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PHY Perspective on NGAUTO

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Supporters

Seeking for supporters for the interim meeting on Feb 21

Introductions

- Presentation intends to provide some perspective on >1Gbs PHY
- Topics:
  - PHY complexity/power/time to market for different speed grades
  - Cabling options vs PHY implementation concerns

NGAUTO PHY relative cost / complexity

- A Complicated topic – simplify setting / assumptions
- Setting:
  - Compare 2.5G, 5G and 10GBase-T1 PHY
  - Compare 10G/5G/2.5G on STP, with 4 connectors 15m link segment
- Assumptions:
  - Compare – relative time to market, power, complexity
  - Purely from a PHY implementation point of view
  - Same silicon technology
  - Perfect STP shielding, EM emission/immunity is not included for the study
  - Design concern and challenges not considered
  - Time to market discussion requires further assumptions
    - Require Grade 2 specification in a suitable package in automobile environment
    - Current state of the art silicon technology is 14/16nm, next node is 7nm

PHY relative cost / complexity (cont)

Speed	Cable Type	Estimated Time to Market	Estimated Relative Power	Estimated Relative Complexity	PHY Assumption for Estimate
2.5 Gig	STP (15m)	< 1 yr prototype ~ 2 yrs to production (current design node)	1 x 2.5GBASE-T1	1 x 2.5GBASE-T1	Symbol Rate ~750Mhz, w FEC Similar analog complexity for 2.5G (STP) and 1G (UTP) Echo same length, same speed cp 1G
5 Gig	STP (15m)	> 1.5 yr prototype ~ 3 yrs to production (next design node)	~3 to 4 x 2.5GBASE-T1	~2 x 2.5GBASE-T1	Symbol Rate ~1.5Ghz, w FEC Analog 2x speed, ENOB > 1G UTP Echo 2x longer, 2x faster cp 1G
10 Gig	STP (15m)	> 2 yr prototype ~ 5 yrs to production (next design node or later)	~ 6 to 8x 2.5GBASE-T1	~4 x 2.5GBASE-T1	Symbol Rate ~3Ghz, w FEC Analog 4x speed, ENOB > 1G UTP Echo 4x longer, 4x faster cp 1G

Cabling Options Vs PHY design challenge

- Another Complicated topic – reorganize and limit settings
- Setting:
  - Single Channel Copper Only
  - Compare PHY issues at 2.5G, 5G and 10G
  - Group cables into 3 types

Group	Unshielded Balanced	Shielded Unbalanced	Shielded Balanced
Examples	UTP	Coax	STP, Twinax

- Assumptions:
  - Emission/Immunity concerns greatly relieved from channel shielding.
  - Practical design challenges / concerns included
  - Grade 2, Automobile Environment

Cabling Options Vs PHY design challenge (cont)

	Unshielded Balanced	Shielded Unbalanced	Shielded Balanced
2.5G	EM immunity makes > PAM3 signaling difficult. Needs elaborate cancellation scheme.	IL similar to shielded balanced cables Lost half of signal, ENOB is at least 1 bit worst compare to Balanced Cables. Immunity is not encouraging, may not pass BCI test	Feasible Ready in current silicon node Little concern on receiver immunity Common-mode rejection in addition to shield improves EMC performance.
5G	Not Feasible	More challenging than Shielded Balanced	Feasible Meet power target in next silicon node Concern on receiver immunity Common-mode rejection in addition to shield improves EMC performance.
10G	Not Feasible	More challenging than Shielded Balanced	Feasible, but 15m AFE requirement is challenging. May not meet power target in next silicon node Concern on receiver immunity, need some cancellation technology or much better shield effectiveness at high frequency (>1.5GHz)

Recommendation

- Adopt 2.5G Speed as Objective:
  - Support data rates of 2.5 Gb/s at the MAC/PLS service interface.
  - Define the performance characteristics of an automotive link segment and a PHY to support 2.5 Gb/s point-to-point operation over this link segment supporting up to four inline connectors for at least 15m on at least one type of automotive cabling (e.g., UTP, STQ, STP, SPP, Coax, or Twinax).