Tentative Minutes of the IEEE P802.11 Working Group

Interim meeting
Atlanta, GA
September 20-23, 1993

Monday, September 20, 1993, 8:30 AM

The meeting was called to order at 8:30 AM by Vic Hayes, chairman IEEE P802.11[1).].. John McKown vice-chairman, Carolyn Heide secretary (Jim Schuessler acting secretary). John McKown and Larry Z. managing document originals and copying, Jerry Socci managing distribution and pigeon hole organization. Leon Scaldeferri handling the attendance list. The agenda document for this meeting is 802.11-93/124.

Frank O'Neill, LXE Corporation, welcomed everyone to Atlanta. LXE is sponsoring this meeting.

Objectives:
- Working on the Issues list
- Drive towards creating a MAC protocol

[1)]The officers of the Working Group are:

Mr. VICTOR **HAYES**	Mr. JOHN McKOWN	Ms CAROLYN L. HEIDE
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- Drafting text for insertion in Standard
- Discussion on impact of July IP disclosures
- MAC/PHY interface definition
- decide on PHY headers + preamble
- Wording of FH PHY spec.
- Closing proposals for DS PHY specs
- Continue work on IR, DS and FH template

1. Opening

1.1 Roll Call: People in the room were invited to introduce themselves.

1.2 Voting rights: Voting tokens were distributed in the attendance book to be picked up by voting members during attendance list circulation. There is a paper describing voting rights and information for new members, IEEE 802.11-92/00, 00.1 and 00.2. In subgroups everyone can vote.

1.2.1 Rules:

Working Group level: by voting members only
Have token, provided in attendance list
Participate in at least 2 out of 4 consecutive plenary meetings, voting starts at third meeting
participate is at least 75 % in meeting room
one interim may be exchanged for a plenary
    75 voting members   quorum depends on NM
    30 nearly members
    80 aspirant members

1.3 Attendance list, Registration: The attendance list was distributed - 75% attendance according to the attendance list is required to qualify for participating the meeting as a whole, so make sure to sign the book. Copies of the attendance list are handed out before the end of each meeting.

1.4 Logistics: Document distribution is done using pigeon holes - you will find your copies and messages in the referenced location in the expanding file folders in the slot *in front of* your name. Breaks will be at 10:00 AM and 3:00 PM, and lunch is approximately 12:00 to 1:30 PM.

1.5 Other announcements: none

2. Approval of the minutes of the previous meeting

2.1 Denver meeting, Document IEEE P802.11-93/117: No quorum, so no vote was taken. No comments on minutes.

2.3 Matters arising from the minutes: none.

3. Reports

3.1 Report from the Executive Committee, July Meeting, by Vic Hayes

- Vic reported that he voted for two separate groups to be formed from the old 802.3 group for two efforts at 100 Mbit/s.

4. Registration of contributions to be presented

See partial document list below.

