Approved Minutes

IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces

Task Force

Plenary Meeting
November 13-15, 2018
Bangkok, Thailand

Prepared by Kent Lusted

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IEEE P802.3ck 100 Gb/s Electrical Lane Task Force – November 13, 2018

Prepared by Kent Lusted

IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces Task Force meeting convened at ~1:00 p.m., by Beth Kochuparambil, IEEE 802.3ck Task Force Chair.

Beth welcomed attendees.

Introductions were made.

Chair reviewed agenda in http://www.ieee802.org/3/ck/public/18_11/agenda_3ck_01a_1118.pdf

Motion #1:
Move to approve the agenda:
- Moved by: Thananya Baldwin
- Second by: Pavel Zivny
- Passed by voice without opposition

Chair noted that the September minutes were posted shortly after the meeting. Chair noted that she received requests for corrections or modifications to the posted minutes from Mike Dudek and Kapil Shrikhande. The corrected version was posted as http://www.ieee802.org/3/ck/public/18_09/minutes_3ck_0918_editMarkup.pdf   Chair asked if there were any other comments on the minutes. No one responded.

Motion #2:
Move to approve the September 2018 meeting minutes
- Moved by: Thananya Baldwin
- Second by: Brad Booth
- Passed by voice without opposition

Chair reminded participants to observe meeting decorum. Called for members of the press. No one indicated. Photography and recording are not permitted.

Chair reviewed the ground rules for the meeting.

Chair reviewed the IEEE structure.

Chair reviewed the Bylaws and Rules slides in
http://www.ieee802.org/3/ck/public/18_11/agenda_3ck_01a_1118.pdf

Chair asked if there was anyone unfamiliar with the Bylaws or Rules. Chair noted that the link for the Policies and Procedures was recently changed. No one responded.

IEEE Patent Policy: Chair reviewed the Patent related slides on the 4 slides contained in the agenda. Chair called for potentially essential patents. No one responded. Chair read the Guidelines for IEEE WG meetings.   No one responded.

Chair advised the WG attendees that:
- The IEEE's patent policy is described in Clause 6 of the *IEEE-SA Standards Board Bylaws*;
- Early identification of patent claims which may be essential for the use of standards under development is strongly encouraged;
- There may be Essential Patent Claims of which the IEEE is not aware. Additionally, the IEEE, the WG, nor the WG chair can ensure the accuracy or completeness of any assurance or whether any such assurance is, in fact, of a Patent Claim that is essential for the use of the standard under development.

No one responded.

Chair reviewed the slide with a statement on the participation requirements for IEEE 802 Meetings. Chair noted that by participating in the IEEE 802 meeting, that participants accept these requirements. Chair asked if there were questions about the participation requirements. No one responded.

Chair reviewed the IEEE 802.3 Standards Process.

Chair reviewed the approved project documents.

Reviewed the email reflector and web information for the Task Force in the agenda deck.

Chair reviewed the attendance procedures. Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Goals for the meeting:
- Adopt a timeline
- Understand consensus level on C2M direction
- Movement on Backplane and Cu Cable studies

Chair reviewed topics of conversation for the meeting:
- FEC Analysis
- Package Model
- C2M budget/equalization
- COM Architecture/Modifications
- Backplane and Copper Cable

Chair noted that liaisons were received from ITU-T SG15 and COBO. The ITU-T liaison was for the P802.3cb Task Force, which was disbanded. David Law assigned the 802.3ck Task Force to determine if a response was needed and create it, if necessary.

Chair reviewed the presentation schedule. The agenda was very full and kindly asked participants to be succinct and keep within the allocated time.

Chair displayed the liaison letter from the ITU-T SG15. (See: http://www.ieee802.org/3/minutes/nov18/incoming/ITU_SG15_LS-146_to_IEEE_802d3.pdf) Chair summarized the letter. Chair proposed that no response was necessary. Chair asked if there was objection to not sending a response. Suggestion from the floor to defer this question to give people time to review the liaison attachment.

