IEEE P802.3bz 2.5/5GBASE-T Task Force Submission

Premises Cabling Impulse Noise Results

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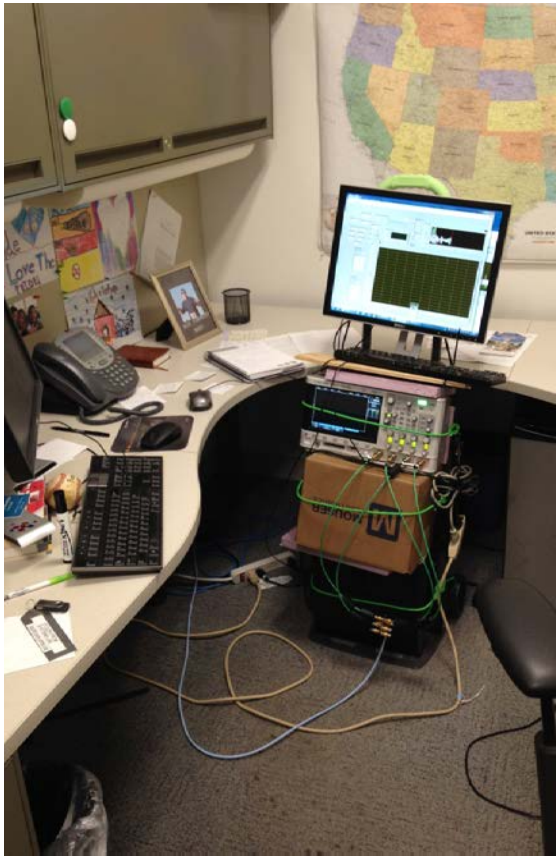
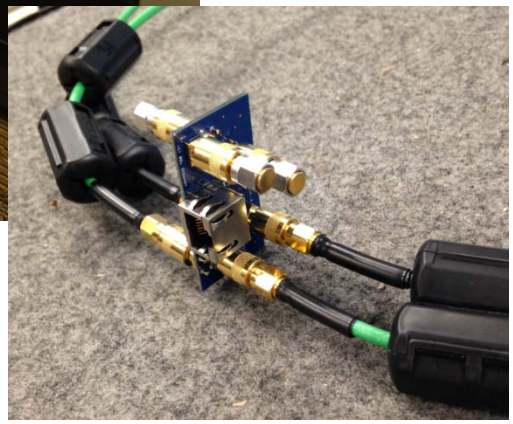
CommScope Systems Engineering

Direct MDI connector attached Oscilloscope

Startup



Packaged for travel

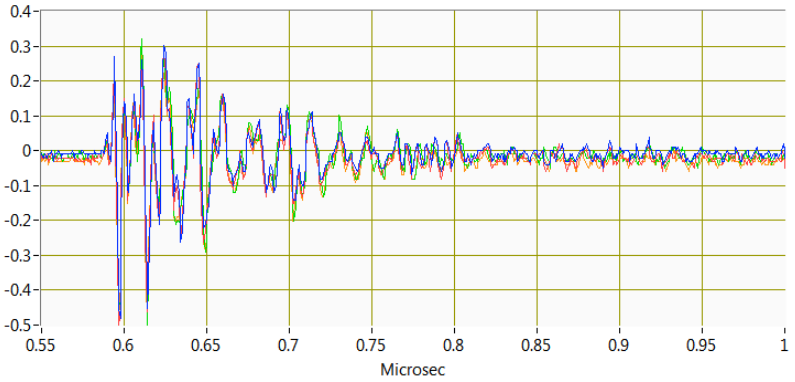


Traces recorded from side pair and split pair of a Bel Cat 6 modular to SMA Breakout

