

Alien Crosstalk and Balance Measurement of RTPGE Links

Contribution to IEEE 802.3bp Task Force Interim Meeting
January 2013
Phoenix, AZ USA

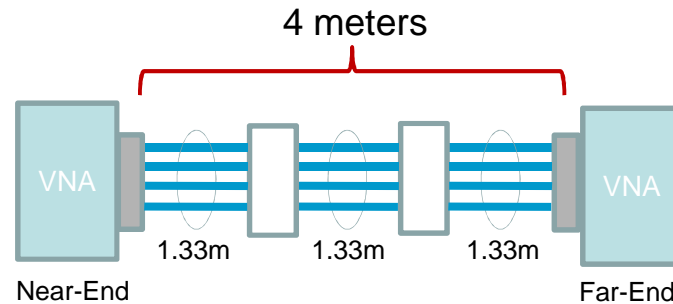
Richard Mei
CommScope

connect+evolve

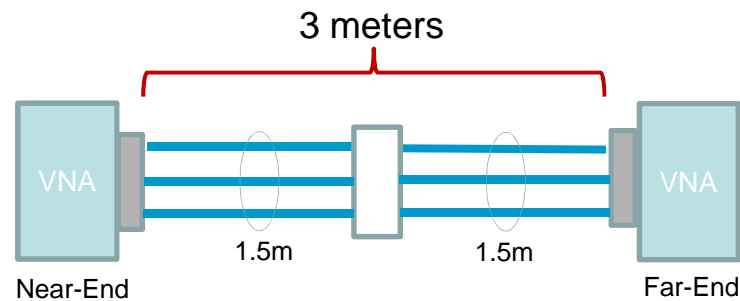
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- Early Understanding of Automotive Configurations from OPEN Alliance
 - Alien Crosstalk Measurements
 - Chanel Measurements
 - Balance Measurements
 - Summary of Test Results
 - Observations/Next Steps
 - Conclusion

- Mehmet Tazebay – Broadcom
- Kirsten Matheus – BMW
- Joseph Chou – Realtek
- Benson Huang – Realtek
- Xiaofeng Wang – Qualcomm
- George Zimmerman – CME/CommScope
- Stefan Buntz - Daimler

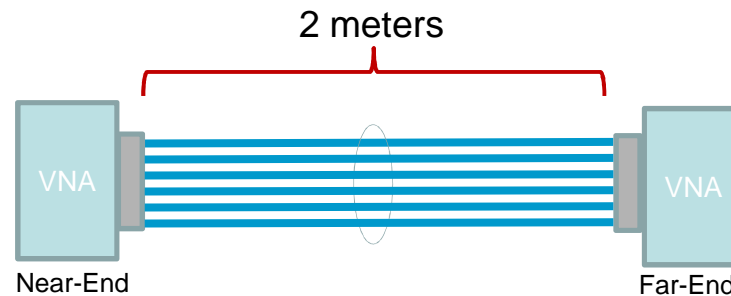
1. Configuration 1: 4 RTPGE links at 4m with 2 inline connectors (3-around-1)