Chair displayed the liaison letter from COBO. (See: http://www.ieee802.org/3/minutes/nov18/incoming/COBO_to_IEEE_802d3_Oct_2018.pdf) Chair summarized the letter. Robert Lingle spoke about the response created in the IEEE P802.3cm Task Force. Chair asked participants to review the response from 802.3cm in preparation for a response before the end of the interim meeting.

Chair announced a series of ad hoc meetings. The meetings are December 5, December 12, December 19, 2018 and January 2, 2019.

Chair reviewed the future meeting dates.

Future Meetings:
- January 2019 Interim
  - Week of January 14, 2019 - Long Beach, CA, USA
- March 2019 Plenary
  - Week of March 11, 2019 - Vancouver, BC, CA

- May 2019 Interim
  - Week of May 20, 2019 - Salt Lake City, UT, USA

Anyone interested in hosting a meeting should contact the Chair or Steve Carlson.

Presentation #1:
"Timeline Proposal for 802.3ck", Beth Kochuparambil
See: http://www.ieee802.org/3/ck/public/18_11/kochuparambil_3ck_01_1118.pdf
- Chair noted that she intends to have a motion to adopt the timeline later in the meeting.

Presentation #2:
"Interleaved 100GbE FEC Sublayer", Mark Gustlin
See: http://www.ieee802.org/3/ck/public/18_11/gustlin_3ck_01_1118.pdf
- Discussed the need to investigate the clock content issue observed in P802.3bs.
- Discussed the DFE tap weight impact on the error propagation.
- The solution on slide 16 would require the retimer device to terminate and regenerate FEC.
- On slide 14, the bottom diagram should be 100GAUI-2 and the middle row diagram is 100GAUI.
- With respect to slide 15, Chair noted that the 2x50G AUI may require expanding the scope of the project.

Presentation #3:
"RS(544,514) FEC performance for 100G", Pete Anslow
See: http://www.ieee802.org/3/ck/public/18_11/anslow_3ck_01_1118.pdf
- It was noted that an FFE plus 1-tap DFE RX architecture would not exhibit the error propagation. It was shown in a previous presentation from the author.
- These simulations assume copper cable or backplane reaches.

Chair noted that 2 late presentations were received from Mike Li. Chair noted that she intends to schedule them in with their topics and asked if there was objection. No one responded.

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Chair noted that participants attending the social event will need to provide additional information to the meeting coordinators.

Chair received several presentation updates since the posting last week. Chair also noted that there were 2 presentations from Rich Mellitz and Ali Ghiasi with technical changes. She asked if there was objection to hearing the updated presentations. No one responded.

Presentation #4:
"COM 100G Revision History, Latest Feedback/Update and Configuration Spreadsheet ", Rich Mellitz
See: http://www.ieee802.org/3/ck/public/18_11/mellitz_3ck_01b_1118.pdf
- Updated version 01b with correction of a participants name.

Chair thanked Rich Mellitz for his continued work on the COM code.

Presentation #5:
"Physical Aspects of Packages for 100GEL & PKG ad-hoc Physical Aspects Summary ", Liav Ben-Artsi
See: http://www.ieee802.org/3/ck/public/18_11/benartsi_3ck_01_0918.pdf
- The package model is ~5 dB @ 26.56GHz. Looking at a way to get to ~4 dB.
- Discussed the 80 fF Cball assumption proposed. There was a request for supporting data used to make the proposal.

Break at ~3:05 p.m. Resumed at ~3:30 p.m.

Presentation #6:
"Impedance and Reach COM Analysis ", Nathan Tracy
See: http://www.ieee802.org/3/ck/public/18_11/tracy_3ck_01_1118.pdf
- Discussed the impact of the trace insertion loss when the impedance was changed.

