An Initial Assessment of System Background Noise in 10GBASE-T Systems

IEEE P802.3bq 40GBASE-T Task Force

Pete Cibula (Intel)

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Initial Noise Assessment - Purpose & Goals

- Purpose – Begin to characterize background noise in representative systems that are candidates for 40GBASE-T PHYs
  - Support the PHY Baseline Proposal ad hoc's request for "…measurement results of background noise in systems, including broadband, stationary, and nonstationary narrowband sources."

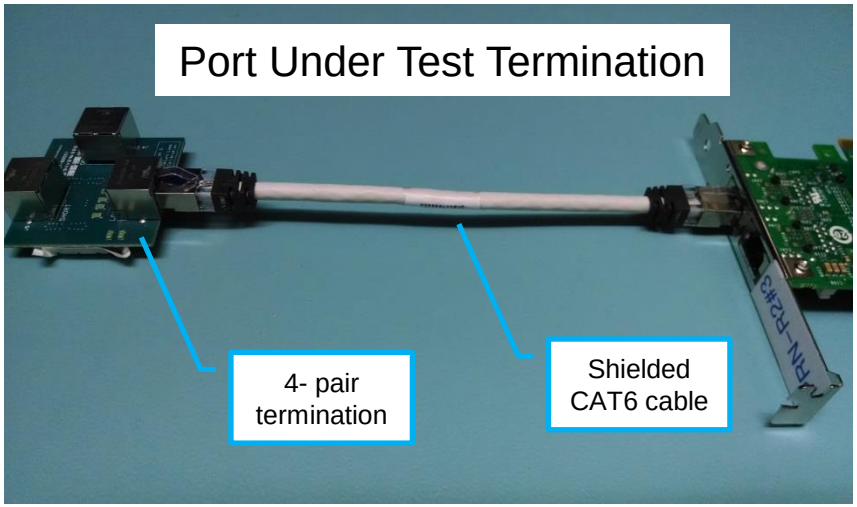
- Goals - This an initial and limited assessment intended to…
  - Provide early but representative background noise levels to PHY developers
  - Stimulate discussions on measurement methodologies and ideas for further work in this area

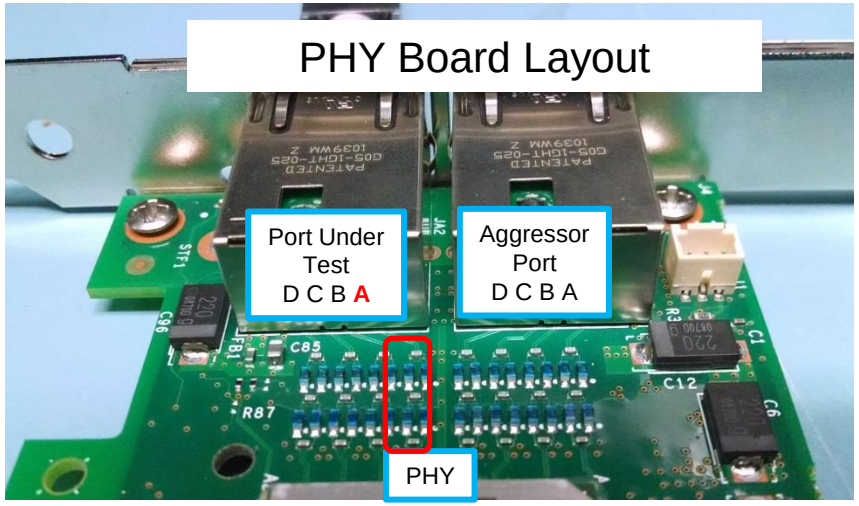
Measurement Methodology

- Uses a 10GBASE-T PHY *in situ* self-test function to analyze noise characteristics seen along the MDI path
  - Capable of measuring noise, crosstalk and alien crosstalk
  - Limited frequency range (1MHz to 400MHz)
  - Intended for field debug to verify the health of the MDI path
    - Reference: "Forget ICT--Use MDI Testing with 10GBASE-T PHY" (EE Times, 2/21/2010)

