

IEEE802.3ab Minutes for Plenary meetings 10-13 November 1997
Montreal, PQ, CANADA

MEETINGS HELD:

Monday 10 November: 0830-1200

Presentation of draft 1.0

Tuesday 11 November: 1300-1800

Resolution of startup

Wednesday 12 November: 0830-1230, 1330-1600

Planning, interim meetings, reports, draft review

SCHEDULE TO MARCH 98 (as per group consensus):

3 Nov 97: D1.0 posted

10-12 Nov 97: d1.0 review

17 Nov 97: post d1.1 reflecting changes from plenary

17 Dec 97: comment period for d1.1 closes (see review process below)

12-13 Jan 98: interim meeting in Dallas hosted by TI (hotel to be announced)

16 Jan 98: post d2.0 reflecting resolution of comments on d1.1

13 Feb 98: comment period for d2.0 closes

16-17 Feb: interim in San Francisco Bay area (location & hotel to be announced)

23 Feb 98: post dd.1 reflecting resolution of comments on d2.0

9 March 98: 802 plenary opens

REVIEW PROCESS (as per group consensus)

1. All drafts to be distributed electronically via the FTP site
2. Comment form to be posted to FTP site
3. Comments to be sent to editor by email (preferred) or FAX
4. Editor will distribute comments for resolution
5. Responses will be sent to commentors via email
6. Comments and responses will be posted to the FTP site
7. Revised draft showing comment resolution will be posted to FTP site to provide
8. Task Force will review and approve comments, responses and draft changes and resolve open comments.

ASSIGNED ACTION ITEMS:

Hiep Tran, Sreen Raghavan to simulate startup routine

Chris DiMinico to prepare informative annex on new cable installation guidelines

John Creigh to post MatLab test code to reflector

John Creigh to provide text on jitter for receive electrical spec on 40-87

John Creigh to determine source of symbols in 40.4.1.2

Colin Mick to determine how to include MatLab code in draft

Colin Mick to correct typos on 40-86

Colin Mick to clean up internal references

Colin Mick—check Auto-Negotiation physical interface between 1000BASE-T and 100BASE-TX

Colin Mick—common mode to TX values as per Wednesday #16

Dan Dove to provide input on test specifications

Dan Dove to provide common mode measures

Jim Parker—text on GMII electrical jitter spec

Sreen Raghavan and Hiep Tran to provide input on transmit timing

Ramin Nobakht, Dan Ray and John Creigh to provide transmit distortion numbers

Dan Dove, Sailesh Rao to work out details on start-up & prepare state machine.

John Creigh, Sreen Raghavan and Ramin Nobakht to review start-up

UNASSIGNED ACTION ITEMS:

Investigation of alien next

FORMAL PRESENTATIONS (to be posted to FTP site):

Clause 40 Cabling Specifications Update—Chris DiMinico

1000BASE-T PMA Issues and Notes—John Creigh, Oscar Agazzi

1000BASE-T Auto-Negotiation—Mark Feuerstraeter

SC25/WG3 meeting, Munich: 15-17 Sept 1997 (Customer Premises Cabling)—Alan Flatman

Phase Requirements in 1000BASE-T Start-up Protocols—Hiep Tran

Startup Protocol for 1000BASE-T—Oscar Agazzi, Andy Castellano, John Creigh, Mehdi Hatamian, Henry Samueli

Startup Protocol for 1000BASE-T—Dan Dove

A Risk-Free Startup Protocol for 1000BASE-T—Sailesh Rao

MOTIONS PASSED:

Limit consideration of start-up proposals to those by Rao, Agazzi, Tran, Kardontchik, Azadet, Dove
M Makarem 2nd ? Y: 24, N: 1, AB: 14 (technical passed)

Accept Dan Dove compromise proposal as the startup protocol for 1000BASE-T

M: Jover, S: Rao, Y: 23, N: 7, A: 18 (Technical, passed)

