Minutes

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

Interim Meeting
September 12-13, 2018
Spokane, WA, USA

Prepared by Kent Lusted

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IEEE P802.3 100 Gb/s Electrical Lane Study Group – September 12, 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 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_09/agenda_3ck_01a_0918.pdf

Motion #1:
Move to approve the agenda:
- Moved by: Chad Jones
- Second by: Rita Horner
- Passed by voice without opposition

Chair noted that the July minutes were posted shortly after the meeting. Recording Secretary noted that he received no requests for corrections or modifications to the posted minutes. Chair asked if there were any other comments on the minutes. No one responded.

Motion #2:
Move to approved the July 2018 meeting minutes
- Moved by: Adee Ran
- Second by: Rich Mellitz
- 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_09/agenda_3ck_01a_0918.pdf

Chair asked if there was anyone unfamiliar with the Bylaws or Rules. 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 in 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 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.

Chair displayed a list of the action items from the July plenary meeting.

Goals for the meeting:
- Continue technical discussion leading to baseline proposals
- Adopt a timeline

Chair provided a summary of the Task Force status.

Chair reviewed the adopted objectives.

Chair noted that no liaisons were received. It was noted that there was an outstanding response to OIF. However, it was determined that no substantial decisions have been made and that it would be further deferred. No one objected.

Chair reviewed the presentation schedule. Chair reviewed the requests for changes to the order. No one objected.

Chair reviewed the future meeting dates.

Future Meetings:
- November 2018 Plenary
    - Week of November 11, 2018 - Bangkok, Thailand
- January 2019 Interim
    - Week of January 14, 2019 - Long Beach, CA, USA
- March 2019 Plenary
    - Week of March 11, 2019 - Vancouver, BC, Canada

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

Chair thanked Dell EMC for hosting the September interim!

Chair noted that there is likely to be three ad hocs before the November plenary meeting. The details will be announced over the email reflector.

Presentation #1:
"Power Considerations for 400GAUI-4 ", Brian Welch
See: http://www.ieee802.org/3/ck/public/18_09/welch_3ck_01a_0918.pdf
- Discussed the power of the electrical I/O in the module.
- Optical power includes any function associated with the optical side.

Presentation #2:
"Host-to-Module Wiring ", Dave Ofelt
See: http://www.ieee802.org/3/ck/public/18_09/ofelt_3ck_01b_0918.pdf
- Updated version '01a' with a change to a diagram to add missing wires

- Discussed if mux chips will be prevalent in the system or not.
- It was noted that there were errors in the block diagrams on slides 8-10. Updated version '01b'.

Presentation #3:
"100G SERDES Power Study ", Phil Sun
See: http://www.ieee802.org/3/ck/public/18_09/sun_3ck_01a_0918.pdf
- Updated version '01a' with technical updates. Chair asked if there was objection. No one responded.
- It was noted that the presentation did not include a recent 10nm SERDES paper reference from Intel.
- There was a request to clarify if the power numbers include voltage regulator overhead.
- The contribution assumes that 8 taps are required for the channel.

There were several requests to minimize the changes to presentations after the initial posting. The substantive changes were difficult to review during the meeting.

Chair noted that updated presentations with substantial changes will need to be previewed by the Task Force before she asks for approval to hear it.

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

Presentation #4:
"Methodology and Architectural Considerations for C2M", Ali Ghiasi
See: http://www.ieee802.org/3/ck/public/18_09/ghiasi_3ck_02_0918.pdf
- Retimers may or may not be in the path between the ASIC and the optical module.
- Discussed options for the link training process to a module.
- Proposal would provide an option to use COM for the system designers. Compliance would not require it.

Break at ~10:45 a.m.   Resumed at ~11:05 a.m.

Presentation #5:
"Ethernet 100Gb/s Per Lane VSR Studies: Typical TX FFE + RX CTLE/FFE vs. Longer TX FFE + RX CTLE ", Mike Li
See: http://www.ieee802.org/3/ck/public/18_09/li_3ck_01b_0918.pdf
- It was noted that the analysis should be repeated for another set of channels.
- There was a request to include more information on the analog delay variation impact.

- The package assumption is ~3dB insertion loss. There was a request to use a higher loss package that is commonly found in a switch.
- Updated version '01b' with color coding on slide 8 fixed.