Presentation #7:
"Chip to Module and Direct Attach Cable Channel Analysis ", Nathan Tracy
See: http://www.ieee802.org/3/ck/public/18_11/tracy_3ck_02a_1118.pdf
- There was a request to provide ERL data for these channels.
- There was a request for data on the lifetime effects of cables in an operating environment (specifically thermal and humidity).

Presentation #8:
"100G C2M Direction Check", Kent Lusted

See: http://www.ieee802.org/3/ck/public/18_11/lusted_3ck_02a_1118.pdf
- Updated version '02a' with a editorial change to move a graphic on a slide to enhance readability. No one objected.
- There was a request to add an item for information on the environmental impact on circuit board construction.

Presentation #9:
"Performance Comparison Study for Rx vs. Tx Based Equalization for C2M Links ", Karthik Gopalakrishnan
See: http://www.ieee802.org/3/ck/public/18_11/gopalakrishnan_3ck_01a_1118.pdf
- Clarifying questions were asked and answered.

Presentation #10:
"Ethernet 106 Gbps VSR C2M Simulation Studies", Mike Li
See: http://www.ieee802.org/3/ck/public/18_11/li_3ck_01_1118.pdf
- Discussed the change in the results with the improved CTLE.
- Discussed the validity of the noise assumptions in the package.

Presentation #11:
"C2M Receiver Architecture ", Ali Ghiasi
See: http://www.ieee802.org/3/ck/public/18_11/ghiasi_3ck_02_1118.pdf
- Discussed the power assumptions in the Boesch paper referenced on slide 6.

Chair stated the intent to cover the Ghiasi_3ck_03_1118 presentation before the end of the day in order to make time for straw polls and discussion on Wednesday.

Presentation #12:
"C2M Simulations with Improved CTLE", Ali Ghiasi
See: http://www.ieee802.org/3/ck/public/18_11/ghiasi_3ck_03a_1118.pdf
- Updated version '03a' with technical changes. Chair summarized the changes and asked if there was objection to hearing the updated presentation. No one responded.
- Discussed the tradeoffs with the proposed CTLE parameters on slide 6.

Chair reviewed the progress to date. Chair presented some options for the start time for Wednesday. There was agreement to leave the start time for Wednesday at 8:00 a.m.

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Motion #3:

Move to:
- Adopt the timeline proposed on slide 5 of kochuparambil_3ck_01_1118

M: Matt Brown
S: Liav Ben-Artsi
Procedural (>50%)
Y: 44, N: 0, A: 8
Results: passes!

Break for the day at ~6:00 p.m.

IEEE P802.3ck 100 Gb/s Electrical Lane Task Force – November 14, 2018

Prepared by Kent Lusted

IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces Task Force meeting convened at ~8:00 a.m., by Kent Lusted on behalf of Beth Kochuparambil.

Kent welcomed attendees.

Kent outlined the plans for the day: hear presentations, conduct straw polls.

Kent reminded participants to sign the attendance book and into the IEEE Meeting Attendance Tool.

Kent reminded participants on the details of the social event in the evening. He noted that the Task Force intends to break for the day by 5:30 p.m.

Kent asked participants to send straw poll requests to him and the Chair.

Presentation #13:
"100GEL C2M Channel Model Study ", Toshiyasu Ito
See: http://www.ieee802.org/3/ck/public/18_11/ito_3ck_01_1118.pdf
- The study did not include the SFP connector. The author expects that the DSFP results should be quite similar.
- It was noted that the S-parameters are available on the tools webpage. (see: http://www.ieee802.org/3/ck/public/tools/index.html)

Presentation #14:
"100GEL Compliance Test Fixtures - MCB, HCB Design ", Sam Kocsis
See: http://www.ieee802.org/3/ck/public/18_11/kocsis_3ck_01_1118.pdf
- No AC caps were used in the measurement data on slide 2.
- Discussed the possibility of a new procedure to test and qualify the test fixtures. The fixtures need to be robust enough to handle the volume of testing on a manufacturing line.