Straw Poll ranking start-up proposals(multiple choices were allowed in the poll):

Sailesh Rao proposal:	27
Dan Dove proposal	15
Kamran Azadet proposal:	11
Oscar Agazzi proposal:	10
Hiep Tran proposal:	5
Jaime Kardontchik proposal:	1

Poll on February 16-17 meeting location:

Irvine:	12
San Francisco Bay Area:	25

Straw poll on guidance to provide information on cabling for “new” CAT 5 installations per TIA references

Y	13
N	12
A	13

Motion re GMII electrical jitter: 802.3ab recommends that the following be added to the GTX_CKM specification: “Jitter on GTX_CLK shall not exceed 1.0ns pk-pk relative to an un-jittered reference at the same frequency as the GTX_CLK under test.” Y: 21, N: 0, AB: 6

DETAIL:

Monday, November 11

- George Eisler presented the agenda for the day—presentations by subclause authors, followed by critiques from 1st level reviewers.
- Chris DiMinico presented 40.9—link segment characteristics
 - 2.1 Changes in ANSI/TIA/EIA-568A will cover return lost FEXT & ELFEXT
Addendum with changes comes up for vote on 17Nov98
Will be reflected in ANSI/TIA/EIA568A and ANSI/TIA/EIA-TSB67

2.2 DiMinico suggested that the normative section cover the installed base of cables, but that an informative section be added to give recommendations for future installations based on at least 19956 cabling specifications. He suggested that this information be covered in an informative section or annex.

2.3 DiMinico warned the group about the possibility of alien crosstalk and suggested that the problem be investigated. Alien crosstalk with Category 5 cabling can occur when multiple cables are "speedwrapped" into a single bundle so they can be pulled as a single cable and the wraps are not removed after the cable has been pulled. It can also happen when cables are dressed tightly together with cable ties at the wiring closet or machine room.

2.4 Concern was raised about return loss limits for the channel and basic link. There may be a problem with two connecting cables in close proximity that would limit the use of cross connects and require specification of interconnects..

A cross connect uses a punchdown block and patch panel so there are two short connectors in close proximity.

Eqpt-----Patch-----Pblock-----Wall outlet

An interconnect eliminates the patch panel, so the equipment is connected by connecting cable directly to the punchdown block.

Eqpt-----Pblock-----Wall outlet

2.5 Colin Mick asked how the link section dealt with quad and shielded cable. DiMinico responded that 40.9 defined links in terms of performance rather than construction. As long as links built with quad or shielded cable meet the performance specs in 40.9 there should not be a problem.

2.6 A question was raised about skew. DiMinico indicated that skew values are provided in ANSI/TIA/EIA-568A.

3. John Creigh presented sections 40.5 (PMA) and 40.7 (PMA Electrical.)

3.1 These sections are updated versions of similar subclauses that appeared in 802.3y (100BASE-T2.) There has been a major rework of 40.7.

3.2 Major issues:

3.2.1 Jitter specs for high & low frequency limits, TX-TCLK to TX_Output jitter, HF limit and maximum tolerable SNR degradation from jitter.

3.2.2 DC Wander and rate of occurrence of errors attributable to DC Wander

3.2.3 MDI impedance balance—do we need a value for this and, if so, is the current spec OK?

3.2.4 MDI differential impedance—is the current value adequate?

3.2.5 Transmitter distortion—should a hybrid be added to the transmit test fixture?

3.2.6 Test channel—This is needed to test for jitter. Creigh proposes changing the digital filter device used for 100BASE-T2 with a fixture assembled from four different cable segments.

3.2.7 Rise & fall items for the transmitter—currently using 3/5 microseconds.

4. Sailesh Rao presented sections 40.3 (PHY Control) and 40.4 (PCS)

4.1 PHY CONTROL

4.1.1 Based on T2

4.1.2 Changed "Not_OK" in T2 loc_rcvr_status to "TNOK" and "RNOK" in 1000BASE-T to split loc_rcvr_status. Did not touch rem_rcvr_status.4.1.3 Added PHYC_Coding_indicate

4.1.4 Added PHYC_TXMode_indicate

4.1.5 Current version reflects the HDSL startup algorithm. The state machine is the same as in T2, but adds a Timing Acquisition state.