2. Configuration 2: 3 RTPGE links at 3m with 1 inline connector (2-around-1)

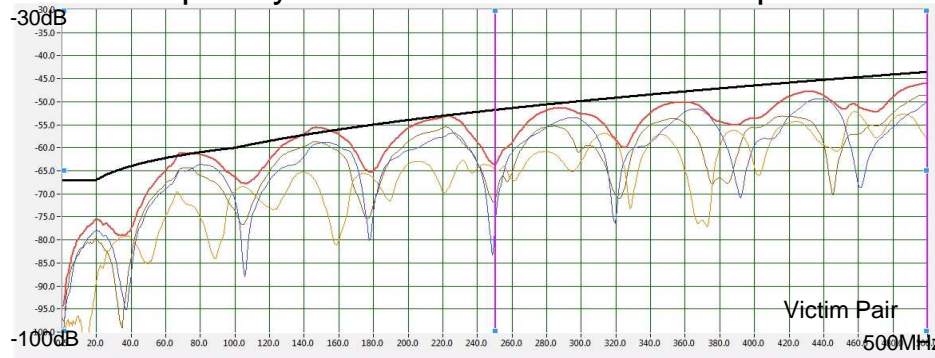


3. Configuration 3: 6 RTPGE links at 2m with no inline connectors (5-around-1)

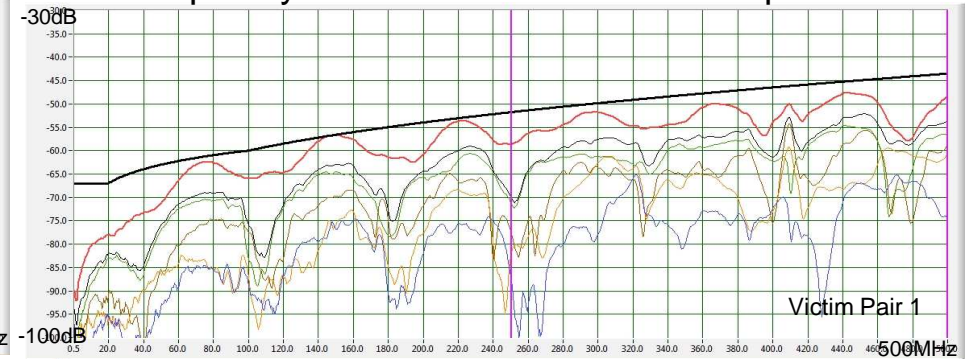


Alien Crosstalk of Configuration 1

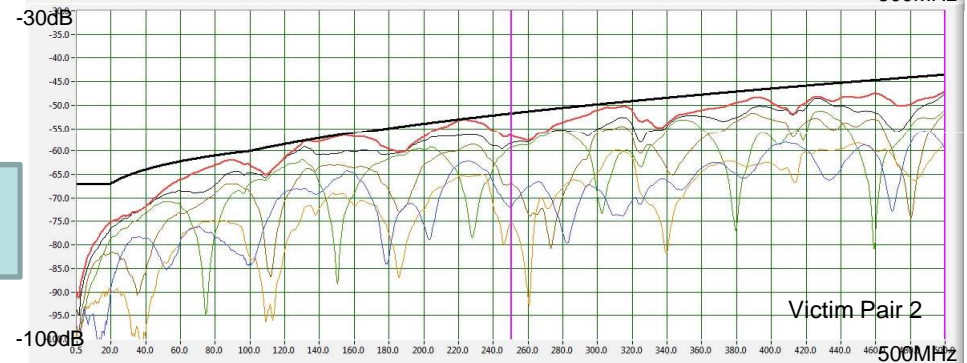
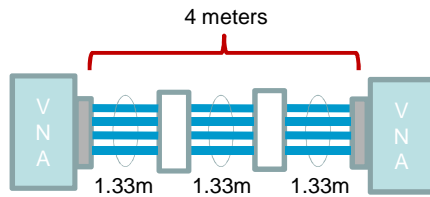
1-pair system PSANEXT to Cat-6A Spec