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Chair noted there will be discussion on C2M topics soon.

Chair reminded participants to review the liaison letters that were posted to the website. She will be asking for direction from the Task Force on responses.

Presentation #15:
"Next Generation Ultra Low Loss PCB Materials", Rob Stone
See: http://www.ieee802.org/3/ck/public/18_11/stone_3ck_01_1118.pdf
- The trace width on slide 5 was 6 mil.
- Additional information from the suppliers is available by contacting the author.
- Discussed the material loss assumptions needed to make 9.5 inch traces feasible with 16dB channels.

Break at ~9:05 a.m. Resumed at ~9:20 a.m.

Straw Poll #1:
I would support limiting the C2M scope of the adaptive equalizations to slavick_3ck_02_0918 (slide 10) option A and B.
Yes: 52   No: 0   Abstain: 7
During the discussion of Straw Poll #1, it was noted that a given C2M transmitter may be adjusted to an optimum value for a given channel, possibly thru a select few pre-determined settings, but not an adaptive equalizer controlled thru a link training protocol.

Straw Poll #2
I would support using COM as a tool for the AUI C2M channel analysis to progress towards a baseline proposal.
Yes: 48   No: 0   Abstain: 14

Straw Poll #3
I would support including an informative section in the specification for host channel performance based on COM
Y: 29 , N: 1 , A: 29
Room count: 76

Attendance straw polls:

I will attend the IEEE 802.3ck meetings at the January interim in Long Beach, CA, USA (week of January 14, 2019)

      Y: 54   , M: 13

I will attend the IEEE 802.3ck meetings at the March Plenary in Vancouver, BC, Canada (week of March 11, 2019)

      Y: 55 , M: 13

Break at ~10:10 a.m. Resumed at ~10:30 a.m.

Chair displayed the liaison letter sent to ITU-T SG15. Chair displayed the response from ITU-T SG15. (See:
http://www.ieee802.org/3/minutes/nov18/incoming/ITU_SG15_LS-146_to_IEEE_802d3.pdf).
Pete Anslow noted that the attachment has a incorrect reference to IEEE P802.3ap-2007. Pete offered to submit a comment to ITU-T as the rapporteur and therefore there would be no need to respond. Chair asked if there was objection to following this path. No one responded.

Chair displayed the liaison letter received from COBO. Chair displayed the response letter proposed by the P802.3cm. Brad Booth (Chair of COBO) suggested that the response include the 802.3ck timeline, if one had been adopted; others suggested some acknowledgement of .3cn in the letter. Chair made changes and save the file as
http://www.ieee802.org/3/ck/public/18_11/IEEE_802d3_to_COBO_1118_draftV2.pdf

Motion #4:
Move that:
- the Task Force approve the text in IEEE_802d3_to_COBO_1118_draftV2.pdf with editorial license granted to the Chair (or his appointed agent) as a liaison to COBO

M: Thananya Baldwin
S: Mike Dudek
Technical (>=75%),
Results: passes by voice without opposition

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Chair outlined the plans for the rest of the day: review and discuss backplane topics.

Beth passed the Chair responsibilities to Kent Lusted.

Presentation #16:
"Backplane Discussion Direction Check", Beth Kochuparambil

See: http://www.ieee802.org/3/ck/public/18_11/kochuparambil_3ck_02_1118.pdf
- No questions were asked

Kent Lusted passed the Chair responsibilities back to Beth Kochuparambil.

Presentation #17:
"Server Backplane Channel Analysis ", Howard Heck
See: http://www.ieee802.org/3/ck/public/18_11/heck_3ck_01_1118.pdf
- The connector used for the analysis is a 100 Gbps class connector.
- The crosstalk trace spacing is 3x. There was a request to study 5x spacing.
- The COM configuration for the DFE solution is on slide 5. The FFE COM configuration is in backup.
- There was a request to study the effect of a longer TX FFE on the channels in the presentation.