4.1 PCS

4.2.1 based on T2, but changed nibbles to bytes

- 4.2.2 Same side stream scrambling as T2, but must generate 12 bits—8 for GMII byte plus bits for convolutionary encode and carrier expansion
- 4.2.3 Currently using a 2-level signal during startup, but can go to 3 level or reduce transmit power variation and ensure similar levels at transmit & idle.
- 4.2.4 Creigh indicated a preference for 3hree (+2,0,-2) levels
- 4.2.5 Rao noted that the PCS section needs some tuning. Much of it was drawn from T2 and requires changes to reflect use of four pair rather than two, GMII rather than MII, etc.
- 4.2.6 Symbol probability during Trellis coding

Symbol	-2	-1	0	+1	+2
Probability	11/64	14/64	14/64	14/64	11/64
- 5.0 Mark Feuerstraeder presented 40.6—management functions
- 5.1 Proposed handling AutoNegotiation next page internally within PHY. This means that some of the bits (e.g., seed bits) sent across the link will not be shown, but these bits are not needed by the end user.

AN OPEN DISCUSSION ON STARTUP FOLLOWED

- 6.0 Oscar Agazzi made a presentation summarizing the three primarily startup proposals—
 - ISDN-like: master and slave converge in half-duplex
 - HDSL-like: master and slave converge in full-duplex
 - modified ISDN-like: send bursts from master during slave convergence
 His key points—
 - There is no evidence that Phase Drift at the slave is a problem during PLL freeze.
 - When comparing modified ISDN-like and HDSL-like, non-reference-directed convergence at the DFE is not guaranteed if phase must be acquired simultaneously.
 - HDSL field experience is not applicable to 1000BASE-T because:
 - HDSL operates on one pair, not four
 - 1000BASE-T requires 4dB of coding gain but Coding gain is not available during startup
 - A/D resolution of 1000BASE-T is lower
- 7.0 Sailesh Rao made a presentation in support of HDSL-like
 - HDSL works on two pair, not one.
 - Both HDSL and 1000BASE-T use two-level codes during startup
 - The operational environment of 1000BASE-T is much cleaner than that of HDSL
- 8.0 Sreen Raghavan noted that at the physical level, the two HDSL channels are separate and that in HDSL there is no coding in training or operations.
- 9.0 Dan Dove raised concern about accumulated Phase Error and the potential impact of freezing at a point of maximum error.
- 10.0 Ramin Nobakht stated that changing the bandwidth during the freeze period should have no effect on the PLL.
- 11.0 Sreen Raghavan stated the he has simulated both HDSL-like and ISDN-like and is satisfied that both work. He prefers ISDN-like because he feels it is more robust.
- 12.0 Sailesh Rao stated that in the ISDN-like approach, during Master DFE/timing convergence the adaptation is on only 25 percent of the time, making it vulnerable to jitter.
- 13.0 Refutation of 11.0 by Oscar Agazzi & Sreen Raghavan.
- 14.0 George Eisler asked if there was any chance for a compromise between the various proposals.
- 15.0 Brief conceptual approaches for compromise were presented by Hiep Tran and Kamran Azadet.
- 16.0 Dan Dove specified two points: 1) Don't want any restriction on what the master and Slave do after some period of time and 2) we should assume that the slave may not have recovered timing during step two and might still be on local time.
- 17.0 Monday meeting closed.

