Required EMC and Noise Measurements For Immunity Analysis in Automotive Environment

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Noise Sources for Immunity

- As we understand, there are three different general types of noise in the automotive systems:

  - Wideband Noise caused by Transient Impulses (ISO 7637-2/OEM specifics)

    - Caused by sparks in the engine, etc

  - Narrowband RF Interferences (ISO11452-2/OEM specifics)

    - From all sorts of wireless, cellular, radar devices internal or external to the car

  - Random White Noise (AWGN)

    - Electronic Noise Sources

    - Are there any OEM specific noise sources to consider? (e.g. Xtalk on boards)

Goals for EMC/Noise Characterization

- We need the actual differential and common mode noise amplitudes measured at the target channel terminals in units of "Volts/dBm" (or "dBm/Hz" over a BW), and not a "transfer function" in "dB"

  – There are many measurement plots for coupling attenuation of many types of STP and SPP cables, but PHY vendors cannot simply use the coupling attenuation transfer function to calculate the differential ingress voltages in response to a e.g. a 100V/m electrical filed at the cable.

  – Additionally, PHY vendors do not know what is the realistic worst-case test setup. For example:

    - What length of the cable needs to be exposed? How far from the DUT terminals?

    - How much of the cable is shielded by the car conductive body?

- What other new interreference sources and/or RFI frequencies should be included based on the latest technologies deployed?

  – Wireless chargers, etc?

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Required EMC/Noise Specifications for Immunity

- Ideally, we'd like to eventually have limit lines defined for ingress differential and common-mode voltages on the lines
  - Wideband Noise
    - Provide PSD over a bandwidth for different wideband noise sources
    - Can the cable be exposed to all at the same time

  - Narrowband RFI
    - Provide the ingress magnitude on the terminals in units of Volts or dBm for all combinations of possible frequencies

  - Specify realistic worst case condition:
    - How many of the noise sources can affect the cable at the same time

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