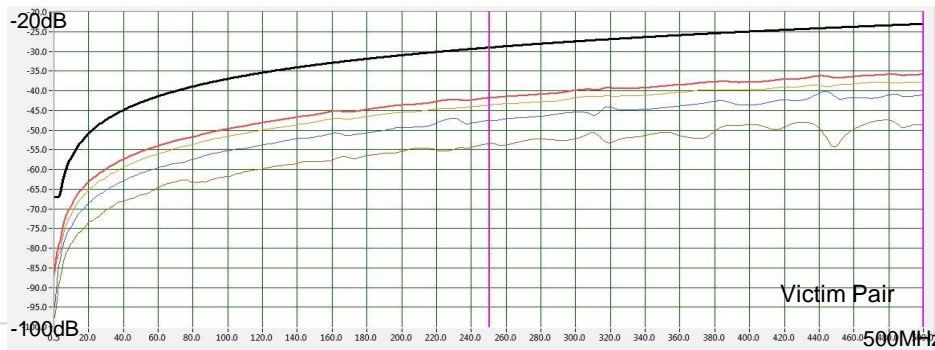
2-pair system PSANEXT to Cat-6A Spec



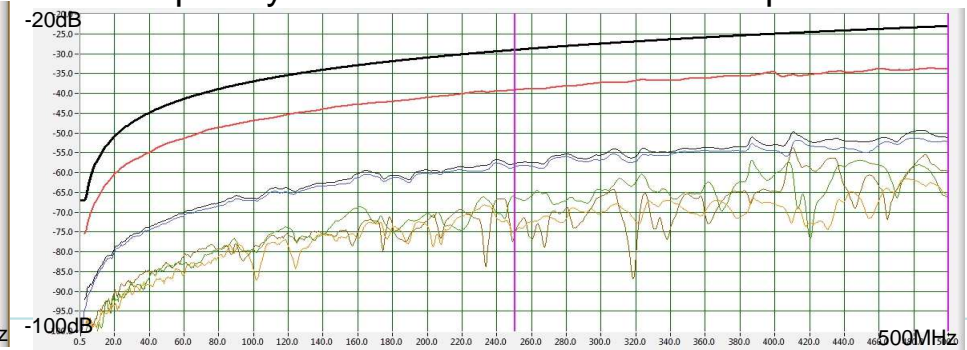
1-pair System	2-pair System
Near-End PSANEXT	Near-End PSANEXT for Victim Pair 1
	Near-End PSANEXT for Victim Pair 2
Far-End PSANEXT	Far-End PSANEXT for Victim Pair 1
	Far-End PSANEXT for Victim Pair 2
Near-Far PSAACR-F	Near-Far PSAACR-F for Victim pair 1
	Near-Far PSAACR-F for Victim pair 2
Far-Near PSAACR-F	Far-Near PSAACR-F for Victim pair 1
	Far-Near PSAACR-F for Victim pair 2