Tuesday, November 11, 1997

- 1.0 Alan Flatman made a short presentation summarizing results of ISO/IEC SC25, working group 3 October 1997 meeting
- 1.1 Channel and link definitions in 11801 aligned to those in ANSI/TIA/EIA-568A
 - 1.2 Return loss values firmed up
 - 1.3 New edition of 11801 due in 2000.
 - 1.3.1 Delete Cat 3, Cat 4, 150 ohm cabling
 - 1.3.2 Add power-sum and far-end crosstalk measutres
 - 1.3.3 Specific cable coupling attenuation
 - 1.3.4 200MHz ClassE/Cat 6 UTP
 - 1.3.4.1 4 pr
 - 1.3.4.2 RJ45
 - 1.3.4.3 (like Anixter Level 7 System)
 - 1.3.4.4 >10dB better NEXT
 - 1.3.5 600MHz Class F/Cat 7 STP
 - 1.3.5.1 2 pr RJ 45
 - 1.3.5.2 4 pr with new connector
 - 1.3.5.3 working on field testing
 - 1.3.6 Open office (zone) wiring
 - 1.3.7 Centralized optical architecture (to 300M)
 - 1.4 Classification for fiber
- 2.0 Hiep Tran presented a compromise start-up proposal
- 3.0 Bin Gao presented Jaime Kardontchik's most recent compromiose start-up proposal (as per reflector)
- 4.0 Sailesh Rao made a presentation on the proposed HDSL-like start-up.
- 5.0 Comment from John Creigh that killer packet is designed to deal with DC Wander, not timing issues.
- 6.0 Dan Dove offered a compromise start-up proposal
- 7.0 Dan Ray made a presentation comparing ISDN, HDSL and the HDSL-like proposal for 1000BASE-T. (2 slides, one reproduced below)

	EC taps	DFE/FFE Taps	Loss@Nyquist	Signal/Echo ratio
ISDN	>100	>64	>30dB	-23dB
HDSL	>100	>80	>28dB	-26dB
1000BASE-T	~50	~10	<20dB	>16dB

- 8.0 Mike McConnell reiterated the compromise proposed by Kamran Azadet
Have a defined period of sequenced start-up followed by an open period which could be used for blind start-up. 3 periods: master transmit, slave transmit, forced convergence

EDITOR'S NOTE: At this point there were six start-up proposals:

- Sailesh-Rao (HDSL-like)
 - Oscar Agazzi (ISDN-like)
 - Hiep Tran (sequenced compromise)
 - Jaime Kardontchik (sequenced compromise)
 - Kamran Azadet (sequenced compromise)
 - Dan Dove (sequenced compromise)
- 9.0 Motion to limit consideration to proposals from Rao, Agazzi, Tran, Kardontchip, Azadet, & Dove
- 9.1 Moved by Makarem
 - 9.2 Move to table by Thompson (S by) failed 7Y, 23N, 6ABS
 - 9.3 Motion passed Y24, N1, AB14
10. Motion to vote on start-up on Wednesday
- 10.1 M Makarem, S Thomson)
 - 10.2 Motion failed Y9, N13, AB21

11. Straw poll on start-up proposals

Sailesh Rao proposal:	27
Dan Dove proposal	15
Kamran Azadet proposal:	11
Oscar Agazzi proposal:	10
Hiep Tran proposal:	5
Jaime Kardontchik proposal:	1
12. Vote to adopt Rao proposal
 - 12.1 Move group adopt the Sailesh.HDSL proposal for start-up
 - 12.2 M Dove, 2nd Ray
 - 12.3 Y20, N8, AB20 (technical motion, fails—21 required)
13. Motion for revote
 - 13.1 M Dove, 2nd Jover
 - 13.2 Move to table M—Hatamian, 2nd—McConnell failed Y18, N22, AB9
 - 13.3 Y23, N18, AB 9 (procedural, passes)
14. Revote on Rao proposal
 - 14.1 Y 23, N15, AB14 (Technical, fails 29Y required)
15. Vote to adopt Azadet proposal
 - 15.1 Accept Kamran's compromise proposal as the start-up solution for 1000BASE-T
 - 15.2 M McConnell, 2nd Hatamian
 - 15.3 Call the question Y13, N13, AB15 (procedural, chair votes N to break tie, fails, allowing additional discussion)
 - 15.4 Y10, N24, AB16 (technical, fails)
16. Vote to adopt Dove proposal
 - 16.1 Move to accept Dan's compromise proposal as the start-up protocol for 1000BASE-T
 - 16.2 M Jover, 2nd Rao
 - 16.3 Y 23, N7, AB18 (Technical, passes)