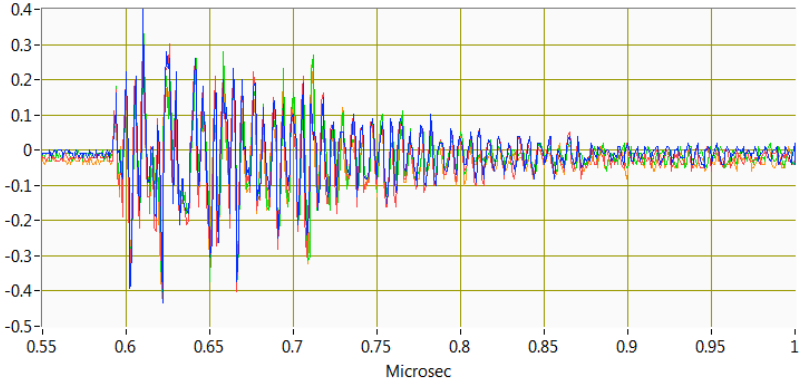
The following slides show a variety of typical impulse types

No need to examine them in detail, but useful to see for understanding the phenomena

- Each plot has 4 direct Oscilloscope channels with a scale in volts showing essentially the common mode (with square root 2 impedance factor ignored)
- Interestingly, most are nearly identical and overlapping, showing the 2 pairs as balanced but also having very similar Common Mode
- Scope bandwidth extends out to 1 GHz, although all of these show most energy below 500 MHz