1-pair system PSAACR-F to Cat-6A Spec

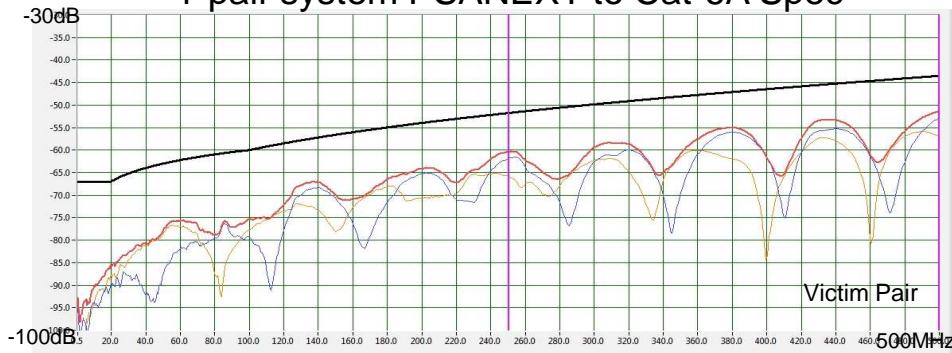


2-pair system PSAACR-F to Cat-6A Spec

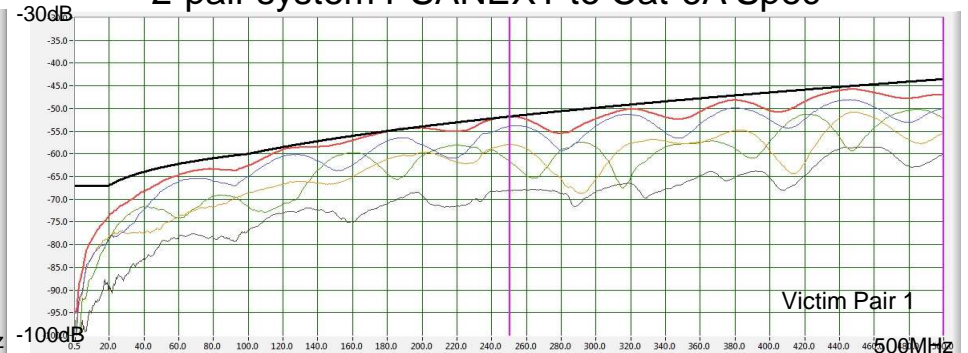


Alien Crosstalk of Configuration 2

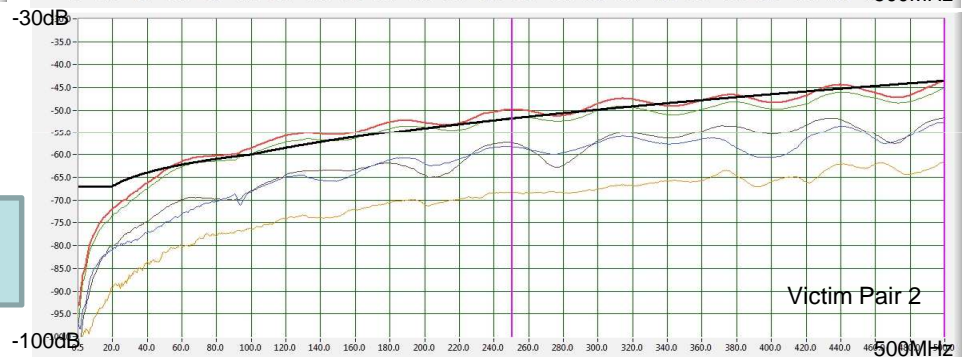
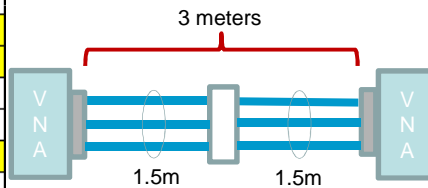
1-pair system PSANEXT to Cat-6A Spec



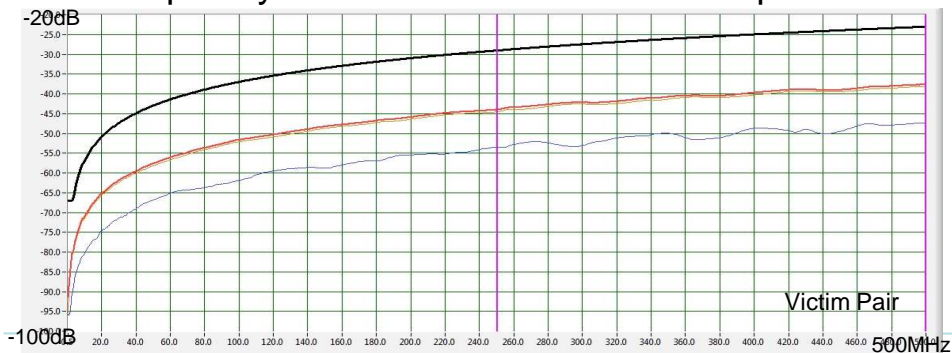
2-pair system PSANEXT to Cat-6A Spec



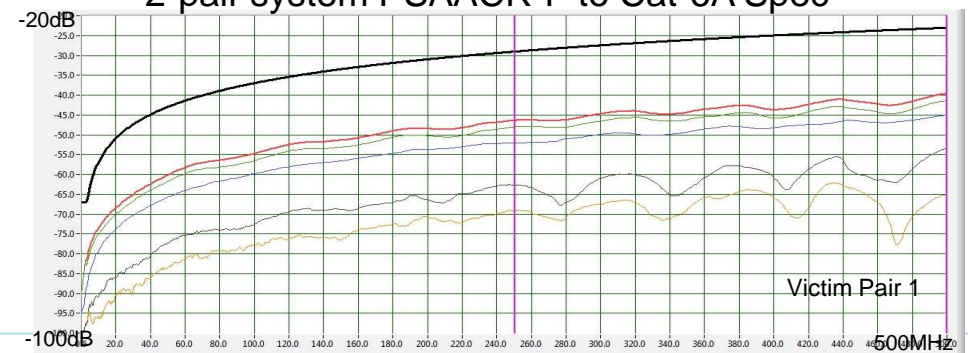
1-pair System	2-pair System
Near-End PSANEXT	Near-End PSANEXT for Victim Pair 1
	Near-End PSANEXT for Victim Pair 2
Far-End PSANEXT	Far-End PSANEXT for Victim Pair 1
	Far-End PSANEXT for Victim Pair 2
Near-Far PSAACR-F	Near-Far PSAACR-F for Victim pair 1
	Near-Far PSAACR-F for Victim pair 2
Far-Near PSAACR-F	Far-Near PSAACR-F for Victim pair 1
	Far-Near PSAACR-F for Victim pair 2