93/96	WMAC Protocol - Comparison against MAC Criteria (Wim Diepstraten, NCR)
93/115	Protocol layering alternatives for practical implementation (M. Fischer)
93/129	Brief outline of the IETF work concerning 'Wireless Mobility' (Charles Perkins of IBM Research)
93/132	Tentative agenda of the Direct sequence Spread Spectrum ad-hoc group, September 1993 meeting
93/133	Infrared Modulation Method: Baseband Return to Zero with Bit Insertion (Tom Baumgartner, Spectrix)
93/134	Notice of Patent Applicability (Tom Baumgartner, Spectrix)
93/135	Simulation results of several WLAN modulation methods (Naftali Chayat and Michael Rothenberg, LANNAIR)
93/136	Opinions on issues 13.6 and 17.3, and new issues (Pablo Brenner, LANNAIR)
93/137	Implementation architecture, suggested preambles and study, VLSI components for for 1 Mbit/s GFSK and for higher bitrate FQPSK, offset QPSK WLAN (Shuzo Kato, Shuji Kubota, Kazuhiko Seki, Tetsu Sakata, Kiyoshi Kobayashi and Yoichi Matsumoto, NTT Japan)
93/138	1 Mbit/s and higher data rate PHY/MAC: GFSK and FQPSK(K. Feher et al, University of California Davis)
93/139	Notice of patent applicability (K. Feher et al, University of California Davis)
93/140	MAC/PHY Functional Partitioning (Phil Belanger, Xircom, Greg Ennis, Symbol Technologies, and Wim Diepstraten, NCR)
93/141	NCR Corporation's Intellectual Property Statement on the NCR proposals
93/142	Update of Propagation Losses and Impulse Response of the Indoor Optical Channel (Cipriano Lomba et al., University of Aveiro, Pt)
93/143	Optimum code patterns for PCM synchronization (Merwin W. Williard, Symetrics Inc.)
93/144	Data Compression in Wireless LAN, General Issues (Robert Lutz, STAC)
93/145	Establishment of DSSS PHY parameters (Jan Boer, NCR and Paul Struhsacker, Telxon)
93/146	The need for MAC data delimiters in the PHY (Wim Diepstraten, NCR)
93/147	The importance of short Rx-Tx turnaround time (Wim Diepstraten, NCR)
93/148	Preamble and MAC header to support Hop acquisition for a frequency hopped PHY (Jerry Socci and Ken Ju, National Semiconductor)
93/149	Need for etiquette for FH and DS 802.11 compliant PHY (Burchall Cooper, National Semiconductor)
93/150	Preamble for FH PHY (François Le Maut, IBM)
93/151	The Necessary Conditions for support of connection-type and connectionless services on wireless LAN (Chandos Rypinski, LACE)
93/152	Necessary PHY Layer Alternatives for ET band and for "HIPERLAN" (Chandos Rypinski, LACE)
93/153	Revisit to Channelized MAC protocols (Chandos Rypinski, LACE)
93/154	Infrared Modulation Method: 16 Pulse Position Modulation (PPM) (Adriano Moreira et al., University of Aveiro, Pt)
93/155	Proposal to pursue a flexible modulation standard for IR (Walter Hirt and François le Maut, IBM)
93/156	Tentative minutes for the higher data rate FH PHY August 23 1993 (Wayne Moyers, Wise)
93/157	Thermal behaviour of LED Arrays (F.J. Gabiola, F.J. Lopez-Hernandez and A. Santamaria, University of Madrid)
93/158	Analysis of a data compression method as a MAC option (Waychi Doo, National Semiconductor)
93/159	Frame Prioritization in a CSMA/CA MAC protocol (Rick White, Motorola) + slides
93/160	Consideration in FSK Tx pulse shaping and Rx filtering for low ISI at high bit rates (Naftali Chayat, LANNAIR)
93/161	RF Physical Layer baseline document for the Physical media dependent sublayer of a FHSS PHY Tim Blaney and Ed Geiger, Apple Computer)
93/162	Proposed starting point text for Section 6 of Document P802.11-93/20 (Larry van der Jagt, KII)
93/163	Comparison and commonalities of asynchronous sequential access and adaptively partitioned periodic frame MAC proposals (Chandos Rypinski, LACE)

Document 93/43 has not been released from ETSI, pending copyright approval. Further
    individual documents could be released upon request from ETSI chair.
Doc 93/56 Voided.
Doc 93/108 not published due to lack of proper headers and footers.
Doc 93/130, 131 is excerpts from Field Bus Standard and has not been distributed since it is
    available elsewhere and is quite long.

5. Adoption of Agenda:

Discussion of whether we have enough Joint MAC/PHY time and if it is early enough in the
week. Dave Bagby proposes to continue our Monday morning session as a Joint meeting.
Group agrees by acquiescence.

Monday AM (remainder and PM), 20 September, 1993
MAC and PHY subgroups
It was decided to determine which meetings would occur this evening in the PHY group later
today. (Larry V.)

Monday Evening, 20 September, 1993
PHY-IR subgroups, Higher Speed ?

Tuesday AM, 21 September, 1993
Joint MAC/PHY

Tuesday AM (remainder and PM), 21 September, 1993
MAC and PHY subgroups

Wednesday AM & PM, 22 September, 1993
MAC and PHY subgroups

Thursday AM and part of PM, 23 September, 1993
MAC and PHY subgroups

Thursday PM (starting time to be determined),
 23 September, 1993
Full Working Group

6. Unfinished Business:

6.1 Comments on updates of draft standard: none

7. New Business

Vic announces that FCC will have open meeting on Sept. 23rd. at 9 or 10 am. There is a
possibility to have an open channel via telephone. The group was concerned it would draw too
much time from our objectives. Consensus reached to not make the tele-conference available.

8. Adjourn for subgroups - 10:30 PM

Monday AM (remainder and PM), 20 September, 1993
MAC and PHY subgroups

Monday Evening, 20 September, 1993
PHY-IR subgroups

Tuesday AM, 21 September, 1993
Joint MAC/PHY

Tuesday AM (remainder and PM), 21 September, 1993
MAC and PHY subgroups

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MAC and PHY subgroups

Thursday AM and part of PM, 23 September, 1993
MAC and PHY subgroups

Thursday PM (starting time to be determined),
23 September, 1993
Full Working Group

9. Opening

Vic opens meeting at 1:30 pm, Thursday.