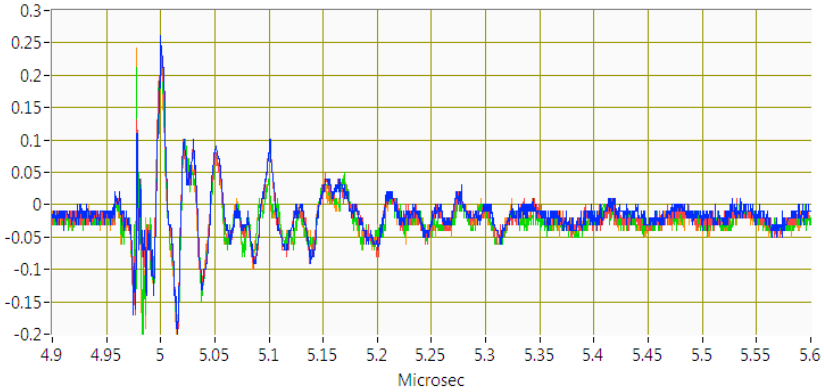


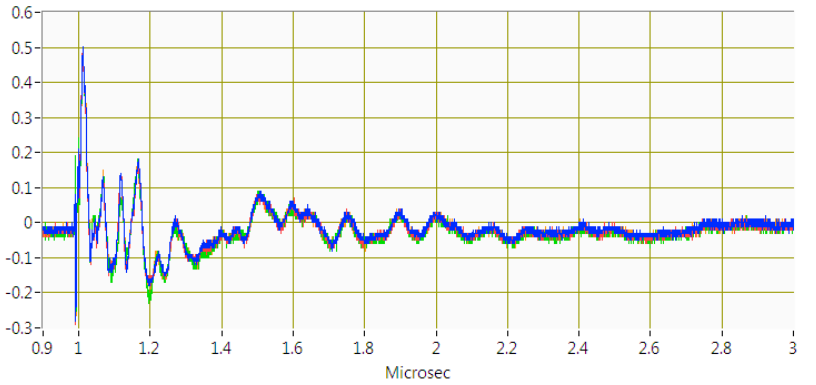
Examples of Classic Broadband Impulses

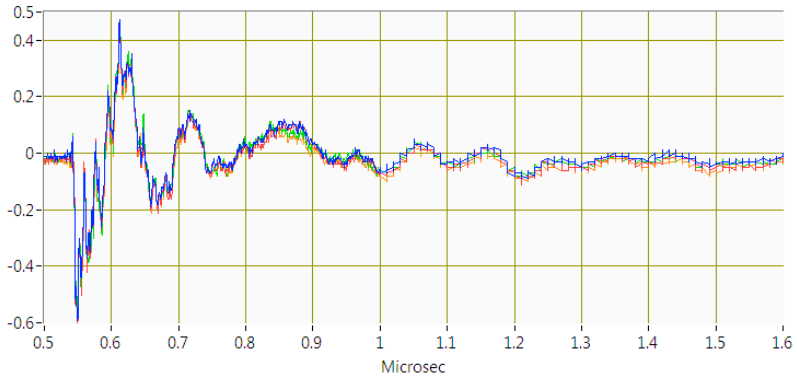


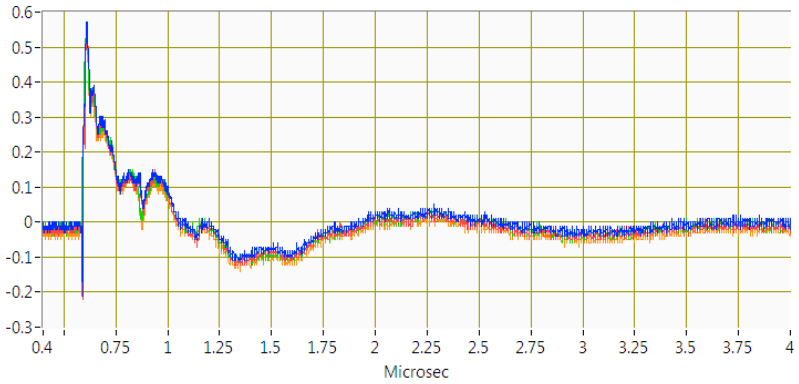
“Not so broadband” impulses

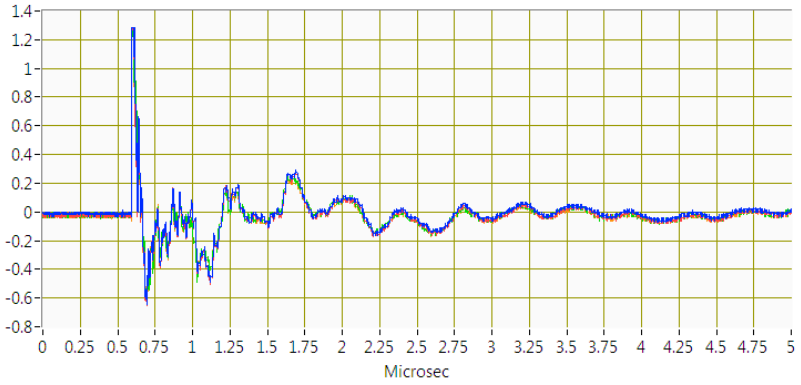
These show a common response where an initial impulse is transformed into a somewhat narrowband impulse because of cabling transmission line reflections and electrical components such as ballasts

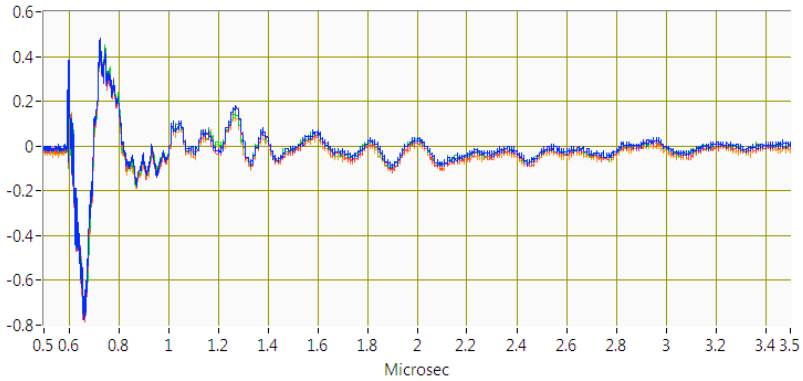












"Keyed impulses"

