

Tentative Minutes of the IEEE P802.11 Working Group

Interim meeting
Dayton, Ohio
September 14 - 17, 1992

Monday, AM, Full Working Group

The meeting was called to order by chairman¹⁾ Vic Hayes, NCR, at 8:50 am, Monday, September 14th, 1992. The minutes were kept by Jim Schuessler, NSC, in the unfortunate absence of Carolyn Heide, Spectrics. Document Distribution, Copying and the Attendance List were kept by Rich Lee, Spectrics. The agenda is document 92/95R.

1) The officers of the Working Group are:

Mr. VICTOR HAYES
Chairman IEEE P802.11
NCR Systems Engineering B.V
Architecture and Systems Management
Zadelstede 1-10
3431 JZ Nieuwegein, NL
E-Mail: Vic.Hayes@Utrecht.ncr.com
Phone: +31 3402 76528
Fax: +31 3402 39125

Mr. RICHARD LEE
Vice Chairman IEEE P802.11
Spectrix Corporation
214 9th Street
Wilmette, IL 60091, USA
E-Mail: richardlee1@attmail.com
Phone: +1 708 251 5378
Fax: +1 708 251 5318

Ms. CAROLYN L. HEIDE
Secretary IEEE P802.11
Spectrix Corporation
906 University Plaza
Evanston, IL 60201-3121, USA
E-Mail: 71041.3262@compuserve.com
Phone: +1 708 491 4543
Fax: +1 708 467 1094

Mr. MICHAEL MASLEID
Editor IEEE P802.11
Inland Steel Co. MS2-465
Process Autom Dept
3210 Watling St.
East Chicago IN 46312, USA
Phone: 219 399 2454
Fax: 219 399 5714

Dr. JONATHAN CHEAH
Editor IEEE P802.11
HUGHES Network Systems
10450 Pacific Center Court
San Diego CA 92121, USA
Phone: 619 452 4847
Fax: 619 546 1953
E-Mail: jcheah@oscar.hns.com

Mr. ROBERT ACHATZ
Editor IEEE P802.11
US Department of Commerce
NTIA/ITS
325 Broadway
Boulder CO 80303, USA
Phone: +1 303 497 3498
Fax: +1 303 497 3680

Mr. CHANDOS RYPINSKI
Editor IEEE P802.11
LACE Inc.
921 Transport Way
Petaluma CA 94952, USA
Phone: 707 765 9627
Fax: 707 762 5328

Mr. NATHAN SILBERMAN
Editor IEEE P802.11
California Microwave Inc
985 Almanor Avenue
Sunnyvale CA 94085, USA
E-Mail: nsilberman@mcimail.com
Phone: +1 408 720 6462
Fax: +1 408 720 6312

Mr. FRANÇOIS Y. SIMON
Editor IEEE P802.11
IBM
P.O. Box 12195 MS E87/B673
Research Triangle Park NC 27709, USA
E-Mail: fygs@ralvmg.vnet.ibm.com
Phone: +1 919 254 4584
Fax: +1 919 254 5410

1. Opening

Vic covers the objectives of this meeting:

MAC Group

- To continue work on the MAC/PHY interface
- Implications of time bounded services
- what are the distribution services
- others, time permitting

PHY Group

- continue to identify objects common to all phys
- review the straw man proposals from the ad-hoc groups
- continue to work on channel modelling and how to structure the document to allow conformance testing.

- 1.1 **Roll call** Introductions were conducted with all present announcing their name, company and location.
- 1.2 **Voting rights** Vic covered voting rights.
- 1.3 **Attendance list, Registration** Vic covered need to sign attendance list. The chairman thanked Jim Geier for hosting the meeting. All attendees must pay Jim \$120.00 for the four days of meetings here at the Hilton in Dayton.
- 1.4 **Logistics (breaks, lunch, copying, document distribution)** Breaks will be at 10 am and 3 pm.
- 1.5 **Other announcements** There were none

Agenda Item 2. Approval of Minutes of Previous Meetings

We don't have a quorum at this meeting, so we cannot approve the minutes. However, we can take comments on them (doc. 92/86). Jonathan Cheah has a new address. Note this. No one had any other comments.

Agenda Item 3. Reports

Vic comments on 802.11 NPRM response to FCC. Comments were proposed by subcommittee and faxed to Washington by Vic (followed up by high quality copy). (See dc 92/90) Vic has provided a copy of an excerpt from NPRM as a document for this meeting

Agenda Item 4. Document Registration

#11-92/64	#11 Issues Document (May 1992)
#11-92/64a2	Changes to issues document IEEE 802.11-92/64 (draft)
#11-92/86	Tentative minutes of the WG , July 1992
#11-92/87	Tentative minutes of the Fu Req group, July 1992
#11-92/88	Tentative minutes of the MAC group, July 1992
#11-92/89	Tentative minutes of the PHY group, July 1992
#11-92/90	ET NPRM Comments as submitted
#11-92/91	Functional Requirements as adopted
#11-92/92	Joint Mac/PHY minutes
#11-92/93	Report of Japanese Standards status (KC Chen)
#11-92/94	Venue for the Dayton Meeting
#11-92/95	Tentative agenda for the September 1992 meeting
#11-92/96	IEC/ISA Fieldbus: PhL-DLL Interfacing and FCS Considerations (Tom Phinney, Honeywell IASD)
#11-92/97	Report of Japanese TTC (François Simon, IBM)

#11-92/98	Wireless LAN, LAN Station management (Steve Chen, Toshiba America)
#11-92/99	A Parametric MAC-PHY interface model (Jonathan Cheah, HNS)
#11-92/100	Proposal for WLAN Architecture (Bob Crowder, Ship Star)
#11-92/101	Timed based services (Bob Crowder, Ship Star)
#11-92/102	Excerpts from Notice of Inquiry on "Current and Future Requirements for use of Radio Frequencies in the USA" (NTIA)
#11-92/103	Proposed input on the Notice of Inquiry (Vic Hayes, NCR)
#11-92/104	Excerpts from the NPRM and TD 90-314 to establish PCS (FCC)
#11-92/105	Proposed input for NPRM and TD 90-314 (Dewayne Hendricks, Tetherless Access)
#11-92/106	Mixed bandwidth DLBT analysis (Wim Diepstraten, NCR)
#11-92/107	Alternatives to Issues Related to Time Bounded services (Paul Congdon, HP)
#11-92/108	Performance of a Reservation Multiple-Access Protocol (Richard LaMaire, IBM)
#11-92/109	Communication Requirements of multimedia applications: a preliminary study (Timothy Kwok, Apple)
#11-92/110	Wireless Networking Requirements of multimedia applications (Timothy Kwok, Apple)

Agenda Item 5. Adoption of Agenda

The following subjects received submissions:

Regulatory

NPRM, 92/103, 105

Comments due by Nov. 9th., so we must do it this meeting. Editing can be done after and further edited on Nov. 13th a few days late. Vic believes quality comments are necessary and wants the November meeting to approve them. He has the full NPRM with him.