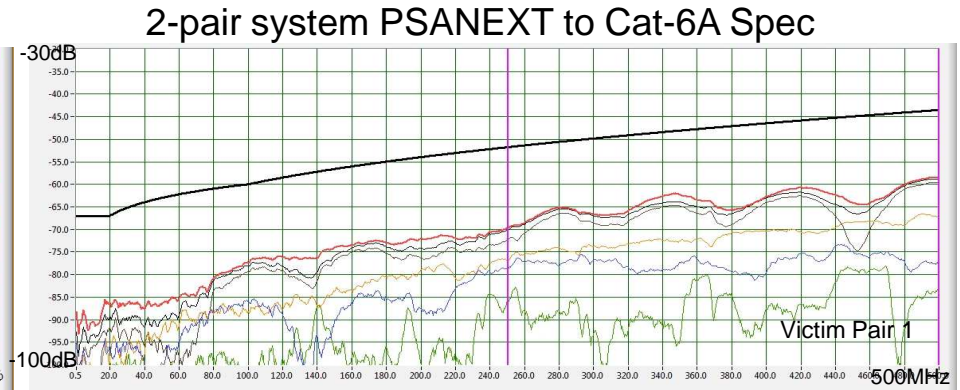
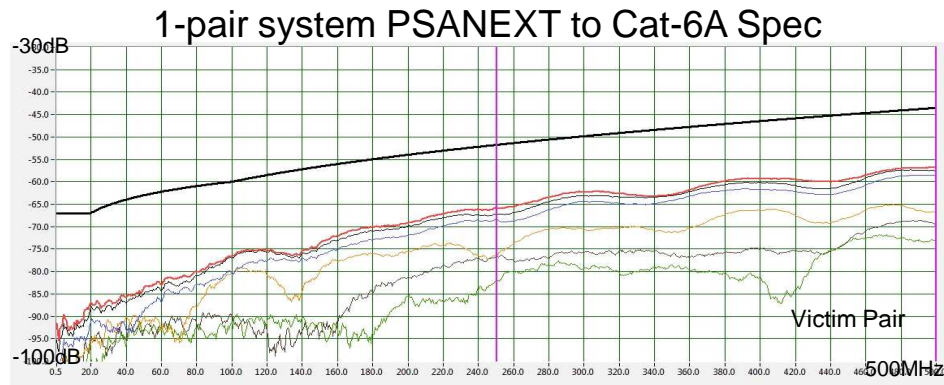
1-pair system PSAACR-F to Cat-6A Spec



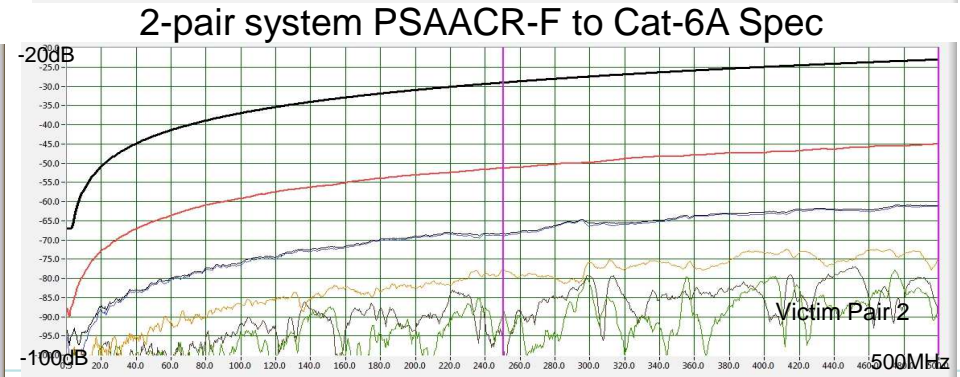
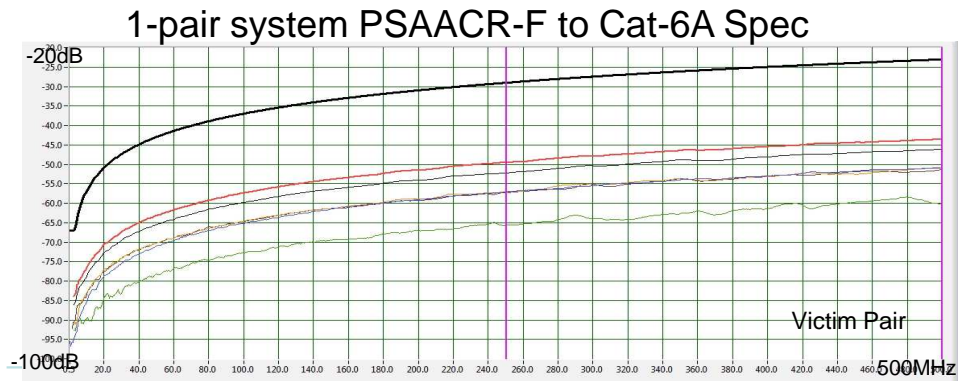
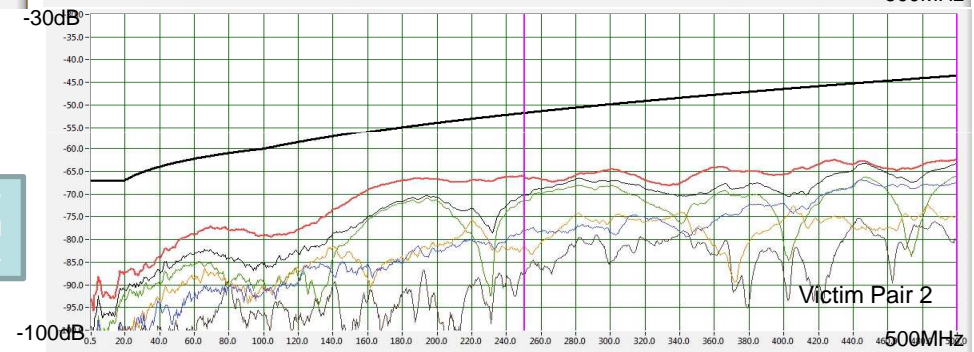
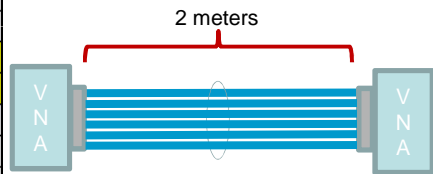
2-pair system PSAACR-F to Cat-6A Spec



