Comparison of EMC Performance vs. Modulation Schemes

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Agenda

- Objective
  - To study the transient BER performance under the BCI test during the induced interference for PAM2 & PAM3
- Simulation
  - Time domain simulations
  - EMC considered in the simulations
    - Immunity: Mode Conversion, BCI current to the Interference referred to input ratio: 1mArms vs. 1mVpp
    - Emission: TX PSD Mask
      - Different Launch Voltage applied to PAM3 simulations
- PAM Modulations Comparison
- Conclusions

Transient Performance vs. Modulation Schemes

- Modulation Scheme Comparison
  - Comparison of PAM2 and PAM3
  - SNR requirement (BER of 10^-10)
    - 15.9 and 20.2 dB for PAM2 and PAM3, respectively

PAM2 vs. PAM3 Performance Comparison

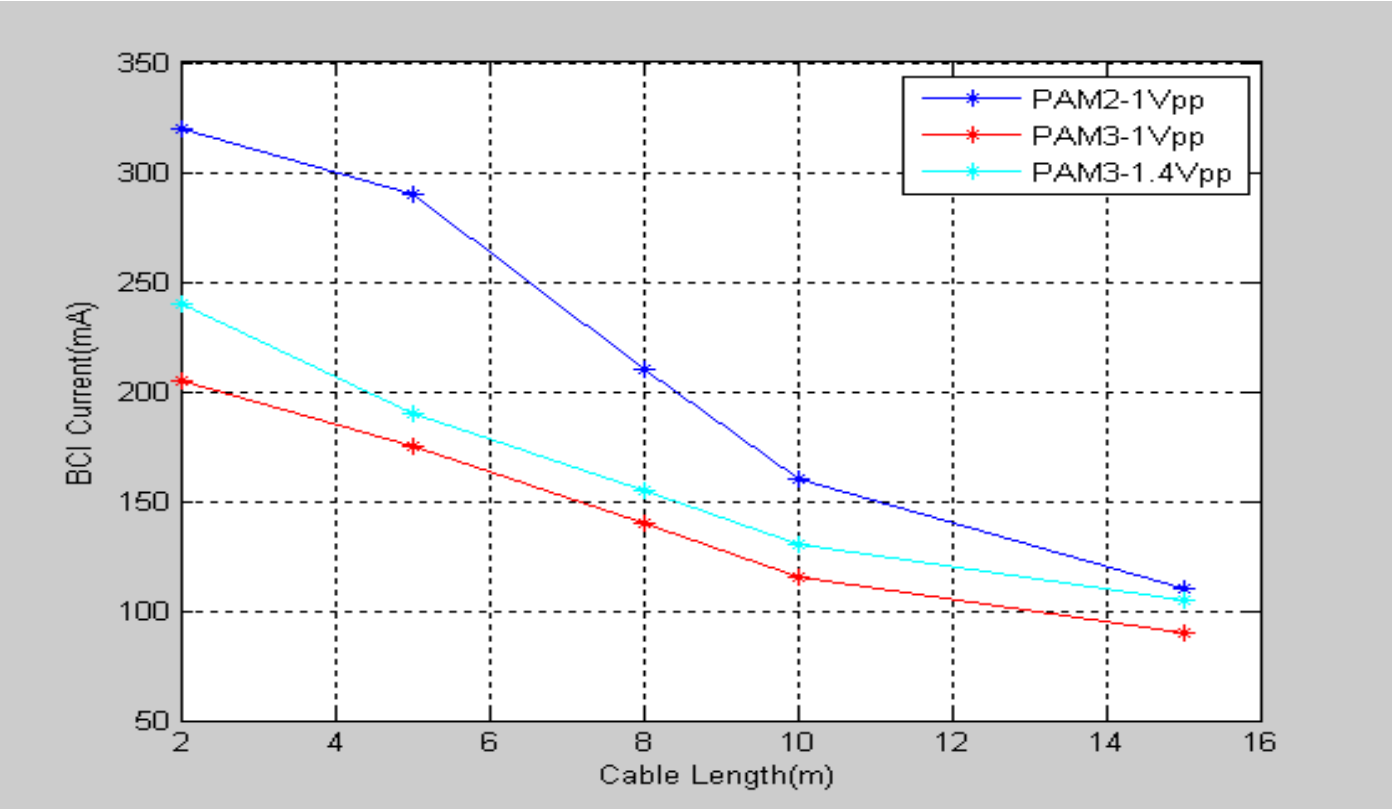
- Simulation Setups & Assumptions
  - 1.1Gsps and 694Msps symbol rate for PAM2 and PAM3 simulations, respectively
  - Zero dB SNR Margin to the target SNR with the assumption of 5dB coding gain
  - Assuming 1mArms BCI current to 1mVpp referred to input
  - PAM2 Output Voltage before the TX PSD filter: 1Vpp
  - PAM3 Output Voltage before the TX PSD filter: 1Vpp and 1.4Vpp