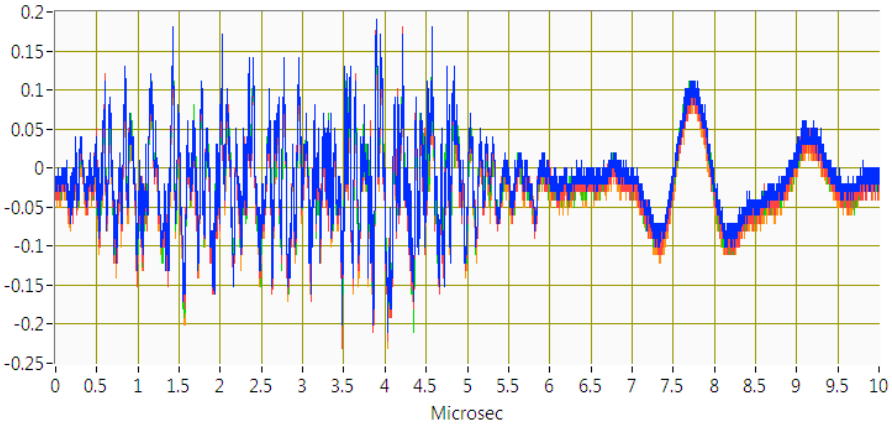
These sharp spikes are body discharges primarily from charged metal

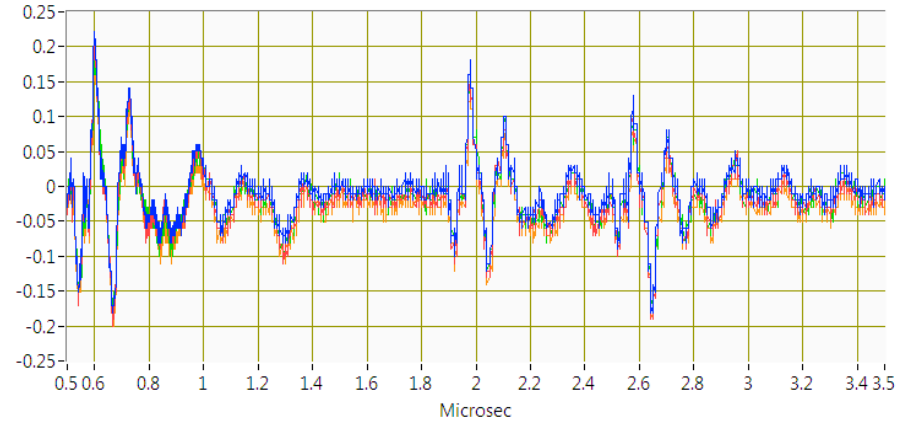
Develop static charge while holding a metal object that then touches equipment ground

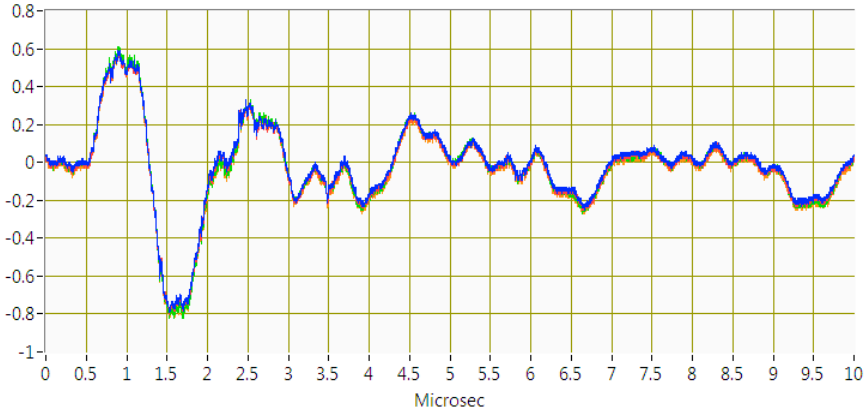
You will likely never know the source of most impulses