NOI- Notice of Inquiry, 92/102-103 NTIA

Asked for comments. In Europe, they are studying 150 MHz in the 5 GHz. band. It may be a good thing for the US to do this also. Comments due Oct. 8th. Vic proposes that Exec. Comm. approve this in order to meet deadline. Asks for comments..

Chan - YES. (supports effort)

Chuck Davis, Question, What services are going to be allowed to use this spectrum?

Vic - For sole use by HIPERLAN standard, developed in ETSI, RES committees. The difference with NPRM is that 1910-1930 is co-primary use, unlike the 150 MHz which is thought to be free. Who will help?

Simon Black - Likes to see original NTIA document first.

Vic - OK, if anyone has comments, please see me and I will add to proposal.

Japan, RCR, 92/93, TTC, doc. 92/97

See paper by K. C. Chen (not present)

François (92/97): Second hand information from one editor. One subgroup TTC 3.x work group is doing a technical report, some sections of which address WLAN. See paper for detail. Report supposed to be available by end of October, and François will make available to committee.

Architecture

General, 92/100

Larry vanderJagt Introduces paper by Bob Crowder. Paper restates what we discussed at the last meeting.

Requirements -time bounded Bob Crowder - 92/101

Time based services, 92/109-110

Management, 92/98, Ryan introduces: Statement on position of Station Management

MAC

Protocol type, 92/108

Time Bounded, 92/107

MAC/PHY Coexistence, 92/106, 92/96

Bob Crowder - 92/101

Items under the Architecture heading will be discussed in a joint meeting. Schedule altered to accommodate new papers.. See new agenda. Vic will chair joint meeting, Dave Bagby will chair MAC subgroup and Larry van der Jagt will chair the PHY subgroup.

Approved.

Agenda Item 6. Unfinished Business none!

Agenda Item 7. New Business none!

Agenda Item 8. Recess for subgroups

Coffee Break: 10:00 am.

Monday, PM, Joint MAC/PHY Working Group

(ed. See Tentative Minutes of the Joint MAC/PHY Working Group for events that occurred during this time.)

Tuesday, AM, Full Working Group

The meeting was called to order by chairman Vic Hayes, NCR, at 8:50 am, Tuesday, September 15th, 1992. The minutes were kept by Jim Schuessler, NSC, in the absence of Carolyn Heide, Spectrics. The agenda is document 92/95R.

OPENING:

Roll Call of members.

Charges

The hotel will add the \$120.00 charge to your bill for the meeting fee.

Document Distribution

Document 92/99 from Jonathan Cheah is still missing - seems to be lost in mail. NPRM - 90/314 - Jim Lovette, Apple, urges committee to form subgroup to draft response to FCC. Who is interested?: Rich Lee, others. This must pass through legal review. Vic reads the current draft. Discussion of whether IEEE should file 3 or 4 days late, due to our November meeting. Dave Bagby and Jim Schuessler assert that we should file on time. Vic takes a straw poll and several support this position. Vic will further draft response and ask committee permission to forward the complete draft.

Larry: We have no formal liaison with WINForum. Until we do, we should have nothing to do with this group

Dave: WINForum's current status is a non-profit organization, based in Virginia. It is a loose organization, open to any company. There is a fee scale based on gross rev., so anybody can join. It doesn't have formal liaison because it is a new group and is very busy trying to do its job. I am one of the formal directors of the group, and was asked to be the formal liaison. I will do this in the future. It's function is definition of coexistence of several services. It is primarily a lobbying organization, focused on the FCC. It is not in the standards business. It does not have too much to do with what is going on here.

Larry: So they are not doing technical work?

Dave: - They are trying to come up with a sharing technique that is better than we have now.

François: Are they a standard body?

Dave: It started by a suggestion from the FCC that it would be helpful if there were a group of companies that were behind one position. The membership is made of 80% old 802.11 members.

Larry: That's kind of what worries me.

Simon. 1.) Press release. What is contained in this?

Dave: Don't have the words with me, contact Benn Kobb (Kobb.b@applelink.apple.com).

Simon: 2.) Do the rules for using the spectrum impact our work?

Dave: Certainly. They are trying to get the maximum flexibility for services in this new spectrum. Ask the question: "What services might we want to use this spectrum for and how best can we use it?"

Michael: Said target is coexistence not interoperability. Is there an implication toward work here? Afraid that some agreements will turn into defacto standards and force us to adopt them.

Dave: Don't think so. There are a number of services that want to use this spectrum. They will be interferers, but hopefully of a like kind. We want to avoid the problems of the ISM band - here very different power levels cause big problems. I know there is a natural inclination to be distrustful of a new organization., but don't think you have anything to fear. Any company can join.

Michael: We need to liaise with this company. Second Question: If companies are in domain of WLAN or are they of a larger domain?

Dave: Mixture. Wireless PBX and others Wider range than 802.11, but task is smaller. Asks how many companies present are members of WINForum - about 10 raise hands.

Larry: There is only a limited resource to get a task done. It would be nice if we didn't dilute this effort.

Chuck: I'm on exec. comm. Existence is fundamentally a regulatory function. Purpose is to lobby FCC and Government for spectrum to allow 802.11 to operate in. Without that we can't operate. Mind set is not to set standards. We are pressed for time. FCC is moving rapidly, whether we like it or not. Efforts of WINForum have endeavoured to support 802.11. We don't have time to wait.

Larry: Limiting factor is resources.

Dave: There is more of a senior level membership in WINForum. These are not the same resources.

Chuck: The same level of activity I see in WINForum is not present in 802.11.

Vic: Displays WINForum press release on screen. Simon requests it be a committee document.

Nathan Silberman: Scope is broader than 802.11. No agenda for standards, but just to get coexistence of services in new spectrum.

Michael: This activity may help with bandwidth allocation and market acceptance. Only some members here are participating. I would ask that meetings be conducted adjacent in time.

Vic: Timing problem. Reaction times are much shorter. Meeting cycle is more frequent.