Wednesday, November 12

- 1.0 Presentation by Chris DiMinico re link section and need for informative information
 - 1.1 Clause 40 will provide a definition of the minimum link requirements
 - 1.2 Would like to add informative annex to cover >1990 cabling practices
 - 1.3 Straw poll re providing informative annex covering recommended cabling practices for Cat 5 cable as per ANSI/TIA/EIA-558A—12 support, 11 oppose
- 2.0 Discussion of alien next
 - 2.1 Speedwrap machines wrap cables together for installation. The speedwrap can create inter-cable next that can be as severe as intra-cable next.
 - 2.2 Tying off/dressing cables at hubs can have a similar effect
 - 2.3 There are current cabling installations where 100BASE-TX does not work because of these conditions.
 - 2.4 We need to expand the link section to deal with inter-cable next
- 3.0 Discussion of review process til March plenary—Colin Mick
 - 3.1 Presentation of 2-draft and 3-draft review cycles
 - 3.2 Consensus for 2-draft review cycle
 - 3.3 Consensus for 1st interim Jan 12-13 in Dallas hosted by TI
 - 3.4 Consensus for 2nd interim Feb 16-17 in SF Bay Area hosted by Level One
- 4.0 Discussion of input on GMII changes as per request from Bob Grow
 - 4.1 After some discussion the group approved the following recommendation to 802.3z Y: 21, N: 0, AB: 6
 - 4.2 802.3ab recommends that the following be added to the GTX_CKM specification: "Jitter on GTX_CLK shall not exceed 1.0ns pk-pk relative to an un-jittered reference at the same frequency as the GTX_CLK under test."
- 5.0 DRAFT REVIEW STARTS HERE
- 6.0 PMA—John Creigh—0.55 BLW in 40-13
- 7.0 Dan Ray—need to add noise measurements for 40.7.1.2.3

- 7.1 +/- 100ps passed without objection
- 8.0 Dan Dove tasked with providing input on test specifications
- 9.0 Dan Ray—50mv noise level
- 10.0 John Creigh tasked with an action item to post test MatLab code to reflector
- 11.0 Colin Mick tasked with an action item to determine how to we put MatLab code in the draft
- 12.0 Ramin Nobakht, Dan Ray and John Creigh tasked with providing transmit distortion numbers
- 13.0 Sreen Raghavan and Hiep Tran tasked with providing transmit timing numbers for consideration
- 14.0 Colin Mick—action item to correct typos on 40-86.
- 15.0 John Creigh tasked with the action item to provide text re jitter in the receive electrical specification on 40-87.
 - 15.1 The slave HF jitter measurement is not as accurate as it could be. We should measure master and slave and use the two values to arrive at a more accurate measure.
 - 15.2 400ps?
- 16.0 Discussion that the common mode test specified in 40.7.1.2.3 is too rigorous. It was agreed to use 100BASE-TX specifications as a starting point.
- 17.0 The issue of impedance balance was raised—is it too rigorous?
- 18.0 Dan Dove was tasked with the action item of providing common mode measures. John Creigh to check.
- 19.0 Dan Dove presented a summary of his start-up proposal.
 - 19.1 The objective of the proposal was to find a middle ground that would provide a mechanism for converging on DFE in the absence of echo and, at the same time, permit blind start-up.
- 20.0 Sailesh Rao, John Creigh, Sreen Raghavan and Ramin Nobakht were tasked with an action item to work out details of the start-up routine and prepare a state machine for the draft.
- 21.0 A motion to switch the role of slave and master in start-up failed.
 - 21.1 Move to change the role of the master and slave in the start-up protocol
 - 21.2 M—Ramin Nobakht, 2nd Hiep Tran
 - 21.3 Y: 3, N: 6, AB: 18 (technical, motion fails)
- 22.0 The group indicated no interest in reviewing the management/Auto-Negotiation section at that time.
- 23.0 Discussion of PHY Control section
 - 23.1 Writeup will be changed to reflect new start-up routine (as per group decision on 11 Nov.)
 - 23.2 Assume 2 level signal for start-up, 3-level signal for idle, 5-level signal for data
- 24.0 The group discussed three start-up level options and selected option "b"
 - 24.1 Option a: +2, -2
 - 24.2 Option b: +1,-1
 - 24.3 Option c: +2, 0, -2