Presentation #6:
"100GEL C2M Channel Analysis Update ", Jane Lim
See: http://www.ieee802.org/3/ck/public/18_09/lim_3ck_01_0918.pdf
- There was a request for the QSFP-DD channels be made available on the Task Force website.
- Discussed the assumptions included in the stated target of 400mW/lane; does not include the optical interface.

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

Chair noted that straw polls were planned on the C2M topic. The straw polls would occur today or tomorrow.

Break at ~12:05 p.m. Resumed at ~1:15 p.m.

Presentation #7:
"Initial C2M Results and Choice of CTLE ", Ali Ghiasi
See: http://www.ieee802.org/3/ck/public/18_09/ghiasi_3ck_01_0918.pdf
- The results shown are for the 15 mm package, not the 30 mm package.

Presentation #8:
"Thoughts About Adaptive Transmitter FFE for 802.3ck Chip-to-Module ", Adee Ran
See: http://www.ieee802.org/3/ck/public/18_09/ran_3ck_01_0918.pdf
- Discussed the potential increase in time for link training via sideband.
- Discuss some interoperability considerations.

Presentation #9:
"C2M Option Trade-Offs ", Jeff Slavick
See: http://www.ieee802.org/3/ck/public/18_09/slavick_3ck_02_0918.pdf
- Discussed the various options shown on slide 11.

Break at ~3:25 p.m Resumed at ~3:40 p.m.

Chair noted that the meeting will run until ~7pm tonight.

Chair noted that she is withdrawing the timeline presentation. Late presentations will be deferred to the end of the meeting on Thursday.

Straw Poll #1:
What should be the C2M channel loss?
(A) ~12dB
(B) ~16dB
(C) ~12 and ~16 dB, 2 AUIs with different losses
(D) More information needed
Pick one
A: 15 ,   B: 25 , C: 15 , D: 11
Room count: 93

Straw Poll #2:
I would support the C2M direction of
(A) slavick_3ck_02_0918 option A,
(B) slavick_3ck_02_0918 option B/C/D/E/F
(C) two AUI types
(D) More information needed
pick one
A: 14,   B: 25,   C: 5,   D: 20

Straw poll #3:
If we go with 16dB, where should equalization be added?
(A) Fixed TX FFE and more complex RX (slavick_3ck… option B)
(B) Adaptive TX with some kind of link training (slavick_3ck… option C/D/E/F)
(C) More information needed
Pick one
A: 39,   B: 11,   C: 16

Straw poll #4
If we were to use Adaptive TX with some kind of link training , what style(s) of link training should be further explored?
(A) Tx FFE set with registers at start-up - leveraging Annex 120D (Slavick_3ck_02 option C)
(B) Repeatedly monitor registers - leveraging Annex 120D (Slavick_3ck_02 option D)
(C) Start-up protocol such as CI 136 (Slavick_3ck_02 E)
(D) A continuous protocol (Slavick_3ck_02 F)
(chicago rules)
A: 25 B: 29   C: 24 D: 22

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

Presentation #10:
"Physical Aspects of Packages for 100GEL & PKG ad-hoc Physical Aspects Summary ", Liav Ben-Artsi
See: http://www.ieee802.org/3/ck/public/18_09/benartsi_3ck_01_0918.pdf
- Clarifying questions were asked and answered.

Chair noted that the FEC related presentations were moved to Thursday morning due to time constraints.

Presentation #11:
"Flexible Package Modeling for COM", Rich Mellitz
See: http://www.ieee802.org/3/ck/public/18_09/mellitz_3ck_01_0918.pdf
- Discussed the impact of Cd.

Presentation #12:
"100Gb/s Backplane Channel Simulation (update) ", Toshiaki Sakai
See: http://www.ieee802.org/3/ck/public/18_09/sakai_3ck_01b_0918.pdf
- Updated version '01b' with correction to slide 7.