Dave: Meetings are very frequent, very politically driven. They do look to this group for the bits and bytes of a standard. But the meeting cycle are never going to coincide.

François Simon: Question of NPRM - will file comment. Point is that 802.11 doing same thing. In fact two groups compliment each other. Why are not they the same?

Dave: The more comments the FCC receives the better. Each company should file comments.

François: We must make sure these comments are the same.

Dave: This doesn't need to be checked. If we have differences, that is fine. I don't believe they are THAT different - talking in generalities here.

Chan: Pleased with the redundancy of WINForum. People on tech. side of spectrum who don't know that this is political process. It is so complicated for 802. to get comments out. FCC is not field for corporate arrogance - reason on your side helps, but this is not sufficient. We need to be normalizing things like megabits per unit area. Our papers on PHY and signally rate assume too much. It is very important we have goal numbers of bandwidth/unit area. If 802.11 does not provide this to FCC, we are going to get nothing. Thinks we can to 5 Mbit/s with 20 MHz. spectrum.

Vic: Asks Dave Bagby to propose way to Liaise with WINForum.

Larry: Drop objection to WINForum at this stage. But, technical work should take place here.

Dave: Felt that work in progress in that group was not appropriate to present here. I will be happy to act as liaison.

Larry: I contend they should never have a technical committee meeting, unless it is in conjunction with us. We are burning resources in both places.

Dave: These are different resources.

Chuck: Timing is being overlooked. If we want to meet every two weeks...

Larry: Max. resources are not being focused

Chuck: We can get the best standard written and have no spectrum to operate in. This is happening now. This has not been a big secret.

Vic: Each resource must decide how they will be most effective.

Nathan: It is impractical for meetings to meet together. WINForum is moving too fast.

Wim: Feels resources are being used 100% for WINForum and same people are not involved in 802.11.

Larry: Proposes every 10th. meeting have with us.

Dave: Suggests we leave this discussion. Points have been made. Real issue is our IEEE organization. should make comments on NPRM. Vic asked for volunteers to work on comments, got some, and we resolved to file ON TIME. This is important. We can divorce WINForum completely - here is Jim Lovette as an individual that has an opinion of what this group should do. We should focus on getting these out to the FCC.

Vic: Who would object to mentioning WINForum? Nobody raises hand.

Simon: Nice to have WINForum as a more recognized body - may involve just putting a document number on press release. Just protocol and formality that should be done.

John McKown.: We are not losing people, but gaining them. Yes, I think WINForum should have a closer relationship.

Rich Lee: Proposes we converge our position on NPRM with WINForum.

Dave: Can't do this since it is under discussion.

Chuck: WINTech broke into voice and packet groups. Wanted to understand implications. Lengthy conference. calls and meetings. Then we got to a point where we started the "Convergence committee" I am on a 3 hour conference. call this afternoon on this topic. I can't say enough about the timing issue.

Larry: We should have been asked first.

Chan: If we endorse WINForum, we should do it in reply comments, not now.

Vic: Let's move on. I will make a proposal with line items, to be responded to by the end of this week. On the other NPRM 92-9.: Backtracking policy proposed that if new freq. don't work out they can move back to old ones.

BREAK: 10 am

Tuesday, AM, Joint MAC/PHY Working Group

(ed. See Tentative Minutes of the Joint MAC/PHY Working Group for events that occurred during this time.)

Tuesday, PM, Joint MAC/PHY Working Group

(ed. See Tentative Minutes of the Joint MAC/PHY Working Group for events that occurred during this time.)

Wednesday, AM, Separate MAC and PHY Working Groups

(ed. See Tentative Minutes of MAC and PHY Working Groups for events that occurred during this time.)

Wednesday, PM, Full Working Group

The meeting was called to order by chairman Vic Hayes, NCR, at 2:00 pm, Wednesday, September 16th, 1992. The minutes were kept by Jim Schuessler. The agenda is document 92/95R.

Our objective today is discussion of comments to the FCC NPRM and channelization. Refer to document 92/105, "Comments on NPRM from PHY Group and Jim Lovette (Apple)" First, we will discuss channelization. Discussion lead by Larry van der Jagt.

Yesterday afternoon identified most important aspect: Given that 20 MHz for unlicensed, how should it be segmented? Unable to conclude. Therefore we looked at details this morning. Now, we need to discuss "segmentation" (refer to this term instead of "channelization")

The FCC has suggested:

Alternative 1: Take 20 * 100 kHz, + 4 * 1.25 MHz and 1 * 10 MHz segments, use separately for each user group.

Alternative 2: to use entire 20 MHz for each of these potential user groups.

Alternative 3: "You tell us"

Simon: Are you saying the 10 MHz is for data only?

Larry: No, anybody with a min. channel width of 2 MHz.

Don, NCR: However, there is an understanding it is for data. The NPRM says three kinds of users: Point to point cordless telephone., Wireless PBX, and Wideband, nonchannelized region. The cordless band is generally understood to be the 100 kHz, the W-PBX - the 1.25 MHz and wide band for data at 10 MHz. Option 2 of the FCC would mean these services must observe rules to enable them to coexist.

Dave: Note the NPRM is suggestions, not laws (yet). This is just to start discussion in the industry. There is nothing from a legal standpoint that defines certain services in certain channel widths or locations. Keep your thinking broad.

Chan: I would recommend there be one 20 MHz channel and that tech. be developed to serve all services. Likes time limits based on bandwidth occupied algorithm. Radio will be cheaper: The broader the bandwidth the less accurate the radio will have to be. (ed. and the radio will be cheaper due to volume manufacturing) Any fixed division is inherently inefficient. Dynamic pool of bandwidth can allow allocation based on actual requirements. Any LAN with voice and data services that 802.11 would propose, could take over the entire market for all these services if done properly. No reason to surrender yet.

Don: This is an argument to use as wide a bandwidth as you can.

Chan: agrees.

Dave: fair game to ask FCC for more Bandwidth

Simon: Question assumption in issue that we are given only 20 MHz. You could say that 20 MHz. is just not enough.

Larry: This is our intention as a first item.

Simon: I guess a benefit of channelization is that if you are given more spectrum, you just get more channels. Problem is that WLAN needs wide bandwidth for higher speed, which argues for no channelization. Europe takes this position with CEPT. You just can't have a few channels now and a few later.

Nathan Silberman: Thinks channelization allows only low throughput low performance. WLAN. We should comment that this is not what our customers need. BUT, we need to propose coexistence criteria to FCC from OUR STANDPOINT.