9.1 Announcements

Master copy of attendance list is available for corrections

9.2 Document list update

Vic updates list with numbers for minutes of this meeting and agendas for next meeting.

9.3 Agenda adjustments

Add new business item

10.   Reports

10.1 MAC group

Dave Bagby, Chair of the MAC Working Group reports. Papers presented and discussed include 93/96, 93/129, 93/136, 93/144, 93/151, 93/163, 93/153, 93/158, 93/159. Our progress on announced agenda subjects included: Issue Working through breakout groups, Driving toward MAC proposal from current proposals, Deferred drafting of any text for draft standard. The group took some issue positions:

Issue 9.5 Support of MAC level compression? Moved: Compression will be supported by providing the necessary mgmt. hook in 802.11 to invoke the mechanism of 802.10 and we will formally request that 802.10 extend their work to include support for compression. If 802.10 declines we will have to revisit this topic. Vote is 25, 5, 1 passes

Vic points out that other 802 groups that responded to him reported they were not working on it. Some concern about pairing 802.10 with compression, but it was pointed out that compression must be done before encryption.

Issue 6.10 Wired LAN equivalent security algo. Discussion only

Issue 4.5 Can a station be a member of an ad-hoc and non-ad-hoc network at the same time? The position was moved and passed in the MAC WG: The standard shall be mute on this issue; the std. shouldn't require simultaneity; not doing anything to explicitly enable or disable function. **Vote is 28, 1, 1 passes.**

Issue 15.8 Shall all stations support the TB services? Much discussion and text added to the issues log. No decision reached. Will discuss next time.

Issue 18.5 Is data rate agility only a PHY matter? WG takes the resounding position NO! Moved to take this position. Tom B. seconds. Vote: 33, 0, 0 passes

New issues were added: Shall 802.11 MAC support multiple data rate PHYs? Much discussion was captured for this in the breakout group and will be added to the issues log. One recommendation was; Yes, for increasing data rates and only for significant throughput gains.

Issue 17.5 What is meant by addressing? IEEE 48-bit was recommended by issue left open.

Issue 17.6 Global addressing and Directory service effect on MAC? Recommend to close because don't understand the question. Moved.   Seconded by Kerry Lynn. Vote 31, 0, 0 passes.

Issue 17.7 Does MAC supply packet number to PHY? Group recommended: MAC does not supply to phy layer packet numbers. (doesn't know what to do with it.) Seconded by Phil B. Vote: 33, 0, 0 passes.

Issue 10.1 Which co-ordination function should be used: Point CF, Distributed CF or Both? Major finding was to distinguish between features of alternatives. Some of the arguments in the issues log were irrelevant to the core issue of CF. Their recommendation was "both". A motion was made to close, but it was postponed. Postponed closure. The group has decided to discuss the underling issues first.
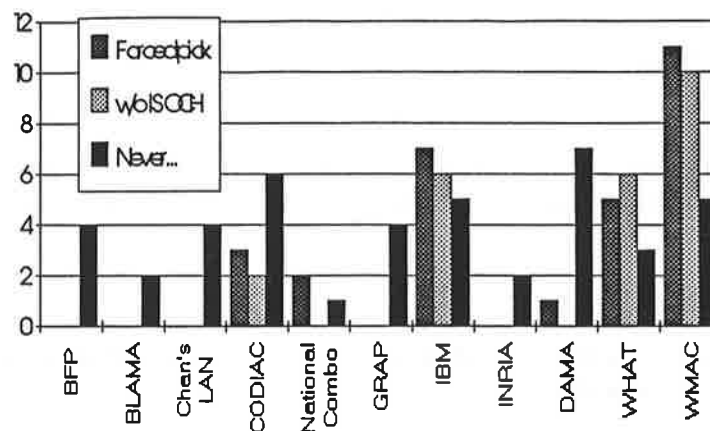

Progress on driving toward MAC foundation: The MAC group took the position by passing the following goal: MAC group is committed to selecting a protocol (either existing or a derivative of existing proposals), to be the foundation used as the basis for future enhancements and refinements by the end of the November meeting. Vote in Working Group: passed by 20, 8, 1

Straw Poll taken:

- First thing Monday morning - some members not yet present.
- Unscientific Informal Poll.
- Differences small in absolute magnitude.
- Secret ballot
- Be careful. Easy to draw unsupported conclusions - But, generally representative of group trends.