Straw poll #5:
Should we continue to use the flexible package modeling shown in Mellitz_3ck_01_0918 to investigate package options?
(pick 1)
Y: 31   N: 2   Need More Information: 6

Straw poll #6:
I would support a target package impedance of ___ Ohms nominally
(A) 100
(B) 95
(C) 92.5
(D) 90
(E) 85
(Chicago Rules)
A: 4, B: 17 C: 22 D: 18 E: 10

Presentation #13:

"Cl 73 AN Baseline Proposal for 802.3ck", Jeff Slavick

See: http://www.ieee802.org/3/ck/public/18_09/slavick_3ck_01_0918.pdf

Motion #3:

Move to adopt the AN baseline proposed in slavick_3ck_01_0918.pdf, slides 6-9

M: Jeff Slavick

S: Dave Ofelt

Technical (>=75%),

Y: 36 , N: 0 , A: 0

Results: passes!

Break for the day at ~6:50 p.m.

IEEE P802.3 100 Gb/s Electrical Lane Study Group – September 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 ~8:00 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 and into the IEEE Meeting Attendance Tool.

Chair noted that two updated presentations from Ramin Farjadrad and Nathan Tracy had technical changes. These were posted to the TF website for consideration. Chair will ask at the time of each of their presentations if there is any objection to hearing the updated presentations.

Presentation #14:
"RS(544,514) FEC performance with 4:1 interleaving", Pete Anslow
See: http://www.ieee802.org/3/ck/public/18_09/anslow_3ck_01_0918.pdf
- There was a request for the SERDES experts to validate that the tap weights are reasonable.
- Discussed the error propagation assumptions.

Presentation #15:
"Preliminary Studies on DFE Error Propagation, Precoding, and their Impact on KP4 FEC Performance for PAM4 Signaling Systems", Geoff Zhang
See: http://www.ieee802.org/3/ck/public/18_09/zhang_3ck_01a_0918.pdf
- Updated version '01a' had corrected pictures. Chair asked if there was objection. No one responded.
- Clarifying questions were asked and answered.

Presentation #14:
"100GEL DSFP MDI Proposal for 802.3ck", Greg McSorley
See: http://www.ieee802.org/3/ck/public/18_09/mcsorley_3ck_01b_0918.pdf
- There was a request for S-parameter files for the connector.

Presentation #15:

"100GEL OSFP MDI Proposal for 802.3ck", Greg McSorley

See: http://www.ieee802.org/3/ck/public/18_09/mcsorley_3ck_02b_0918.pdf

- Clarifying questions were asked and answered.

Presentation #16:

"Supporting Data to Demonstrate 100Gbps Capability of Proposed MDIs", Nathan Tracy

See: http://www.ieee802.org/3/ck/public/18_09/tracy_3ck_01a_0918.pdf

- Updated version '01a' with COM analysis. Chair asked if there was opposition. No one responded.
- The results on slide 7 use the default COM configuration file shown on the page.
- Discussed the differences between the plots on slide 5. It is related to changes in the connector design.
- Discussed the feasibility of meeting COM with a 16dB channel.
- The connector and the host traces were designed to 100 ohms differential.

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

Presentation #17:

"SFP-DD Overview", Tom Palkert

See: http://www.ieee802.org/3/ck/public/18_09/palkert_3ck_02_0918.pdf

Break at ~10:15 a.m. Resumed at ~10:40 a.m.

Presentation #18:

"802.3ck 100G Serial Copper MDIs", Tom Palkert

See: http://www.ieee802.org/3/ck/public/18_09/palkert_3ck_01_0918.pdf

- Discussed the naming convention of the connectors and whether the rate should be included in the name.

Straw poll #7:

I would support the adoption of the 7 proposed MDI connectors in palkert_3ck_01_0918 slide 3?

Yes: 47, No: 2, Need More Information: 12

Room count: 80

Presentation #19:

"MTF Measurement Methods", Greg McSorley

See: http://www.ieee802.org/3/ck/public/18_09/mcsorley_3ck_03_0918.pdf

- Discussed the difficulty with mated test fixtures.

Presentation #20:

"Baseline proposals for copper twinaxial cable specifications", Chris Diminico

See: http://www.ieee802.org/3/ck/public/18_09/diminico_3ck_01_0918.pdf

- Discussed the host loss target assumptions.