Wim: What are you saying?

Nathan: We need more bandwidth, and that 20 is absolute. min. Further, we need to propose a coexistence criteria.

Larry: If you only had a choice between item 1 and 2, you would choose 2 (contiguous)

Dave: Maybe we should try and list all reason for each no matter what we believe.

Larry: So why should it be segmented?

Don: One reason is that we don't have enough spectrum to get by with a single channel. If one LAN uses all 20 MHz, you can't accommodate neighbours at all. First adjacent person (user) will get much less performance. We need a min. of 4 channels, probably 7 or 8. (ed. for isolation of BSAs) Second point is the cost point. One radio would lower the cost, but there WILL be lower bandwidth radios (due to cost). I also disagree that Channelization lowers throughput. It lowers one LAN speed, but not overall throughput. Now, if you want one channel, where do you want it? What happens when we get more bandwidth? We should channelize now, so we can accommodate more bandwidth later.

Chan: First about reserved freq. space. This 15 MHz adjacent is problematic since FCC may mess this up soon. We should plan for it now. Speaking to Don's point. I guess we disagree. If your channelization motivations are to enable overlapping coverage. I believe, anything you can do with the frequency domain you can do with time domain better. The FD argument is only valid for long range radios. As range gets smaller, argument gets weaker. On cost: I am aware of radio costs. I must say: We don't know the cost of anything. Same arguments used for cellular telephones a long time ago - a 2716 EPROM cost \$40 then.. Whatever is made in volume will be cheap.

Wim: Made my position clear yesterday. We need channelization. The different applications use different bandwidth and can't coexist in same channel. Especially the bursty traffic WLAN and Time-bounded WLAN. We need flexible boundaries. The 10 MHz channel is a partial solution with limited speed. Need a number of channelization for a full system. Since you only have 10 MHz., you can only go to certain speed - need higher speeds. An 802.11

Michael: Single infrastructure is important like Chan said. Not sure producers have same interest. We should think about users first. Ch. issue/coexistence is important. Not necessarily FD, but TD may be good alternative. In favor of single 20 MHz. because we can logically separate channelization for different. services. Our one MAC should provide all users needs.

Dave: This unfortunately is not possible. Can't have regulations that specify MAC layer. FCC will not do this.

John: Addresses Don. You said it is obnoxious to users if user performance. decreased after initial installation of a 10 MHz WLAN system. You then argued we should therefore channelize to lower bandwidth/channel This is like saying we are going to limit you to worst case from the beginning!!

Rich: Agree with Don in need to channelize. However, refer to page 70, 15.243, both services are permitted in wide band as well as 802.11. We don't have a reciprocal relationship with the narrow band users. We don't have 10 MHz. channel exclusively for WLAN. Will have mutual interference. WINForum etiquette will reduce this. Only a uniform spectrum, time and power, we have not hit this problem. We still will have interference, even with these channelized services.

Dave: Problem with a channel scheme is that no matter what you pick now, it is probably wrong and almost always non-optimal since the intent is to support services that are not invented yet.

Don: We don't have authority to insure other devices operate in the manner we propose. The job to require all industries to package their systems into one wide band channel is not feasible. The only way to use the whole band is to accommodate narrow band users - which WILL be there.

Larry: I've never been more torn about an issue. Think we must deal with interferers no matter what. If we have a level playing field, we should try to ask for much more bandwidth and solve prob. Alternately, would much rather design a 20 MHz. radio at 2 GHz. than a 100 kHz. radio at 2 GHz. However, don't think 20 MHz. is enough to do effective sharing of bandwidth. So, we should get the 10 as clean as possible and make a fast modulation scheme to get 10 Mbit/s that way. Right solution is to get more bandwidth. If we can't, I don't know.

Simon: Isn't it best to say this. IT IS NOT POSSIBLE. If they come back and say 10 is all you get, then work with it.

Chan: Address wide band LAN degrading performance. in presence of neighbor. two kinds, collocated and adjacent.. twin towers and shopping mall are characterizations of this. They are contiguous interferes. not collocated interferes. Contiguous. interference. is not a factor. Two tools: can be time shared, The little pulses from 100 kHz. systems can be dealt with. (The wider the bandwidth on Channel., the less you interfere with narrow channel) Second point: With Access Point, use as a tool the fact that buildings will be illuminated from outside in, not other way around - this is a 20 dB different. Thinks Don is expert on classic radio design. We differ in that I'm projecting new solutions to these problems.

Bob Buaas: Support for one wide band channel. Knows Tom Stanley is looking for inspired solution. This model does this. There are tech. difficulties and emotional bias for channelized spectrum. We should deal with all of these and a single channel approach will catch on.

Wim: Given different. systems we have to live with, then only consistent way is to implement systems with limited speeds using channelization. This is best incentive to FCC to allocate additional bandwidth.

Simon: Look at European group ETSI RES 10 (CEPT FM7/SE). We asked for 150 MHz. and nothing less and we got it. It was justified numerically. DECT has 20 MHz. exclusively just to coexist with itself. To have all these services coexist is next to impossible. Look outside the US for examples. 20 MHz. does not make sense.

Larry: Said yesterday we should use Japan and Europe as examples. If the world is doing it with more, how can we compete in world markets?

Pinhas Romik: European tech. experts saying this is not enough.

Simon: Lets stick to our guns and ask for what we need.

Larry: At Enbanc said the reason was to create jobs.

Simon: WINForum can play the political games with the 10 MHz.. We are a technical committee that can ask for what we need.

Dave: Suggest we take straw poll to see if there is consensus.

Wim: Can we specify we need some number of JOBS/HERTZ?

Larry: NO need \$/HERTZ.

Chan: No absolute. value of spectrum. You could get a 5 Mbit/s channel in 20 MHz. space using full sweep measure against Rayleigh fades, etc. No matter what scheme, there is some ratio like that. PCS has no better standing in tech. recognition, except that they have prototype systems. They have no legal standing however. Some of those proposals may not be min. cost. In Europe, have high regard with work done. (Ericsson and ...) GSM was very good work. Careful in saying that systems that survive are best tech.

Larry: One other option before straw poll. If we were not hung up on unlicensed, there is more spectrum available. We could compete for licenses for it.

Straw Pole: One Piece: 20 Channelized: 9 Indifferent: 3

BREAK

Larry: Agreed comments so are:

- 1.) our primary position is we want to expand to 70-140 MHz per July filing
- 2.) if that does not happen we want to be considered co-primary unlicensed in a band adjacent to 1910-1930 (70-140 MHz. wide) in addition to primary status in ..