I believe it was decided to investigate both options "b" and "c" and depending on the success of startup simulations select one.—Ramin Nobakht

- 25.0 May need to adjust max wait time (40-21) to 740 ms
- 26.0 Action item assign to John Creigh—determine source of symbols for 40.4.1.2, lines 35-36—check 100BASE-TX
- 27.0 A discussion on scrambler reset---(40.4.1.2.3)
 - 27.1 Is it necessary for rest the scramblers to a random state or can they be set to one state?
 - 27.2 Should we remove a discussion of how the scrameblers are reset?
 - 27.3 Should the scramblers be arbitrarily set with the initialization of the scrambler left to the implementor?
- 28.0 Shift posting or Draft 1.1 to 23 November to provide more time for input
- 29.0 Delete section 40.2—move to bluebook.
- 30.0 Move section 40.8 (signaling) to 40.2
- 31.0 Action item to Colin Mick—clean up internal references

- 32.0 Need to revise figure 40-15 (PHY Control state machine)
- 33.0 Action item assigned to Colin Mick—check to ensure that 1000BASE-T Auto-Negotiation will mesh properly with 100BASE-TX Auto-Negotiation through the RJ45 connector
- 34.0 Action item assigned to Jim Parker (who was not present to defend himself) to create text defining the GMII jitter measurement.

ATTENDEES (last,first,company,phone,email):