Alien Crosstalk of Configuration 3

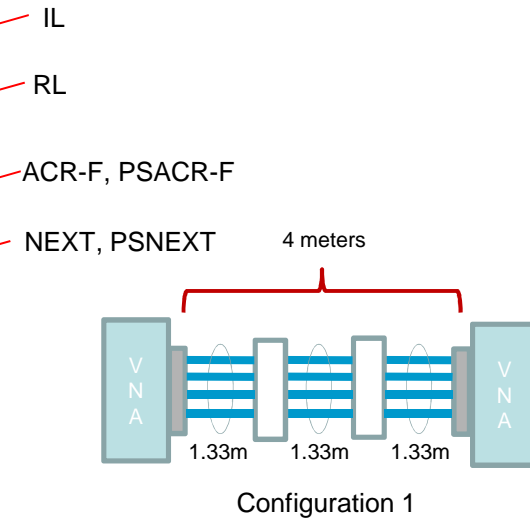
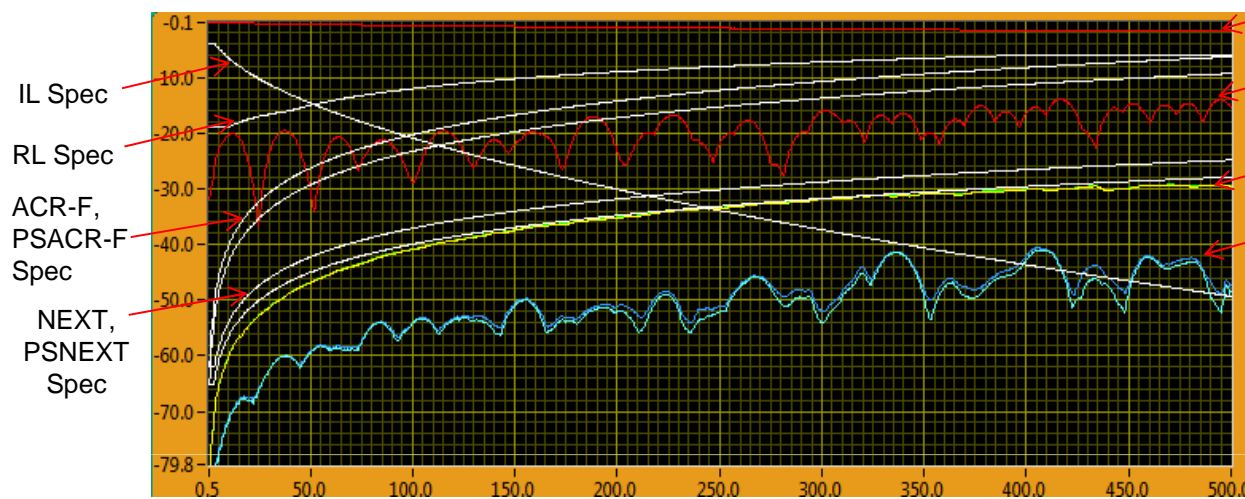


