

IEEE 802.3bp Reduced Twisted Pair Gigabit Ethernet PHY Interim meeting convened at 09:00, Tuesday, May 14, 2013 by Steven B. Carlson, 802.3bp Task Force Chair

Administrative Matters

- Appointment of Recording Secretary - Dave Estes
- Welcome and Introductions
- Review Agenda

Motion #1: Approve Agenda

M: Gary Yuriko

S: Dave Dwelley

Voice Vote

Motion Passes Unanimously

- Attendance Tool link and code
- Task Force Decorum
- Reviewed the goals for the meeting
- Reflector and Web location review
- Meeting Ground Rules Review
- John D welcome to IEEE Interim from the EA
- Attendance policy and tool
- Important Bylaws and Rules
- Patent Policy was read and call made for Potentially Essential Patents
 - No Declarations of Patents were made
- Other Guidelines for IEEE WG Meeting
 - Antitrust and anti-competition laws
- Review of IEEE Structure and P802.3bp Status
- Discussion of Public vs. Private area
- Task Force Operation
- Action Items
 - Continue technical work on automotive link segment performance characteristics and EMC
- PAR and 5 Criteria
- Presentation Issues
 - Late requests/submissions. Too many missed deadlines.
 - Updates will only be accepted if there is a technical correction
 - New filename conventions
- List of presentations

Channel Definitions Ad Hoc Report - Mehmet Tazebay - 9:30 am

- Provided minutes from May 2nd and 9th
- Assess feasibility for 1 pair UTP, if not possible try 1 pair STP, and so on
- Insertion Loss and Return Loss Consensus
 - Review of Automotive Link Segment
 - IL, RL, NEXT, FEXT, multiple disturber crosstalk, alien crosstalk, balance
 - IL closed form equations provided by Commscope have been accepted

- ANSI/TIA-568-C.2 Annex I will be used as a basis for RTPGE link segment RL limits.
- Use Cat 6A cable and connector return losses as basis for RL limit modeling for automotive link segment

There was discussion about temperature range (up to 125 degrees) and concern about potential for confusion because Cat6A model uses mostly solid while RTPGE will use mostly stranded. It was pointed out that we are looking at Cat6A Stranded. To avoid confusion it was suggested that we stop using any references to Cat6A as quickly as possible. It was suggested that it would be helpful if the Standard (possibly in an informative appendix) addressed what would happen if someone attempted to use 802.3bp on legacy cabling. After receiving measurement data to confirm that the presented targets are reasonable, the Task Force can turn the limit into an equation and use that going forward.

EMC and Noise Ad Hoc Report - Mehmet Tazebay - 10:00 am

- Changed the name to include Noise
- Review of past meetings/calls
- Workplan Summary
 - First Phase (data collection)
 - Ingress modeling
 - Egress modeling
 - Second Phase
 - Reach consensus on a baseline limit for EM emissions and define transmit PSD mask
 - Build consensus of all discrete noise sources and background noise
 - Third Phase
 - Develop text for Standard
- Overview of current status
 - Differential Channel Impairments - Green
 - EMC Modeling & limit lines - Yellow
 - Need immunity data
 - Need to choose test methods
 - EMC Channel Transfer Function - Green
 - Alien XTALK modeling - Green
 - In-Car Background Noise - Green
 - Need OEMs to confirm that this is good data
 - Other Noise Sources - Green
- Goal is to achieve consensus on all items within the next month

There was discussion about the twist rate during Alien XTALK tests and concerns about the effect of PoDL on emissions.

The Chair called a break at 10:20AM and reconvened the meeting at 10:55 AM

RTPGE Test Head - Todd Herman - 10:55 am

- Provided an update about the new version of the RTPGE Test Head that improves the design and simplifies to only use one pair.
- UNH is using the new version for their testing.
- Showed punch down tool and brass stands that are used to hold the test heads.
- Showed the test setup with a ground plane
- Showed results of testing a 3m 3pair setup and a 4-around-1 setup

IEEE 802.3bp Sample Channel Characteristics - Curtis Donahue - 11:10am

- Overview of the data the UNH-IOL is collecting
- Test Setup
 - Equipment
 - Test Head
- Showed data that has been collected
- Next Steps
 - Balance parameters
 - Worst-case Alien Crosstalk scenarios
- How to submit assembly samples

Discussion included suggestions to include SI units to measure diameter along with gauge.