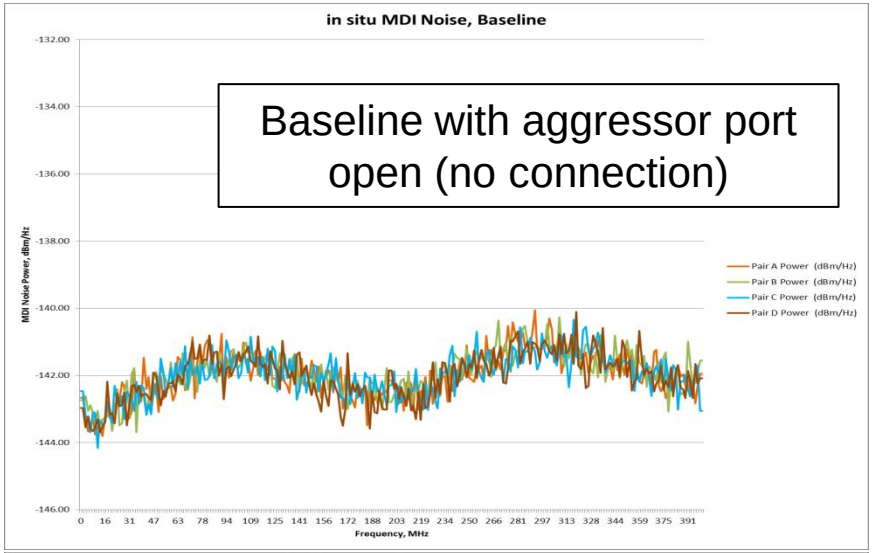
- Acknowledging that this is a non-standard methodology, follow-up characterization is planned to correlate these results with generally available methods and techniques
  - Discussion and collaboration to define those generally available methods and techniques is welcome!

