Noise Specification for RTPGE
EMC Ad Hoc Update

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Channel Noise Modeling

- Differential Channel Impairments
- EMC Noise & Limit Lines
- EMC Channel Transfer Function Modeling
- Alien XTALK
- In-Car Background Noise
- Impulse Noise
- Other Noise sources?

Differential Channel Impairments

- Insertion Loss (aka channel attenuation) varies as a function of length, frequency and temperature.
- Return Loss needs to be properly constrained for FDX systems and can have a direct impact on input dynamic range.
- Both of these impairments can be handled by digital equalization and echo cancellation.
- Status: Channel Ad-Hoc is making progress for defining the differential parameters.

EMC Modeling & Limit Lines

- Stefan Buntz (Daimler) proposed DPI technique for emission & immunity testing (similar to IEC 62132-4) and provided the limit lines in http://grouper.ieee.org/groups/802/3/RTPGE/public/nov12/buntz_01_1112_rtpge.pdf
- CISPR 25 also addresses Conducted and Radiated Emissions' measurement techniques. If CISPR 25 is preferred method of testing then, **Limit lines (dBuV vs. frequency [0.1MHz–1GHz])?**
- ISO 11452-2/4/5 define Radiated Immunity via Antenna, BCI and Strip Line measurement techniques. If they are preferred method of testing then, **Limit lines (dBm vs. frequency [0.1MHz–1GHz])?**

EMC Channel Transfer Function

- CM-to-CM and CM-to-DM conversion transfer functions must be attained for RTPGE channels in order to compute the input-referred noise for the PHY.

- Mehmet Tazebay (Broadcom), Richard Mei (Commscope), Thomas Muller (Rosenberger) made proposals for method and techniques for attaining these transfer functions
  http://www.ieee802.org/3/bp/public/jan13/tazebay_3bp_01a_0113.pdf
  http://www.ieee802.org/3/bp/public/jan13/mei_3bp_01_0113.pdf
  http://www.ieee802.org/3/bp/public/jan13/mueller_3bp_01_0113.pdf

- In principle, 3-port network analyzer measurements can be used to analyze these transfer functions.

Alien XTALK modeling

- Kirsten Matheus (BMW) proposed a few select cable bundle topologies based on use cases agreed-upon by participating OEMs:
  http://www.ieee802.org/3/bp/public/jan13/matheus_3bp_02_0113.pdf

- Several measurements were made based on the presented topologies (Mei et al, Comscope) using CAT6A-based 1- and 2-pair cables
  http://www.ieee802.org/3/bp/public/jan13/mei_3bp_01_0113.pdf

- Preliminary results indicate that alien XTALK is within the limit lines for the select cables. . More test results are expected with the final channel parameters.

In-Car Background Noise

- Stefan Buntz (Daimler) provided a direct measurement technique and results for BG in the car http://www.ieee802.org/3/bp/public/mar13/buntz_3bp_01_0313.pdf
- The background noise was measured as common mode noise (dBuV versus frequency [0.1MHz-1GHz]).
- The EMC channel transfer functions dictate the input-referred common mode and differential mode noise observed by the PHY.
- More test results from different OEMs would be useful.

In-Car Impulse Noise

- ISO 7637-2 lists tests for transient immunity testing (pulses 1-5) for supply lines
  - Is RTPGE with PoE expected to pass these immunity pulses?
  - Are there additional requirements in excess of ISO 7637-2?
  - What criteria is considered passing for this test?
    - Class A requires a BW of the pulse within the PSD of RTPGE!

- ISO 7637-3 lists tests for transient immunity testing for signal lines.
  - Is RTPGE MDI expected to pass these immunity transient test pulses?
  - Are there additional requirements in excess of ISO 7637-3?
  - What criteria is considered passing for this test? Is it different from the ISO 7637-3 standard?

- Is there a mathematical noise model related to real-life measurements?

Open Questions

- What are the gauges of desired TP (lower limit, upper limit)?
- What is the operating temperature range? [-40C to 125C]?
  - Classes of operation in different domains?
- What are the preferred methods of EMC testing?
  - Is DPI/Emissions sufficient for EMC limit lines?
  - Is CISPR 25 required for RTPGE? If so, what class is required?
  - Which of the ISO 11452-X immunity tests are required? What levels will be chosen for passing criteria?
- Are the proposed EMC limit lines acceptable for IEC 62132-4?
- Are the proposed Alien XTALK topologies acceptable?
- What are the higher data rate communication systems in adjacent to RTPGE?
- What is the worst-case expected PSD for in-car background noise (dBuV vs. freq)?
- In-car impulse noise models, measurements, real-life correlation?
- Other noise sources?