Impulse Noise Measurement Test Setup

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Impulse Noise Problem Overview

- **Problem:** Impulse noise events in the enterprise environment may degrade the operational BER of otherwise compliant NGBase-T links to unacceptable levels
  - –Impulse noise effects in the enterprise environment on systems with bandwidth beyond 1000Base-T are not fully understood

- What we already know
  - –10GBase-T is mainly deployed in the data center environment so the existing knowledge base is not fully applicable to the enterprise environment
  - –1000Base-T equipment is known to operate properly in the enterprise environment

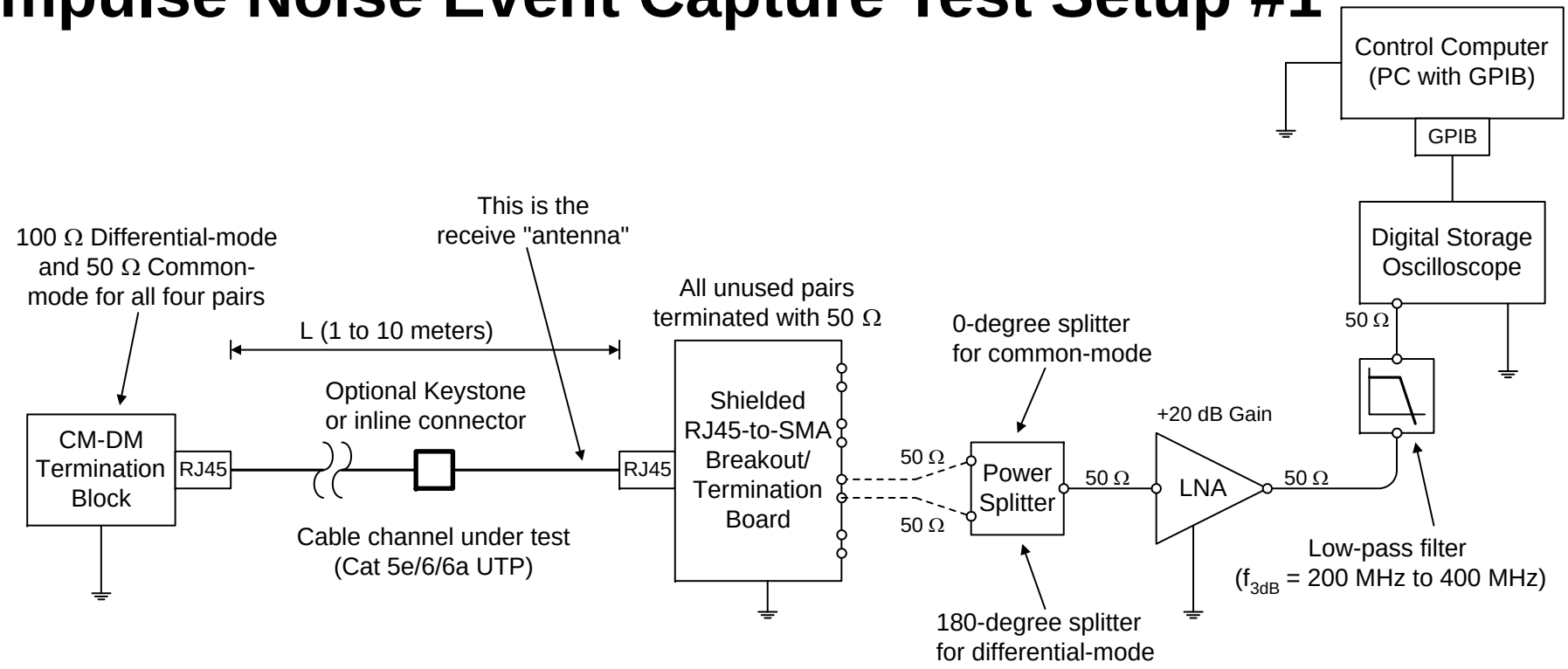
- **First step:** Create a test setup to capture, record, and analyze the characteristics of impulse noise waveforms in the enterprise environment and measure the important characteristics that could affect NGBase-T link quality
  - –Frequency of occurrence (inter-arrival time)
  - –Signal bandwidth and the effect of AFE lowpass filtering
  - –Common-mode and differential-mode waveforms (peak-to-peak voltage) induced in cabling; main interest is worst-case differential waveforms
  - –Determine relative susceptibility of different cable and connector categories

Impulse Noise Measurement Considerations

- Instrumentation must be placed at multiple locations to obtain a valid (and useful) noise profile of the enterprise environment

