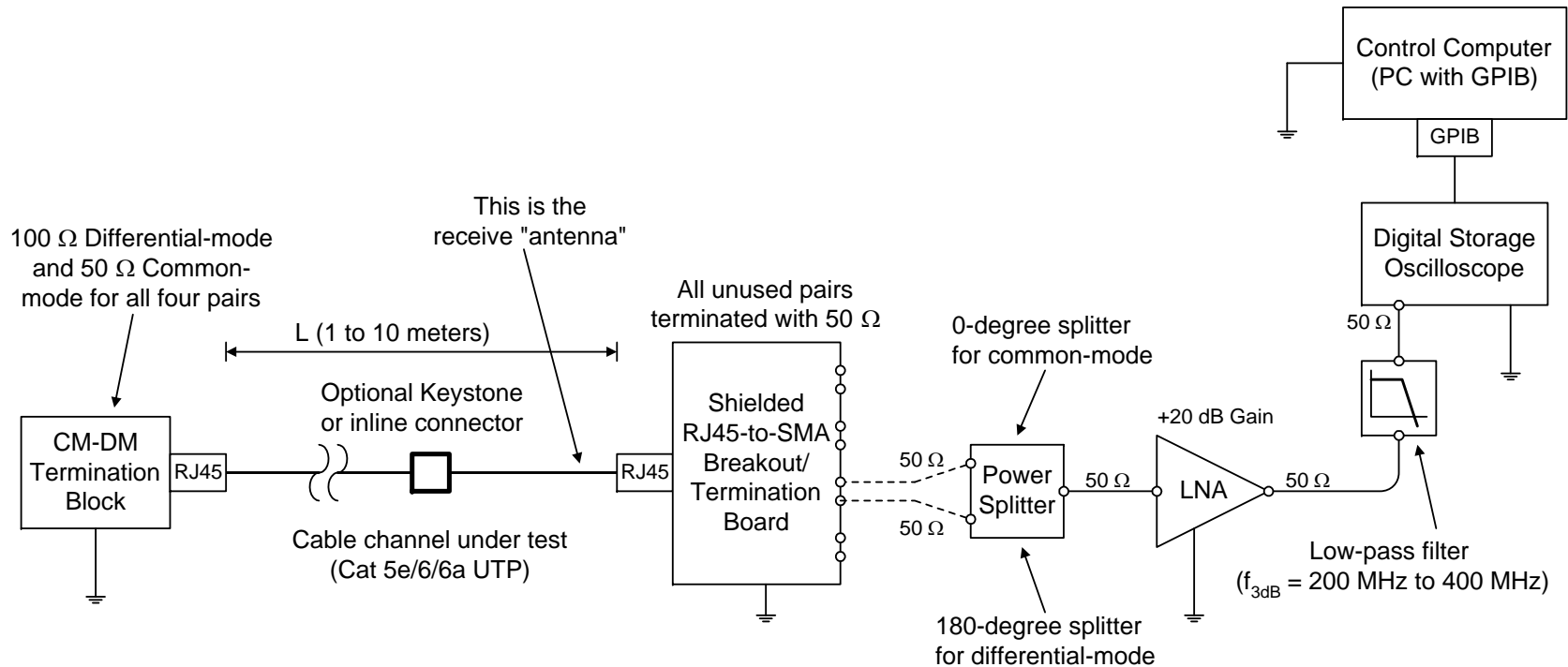
Impulse Noise Problem in Enterprise

- Likely to degrade the operational BER of otherwise compliant links
- What we already know
 - 10GBase-T is mainly deployed in data center environment (controlled environment)
 - 1000Base-T equipment is known to operate properly in the enterprise environment
 - 2.5G/5G systems will be more susceptible than 1000Base-T to impulse noise interference because of the higher symbol rate and wider signaling bandwidth
- Started detailed test setup to analyze the impulse noise waveforms in the enterprise environment

Impulse Noise Experience with 10GBase-T Systems

- Can get 10GBase-T errors in presence of ESD events or compressors turning on and off
- Impulse noise is initially induced as simultaneous common-mode signals in all four pairs
 - Converted into differential mode signals by imbalance in cabling and connectors
 - Common-mode to differential conversion occurs mostly above 100 MHz
 - Most significant channel effects when the noise source is near the port termination

Example Impulse Noise Event Capture Test Setup



- ESD events generate broadband impulses (100 MHz to 800 MHz bandwidth with some resonant peaks); low total energy but fast waveform rise time
- Common ESD events generated most of the detectable impulse noise events when many people were active inside the lab
- Switch contact arcs generate impulse noise events below 100 MHz

Next Steps

- Discuss an objective to address enterprise noise environment
- Measure impulse noise characteristics in the enterprise environment to assess scope of the problem
- Using the measurement setup to capture waveforms in the enterprise environment and determine the important characteristics:
 - Frequency of occurrence (inter-arrival time), total energy, and signal bandwidth
 - Common-mode and differential-mode waveforms (peak-to-peak voltage) induced in cabling
 - Determine relative susceptibility of different cable and connector categories
- Present measurement data to the group for discussion
- Use the observed worst-case measurement data to develop a standard impulse noise impairment test procedure for 2.5G/5G PHY implementations