1-pair System	2-pair System
Near-End PSANEXT	Near-End PSANEXT for Victim Pair 1 Near-End PSANEXT for Victim Pair 2
Far-End PSANEXT	Far-End PSANEXT for Victim Pair 1 Far-End PSANEXT for Victim Pair 2
Near-Far PSAACR-F	Near-Far PSAACR-F for Victim pair 1 Near-Far PSAACR-F for Victim pair 2
Far-Near PSAACR-F	Far-Near PSAACR-F for Victim pair 1 Far-Near PSAACR-F for Victim pair 2

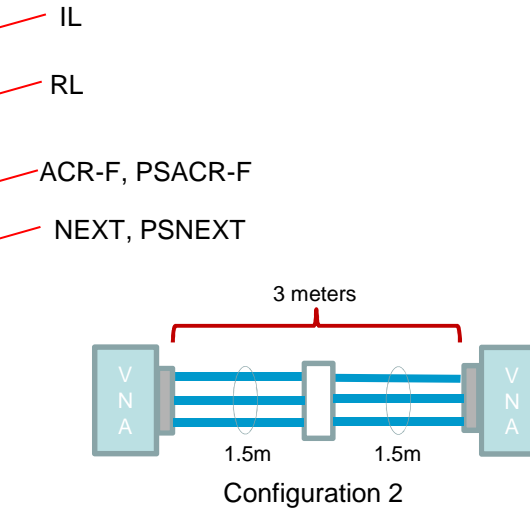
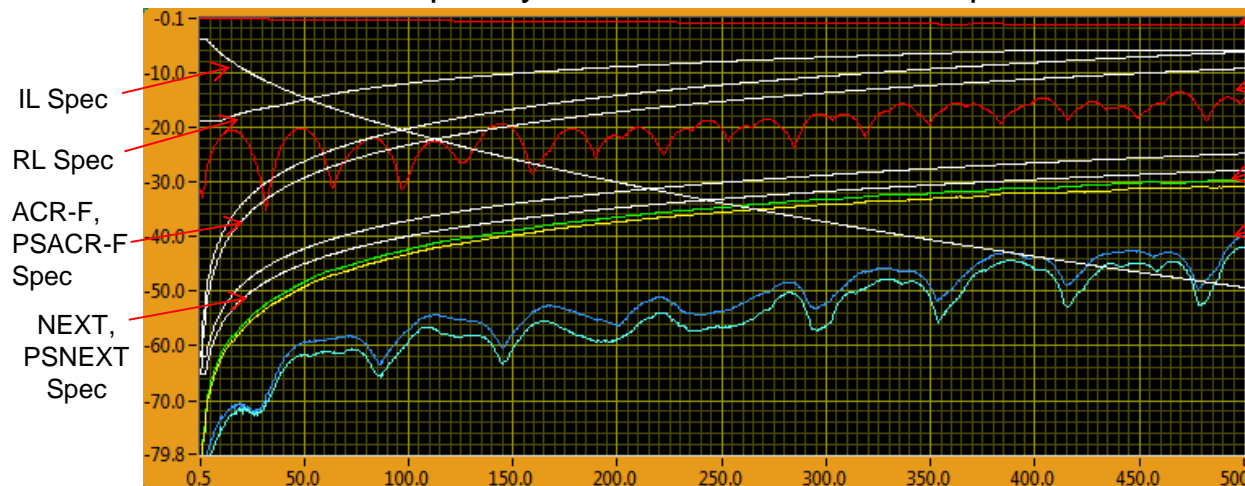