John: What does "coprimary in licensed band" mean?

Rich: Not uncommon for a licensed band to be used with other users. We are looking for best status we can get.

John: Doesn't this negate license of primary users? What is motivation to get a license?

Rich: Licensed would get to put out more power.

Dave: Politically, leery of asking to coexist in licensed band. Attention being paid to licenses. Unlicensed doesn't have political heat. Dangerous - I don't know what would happen.

Don: We might be taking a position against WINForum. I think they are saying they want primary use.

Dave: If we say we want to exist there, implies we CAN exist there. I'm not sure this is possible.

Larry: Licensed base station can put out 7 W. max.

Chan: We should focus on cutting their power, not increasing ours.

Larry: If we have more bandwidth, we should be able to coexist. They have 15 MHz. of bandwidth in each half channel. Should be possible to coexist.

Don: If licensed user walks into building putting out 2W, we could get killed.

Dave: Isn't this the same as the channelization discussion?

Larry: yes, don't channelize. Just take as much bandwidth and use it.

Don: Seems like you are saying wide band can operate with narrow band without interference.

Larry:

Wim: Our interference would be 1:1

Larry: No, only sees power in our band. This is uniform power density. This is how you would analyze the thing.

Dave: Shifting subject to on screen number 2. Ask for more spectrum (140 MHz.)

Wim: Agrees with Dave. Depends on how we ask... Could we live with 70 MHz. to start with?

Don: Est. vary

Simon: How can you say less from day one? Doesn't work.

Larry: Same equip. would not work. But if information transfer requirement is not necessary, you shouldn't use it...

Dave: Negative argument. FCC is sensitive to economic argument. If we recommend throwing away equip. not good.

Larry: In 2001?

Simon: In one building on day one, everyone may buy one!

Larry: Good for gross national product...

Chan: Everyone gets new cell. phones every five years anyway.

Rich: This was the first PHY group deliberation on NPRM. We had to decide if allocation was sufficient. Know it is not. What is reply process to do it with credibility. Things discussed this morning (doc. 105) should be in NPRM comment.

Dave: NPRM asked for comments... We need to say extra bandwidth should come from licensed area.

Jim McDonald, Mot.: Hugh investments here. Can't take risk of sharing spectrum. Both a tech. and political argument. Won't fly with FCC.

Rich: Today, you can go into any band under part 15 under 3/4 mW. rules. This affords path to negotiate to get additional spectrum. We don't know any better way to ask for it at this time. Political comment is correct..

Jim M: Ask for more spectrum from unlicensed not licensed.

Rich: Reply to specific bands between 1850 - 1990 only. Can't ask for bandwidth outside this. Not appropriate to ask at 5 GHz. for instance. (or irrelevant)

Bob: Our chances are low in booting licensed users.

Don: Don't think so, since can't coexist with them.

Simon: Don't want user licenses or site licenses. Type acceptance is OK. Or a manufacturer license

Dave: People in licensed portion are interested in revenue stream and don't want you around. These are licenses to make money. Don't want to antagonize this group. Say to FCC if you only give us what you propose - define how this constrains us, and no more.

Don: Against asking for coprimary status for Dave's reasons and can't exist with licensed users.

Wim: Agrees. Wouldn't this undermine our claim for clear spectrum? This is the most political reason for NOT doing it.

Larry: We are looking for a motion to what we are going to tell the editing committee to do.

Chan: Trying to figure out what we want. First rule is answer the questions they ask. Avoid answering questions they didn't ask as long as possible. I choose our previous position: Our original request for 140 MHz stands and 1910 and 1930 is not enough. However, this new band is useful, and list uses.

Vic: makes motion.

John McKown seconds.

Motion: Editing group of Rich, Vic and volunteers prepare a specification for our comment to NPRM 90-314 using the material prepared during the PHY and joint PHY/MAC meetings for forwarding to the plenary meeting along with a motion to process and approve that document. The group should not take up the issue of co-using the licensed PCS spectrum. [Our previous position for 70 - 140 MHz. is still valid and is not changed by the action in 90-314.]

Approve: 24, Opposed: 0 Abstain: 0 passed.

Rich: Thinks ought to amend PHY group motion of yesterday.

Chan: That was the PHY group not take up the position of diverting or co-using frequency space used for licensed PCS spectrum. We want to repeat our original argument to FCC for 140 MHz.

Dave: Don't want to change intent. (proposes changes)

-----vote----- (see above)

Wim:

Vic: See doc. 105 copy of fax from Jim Lovette. Should comment at end be included? (Consensus to not show entire document to anyone)

Larry: see page 73. Comment on Power Control. Discussion? This morning group was split. Some said expensive and eliminate due to power, money and time reasons. However, others support. Proposed "n" power, but no consensus.

Chan: Measured power control in cellular system. Practice different from spec. Only lower power when very close to base. Base reduces dynamic range when close. There is only value when you are close, since people always maximize transmit power. This is not the same a power control in DSSS. In favor of a gross power control and not a fine one. FCC proposal is improvement over nothing.

Jim M: Put together some simple view graphs. Similar to Chan's comments. Thinks bottom line is that number of transmissions reduces 25%. Notes that power control cost effects RF loss and RF switches.

Don: Thinks you are right according to NPRM, but potential to use power control gaining more than you show.

Jim M: Range limit includes allowance for fade margin.

Larry: Don is saying you may have an opportunity to dynamically update your range table.

Chan: Several motivations for power control proposed. Minimal station power allows closer spacing of stations.

Rich: Are you saying there should be no power control?

Jim M.: Below 100 mW, not required. Allows lowest cost products.

Larry: NPRM says you must be transmitting 100 Mbit/s in order to transmit a watt.

Wim: Yea, but that's a typo..

Nathan: Power control above 100 mW optional. If users need it they will put it there.

Jim M.: Agrees.

John: Isn't making it optional the same as deleting the paragraph.

Dave: Speaks for alt. 3 on screen. FCC is receptive to power control for some reason. Best of both worlds to specify a threshold of output power, under which it is not required. (agreement all around)

Larry: How about if signal is 10 dB down from max.

John: How about 100 mW?

Poll: Does 802.11 want to support dynamic RF power control in comments to the FCC?

1: yes

2: no

3: yes, control not needed below threshold, required above limit of 100 mW.