Ader,Stephen,Compact Data,+44-1223-421-907,sa@compactdata.co.uk
 Agazzi,Oscar,Broadcom.714-450-8700,oea@broadcom.com
 Ahrens,Paul,Fujitsu,408-922-9553,pahrens@fmi.fujitsu.com
 Amer,Khaled,Rockwell,714-221-3610,khaled.amer@rss.rockwell.com
 Augusta,Steve,Cabletron,603-337-5100,augusta@ctron.com
 Aytac,Haluk,HP,408-435-44246,haluk_aytac@hp.com
 Azadet,Kamran,Lucent,732-949-7280,ka@bell-labs.com
 Bandali,Bruce,Sun Microsystems,650-688-9577,Bruce.Bandali@eng.sun.com
 Bestel,John,Lucent,610-712-7790,bestel@lucent.com
 Birchby,Glenn,GEC Plesey Semi,+44-161-682-6844,Glenn.Birchby@gpsemi.com
 Bohbot,Michel,Nordx.CDTm514-639-2028,michel.bohbot@nordx.xom
 Brewer,Steve,3Com,+44-1442-43-8000,steve_brewer@3com.com
 Chai,Jenming,Adaptec,408-956-9662,jenming@eng.adaptec.com
 Chang,Edward,HP,408-447-3497,edward_chang@hp.com
 Chase,Peter,Mitel,613-592-2122,peter_chase@mitel.com
 Christ,Chris,Level One,916-855-5000,chris@level1.com
 Creigh,JohnBroadcom.714-450-8700,jcreigh@broadcom.com
 Cushin,Simon,3Com,+44-1442-438-039,simon_cushin@3com.com
 DeNicola,Paolo,Rockwell,+33 4930 03202,paolo.dinicola@nb.rockwell.com
 Dinh,Thuyen,Valor,619-537-2633,tdinh@valorinc.com
 Dove,Dan,HP,916-785-4187,dan_dove@hp.com
 Duan Lanston,Fujitsu,408-922-9134,daun@compuserve.com
 Dugan,Richard,HP,408-435-4397,richard-dugan@hp.com
 Eisler,George,Rockwell,310-459-9225,geisler@aol.com
 Feuerstraeter,Mark,Level One,916-854-2817,mark@level1.com
 Fitzgerald,John,Bay Networks,978-916-2257,jfitz@baynetworks.com
 Fritz,Scott,TDK Semi,530-478-2871,scott.fritz@tsc.tdk.com
 Froke,Rich,Picazo Communications,408-232-9121,rfroke@picazonet.com
 Gampell,Dave,HP,408-435-6680,dave_gampell@hp.com
 Gerhold,Mark,Unisys,610-648-7109,mark.gerhold@unisys.com
 Grenier,Richard,3com,408-764-7273,richard_grenier@3mail.3com.com
 Guo,Bin,AMD,408-749-5076,bin,guo@amd.com
 Hasley,Lloyd,Motorola,512-895-3294,med80@email.sps.mot.com
 Hatamian,Mehdi,Broadcom,714-450-8700,mehdi@broadcom.com
 Hecht,Gaby,Gadzoox,714-577-6809,ghecht@gadzoox.com
 Hinrichs,Henry,Pulse Engineering,619-674-8208,henryhinrichs@pulseeng.com
 Jiang,Wei Dong,Fujitsu,408-922-9783,wjiang@fmi.fujitsu.com
 Joergensen,Thomas,Intel,+45-4453-0100,thomas.joergensen,ccm.idk.intel.com
 John,Clarence,Lucent,610-712=6567,alccj@micro.lucent.com
 Jover,Juan,Level One,305-674-8880,juan@level1.com
 Kelley,Al,Tensolite,904-829-5600,akelley@tensolite.com
 Kim,Yongbum,Polzgs,617-232-3745,yongbumkim@computers.org
 Kimoto,Athushi,Hitachi Computer Products,408-588-3145,mkimoto@msd.hitachi.com
 Koenig,Christine,MagCon,619-513-2140,ckoenig@magconinc.com
 Konda,Kishan,Level One,916-855-5000mkishan@level1.com
 Kosilek,Josef,Siemens Ag,+49-897-724-5311,josef.kosilek@oen.siemens.de
 Lacerte,Rich,Bay Networks,978-916-1390,rlacerta@baynetworks.com