Straw Poll questions:

- Q1: If you had to pick on protocol right now, which one would it be?
- Q2: If you had to pick a protocol only on the basis of it's data ability (ignoring Isoch) which would it be?
- Q3: Which Protocol(s) would you never accept (as they stand now)?

(For those whose printers do not resolve the colors properly: "Forced to pick" bar is on the left, "Never" bar is on the right.)

MAC group narrowed set of foundation protocol candidates.

- Moved: That we select the following MAC proposals as an initial subset from which a basis for the 802.11 MAC protocol shall be derived:
- CODIAC (Spectrix)
- IBM protocol (IBM)
- Hybrid (National)
- WHAT (Xircom)
- WMAC (NCR/Symbol)

- MAC group Vote: 23, 5, 5

   Motion ratified by vote: 26, 2, 2

Detailed Intellectual Property Discussions required During November Mtg.

- Foundation candidate companies should provide 802 IP license / fairness statements before November meeting.

   Vic points out that it is not "you" that gives the statement, but rather a patent attorney or "responsible manager" from companies stating an official position with a signature.   Phil admonishes the group not to discuss legal matters in this body and thus waste committee time.   Kerry points out that some companies might be wary of releasing any comment due to revealing key detail. Ron B. believes this can be done without revealing too much detail. Consensus of group is not to "play lawyer".

MAC Agenda Subjects and Goals for Nov 93 mtg.

- Determine the MAC foundation protocol.
   - Primary goal for November mtg.
- Foundation Candidate IP exploration.

–   Required for primary goal decisions.
- Compression and Encryption algo. Liaison w/ 802.10.
- Multi phy rate impact exploration.
- Issue working.
    –   Use of small break out group working well, will continue.

Question asked from floor if whether papers on other topics will be considered. Chair states that
        papers on above listed topics will be given priority and if time, other papers will be heard.

Dave finishes report

Break at 2:45 pm.

Regroup at 3:00 pm

DEC has volunteered to provide an Internet Reflector for the group. Should be up in one week.
        System at SUN no longer works.

10.2 PHY group

Larry Van der Jagt reports on progress from the PHY working group. Worked on preambles / PHY
        headers / Header acquisition. They formed a higher speed ad-hoc group to study a possible higher
        speed phy solution. They recognized that they should as much as possible harmonize DS and FH
        specifications to reduce coexistence problems. An issue was opened for an IR PHY template of
        parameters.

FH Ad-hoc group worked on drafting text to place in 93/20 to cover detailed specification of the FH
        modulation decided on at the last meeting. Working drafts of this text will be reviewed at the next
        meeting.

DS Ad-hoc group worked on closing sub-issues associated with 24.12 dealing with DSSS
        parameterization tentatively select OQPSK for 2 Mbit/s operation and BPSK for 1 Mbit/s operation.
        Next meeting they will continue to close sub-issues and have as a goal closing 24.12

IR Ad-hoc group accepted submissions. Not enough input to decide on modulation. An attempt will be
        made to begin detailed modulation discussions at next meeting. Meeting Monday AM in West Palm
        Beach.

Higher Speed ad-hoc group set the goal of defining higher speed PHY in a 12 month time frame. They
        are trying to establish a threshold for what higher speed is. It currently is at least 1.5 Mbit/s.
        Meeting Monday AM in West Palm.

PHY Group Moves: We are interested in opening a formal IEEE 802.11 channel for discussions with the FCC. We move that the 802.11 plenary charge the 802.11 chair with the task of seeking the approval of our governing body for us to do this under the 802.11 name. **(Larry) Seconded by Jan Boer. Vote: 23, 0, 0 passes**

Chan mentions the channel through WINForum has been "narrowed" and supports this effort.

Goals of the next meeting are:

- To close FH Headers / preamble hop acquisition issue
- Continue MAC/PHY work
- Look at constraints on DS and FH in 2.4 Band that have an impact on coexistence
- Close DSSS parameters issue 24.12
- Work on IR parameters issue
- Complete work on text for document 93/20 associate with FH mod. description issue
- Continue higher data rate studies.

Larry present meeting schedule for the next meeting.

10.3   Joint MAC/PHY group

Vic reports on progress made in the Joint MAC/PHY working group.