Transient BCI Performance vs. Cable Length Comparison on Modulation Schemes

- 200mVpp referred to input equivalent to BCI 200mArms

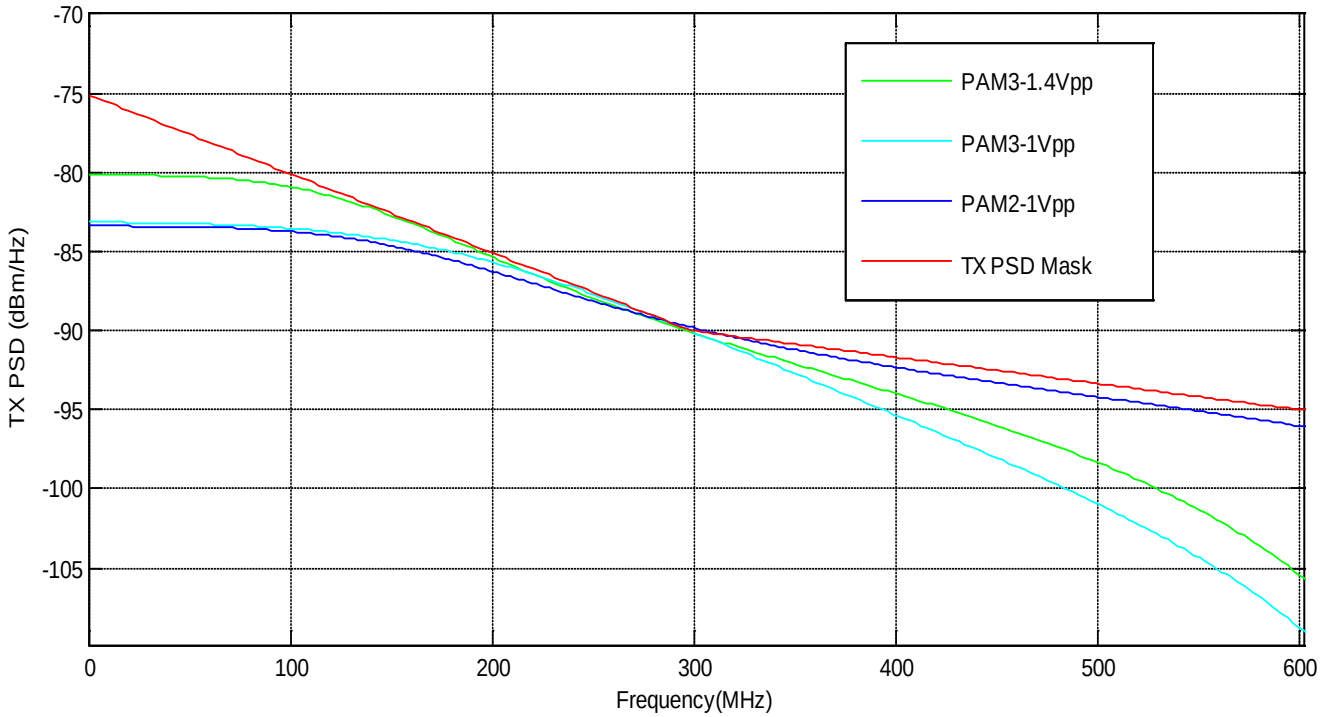
Modulation	PAM2 (1Vpp)	PAM3 (1Vpp)	PAM3 (1.4Vpp)
Max BCI Current (15m cable)	110mA	80mA	105mA
Max BCI Current (15m cable room temp.)	150mA	100mA	130mA
Max BCI Current (10m cable)	160mA	105mA	130mA
Max BCI Current (8m cable)	210mA	130mA	155mA
Max BCI Current (5m cable)	290mA	160mA	190mA
Max BCI Current (2m cable)	320mA	200mA	240mA

BCI Performance vs. Cable Length



TX PSD

- TX PSD Meets the PSD Mask



Conclusions

- The performance of 15m at 25℃ is close to that of 10m at 125 ℃
- PAM3 passes the BCI 200mArms for both 1Vpp and 1.4Vpp at 2m with the assumption of 1mArms to 1mVpp conversion ratio
- Maximizing TX PSD for PAM3 improves performance

Conclusions -continued

- PAM3 is the preferred implementation choice
  - Sufficient margin to pass BCI
  - Lower power consumption vs PAM2
  - Potential issue for PAM2 (possible 512MHz Broadband Cellar Phone Interference -- xiaofeng_3bp_01_1113.pdf)
  - Larger die size for PAM2
  - Higher bandwidth of PAM2 costs more on the PCB filters