Straw Poll #8:

I would support adopting the following baseline proposals for copper twinaxial cable as presented in diminico_3ck_01_0918.pdf

- Figure 136-2 –revised to 100GBASE (slide 8)
- Tx/Rx –PCB IL with TBD (slide 11-13)
- Host Channel IL @ 26.56 GHz with TBD (slide 14)
- Channel and Cable Assembly IL @ 26.56 GHz with TBD (slide 15-16)
- Cable assembly parameters with TBD (slide 17)
- TP0 or TP3 Test Fixture IL: For 0.01 GHz ≤ f ≤ 40(TBD) GHz with TBD (slide 18-19)
- Cable assembly test fixture IL with TBD: For 0.01 GHz ≤ f ≤ 40(TBD) GHz (slide 20)
- Cable assembly test fixture reference IL with TBD: For 0.01 GHz ≤ f ≤ 40(TBD) GHz (slide 21)
- Mated test fixture parameters with TBD (slide 22-23)

Y: 17,   N: 3   ,   Need More Information: 27

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

Break at ~12:20 p.m.   Resumed at ~1:35 p.m.

Chair announced a potential change to the order of the presentations. Chair asked if there was objection. No one responded.

Chair asked participants to inform her and the Vice Chair of any straw polls and motions.

Presentation #21:

"A Dual-Duplex PAM4 100Gbps PHY Analysis", Ramin Farjadrad

See: http://www.ieee802.org/3/ck/public/18_09/farjadrad_3ck_01b_0918.pdf
- ● Updated version '01b' with technical changes. Chair asked if there objection. No one responded.
- ● Discussed synchronous vs. asynchronous mode of operation. The data presented assumed master mode clocking.

Presentation #22:
"A Proposed ADC-DSP Receiver Reference Model for COM", Yuchun Lu
See: http://www.ieee802.org/3/ck/public/18_09/lu_3ck_01_0918.pdf
- ● Discussed the proposed ADC-DSP received model on slide 5.
- ● Discussed the allocation of the noise into the COM margin.

Break at ~3:00 p.m. Resumed at ~3:15 p.m.

Presentation #23:
"Discussion on FFE and DFE Coefficients Calculation in COM", Mau-Lin Wu
See: http://www.ieee802.org/3/ck/public/18_09/wu_3ck_01_0918.pdf
- ● DIscussed bug found and issues with COM instantiation v2.41 by Mellitz. Updated COM instantiation to follow.

Presentation #24:
"Comparison Between Equalization, COM Package Models, and COM for 100GBase-KR Channels", Rich Mellitz
See: http://www.ieee802.org/3/ck/public/18_09/mellitz_3ck_02c_0918.pdf
- ● Updated '02b' version added clarification and moved redundant data to backup slides.
- ● Updated version '02c' with a discussion slide. Chair asked if there was objection. No one responded.
- ● It was noted that the COM spreadsheet list in the slides has several typographical errors.
- ● Discussed the complexity of the proposed changes to COM.

Straw Poll #9:
Do you support a reference receiver for copper cable and backplane COM to be…
    (A) DFE as is in past COM (i.e. Annex 93A)
    (B) ZF/MMSE FFE + DFE
    (C) ZF/MMSE FFE + DFE ADC/DSP model
    (D) Something else
    (E) Need more information
(pick 1)
A: 18   B: 13   C: 4   D: 0   E: 14

Straw Poll #10:

The 802.3ck task force should continue to explore/refine COM as a method for C2M channel evaluation vs equalizer complexity.
Yes: 46, No: 1, Need more information: 1
Room Count 61

Attendance straw Polls:
I will attend the IEEE 802.3ck meetings at the November Plenary in Bangkok, Thailand (week of November 11, 2018)
Y: 33   , M: 20
I will attend the IEEE 802.3ck meetings at the January interim in Long Beach, CA, USA (week of January 14, 2019)
Y: 51   , M: 10

Presentation #25:
"112 Gbps COM Investigations for Backplane with 20 mm Reference Package Addition", Mike Li
See: http://www.ieee802.org/3/ck/public/18_09/li_3ck_02_0918.pdf
  - Discussed the need for the case of a 30 mm package connected to a 20 mm package to represent the switch to end-point device.
  - The 20 mm package case is intended to represent the FPGA case.

Presentation #26:

"Possible Tools for Improving Performance in Electrical Links", Adee Ran
See: http://www.ieee802.org/3/ck/public/18_09/ran_3ck_02a_0918.pdf
  - Updated version '02a' with the removal of a summary slide and replacing it with the correct one. Chair asked if there was objection. No one responded.
  - Discussed the NEXT cancellation concept.