Presentation #18:
"Trace and Chassis Tolerance vs.COM ", Andy Zambell
See: http://www.ieee802.org/3/ck/public/18_11/zambell_3ck_01_1118.pdf
- Discussed the results on slide 19 for the 25mm package case.
- The connector is not 100 Gbps class, but based on a current 50G product available now.
- The channels were provided as information on the impact from a connector that is not fully mated.
- Discussed the potential change to the COM results when the 30mm package loss is reduced to ~4 dB.

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Break for lunch at ~12:05 p.m. Resumed at ~1:05 p.m.

Presentation #19:
"A Look into Channels for High Connectivity and Scalable Systems", Upen Reddy Kareti
See: http://www.ieee802.org/3/ck/public/18_11/kareti_3ck_01a_1118.pdf
- On slide 6, the table data is for 26.56 GHz. The marker M1 on the plot is set for 28 GHz.
- The channels are posted at http://www.ieee802.org/3/ck/public/tools/index.html

Presentation #20:
"System Complexity/Cost Tradeoffs of Single-Duplex vs. Dual-Duplex Schemes", David Malicoat
See: http://www.ieee802.org/3/ck/public/18_11/malicoat_3ck_01b_1118.pdf

Presentation #21:

"Investigation of COM for DFE- and FFE-based reference receivers", Yunchun Lu

See: http://www.ieee802.org/3/ck/public/18_11/lu_3ck_01_1118.pdf

- On slide 5, it was noted that there was a mix of C2M channels and BP/DAC channels that might influence the conclusions.
- On Slide 13, the ADC was assumed to be 7 bits. Discussed the power impact of a 7 bit ADC.

Chair noted that an updated presentation from Toshiaki Sakai was received with technical changes. The presentation has new data and different conclusions. Chair asked if there was objection. No one responded.

Presentation #22:

"100Gb/s KR COM - Reference Receiver (FFE/DFE) - Reference PKG ", Toshiaki Sakai

See: http://www.ieee802.org/3/ck/public/18_11/sakai_3ck_01a_1118.pdf

- The DFE error propagation effect is not included in the results.

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Break at ~2:55 p.m. Resumed at ~3:15 p.m.

Presentation #23:

"112Gbps LR/Backplane COM New Investigations", Mike Li

See: http://www.ieee802.org/3/ck/public/18_11/li_3ck_02a_1118.pdf

- It was noted that the outlier data point on slide 21 needs further investigation.
- Discussed the need to provide details on the method to determine the sampling phase in the baseline proposal for COM.

Presentation #24:

"Discussion on Reference Receiver in COM", Mau-Lin Wu

See: http://www.ieee802.org/3/ck/public/18_11/wu_3ck_01_1118.pdf

- Discussed some aspects of the MMSE simulation platform used by the author.
- There was a request to run the outlier data point channel on slide 21 from li_3ck_02a_1118 with the author's simulation tools.

Presentation #25:

"Use Case for 100G C2C-S", Ali Ghiasi

See: http://www.ieee802.org/3/ck/public/18_11/ghiasi_3ck_01a_1118.pdf

- Discussed the BER requirement differences of an AUI C2C vs. backplane.

Straw Poll #4:

I would support the package model direction

       A: 1 segment similar to 25/50G COM (Annex 93A)

       B: 2 segment package model similar to slide 7 of mellitz_3ck_01b_1118

       C: Need more information

Pick one.

A: 0   B: 19   C: 19

Room count = 54

Straw Poll #5:

I would support the package use cases

       A: 12mm and 30mm + PTH

       B: Two 30mm iterations representing trace impedance manufacturing tolerances

       C: 12mm AND two 30mm representing trace impedance manufacturing tolerances

       D: Need more information

pick one

A: 3, B: 0 , C: 2, D: 33

Straw Poll #6:

For the C2M, I would support the CTLE changes proposed in ghiasi_3ck_03a_1118, slide 6.