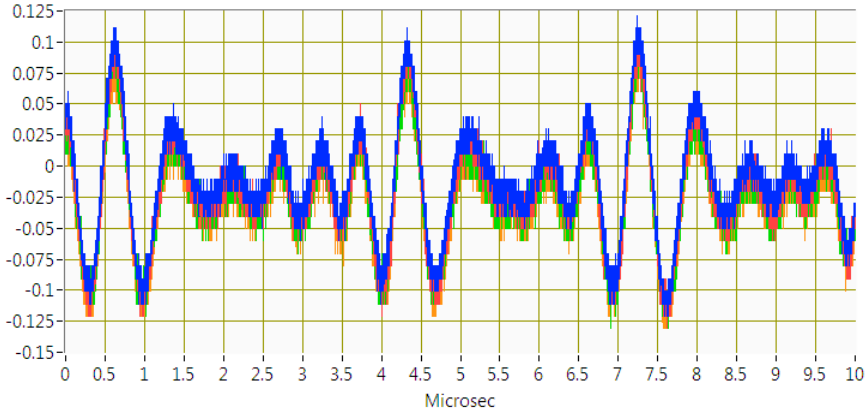
A typical building has hundreds of sources as well as external incoming impulses

Many of these are actually chains of impulses



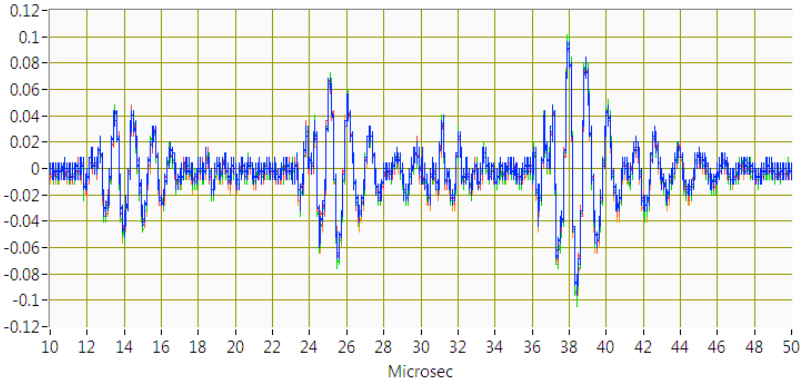




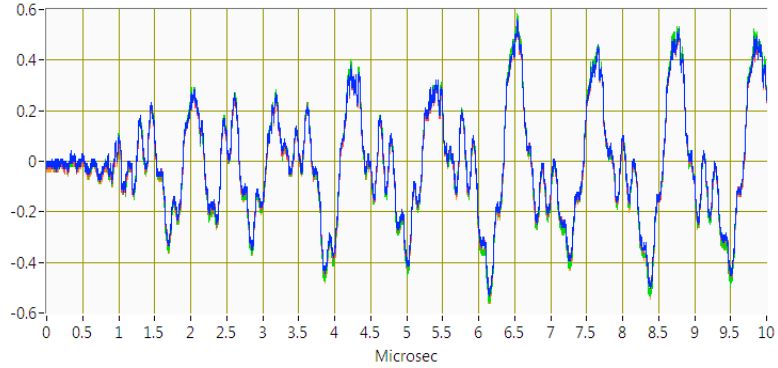


Many sources can easily be identified, such as the Keyed ones of slide 5 and these

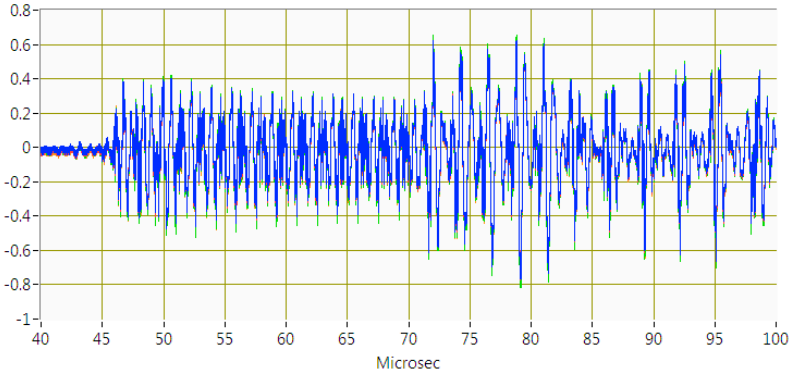
CFL turn-on (30 ft away)