Lam, Du-Tuan, Silicon Dynamics, 408-328-3245, dutuan@sidynamics.com
Lau, Tony, National Semi, 408-721-2022, tonylau@lan.nsc.com
Lee, Howard, Bel H & M, 510-227-0102, Howard.Lee@belf.com
Leonowich, Robert, Lucent, 610-712-5596, leonwich@lucent.com
Lin, Bouchung, Delta Products, 919-380-8883, dpr-douchung@deltaca.com
Lin, Chan-De, Macronix, +886-3-578-8888x4008, cdlin@mkic.com.tw
Lin, Ray, Digital Equipment, 978-506-6714, ray.lin@digital.com
Makarem, Rabih, SMC, 714-707-2422, makarem@west.smc.com
Masood, Murhan, SMC, 516-435-6169, burhan.masood@smc.com
McClellan, Kelly, SMC, 714-707-2393, mac@west.smc.com
McConnell, Mike, Broadcom, 714-450-8700x294, mikem@broadcom.com
Miau, Tremont, ADI, 781-957-1222, tremont.miao@analog.com
Mick, Colin, The Mick Group, 650-856-3666, ckm@mickgroup.com
Miller, L.D., Bay networks, 408-495-2852, ldmillier@baynetworks.com
Mlinarski, Fanny, Scope Communications, 508-786-9600x110, fanny@scope.com
Murphy, Denis, Pulse, 619-674-8317, denismurphy@pulseeng.com
Naganuma, Ken, Toko, 847-635-3246, knaganuma@tokoam.com
Nim, David, Lite-on Communications, 408-945-4118, daven@litecom.com
Nobakht, Ramin, Rockwell, 714-221-6862, ramin.nobakht@rss.rockwell.com
Noble, Steve, Cabletron, 603-337-1194, noble@ctron.com
Obara, Satoshi, Fujitsu, +81-445-474-1936, obaWlancc.cs.fujitsu.co.jp
Oh, Stepen, National Semi, 408-721-2326, oh@galaxy.nsc.com
Payne, Bob, TI, 972-480-2368, bpayne@ti.com
Payne, John, JLP Associates, 408-873-7586, jlpa@ix.netcom.com
Proffitt, John, Motorola, 770-729-7112, john_proffitt@email.mot.com
Raghavan, Sreen, ComCore, 619-535-0074, sreen@comcore.com
Rao, Sailesh, Level One, 908-972-0707, sailesh@level1.com
Rautenberg, Peter, Alcatel, +49-216-627-2778, prautehberg@compuserve.com
Ray, Dan, Level One, 916-854-2828, dray@level1.com
Rees, Huw, GEC Pleasey Semi, +44-1793-518-759, hr@swindon.gpsemi.com
Rodriguez, Carlos, Hirschmann, +49-712-714-1612, crodruiqu@nt.hirschmann.de
Ross, Floyd, Fujitsu Nexeon, 978-266-4583, ross@nexeon.com
Rubin, Lawrence, Jato, 512-407-2136, lrubin@jatotech.com
Sadeghi, Koshrow, SMC, 714-707-2420, sadeghi@west.smc.com
Seto, Koichiro, Hitachi Cable, 408-260-2630, seto@sj.hitachi-cable.com
Shen, Steven, NEC, 408-588-6005
Smith, Michael, ControlNet, 408-341-1428, michael@controlnet.com
Sternner, Rudy, AMD, 408-749-5189, rudy.sternner@amd.com
Strong, Stephen, Shomiti Systems, 408-437-3952, sstrong@shomiti.com
Teung, Tommy, Asante, 408-435-8401, tleung@asante.com
Thomson, Doug, Ohm Technologies, 714-752-1028, dougt@ohmtech.com
Tomura, Masaaki, Hitachi Cable America, 914-993-0990, tamura@hitachi-cable.com
Tran, Hiep, TI, 972-995-7885, htran@hc.ti.com
Tsukutani, Nacki, Hitachi Cable, +81-294-42-5029, tsuku@fksg.hitachi.cable.co.jp
Verheggen, Bill, Intel, 503-264-8594, william_c_verheggen@ccm.intel.com
Vermeersch, Dean, AMP, 717-986-3143, deanv@amp.com
Vijeh, Nader, Fore Systems, 408-467-4623, nader@fore.com
Vogel, David, Level One, 916-855-5177, dvogel@level1.com
Wang, Greg, Delta Products, 570-668-5163, dpc-gred@deltaca.com
Wertheimer, Ariel, Digital Equipment, +972-2-589-2555, ariel@isv.dec.com
Wery, Willem, Intel, 503-264-9873, willem_Wery@ccm.jf.intel.com
Wilson, David, TI, +44-1604-663-414, David.Wilson@tiuk.ti.com
Wong, David, Allayer, 408-573-8880x108, dwong@allayer.com
Wu, Robert, Accton, +886-3-577-0270, rwu@accton.com.tw

Yu, Mark, Lucent, 732-949-2185, my@lucent.com
Zeile, Mike, ComCore, 818-880-5192, mikez@comcore.com