4: yes, control not needed below threshold, required above it -10 dB from max. authorized transmit power

Vote 1:0, 2:3, 3:2, 4:13, abstain: 5

Vic: thanks Jim Geier for hosting meeting.

_____: thanks all for coming to beautiful Dayton.

Tomorrow MAC group at 8:30, PHY group in other room.

Adjourn for evening: 5 pm.

Thursday, AM, Separate MAC/PHY Working Groups

(ed. See Tentative Minutes of MAC and PHY Working Groups for events that occurred during this time.)

Thursday, PM, Full Working Group

9. Opening

The meeting was called to order by chairman Vic Hayes, NCR, at 1:40 pm, Thursday, September 17th, 1992. The minutes were kept by Jim Schuessler, NSC, in the absence of Carolyn Heide, Spectrics. The agenda is document 92/95R.

9.1 Announcements We will receive a report from FCC Open meeting held yesterday from Jim Lovette around 2:00 pm.

9.2 Document list update the following documents were added since the opening full Working Group meeting:

#11-92/110	Wireless Networking Requirements of multimedia applications (Timothy Kwok, Apple)
#11-92/111	Considerations regarding medium characteristics and capture effects
#11-92/112	Slides for docs 92/109 and 92/110
#11-92/113?	WINForum Reply Comments to NPRM 92-9
#11-92/114?	WINForum News release
#11-92/115	Outline of Comments on NPRM 90-314

Rich: Did everybody receive a copy of 92/115? Note: bring 100 copies to a Plenary meeting.(i.e. La Jolla). See Vic for a Word for Windows format. Make sure you have the word "submission" at the bottom.

Note the California Microwave bulletin board number is 800-248-0211. document template will be there.

Vic: Asked in a telephone call that Benn Kobb contact Dave Bagby to make a Liaison document with WINForum.

9.3 Agenda adjustments

Dave Bagby requested to add under New Business: Why do we hold interim meetings? or How can we prevent duplication of work?

Larry: Disagree with planning new business, should be done when we are at the item. (After some discussion): Only objection is that WHEN we get to the New Business item, people be allowed to add new business at that time.

10. Reports

10.1 MAC group Dave Bagby, chair MAC group, reports:

Held discussion of Time-bounded services. Looked at issues log and recorded progress. Only had one or two issues with consensus. If we had a quorum here i would put it on a foil and have you vote on it.

Today we talked about Distribution Services (DS) and DS Services (DSS). Contributions are desired for next meeting.

Many documents were covered. See doc. list.

Objective for next meeting are essentially the same. Time-bounded services, DS and interaction of Time-bounded / DS, and MAC/PHY interface.

10.2 PHY Group Larry van der Jagt, chair PHY group, reports:

Responded to NPRM 90-314

Reviewed and accepted as a starting point for work François draft standard outline document.

Reviewed and accepted as starting point for work DLL-PHY (Mac-PHY) services primitives detailed in 92/96

Extended service primitives to include transfer of parameter control vector

Output document will be minutes (only output document)

Formed a channel / conformance ad-hoc group

Objective for next Meeting:

Accept input from DS, FH, IR and Channel Ad-hoc

Continue Filling in outline draft standard

matter arise from 90-314 NPRM

note: 92/111 is not a PHY group document

Anyone willing to chair La Jolla PHY Group? Larry can't make it.

Vic: how about the MAC/PHY interface

Larry: Service primitives are the MAC/PHY interface. Objective is to start writing the standard document.

Paul: Is the outline a standard committee document?

Larry: thought François doc. is the start of our work.

Paul: Will it be reissued each meeting?

Larry: Yes.

John: Can anyone state why we should not treat François document a draft standard.

Vic: not sure, so empty now.

Dave: maybe we could ask you to do that...

Larry: More specific question is motion saying adopt it as draft #1 and number subsequent draft revisions

Jim: No. Other committees issue a standard committee document number to the draft standard. Committee votes to release a new revision at significant milestones. This avoids a new version number at each meeting.

10.a Report from FCC Open meeting

-----phone call -----(ed. "Jim" refers to Jim Lovette in this section)

Jim Lovette phone call report: Lots of smiling faces in Computer industry, not so smiling from PCS industry. We share their concerns. Issues: Have FCC news release, his notes, verbatim transcript from FCC statement, notes on press conference

Comment on what this is all about. FCC has been driving new tech. going back several years. Also nexus with efforts from thunderbolts from congress to preserve existing microwave links. resolution of this clash. Deal we cut. Commissioners stated this appears to be good compromise.

Quote FCC: Allocated 220 MHz of 2 GHz spectrum. wide range of new services, including data-PCS and other mobile services. Transition framework: Licensed framework includes defacto moratorium on deployment of PCS for three years. Possibility of sharing. Comm. Marshall said positioned to make new tech. want to share.

Separate spectrum for unlicensed, no three year moratorium, immediate deployment. Indication that fixed users should be given priority access to Gov. spectrum in other 2 GHz. spectrum. Apple issued separate request called Data-PCS. Worried that folded into reg. PCS. This did happen in PCS notice of inquiry, but now reversed through efforts of WINForum and 802.11 and others. Unlicensed can be dealt with immediately. We presented a better case to FCC with more unanimity. PCS are fragmented group.

If incumbents and new technologists can get together - this is best. Must build product. If negotiations fail, dispute resolution process will come into effect. FCC asked for comments on appropriate method. New Tech. group will have even playing field with incumbents.

All of our efforts have born fruit. Tom Stanley stated that he believes products will be released almost immediately
Questions from audience.

--Any comments about Etiquette?

Jim: No, This dealt specifically with clearing frequency for new tech. Did not deal with how those frequencies are used.

Richard Lee: Comment on what our position should be?

Jim: Should be comfort and confidence on our effort. It will be worthwhile. Filing comments is a part of the process, not a end point. We should show technology, liaisons, international and domestic in addition to filing comments. today comments refereed to trade and US jobs. Had trouble convincing ourselves this was worth doing. We went ahead and now it is validated and confirmed. We can get back to work on etiquette. Glad this happened in a hurry. No shift in strategy in trying to do more detailed MAC's etc.

Don: Comment on rules that would cause incumbents to negotiate with us?

Jim: They can no longer enjoy windfall profits. FCC implied there is no hostage situation with respect to spectrum. You can build product and they must come. Their position is co-primary. New Tech. users can request involuntary movement of incumbent.

Dave: Is there any time frame for unlicensed? (licensed?)

Jim: We can start today, unlike other PCS users who must wait 3 to 8 years.