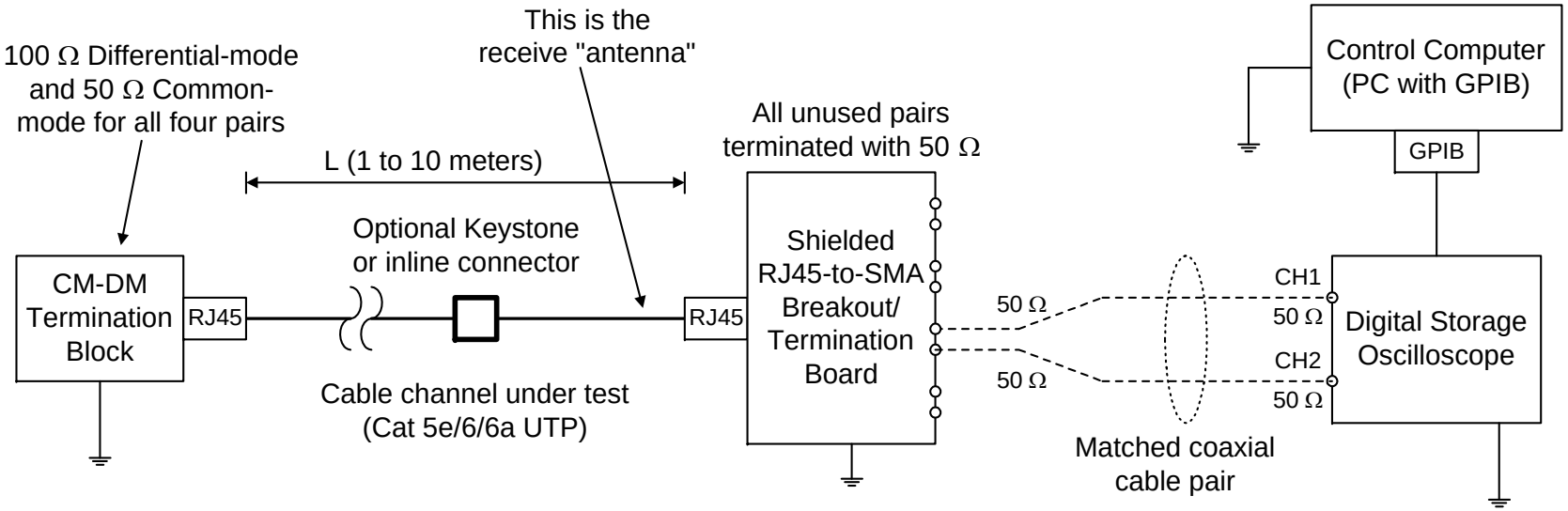
- Example location #1: Wired port in an office “bullpen” cubicle
  - Lots of human activity in an area with no ESD mitigation
  - Potential for lots of ESD induced impulse noise events near LAN ports
  - Additional potential for on/off switch arc transient induced impulse noise events
- Example location #2: Wireless access point placement
  - Less nearby human activity; potentially less ESD events
  - Potential for on/off switch arc transient induced impulse noise events
- Relevant for all locations
  - How bad is the impulse noise produced from office HVAC equipment?
  - Are there additional unexpected noise sources picked up due to cable routing (floor and/or ceiling) and other office equipment?

Impulse Noise Event Capture Test Setup #1



- Scope channel should have at least 500 MHz bandwidth, 2 Gsps sampling rate, and 10000 samples memory capture depth (5 usec time span)
- LNA is mainly required to capture low-level differential-mode waveforms
- Lowpass filter simulates effect of AFE and adds additional anti-alias filtering
- Impulse capture threshold controlled by scope trigger level
- Captured impulse waveforms recorded on control computer for later analysis
- Proper site placement of noise survey instrumentation is critical to gathering valid data

Impulse Noise Event Capture Test Setup #2



- Captures both common-mode and differential mode impulses simultaneously, but requires better scope with more bandwidth, memory depth, and sensitivity
- Scope channels should have at least 1 GHz MHz bandwidth, 5 Gsps sampling rate, and 25000 samples memory capture depth (5 usec time span)
- Use post-processing of captured waveforms to generate common-mode and differential mode impulse noise events and simulate any AFE lowpass filtering
- Scope vertical sensitivity may limit resolution of differential-mode waveforms
- Impulse capture threshold controlled by scope trigger level

Design of RJ45 CM-DM Termination Block