Channel Measurements of 2-pair System

2-pair system to Cat-6A Channel Specs



2-pair system to Cat-6A Channel Specs



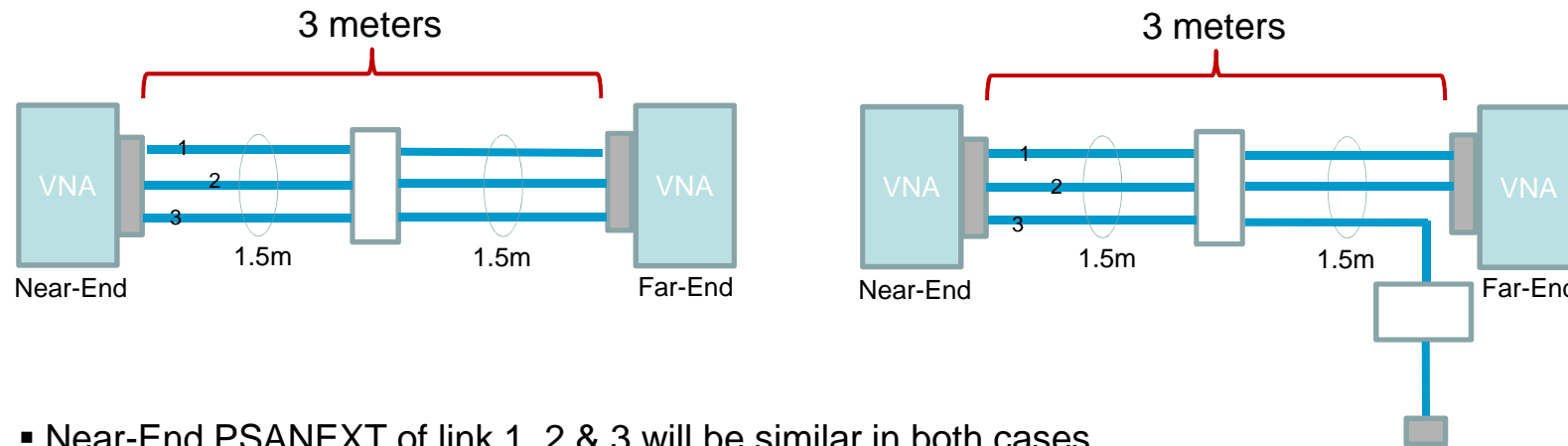
2-pair Cable to Cat-6A Cable TCL Spec



$$TCL_{cable} \geq 30 - 10\log(f/100) \text{ dB}$$

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- Individual 1-pair and 2-pair inline connectors were used, not multi-pin connectors
 - Cat-6A channel performance (both internal and external parameters) is achievable with new type of cabling
 - PSANEXT relaxation for shorter links is implemented to the spec line
 - Balance performance of both 1-pair and 2-pair prototype cables is well-behaved
 - Connector balance is generally worse than cable balance

- Tests were conducted based on an early understanding of some RTPGE user cases
- Although there probably will be differences between these test configurations and the final possible user cases, the coupling mechanism of alien crosstalk is not going to vary much



- Near-End PSANEXT of link 1, 2 & 3 will be similar in both cases
- Far-End PSANEXT of link 1, 2 will be similar in both cases
- Far-End PSANEXT of the branch-out link 3 will be better
- PSAACE-F in both cases will be comparable (except IL difference of branch-out link)

- The inline connector in close proximity to the victim connector is the major contributor of alien crosstalk. The more “direct-coupled” disturbing connectors we have around the victim connectors, the worse channel alien crosstalk performance we have for the victim channel
- Need to determine the “worst-case” RTPGE channel configuration based on the user cases
- Current Cat-6A balance specifications (TCL and TCTL/ELTCTL) are not adequate for automotive environment – Require new specifications that correlate well with EMC transfer function of the cabling
- Need user cases for commercial vehicles (trucks and buses) to determine the “worst-case” channel configuration that utilize longer RTPGE links (~40 meters)

- Cable, connecting hardware, link and channel performance (internal and external parameters) are well defined in TIA Cat-6A/ISO Class EA standard. It is the foundation for 10GBASE-T transmission and is the only cabling standard with a detailed alien crosstalk modeling
- Some internal parameters from Cat-6A specs (100m) need to be scaled for RTPGE channels due to a shorter distance (IL, ACR-F, PSACR-F). The current distance objective is 15m for cars/van/light trucks, and 40m for commercial vehicles
- By specifying RTPGE channel performance (IL, RL, NEXT, PSNEXT, ACR-F, PSACR-F, PSANEXT, PSAACR-F) to Cat-6A level (bandwidth – TBD), Task Force can shift its focus to more challenging problems such as EMC and coding scheme.

Thank You

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