Example 1835 to 1925 band. We get priority in kicking them out.

Chan: Remaining competitors are W-PBX and cordless telephone. Correct?

Jim: Yes, we need to work this out.

Chan: Eligible co-users

Jim: Yes, better term.

Larry: In other NPRM, these are co-habitator of band. Integrated devices a combination of all of the above are in our minds. Wondering if this is viewed as something broader. If other users that have considered licensed spectrum. as only answer might now consider this band.

Jim: This is not new. There are strange and diverse users in the wings. This has been a backup plan of these industries all along, and remains a problem.

Next steps: Calls for further notice of rule making include the unlicensed issue. Looking for 802 spectrum allocated early next year. Not unrealistic. has momentum.

Vic: can you fax anything to hotel?

Jim: yes. Can't verify valid transcripts yet. Will blank out statements about visits to Apple.

--- Relating to incumbents. How does FCC plan to address negotiations with existing users if you don't know where they are (ref. to mobility)

Jim: There are ways.... This spectrum must be cleared nationally in order to make this band useful. FCC can't allow interference. FCC is willing to make them move. FCC is requesting an industry group to volunteer themselves for the negotiations.

Vic: Thanks Jim personally. (Clapping around room)

Jim: Must point out this is a joint effort from many many individuals. This is noted in congress. New Tech. (802 and others) has been heard in congress.

-----end of phone call-----

10.2 PHY group

Resume Meeting

Larry: If we were to vote draft document a draft standard it could become such.

François: My intention was to at next meeting make a cover sheet as a submission with a motion to accept as draft.

Dave: The procedural details could be handled off-line, please.

Vic: Agrees

Larry: Sends message that he does not like format of report.

Dave: Didn't take time for votes because we don't have quorum.

Larry: Unless you have a reason for imposing another level of organization., I don't see a need for this...

10.3 MAC/PHY Group Report Vic Hayes reported:

Convened Monday - Wednesday and reviewed 109, 110, 98, 96, 106 and NPRM, 104 and 105. They generated output doc 115 "NPRM Response for Wireless LANs" edited by Rich Lee and Vic. Rich will present it now.

Rich: Have a copy? First four items are "boiler plate" sort of. Like a three column balance sheet: item 5, 6 and 7. Areas of full agreement, areas of qualified endorsement, items of disagreement.

Dave: On point in 6: Wants both cases of power control explicitly stated.

Chan: Wonders if can say except peak power level is 10 dB below max., out of band emissions don't follow you down. If your power level is small enough then your emission becomes fixed. Wasn't thinking of linking to power control - refer to max. power you can transmit. Wants it easy to design a 100 μ W transmitter.

John: in 6: a. Specify want to stick "max. authorised" in front of word "peak"

Don: Found places where power measurement requires peak and someplace else it requires average.

Larry: In every case we are being saddled with a Peak rather than average measurement. Thinks this is OK depending on measurement technique.

Rich: Variable depending on measurement technique. what do we want to say?

Larry: I agree with NPRM - you should limit the peak. You can't play games under an average.

Rich: Others agree. OK change to say accept Peak Power measurement in sec. 15.253 areas. This gets moved to area of Agreements.

Don: Top of second page could be improved. Ref. Min. Occupied bandwidth. Should say we agree and an associated max. power spec. den. (period) Then in comments, second one, says what we REALLY would like to see.

Nathan: Comment on power control. Good idea, but don't want FCC to tell us how to do it. Don't want power control in the doc.

Rich: This was voted on earlier. Deal with Don's comment. (No disagreement to proposed change)

Don: one more change..."appears to be the intent of" ..

Rich: Dealing with "agree with min. occupied bandwidth specification"

Dave: Can we do this off-line?

Yes -all.

Rich: Do all agree with the intent of this third paragraph?

no disagreement.

Don: something) different than WINForum recommendation.

Rich: OK, but this is the same as that. ... (ref. Watts/Hz verses Watts/sq. rt. Hz.)

John: Actually WINForum is not sure on this. This is a big improvement over NPRM. (agreement around room)

Rich: Vic make note to track WINForum on this. Is there any other disagreement?

Jim McDonald: Freq. Stability issue concern. Worried over cost factor to achieve this potential rule.

Rich: Recommendation is OK here. All specified emission fall within band. This give latitude to design with higher toll. clock, with restriction of not radiating outside band.

John: Consider putting parenthesis.

Rich: not there yet.

(ed. Apologies from taker of minutes, much dialog was not recorded on this topic.)

Last item in 6 should be have times floor per unit

Rich: Item 7: Only state we are "oppressed" within our small allocation. See package in back of 115. Want formal motion to move ahead procedurally.

Dave: Tell me the intent of "decide if appropriate to still file, etc., etc."

Vic: Depended on Jim Lovette's comments today.

Larry: People recommended to review this are not proper since they have not been present for all this discussion.

Dave: Agrees.

Vic: Committee to review altered to Lee, Lovette, Hayes, van der Jagt, Chandos.

Dave: Still uncomfortable with statement that you might decide not to file. There is no late filing. This is more latitude than I wish to give the editors.

Vic: inserts "of certain paragraphs"

Dave: not acceptable. (due to time pressure, kept in)

Rich: Motion to approve resolution. (as worded in last page of doc 115)

Second by Dave Bagby. Dave calls the question, second by John McKown, Result of calling the question: 10, 0 2.

Result of vote on the motion vote: 10: 0: 2. Motion passes.

11. Unfinished business

- 11.1 Recap of output documents.** 92/115 is the only output document. This will be sent by fax to the voting members.
- 11.2 Recap of document distribution.** Vic announces that the two documents from WINForum may be cancelled, pending a better liaison statement.
- 11.3 Next Meeting** This meeting is the plenary meeting in La Jolla. Vic will make the schedule after consultation with the chairs of the subgroups. The last mailing date will be 18 October. The objectives will be:

continue time bounded services
additional discussion on distribution systems
work on MAC/PHY
accept input from DS FH IR ad hocs
filling in outline
90-314 issues

- 11.4 Other Intermediate Meetings required?** Larry proposes to schedule a meeting Sunday. A straw poll reveals support of only two members. Asked whether there would be objection against scheduling sub-groups on Monday morning, several members raised their hands.

The chair decides that no interim meeting has to be scheduled.

- 11.5 Confirmation of January Meeting** The January meeting will be confirmed as soon as the chair received further information from Ken Biba.

12. New business Dave: Request chair make some way to have binding authority at interim meetings. We must have this capability to make progress.