93/115	J	Protocol layering alternatives for practical implementation (M. Fischer)
93/140	J	MAC/PHY Functional Partitioning (Phil Belanger, Xircom, Greg Ennis, Symbol Technologies, and Wim Diepstraten, NCR)
93/147	J	The importance of short Rx-Tx turnaround time (Wim Diepstraten, NCR)
93/162		Proposed starting point text for Section 6 of Document P802.11-93/20 (Larry van der Jagt, KII)

Motion passed by working group needs to be ratified here. Original motion vote: 30, 6, 6: passes. Vic Moves:

1.) We revise our reference model as proposed in 92/140 without the PHY Convergence Layer and Medium Independent Layer, and
2.) adopt the described approach to refine the MAC/phy interface, and
3.) Leave open the sub-issue of to have or not have an exposed DTE/DEC interface at the MAC/PHY boundary, and
4.) close issue 1.5 by referring to the adopted reference model.

Seconded by Dave B.

Greg Ennis states that a new picture of the model has been created in the mean time and shows it to the group. Presents a **motion to amend the motion..** (to substitute new model picture shown on slide)

Larry opposes the new model since he claims this is a substantive technical change to our earlier motion. It is not the same as that of 93/140. Wants to know if this change is in order from Vic. (There is much discussion whether this is a substantive technical change.) Vic rules that it is a substantive change. Larry urges this to be voted down because there was much time spent a

long time ago and a decision was made. Why is the MAC/PHY group concerned about the PHY layer?

Greg withdraws the motion to amend. (Discussion continues on original motion to ratify exact words from working group.)

Bob Grow comments that what we currently have and what is presented here in 93/140 is not accurate. Does not believe changing the model until we understand the issues better is making progress.

Dave believes it is proper for the MAC/PHY group to address internals of the PHY because that group is a superset of the PHY group. Makes a suggestion that when we all meet in one meeting we do so as a "plenary" of 802.11 and not a working group. This would further progress since we would not have to ratify every decision made.

François Simon asks for clarification of the location of the DTE/DCE interface.

Bob E. reminds group that model is just that and not a physical implementation. It's purpose (one purpose) is to facilitate where things get done. Urges group to consider the purpose of the model.

Ron B. comments that some future functions and/or requirements may not be accommodated by the new model.

Greg E. agrees with Larry that "the model is important". One purpose is that it guides our specification effort. Another purpose is as a means to communicate, especially for members of this committee. Greg believes the model will and should undergo further refinement.

Larry agrees the model will change, but makes the point that current model was created over a long period of committee time. This new model has only had two hours of discussion and we should not be so hasty to change the present one.

Wim recalls that our current model (born July 1992) was not a result of many meetings, but rather some limited amount of time. Points out this is a valid refinement of that model.

Michael urges the committee to accept what we have here (new one) to facilitate progress. MAC decision on foundation protocol next meeting needs a model.

Vote: 9, 4, 4 fails due to 75% rule. (9/13 = 0.69) (Model remains unchanged)

The WG passed a motion addressing service primitives. Vote in working group was: 42, 0, 0: passes. To ratify it, Vic moves:

We adopt the service primitives as described in 93/162 as the service primitives for the PhSAP associated with data transference between MAC and PHY. (These primitives have previously been described in 92/96, and 92/119) Issue 12.1 be appropriately modified to reflect this decision.

Dave B. Seconds. Vote: 14, 0, 2 passes

PHY input
Kamilo Feher presented slides showing the improvement in performance by switching from 1 Mbit/s to 500 kbit/s.
Rate switching was not the only parameter.
Larry presented some conclusions from the PHY group:

1.) There is a strong majority opinion in the PHY Group that rate switch should be included in standard providing it does not introduce significant performance degradation to basic rate operation.

2.) There is a majority opinion that 802.11 will still be a useful standard without rate switching.

3.) 100 uS preambles are probable.

MAC Input
Rate discussion occurred in MAC meeting and report will be later. It definitely effects the MAC in nontrivial way.

11.   Unfinished business

11.1   Recap of output documents

Chair asked to send letter to chair of 802.10. Leon will provide input to Vic.

11.2   Recap of document distribution

Minutes of meeting on Higher Speed PHY will be reduced due to high volume of related input.

11.3   Next Meeting

* Additional objectives/logistics for next meeting

2 Monday AM meeting rooms

Sponsors HIPERLAN Tutorial. No objection from group to have Vic sponsor this.