RTPGE Channel Performance Formulation Proposal - Todd Herman - 11:25 am

- IL Model
 - Includes factors for stranded/solid, temperature, and conductor diameter
- RL Model
- Power Sum Alien NEXT Model
 - Preliminary parameters for short channel
- Power Sum Alien Attenuation to Crosstalk Ratio, Far End Model
- LCL, LCTL, TCL, and TCTL should be specified based on EMC modeling

1 pair or 2 pairs for RTPGE: Impact on System Other than the PHY Part 2: relative Costs - Kirsten Matheus - 11:40 am

- Cost is a sensitive topic, however the large amount of contributors means that the discussion cannot be attributed to one specific provider.
- A diagram was provided to show which elements were considered when calculating relative costs for both the harness and the PCB
- Several comparisons of harness costs using different cable types were provided
- A PCB cost comparison was included for 1-pair UTP vs. 2-pair UTP
- Summary
 - Harness side - 1 pair UTP is favorable over two pair UTP, which is (just) favorable over coax, which is favorable over shielded.
 - PCB side - increase in space for 2-pair is 25% to 100% increase
 - For the overall costs both elements are equally important

- Harness costs won't reduce much over time, PCB costs may reduce, so in the future the harness costs may be more important
- Backup slides to provide details for calculations and comparisons

Discussion included a suggestion to compare 1-pair UTP jacketed vs. 1-pair UTP non-jacketed.
Discussion also included questions about the relative cost for PoDL.

The Chair called a lunch at 12:05pm and reconvened at 2:00 pm

Feasibility of 1-UTP for RTPGE: Impacts of Gauge, Temperature, and Modulation

Xiaofeng Wang - 2:00

- Objectives are to study the feasibility of 1-pair UTP and compare different PAM-M schemes
- System model and assumptions were provided
- Salz SNR Results
 - PAM2 has higher margin than PAM-M with $M > 2$ at lower temps
 - Temperature affects performance more than gauge does
- Feedback Taps
 - Very large feedback coefficients, so some peaking gain is needed
- Susceptibility to NI
 - Lower modulation has better immunity
 - PAM2 has a 2-2.3 db advantage over PAM4
 - Can also measure eye opening at $BER=1e-10$, PAM2 performs better than PAM4
- Conclusions and Recommendations
 - Reasonable SNR for all cables sizes and temperature ranges considered
 - Temperature has significant impact
 - Define TCL to reduce background noise and increase NI immunity
 - PAM2 shows better immunity
 - Need model of impulse noise
 - Need to evaluate measured channels with realistic equalization schemes

Discussion pointed out that coding overhead has not yet been included.

Impulse Noise Model - Thomas Hogenmüller - 2:20pm

- Different noise spectra at different locations within car
- Determine where the noise is coming from
- Main source of impulse noise is the spark plugs
- Conclusion of impulsive noise analysis
 - Below 100 MHz ISO pulses are applicable
 - Above 100MHz the spark plug impulses are dominant
- Modeling of Impulsive Noise
- Spark Impulsive Noise Parameters
- Frequency Response of Noise Model
- Conclusion
 - ISO pulses are not sufficient

- Main impulse noise source are spark plugs
- What's available:
 - Measurement data base for power lines
 - Mathematical description of noise
 - FPGA Based emulator (for automotive use)
- PhD-Thesis from Thorsten Huck is available in German

Discussion included potential future research topics for hybrids and electric vehicles. Thomas will provide parameters about the Spark Impulsive Noise to the EMC Adhoc.

The chair announced that the scheduled presentations are complete and late submissions will now be presented.

Insertion/Return Losses vs. Temperature Performance of RTPGE Cable Assemblies - Sasha Babenko - 2:40 pm

- Focused on the entire channel between two Ethernet nodes including ECU connectors, cable, and inline connectors
- Purpose was to investigate IL/RL on actual cable assemblies at temperatures -40, +23, +85, +105, +125
- Test sample descriptions and test setup was provided
- Test Results are plotted in the presentation
- Conclusions
 - No permanent degradation from the temperature changes for this test
 - High temps degrade IL/RL performance
 - Special attention needs to be paid to raw cable performance
 - Inline connections and untwist of differential pairs may create resonances

Discussion included questions about the factor regarding change in performance per degree for these measurements. Discussion that the results are more dependent on the primary insulation rather than the jacket material. Some samples were crimped and some were soldered.

The Chair called a break at 3:10pm and reconvened at 3:30pm

Considering all Noise Sources over a single data and power pair - Yair Darshan - 3:30pm

- To ensure that we cover all noise sources when specifying the total differential maximum noise
- EMI is one of the noise sources, the power source and the load are also noise sources
- Proposed general case for noise source
- If all noise sources are equal, each one is about 7.8db below the total noise
- Summary
 - The requirements for each noise source needs to be less than the total noise limit
- Proposed next steps
 - get $e_n(f)$ test data
 - generate a list of all known noise sources

- derive the spec values for each noise source
- define a detailed table of differential noise per frequency

Discussion included that for data integrity we care about total noise within only a specific frequency range. To keep the device working we care about total noise including down to dc. A question for the group: What is the noise frequency range that affects data integrity?