Vic: agreed, will look into.

13. Closure The meeting adjourned at 5:05 pm without the quorum

Tentativ meeting schedule

Date	Month	Year	Place	Type	Location	Host
09-13	November	1992	La Jolla, CA	Plenary	Hyatt Regency Hotel	
TBD	January	1993	Los Angeles area	Inter	TBD	Xircom
08-12	March	1993	Baltimore, MD	Plenary	Omni, inner harbour	
10-13	May	1993	Wilmington, DE	Inter	Radisson Hotel	Ship Star
12-16	July	1993	Denver, CO	Plenary	Sheraton Denver Technology Center	
TBD	September	1993	TBD	Inter	TBD	Open
08-12	November	1993	? W Palm Beach, FL	Plenary	?Ramada Resort	
TBD	January	1994	TBD	Inter	TBD	
07-11	March	1994	Vancouver, BC	Plenary	Hotel Vancouver	
TBD	May	1994	TBD	Inter	TBD	
11-15	July	1994	Minneapolis. MN	Plenary	Radisson South	
TBD	September	1994	TBD	Inter	TBD	
07-11	November	1994	? Irvine, CA	Plenary	? Irvine Marriott	

We received invitations to host a meeting from GM to Oshawa (Ontario, Canada), LXE to Atlanta (GA), DEC to Boston area, and ICIL to Hong Kong.

Appendix 1 Attendance list

<u>Name</u>	<u>Company</u>	<u>communications</u>	<u>Voting member</u>
APONTE Mr. JOSE	DECCC	+1 513 223 2333 apontej@	
BAGBY Mr. DAVE	Sun Microsystems	+1 415 336 1631 david.bagby@sun.com	vm
BLACK Mr. SIMON	Symbionics	+44 223 421025 sab@symbionics.co.uk	vm
BUAAS Mr. ROBERT A.	The Buaas Corpotation	+1 714 968 0070 buaas@nosc.mil	vm
CHOI Mr. BRIAN	DISA/CTA	+1 703 696 1907	
CHRISTENSEN Mr. JOHN	Booz, Allen & Hamilton Inc	+1 703 902 5266	vm
	christensen_john@tysons.bah.pc.niaid.nih.gov		
CONGDON Mr. PAUL	Hewlett Packard	+1 916 785 5753 ptc@hprnd.rose.hp.com	vm
COOPER Mr. BURCHALL	LXE	+1 404 447 4224	vm
DAVIS Mr. CHARLES S.	Protocol Systems Inc.	+1 503 526 8500 chuckd@protocol.com	
DIEPSTRATEN Mr. WIM	NCR Systems Engineering B.V.	+31 3402 76482 wim.diepstraten@utrecht.ncr.com	vm
ENG Mr. JOHN W.	Digital	+1 508 486 7734 eng@nac.enet.dec.com	vm
GAUTHIER Mr. ROBERT	Rockwell International	+1 714 833 4189 gauthier@nb.rockwell.com	vm
GEIER Mr. JAMES T.	C.E.T.A. Corp	+1 513 427 2382 71165.2045@compuserve.com	
GULICK Mr. DALE E.	Advanced Micro Devices	+1 512 462 5102	
HAYES Mr. VICTOR	NCR Systems Engineering B.V	+31 3402 76528 Vic.Hayes@Utrecht.ncr.com	vm
ISHIFUJI Dr.Eng. TOMOAKI	HITACHI Central Research Lab.	+81 423 23 1111 ishifuji@crl.hitachi.co.jp	vm
JAGT Mr. LARRY van der	Knowledge Implementations Inc	+1 914 986 3492	vm
JOHNSON Mr. DONALD C.	NCR Corporation WHQ 5E	+1 513 445 1452 donald.c.johnson@daytonoh.ncr.com	vm
KWOK Dr. TIMOTHY C.	Apple Computer Inc	+1 408 974 8311 kwok@apple.com	vm
LAMAIRE Dr. RICHARD O.	IBM T.J. Watson Research Center	+1 914 784 7571 lamaire@watson.ibm.com	
LEE Mr. RICHARD	Spectrix Corporation	+1 708 251 5378 richardlee1@attmail.com	vm
MACNAB Mr. COLIN L.M>	GEC Plessey Semicond	+1 408 439 6075	

Appendix 1 Attendance list

<u>Name</u>	<u>Company</u>	<u>communications Voting member</u>
McDONALD Mr. JIM	Motorola	+1 708 576 3169
McKOWN Mr. JOHN	Motorola	+1 708 632 6551 vm mckown@whitefish.rtsg.mot.com
MAHESHWAR Mr. TIRUCHINAPALLI M.		+1 614 771 7648 tmaheshw@sunflash.ec.usf.edu
MIURA Dr. AKIRA	Panasonic Technologies Inc.	+1 415 858 1000 vm miura@tadw.panasonic.com
MOORE Ms. BARBARA J.	C.E.T.A. Corp	+1 513 253 2832 mooreb@logdis.hqafic.wpafb.af.mil
NATARAJAN Dr. K.S.	IBM T.J. Watson Research Center	+1 914 784 7844 vm nataraj@watson.ibm.com
ROOD Prof. ROBERT D.	GTE Government Systems	+1 508 880 4289
ROMIK Mr. PINHAS	DCL Technologies Ltd	+972 52 584684
ROTHENBERG Mr. MICHAEL	LANNET Data Communications LTD	+972 3 5447150 vm mrot@lannet.com
RYPINSKI Mr. CHANDOS	LACE Inc.	+1 707 765 9627 vm
SCHUESSLER Mr. JAMES E.	National Semiconductor	+1 408 721 6802 vm jim@berlioz.nsc.com
SCOTT Mr. GREGOR D.	Defense Information Systems Agency	+1 908 532 7726 c3a-std@monmouth-emh3.army.mil
SHENG Mr. J. MAX	Toshiba America Information Systems Inc	+1 714 587 6679 maxs@tais.com
SILBERMAN Mr. NATHAN	California Microwave Inc	+1 408 720 6462 vm nsilberman@mcimail.com
SIMON Mr. FRANÇOIS Y.	IBM	+1 919 254 4584 vm fygs@vnet.ibm.com
STOROSHCHUK Mr. OREST L.	General Motors of Canada	+1 416 644 6994 vm
TZE Mr. RYAN H.	Toshiba	+1 714 587 6769 vm ryant@tais.com
WASKEVICH Mr. DAVID J.	Spectrix Corporation	+1 708 491 4534 vm