Yes: 32

No: 0

Need more information: 5

Straw poll #7:

I would support the following package Loss (trace, PTH, Cp) parameter cases

       A: Loss parameters as stated in slide #7 of mellitz_3ck_01b_1118 which comes up to ~5dB of loss @26.6GHz for the 30mm PKG

       B: Updated loss parameters as supplied by Rich Mellitz and comes up to a 4dB of loss @26.6GHz for the 30mm PKG

       C: Loss parameters as stated in B for the 30mm PKG case and as stated in A above for the 12mm PKG case

       D: Need more information

A: 0, B: 1 , C: 1 , D: 30

Chair announced a start time of 8:30 a.m. on Thursday. The day will start with a review of the copper cable assembly baselines.

Break for the day at ~5:30 p.m.

IEEE P802.3ck 100 Gb/s Electrical Lane Task Force – November 15, 2018

Prepared by Kent Lusted

IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces Task Force meeting convened at ~8:05 a.m., by Beth Kochuparambil, IEEE 802.3ck Task Force Chair.

Beth welcomed attendees.

Chair outlined the plans for the day: hear presentations, conduct straw polls, closing business.

Chair reminded participants to sign the attendance book.

Chair noted that the second presentation on 100GEL Cable Assembly Characteristics from Sam Kocsis will not be given at the meeting.

Presentation #26:
"Baseline proposals for twin-axial cable Specifications", Chris Diminico
See: http://www.ieee802.org/3/ck/public/18_11/diminico_3ck_01_1118.pdf
- Discussed the feasibility of 2m reach with the QSFP-DD MDI connector.
- On slide 13, the blue line is synthesized bulk cable IL. The red line is the cable assembly IL, including MCBs.
- It was noted that the presentation does not conclude that the 2m QSFP-DD copper cable solution is feasible.

Presentation #27:
"Synthesized Cable Assembly for 0.3ck Project Advancement", Rich Mellitz
See: http://www.ieee802.org/3/ck/public/18_11/mellitz_3ck_02_1118.pdf
- Channels provided are posted on the Task Force website.
- On slide 9, the red dotted line is 1E-4.
- On slide 4, the 10dB IL includes the cable plus the wire attachment.

Straw Poll #8:
I would support the minimum Insertion Loss as the primary requirement for the HCB development.

Yes: 11
No: 5

Abstain: 39

Straw Poll #9:

I would support the inclusion of stacked connectors in the channel analysis towards baseline proposals.

Yes: 3
No: 19
Abstain: 31

Break at ~10:00 a.m. Resumed at ~10:20 a.m.

Straw Poll #10:

I would support a reference impedance of ___ Ohms nominally
(A) 100
(B) 95
(C) 92.5
(D) 90
(E) 85
(Chicago Rules)
A: 25   B: 8   C: 0   D: 0   E: 0

Straw Poll #11:

I would support expanding the loss budget for the copper cable channel IL (TP0-TP5) beyond 28dB.
Y: 10 , N: 15 , A: 22

Straw Poll #12:

I would support further exploration and study of C2C-S without the need for segmented/regenerated FEC (300 mm?).
Yes: 37 ,   No: 1   , Abstain: 9

Presentation #28:

"Nomenclature", Kent Lusted
See: http://www.ieee802.org/3/ck/public/18_11/lusted_3ck_01a_1118.pdf
  ● Updated version "01a" with editorial changes. There was no objection to hearing the updated presentation.
  ● It was noted that the presentation is not intended to be a complete proposal because it does not include references in other Clauses of the specification.
  ● It was noted that there is a straw poll planned to measure the consensus on the single-lane PHY naming preference.

Straw poll #13:

For the single lane copper cable and backplane PHYs, I would support the nomenclature to be:

A: 100GBASE-CR and 100GBASE-KR

B: 100GBASE-CR1 and 100GBASE-KR1

C: Something else

A: 29 , B: 23 , C: 0

Chair reviewed the future meetings.