Motion #4:
Move to
adopt the MDIs in palkert_3ck_01_0918, slides 3-9
M: Greg McSorley
S: Nathan Tracy
Technical (>=75%),
Y: 36, N: 6,   A:=21
Results: passes!

Chair asked for a show of hands regarding moving Straw Poll #8 to a similar motion. Discussion of benefits of framework -style baselines ensued. Conclusion was to not move into motion at this time.

Chris Diminico ask for participants to share what information they would like to see on the copper twin-axial cable baseline. The feedback included:
- Remove the TBDs in the framework.
- Example of an end-to-end channel and realistic MDI connectors. Data to support manufacturing feasibility.

Chair announced ad hocs will be on October 3, 17, 24. Details will be announced over the Task Force email reflector.

Early registration for the November 2018 Plenary in Bangkok, Thailand ends on September 24.

Motion #5:
Move to adjourn.
M: Greg McSorley
S: Mike Dudek
Procedural (>50%)
Passes by voice

Meeting adjourned at ~5:50 p.m.

Attendees

Last Name	First Name	Employer	Affiliation	Wednesday	Thursday
Anslow	Pete	Ciena Corporation	Ciena Corporation	x	x
Baca	Rich	Microsoft	Microsoft	x	x
Baden	Eric	Broadcom	Broadcom	x	x
Balasubramonian	Venugopal	Marvell	Marvell	x	
Baumgartner	Steven	Global Foundries	Global Foundries	x	x
Ben Artsi	Liav	Marvell Semiconductor	Marvell Semiconductor	x	x
Bhatt	Vipul	Finisar	Finisar	x	
Braun	Ralf-Peter	Deutsche Telekom	Deutsche Telekom	x	x
Burrell	Gary	Elenion	Elenion	x	
Butter	Adrian	Global Foundries	Global Foundries	x	x
Carlson	Craig	Marvell	Marvell	x	x
Chalupsky	David	Intel	Intel	x	x
Chattopadhyay	Biman	Synopsys	Synopsys	x	x

Choudhury	G. Mabud	OFS	OFS	x	x
Cole	Chris	Finisar	Finisar	x	
Dawe	Piers	Mellanox	Mellanox	x	x
DeAndrea	John	Finisar	Finisar	x	
Djahanshahi	Hormoz	microsemi	microsemi	x	x
Dudek	Mike	Marvell Technologies	Marvell Technologies	x	x
Ewen	John	Global Foundries	Global Foundries	x	x
Farjad	Ramin	Aquantia	Aquantia	x	x
Filip	Jan	Maxim Integrated	Maxim Integrated	x	
Fung	Lawrence	Finisar	Finisar	x	x
Ghiasi	Ali	Ghiasi Quantum, Huawei	Ghiasi Quantum, Huawei	x	x
Gopalakrishnan	Karthik	Inphi	Inphi	x	x
Gore	Brandon	Samtec	Samtec	x	
Gorshe	Steve	microsemi	Microchip	x	x
Gustlin	Mark	Xilinx	Xilinx	x	x
He	Xiang	Huawei	Huawei	x	x

Healey	Adam	Broadcom Inc	Broadcom Inc	x	x
Heck	Howard	Intel	Intel	x	x
Hiroaki	Kukita	Yamaichi Electronics	Yamaichi Electronics	x	
Holden	Brian	Kandou Bus	Kandou Bus	x	x
Horner	Rita	Synopsys	Synopsys	x	x
Huang	Cathy	Huawei	Huawei	x	x
Ingham	Jonathan	Foxconn Interconnect Technology	Foxconn Interconnect Technology	x	
Isono	Hideki	Fujitsu Optical Components	Fujitsu Optical Components	x	x
Issenhuth	Tom	Huawei	Huawei	x	
Jackson	Ken	Sumitomo	Sumitomo	x	x
Johnston	Margaret	Cadence	Cadence	x	
Jones	Chad	Cisco	Cisco	x	
Kareti	Upen Reddy	Cisco	Cisco	x	x
Kimber	Mark	Semtech	Semtech	x	x
Klempa	Mike	UNH-IOL	UNH-IOL	x	x
Kochuparambil	Beth	Cisco	Cisco	x	x