The chair announced that papers on impulse noise have been added to the private area and provided the password for the private area.

The chair recessed the meeting until 5/15/13 at 9:00 am in the Buckingham Room.

Wednesday, May 15, 2013

The chair started the meeting at 9:00 am

Approve the minutes from Orlando

Motion #2: Approve March 2013 Minutes

M: Dave Dwelley

S: George Zimmerman

Voice Vote

Motion Passes Unanimously

Review of Meeting Guidelines, Decorum, Wireless access information, and private area password.

Future Meetings

July 16-19, 2013 Plenary in Geneva, CH

September 2, 2013 Interim in York, UK

Differences between Plenary and Interim meetings were discussed.

Immunity Analysis & Test Results via Bulk Current Injection Method for 1-pair UTP Channels
- Mehmet Tazebay - 9:10am

- Objectives
 - Utilize BCI to measure and quantify CM and DM transfer functions
 - Compute the CM and DM noise
- Setup
 - 2m 1-pair UTP AWG22 prototype cable
 - Current Injection Probe (CIP)
 - Well-balanced UTP-to-SMA test heads
 - 3-port Network Analyzer
- Bulk Current Inject (BCI) Test Setup and Test Head were shown.
- Background noise measurements were provided.

- CM/DM BCI Transfer Functions were plotted
- Current Injection Probe Calibration was shown
- Mode Transfer Impedance equations were provided
- Common Mode and Differential Mode Transfer Impedance plots were shown
- Vcm and Vdm for constant BCI was plotted
- Vcm and Vdm for a BCI Profile was plotted
- CM/DM Noise Calculation
- Conclusions
 - BCI is an effective technique for analyzing and quantifying the ingress model for EMC immunity
 - It is feasible to characterize the mode-conversion channel functions via BCI
 - Given BC levels & #2, it is feasible to calculate the CM and D noise levels at the input of the receiver
 - There exists 1-pair UTP channels which can yield the DM noise as low as 55mV-pp

Discussion included questions about the periodic peaks, it was answered that they are caused by resonance within the 2m cable. It was pointed out that using this size BCI probe makes the measurements close to worst-case. The untwist at the connector will probably be the worst part of the channel. The question about the difference for non-jacketed vs. jacket was raised? It is assumed that the jacket will not affect these results. The jackets change insertion loss over temperature more than this.

Coupling Attenuation Measurements for Cables & Channels - Paul Kish - 9:45 am

- This is a presentation based on Cat6A cables
- Absorbing Clamp diagram was shown
- Coupling Attenuation Setup for Cables was shown
- Coupling Attenuation Setup for Cables was shown
- Coupling Attenuation measurements were provided
- Cat6A F/TUP was compared with Cat6A UTP
- Cat6A UTP cable was compared with Cat6A UTP Channel
- Summary
 - Cat6A Channels generally meet the requirements
 - Cat6A FTP channels are generally 10dB to 20dB higher than the requirements

Discussion included the 1m reference distance to ground plane.

The Chair called a lunch at 10:00 am and reconvened at 1:00 pm

1-pair 15m RTPGE - Mehmet Tazebay - 1:10 pm

- Motivation and Direction
 - Presentations have shown that 1 Gb/s on 1-pair is achievable
 - Affirming a 1-pair solution will focus the task force

Motion #3: The IEEE P802.3bp Task Force affirms a 1-pair PHY Solution at 15m.

M: Kirsten Matheus

S: Wael Diab

Technical motion, requires 75%

Everyone in the room votes

Y:32 N:0 A:7

Motion Passes

Discussion on the motion included a review of the 802.3bp Objectives. It was pointed out that this motion affirms the decision made in March to work through the various possible solutions starting with 1-pair UTP. It does not commit the TF to 1-pair UTP as the final solution.

Motion #4: Motion to Adjourn

M: Wael Diab

S: Mehmet Tazebay

Voice Vote

Motion Passes Unanimously

Meeting ended at 1:50pm

P802.3bp Task Force Sign-In Sheet -

TUESDAY, May 14 - Wed, May 15

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P802.3bp Task Force Sign-In Sheet

Tuesday, May 14 - Wed May 15

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P802.3bp Task Force Sign-In Sheet - May 14/15

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