Chair reviewed the announced ad hocs for December 5, December 12, December 19 and January 2. The announcement was sent over the reflector (see: http://www.ieee802.org/3/100GEL/email/msg00129.html) .

Motion #5:

Move to adjourn.

M: Dave Ofelt

S: Ali Ghiasi

Procedural (>50%)

Passes by voice without opposition.

Meeting adjourned at ~11:25 a.m.

Attendees

Last Name	First Name	Employer	Affiliation	Tuesday	Wednesday	Thursday
Abbott	Justin	Lumentum	Lumentum		x	
Anslow	Pete	Ciena Corporation	Ciena Corporation	x	x	x
Bagdonah	Ighas	Equinox	Equinox	x		
Baldwin	Thananya	Keysight Technologies	Keysight Technologies	x		
Ben Artsi	Liav	Marvell Semiconductor	Marvell Semiconductor	x	x	x
Booth	Brad	Microsoft	Microsoft	x	x	x
Braun	Ralf-Peter	Deutsche Telekom	Deutsche Telekom		x	x
Brooks	Paul	Viavi Solutions	Viavi Solutions	x	x	x
Brown	Matt	MACOM	MACOM	x	x	x
Butter	Adrian	Avera Semiconductor	Avera Semiconductor	x	x	x
Cady	Ed	Luxshare	Luxshare	x	x	
Castro	Jose	Panduit Corp.	Panduit Corp.	x	x	x
Chang	Frank	Source Photonics	Source Photonics	x	x	x

Chattopadhyay	Biman	Synopsys	Synopsys	x	x	x
Chen	C. C. David	Applied Optoelectronics	Applied Optoelectronics	x		
Chuang	Keng Hua	HPE	HPE	x	x	x
Cole	Chris	Finisar	Finisar	x	x	
D'Ambrosia	John	Futurewei	Subsidary of Huawei	x		x
Dawe	Piers	Mellanox	Mellanox	x	x	x
DeAndrea	John	Finisar	Finisar	x	x	
DiMinico	Christopher	MC Communications/Panduit	MC Communications/Panduit			x
Dudek	Mike	Marvell Technologies	Marvell Technologies	x	x	x
Estes	Dave	Spirent Communications	Spirent Communications	x	x	x
Farhoodfar	Arash	Inphi	Inphi	x	x	x
Ghiasi	Ali	Ghiasi Quantum, Huawei	Ghiasi Quantum, Huawei	x	x	x
Gilb	James	GA-ASI, USD, Gilb Consulting	GA-ASI, USD, Gilb Consulting	x	x	
Gopalakrishnan	Karthik	Inphi	Inphi	x	x	x
Grow	Bob	RMG Consulting	RMG Consulting			x
Gustlin	Mark	Cisco	Cisco	x	x	x

He	Xiang	Huawei	Huawei	x	x	x
Healey	Adam	Broadcom Inc	Broadcom Inc	x	x	x
Heck	Howard	Intel	Intel	x	x	x
Hiroaki	Kukita	Yamaichi Electronics	Yamaichi Electronics	x	x	x
Huang	Yifan	Amphenol	Amphenol	x	x	
Ishibe	Kazuhiko	Anritsu	Anritsu	x	x	x
Isono	Hideki	Fujitsu Optical Components	Fujitsu Optical Components	x	x	
Issenhuth	Tom	Huawei	Huawei	x	x	x
Ito	Toshiyasu	Yamaichi Electronics	Yamaichi Electronics	x	x	x
Jackson	Ken	Sumitomo	Sumitomo	x	x	
Kareti	Upen Reddy	Cisco	Cisco	x	x	x
Kawatsu	Yasuaki	Apresia Systems	Apresia Systems		x	x
Kimber	Mark	Semtech	Semtech	x	x	
Klempa	Mike	UNH-IOL	UNH-IOL	x	x	x
Kochuparambil	Beth	Cisco	Cisco	x	x	x
Kocsis	Sam	Amphenol	Amphenol	x	x	x