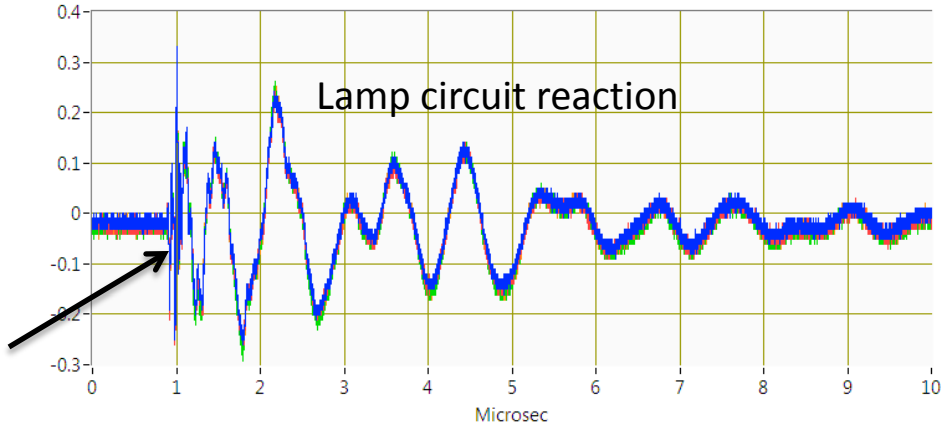
Overhead tube fluorescent turn-on



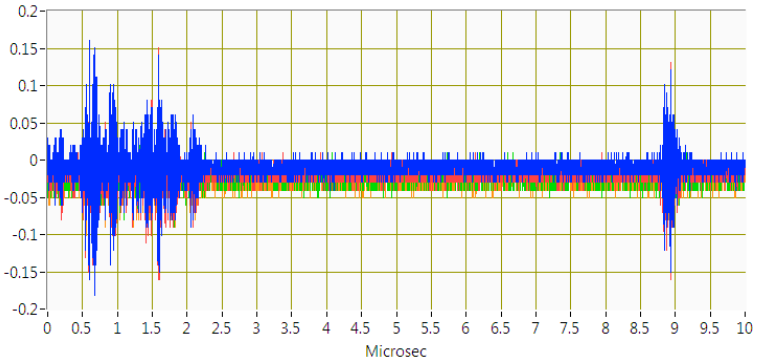
Overhead tube fluorescent (longer trace)

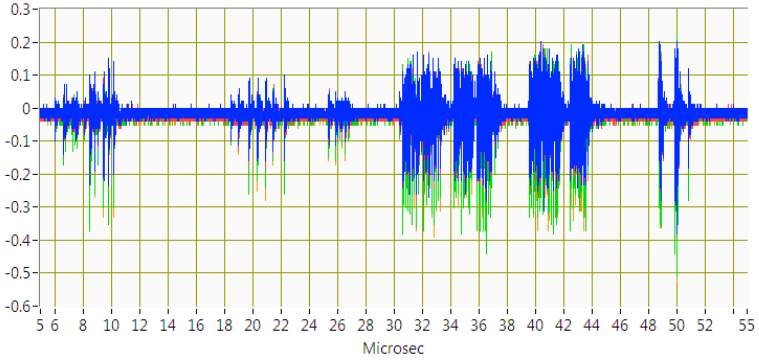


Desktop Fluorescent Lamp



“Desktop” coffee grinder (very similar to the old standards-bearer, the pencil sharpener)





Conclusions and Recommendations:

1. Data from 6 different sites show a wide range of impulse noise characteristics

2. This is a risky test since line impulses well into the Kilovolt range are not uncommon – Recommend that this test study should be replaced with a slightly different one, with ICM providing the same protection that actual PHY chips will rely on and so that the actual resultant chip impulse levels can be assessed

3. None of these measurement sets indicates a strike rate and levels high enough to support a bit error rate influence calculation - With correctly installed cabling, impulse noise does not appear frequent enough to justify a bit error rate characterization

4. Recommend examining long impulses or impulse chains to understand error bursts and the levels that will force a connection to go down, requiring re-training and/or re-negotiation, which will be important for maintaining quality for the Access Point application