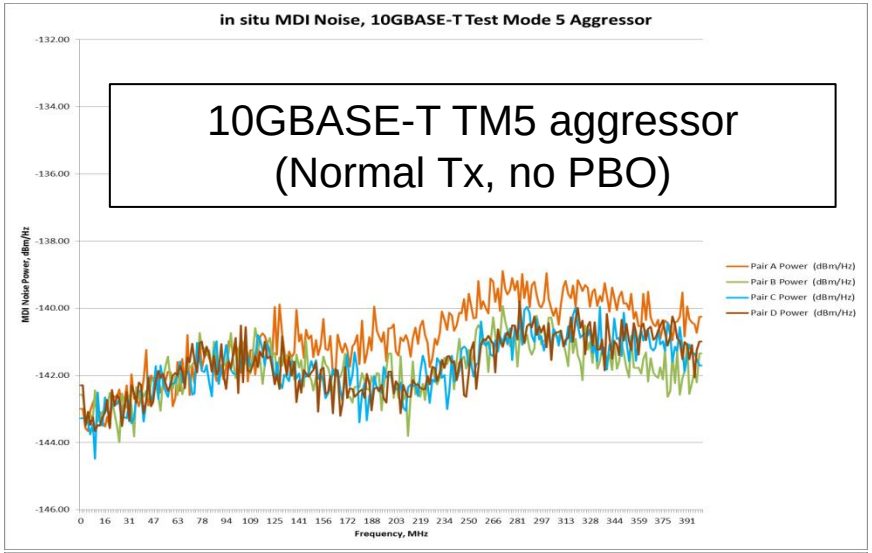
Measurement Setup & Environments

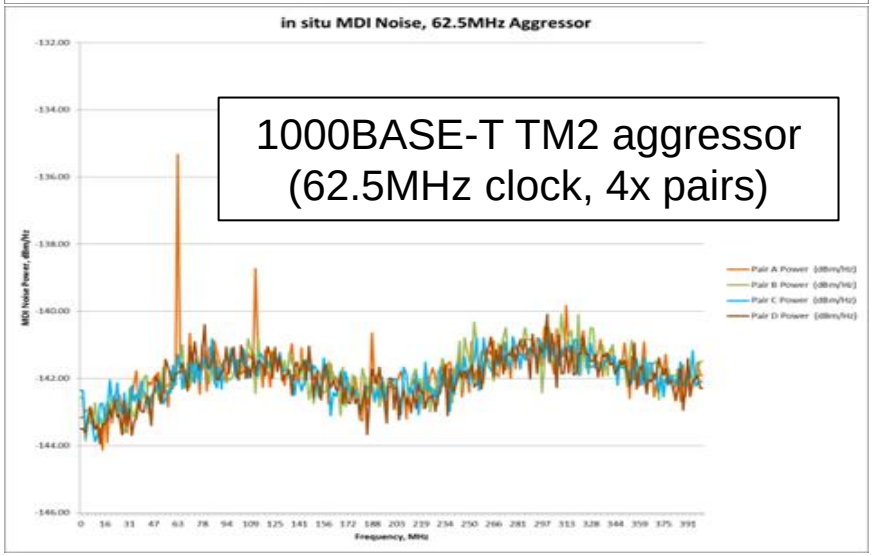


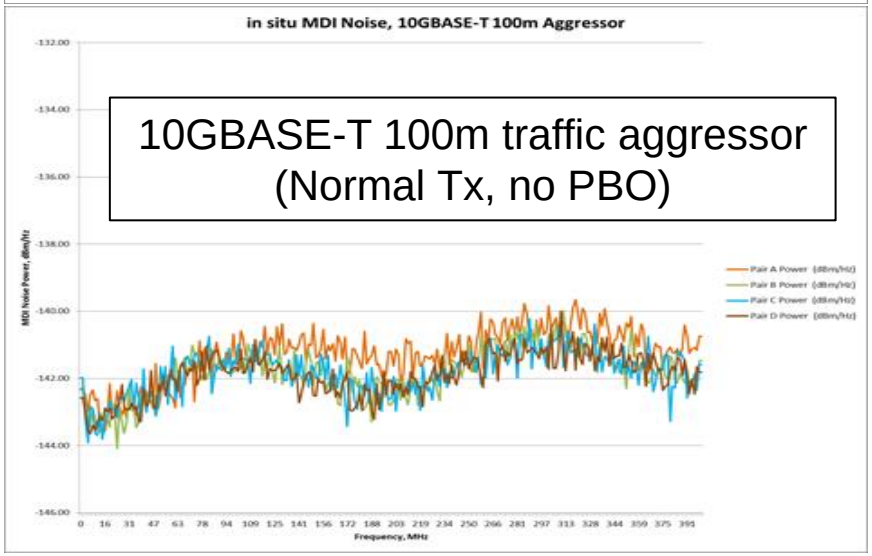


Sample MDI Noise Measurements









Results & Observations

- Average measured *in situ* background noise for this system (10GBASE-T network adapter) is between

  -141dBm/Hz and -142dBm/Hz

- Other system noise sources, including traffic from adjacent PHYs, can increase both peak and average background noise levels
- Background noise sources may not couple equally across all MDI pairs

Measurement Case	MDI Pair	Average Noise
Baseline	Pair A (1-2)	-141.9 dBm/Hz
	Pair B (3-6)	-141.8 dBm/Hz
	Pair C (4-5)	-141.9 dBm/Hz
	Pair D (7-8)	-141.9 dBm/Hz
	All pair average	-141.87 dBm/Hz
1Gb Test Mode 2	Pair A (1-2)	-141.7 dBm/Hz
	Pair B (3-6)	-141.7 dBm/Hz
	Pair C (4-5)	-141.8 dBm/Hz
	Pair D (7-8)	-141.9 dBm/Hz
	All pair average	-141.79 dBm/Hz
10Gb Test Mode 5	Pair A (1-2)	-140.7 dBm/Hz
	Pair B (3-6)	-141.7 dBm/Hz
	Pair C (4-5)	-141.6 dBm/Hz
	Pair D (7-8)	-141.5 dBm/Hz
	All pair average	-141.37 dBm/Hz
10Gb 100m Traffic	Pair A (1-2)	-141.2 dBm/Hz
	Pair B (3-6)	-141.7 dBm/Hz
	Pair C (4-5)	-141.7 dBm/Hz
	Pair D (7-8)	-141.8 dBm/Hz
	All pair average	-141.57 dBm/Hz

Increase in average power with broadband aggressors like 10GBASE-T signaling

Conclusions & Next Steps

- Conclusions
  - Background noise for one 10GBASE-T system is between approximately between -141dBm/Hz and -142dBm/Hz from 1MHz to 400MHz when measured using an *in situ* technique
  - Both peak and average background noise levels may increase in the presence of other system noise sources; the effect may vary across MDI pairs
- Next Steps
  - Develop standard instrument based measurement techniques and reproduce results

Thank You!