* Last Mailing Dates:

Next one is Oct. 1

Last mailing is Oct. 20

11.4   Other Intermediate Meetings required?

11.5   Confirmation of January Meeting

12.   New business

12.1 Doc 93/152:

Chan presents paper on "Necessary PHY Layer Alternatives for ET Band and for HIPERLAN". Desires group to work in parallel on these two other bands. He would like to propose a motion to this effect at the November meeting. In the mean time he welcomes input from the committee.

John M. comments that we need this effort. If there are new bands we should not ignore them. Vic comments that what has happened recently with the FCC is important.

12.2 Liaison Report on WINForum

Dave B. reports on WINForum. States that the committee is split along lines of telephone companies and computer companies. The telephone companies seem to be in control at this point. WINForum did make recommendations to the FCC. Waiting to see what the FCC has done. This will be his last report. Dave has resigned as a Board Member and Sec. of the group. His reason was one of lack of indemnification insurance. Result was that he personally was liable for any decisions made by the group. Dave is personally disappointed in results from the group and urges the group to investigate the group for themselves.

Don asks why WINTech didn't represent interests. Dave responds that there is much controversy over this issue.

Chan comments he understands the common carrier interests. In one case the amount of spectrum conveyed to the FCC showed it skewed toward the common carriers. Dave replies and agrees with Chan.

John McKown states that is possible to make a technical defense for the document that was finally presented to the FCC.

There is a discussion of how we should represent our position to the FCC.

Vic takes a poll of members on whether the MAC/PHY Joint Working Group be made a plenary session. There is no objection.

Vic thanks LXE and Frank for sponsoring this meeting.

13.   Closure   4:30 PM

Tentative Meeting Schedule

Date	Month	Year	Place	Type	Location	Host
20-23	Sept	1993	Atlanta, GA	Inter	Holiday Inn Buckhead	LXE
08-12	Nov	1993	W Palm Beach, FL	Plenary	Ramada Resort	
10-13	Jan	1994	San Jose area	Inter	TBD	WiSE, NSC, or Symbol
07-11	March	1994	Vancouver, BC	Plenary	Hotel Vancouver	
09-12	May	1994	Oshawa, Ontario	Inter	GM of Canada	GM
11-15	July	1994	Orlando, FL	Plenary	Walt Disney Swan	
TBD	Sept	1994	TBD	Inter	TBD	Open
07-11	Nov	1994	Incline Village, NV	Plenary	Hyatt Regency, Lake Tahoe	
TBD	Jan	1995	TBD	Inter		Open
TBD	Mar	1995	TBD	Plenary		
TBD	May	1995	TBD	Inter		Open
TBD	July	1995	TBD	Plenary		
TBD	Sept	1995	TBD	Inter		Open
TBD	Nov	1995	TBD	Plenary		

We received invitations to host a meeting from DEC to Boston area, ICIL to Hong Kong and LACE.

Appendix 1
Attendance list (continuation)

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Appendix 1
Attendance list (continuation)

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Appendix 2
Document list

See page 3 for the document list

The following is the list with document number reservations:

93/164	Modulation selection Criteria (Nathan Silberman)
93/165	Comments on issues pertaining to the MAC/PHY boundary.
93/166	Tentative minutes of the full Working Group meeting held September 20-23, 1993, Atlanta, GA
93/167	Tentative minutes of the MAC sub-Group meeting held September 20-23, 1993, Atlanta, GA
93/168	Tentative minutes of the PHY sub-Group meeting held September 20-23, 1993, Atlanta, GA
93/169	Tentative minutes of the PHY IR ad-hoc Group meeting held September 20-23, 1993, Atlanta, GA
93/170	Tentative minutes of the PHY DS ad-hoc Group meeting held September 20-23, 1993, Atlanta, GA
93/171	Tentative minutes of the PHY HS-FH ad-hoc Group meeting held September 20-23, 1993, Atlanta, GA
93/172	Working text related to the FH modulation issue (Larry / PHY group)
93/173	Further definition of MAC/PHY service primitives
93/174	Tentative agenda for the plenary meeting of the Full Working Group, November 8-12, 1993, West Palm Beach
93/175	Tentative agenda for the PHY-IR ad-hoc Group, November 8-12, 1993, West Palm Beach, FL
93/176	Tentative agenda for the PHY-DS ad-hoc Group, November 8-12, 1993, West Palm Beach, FL
93/177	Tentative agenda for the PHY-HS-FH ad-hoc Group, November 8-12, 1993, West Palm Beach, FL
93/178	Tentative minutes of the joint MAC/PHY sub-Group meeting held September 20-23, 1993, Atlanta, GA