Lackner	Hans	QoSCom	QoSCom			x
Li	Mike	Intel	Intel	x	x	x
Lin	Allan	Marvell	Marvell	x	x	
Lingle, Jr.	Robert	OFS	OFS	x		
Liu	Zhenyu	Credo Semiconductor	Credo Semiconductor	x	x	x
Lu	Yuchun	Huawei	Huawei	x	x	x
Lusted	Kent	Intel	Intel	x	x	x
Lyubumirsky	Ilya	Inphi	Inphi	x	x	x
Malicoat	David	Senko/Aquantia	Senko/Aquantia	x	x	x
Masuda	Takeo	OITDA/PETRA	OITDA/PETRA		x	
Matoglu	Erdem	Amphenol	Amphenol	x	x	x
Mellitz	Richard	Samtec	Samtec	x	x	x
Miura	Hiroshi	Mitsubishi Electric	Mitsubishi Electric	x		
Nagata	Megumi	Fujitsu	Fujitsu	x	x	x
Nagaz	Takao	Hirose	Hirose		x	
Nicholl	Gary	Cisco	Cisco			x

Nicholl	Shawn	Xilinx	Xilinx	x	x	x
Oberg	Mats	Marvell	Marvell	x	x	x
Ofelt	David	Juniper Networks	Juniper Networks	x	x	x
Palkert	Tom	Molex - MACOM	Molex - MACOM	x	x	x
Pepper	Gerald	Keysight Technologies	Keysight Technologies	x		
Pham	Phong	US Conec	US Conec	x	x	x
Quan	Mingyan	Huawei	Huawei	x	x	x
Radhamohan	Rajesh	Maxlinear	Maxlinear	x	x	x
Rechtman	Zvi	Mellanox	Mellanox	x	x	x
Sakai	Toshiaki	Socionext	Socionext	x	x	x
Sekel	Steve	Keysight Technologies	Keysight Technologies	x	x	x
Shuai	Jialong	Huawei	Huawei	x	x	x
Sommers	Scott	Molex	Molex	x	x	x
Stassar	Peter	Huawei	Huawei	x	x	x
Stone	Rob	Broadcom	Broadcom	x	x	x
Sun	Liyang	Huawei	Huawei	x		

Suzukz	Haoki	Mitsubishi Electric	Mitsubishi Electric	x		
Swanson	Steve	Corning	Corning		x	
Szczepanek	Andre	HSZ Consulting	HSZ Consulting	x	x	x
Takefman	Mike	Inphi	Inphi	x	x	x
Tamura	Kohichi	Oclaro	Oclaro	x	x	
Tan	Kan	Tektronix	Tektronix	x	x	x
Tracy	Nathan	TE Connectivity	TE Connectivity	x	x	x
Trowbridge	Steve	Nokia	Nokia	x	x	x
Umnov	Alexander	Corning	Corning		x	
Vitali	Marco	Sicoya	Sicoya	x	x	
Wang	Roy	HPE	HPE	x		
Wu	Mau-Lin	MediaTek	MediaTek	x	x	x
Xu	Yu	Huawei	Huawei	x		
Young	James	CommScope	CommScope	x	x	x
Yuchun	Lu	Huawei	Huawei	x	x	
Zambell	Andrew	Amphenol	Amphenol	x		

Zerna	Conrad	Frauerhofer IIS	Frauerhofer IIS		x	x
Zhang	Kevin	IDT	IDT	x	x	
Zhang	Rui	LOROM	LOROM		x	x
Zhao	Wenyu	CAICT	CAICT	x	x	
Zhuang	Yan	Huawei	Huawei	x	x	x
Zivny	Pavel	Tektronix	Tektronix	x	x	x