Lambrecht	Frank	Gigamon Inc	Gigamon Inc	x	x
Lapak	Jeff	UNH-IOL	UNH-IOL	x	
LeCheminant	Greg	Keysight Technologies	Keysight Technologies	x	x
Levin	Alex	Microsoft	Microsoft	x	x
Li	Mike	Intel	Intel	x	x
Lim	Jane	Cisco	Cisco	x	x
Lingle, Jr.	Robert	OFS	OFS	x	
Liu	Hai-Feng	Intel	Intel	x	
Liu	Karen	Lightwave Logic	Lightwave Logic	x	
Lusted	Kent	Intel	Intel	x	x
Lyubumirsky	Ilya	Inphi	Inphi	x	
Maki	Jeffery	Juniper Networks	Juniper Networks	x	x
Malicoat	David	Senko/Aquantia	Senko/Aquantia	x	x
Matoglu	Erdem	Amphenol	Amphenol	x	x
Matsui	Yasuhiro	Finisar	Finisar	x	
McMillan	Larry	Western Digital	Western Digital	x	x

McSorley	Greg	Amphenol	Amphenol	x	x
Mellitz	Richard	Samtec	Samtec	x	x
Muller	Shimon	Axalume	Axalume	x	x
Nakamoto	Edward	Spirent Communications	Spirent Communications	x	x
Nicholl	Shawn	Xilinx	Xilinx	x	x
Nishimura	Takeshi	Yamaichi Electronics	Yamaichi Electronics	x	x
Nowell	Mark	Cisco	Cisco	x	x
Ofelt	David	Juniper Networks	Juniper Networks	x	x
Pachon	Arturo	TE	TE	x	x
Painter	Chris	Marvell	Marvell	x	x
Palkert	Tom	Molex - MACOM	Molex - MACOM	x	x
Parthasarathy	Vasu	Broadcom	Broadcom	x	
Pham	Phong	US Conec	US Conec	x	
Philips	Jeff	Teledyne Lecroy	Teledyne Lecroy	x	x
Piehler	David	Dell EMC	Dell EMC	x	
Priest	Ed	Juniper Networks	Juniper Networks	x	x

Quan	Mingyan	Huawei	Huawei	x	x
Rabinovich	Rick	Keysight Technologies	Keysight Technologies	x	x
Ran	Adee	Intel	Intel	x	x
Rechtman	Zvi	Mellanox	Mellanox	x	x
Rotolo	Salvatore	ST Microelectronics	ST Microelectronics	x	x
Sakai	Toshiaki	Socionext	Socionext	x	x
Shrikhande	Kapil	Innovium	Innovium	x	
Slavick	Jeff	Broadcom Limited	Broadcom Limited	x	x
Sommers	Scott	Molex	Molex	x	x
Sprague	Ted	Infinera	Infinera	x	x
Srivastava	Atul	NEL-A	NEL-A	x	
Stassar	Peter	Huawei	Huawei	x	x
Stephens	Jeremy	Intel	Intel	x	x
Stone	Rob	Broadcom	Broadcom	x	x
Summers	Robert	Maxim Integrated	Maxim Integrated	x	x
Sun	Liyang	Huawei	Huawei	x	x

Sun	Phil	Credo	Credo	x	x
Takahara	Tomoo	Fujitsu Laboratories	Fujitsu Laboratories		x
Tooyserkani	Pirooz	Cisco	Cisco	x	x
Tracy	Nathan	TE Connectivity	TE Connectivity	x	x
Trowbridge	Steve	Nokia	Nokia	x	x
Twombly	Jeff	Credo	Credo	x	x
Ulrichs	Ed	Source Photonics	Source Photonics	x	
Umnov	Alexander	Corning	Corning	x	
Welch	Brian	Luxtera	Luxtera	x	x
Wu	Mau-Lin	MediaTek	MediaTek	x	x
Xu	Yu	Huawei	Huawei		x
Yamamoto	Shuto	NTT	NTT		x
Yang	Wieruz	Huawei	Huawei	x	
Young	James	CommScope	CommScope	x	x
Yuchun	Lu	Huawei	Huawei	x	x
Zambell	Andrew	Amphenol	Amphenol	x	x

Zhang	Geoffrey	Xilinx	Xilinx	x	x
Zhou	Richard	Charter	Charter	x	x
Zivny	Pavel	Tektronix	Tektronix	x	