Submission to: IEEE P802.11 Wireless LANS

Title: **PAR Example**

Date: Sept., 1999

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IEEE STANDARDS PAR FORM EXAMPLE

(1/96)

This is an example for consultation to the Mac enhancements study group to assist in forming the PAR. The example is from IEEE802.11a the 5GHZ high rate PHY.

Fill in the answers to the questions in the bracket provided. A Hard Copy of this document must be printed, signed with the appropriate signatures and mailed or faxed to the Standards Department for submission to NesCom.

1. **Sponsor Date of Request _____**

2. **Assigned Project Number (confer with staff) _____**

3. **PAR Approval Date (leave blank) _____**

4. **Project Title, Copyright Agreement and Working Group Chair for This Project**

I will write/revise a Standards Publication with the following TITLE (Spell out all acronyms)

[X] **Standard [for] (Document stressing the verb "SHALL."), or**

[ ] Recommended Practice for (Document stressing the verb "SHOULD.") or

[ ] Guide for (Document stressing the verb "MAY.")

TITLE:

[
Standard for Wireless Medium Access Method (MAC) and Physical Layer (PHY) Specifications - SupplementStandard for High Speed Physical Layer (PHY) for High Speed Wireless Local Area Networks (LAN) in the 5 GHz band]

I hereby acknowledge my appointment as Official Reporter (usually the W.G. Chair) to the (Name of Working Group)

[Vic Hayes, Chair P802.11 802.11
Working Group for Wireless Local Area Networks]

In consideration of my appointment and the publication of the Standards Publication identifying me, at my option, as an Official Reporter, I agree to avoid knowingly incorporating in the Standards Publication any copyrighted or proprietary material of another without such other's consent and acknowledge that the Standards Publication shall constitute a "work made for hire" as defined by the Copyright Act, and, that as to any work defined, I agree to and do hereby transfer any right or interest I may have in the copyright to said Standards Publication to IEEE.

Signature of Official Reporter _____

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5. **Describe this project: (Choose ONE from each group below)**

a. [ ] Update an existing PAR
[ ]Yes or [X]No
If YES, project number/approval date)_____

Is this in ballot now? [ ]Yes or [ ]No

b. [ ] New Standard
[ ]Yes or [ ]No
[ ] Revision of an existing standard.
[ ]Yes standard number/year_____ or [ ]No
[X] Supplement to an existing standard
[X]**Yes standard number/year 802.11 (in approval)**
_____ or [ ]No

c. [X] Full Use (5-year life cycle)
[ ] Trial Use (2-year life cycle)

d. Fill in target completion date for submittal to IEEE Standards Review Committee (RevCom).

[31 July 1999]

6. Scope of Proposed Project (What is being done including the technical boundaries of the project?)

[To develop a High Speed (about 20 Mbit/s) PHY for use in fixed, moving or portable Wireless Local Area Networks. The PHY will be used in conjunction with the 802.11 Medium Access Control (MAC). The 802.11 MAC will be reviewed to assure it's capability to operate at the speeds targeted by the project.]

7. **Purpose of Proposed Project [Why is it being done, including the intended user(s) and benefits to that user(s)]**

[To create a high speed wireless access technology suitable for data, voice and image information services. This technology should be beneficial for improved access to fixed network LAN and internetwork infrastructure (including access to other wireless LANs) via a network of base stations, as well as creation of high performance ad hoc networks. To create a high speed wireless access technology suitable for data, voice and image information services. This technology should be beneficial for improved access to the Global Information Infrastructure and wired LANs, as well as creation of high performance ad hoc networks.

The project will focus on communication techniques which use the spectrum efficiently and enable a high aggregate throughput, as well as high speed for an individual network.]

8**. Sponsor (Give full name; spell out all acronyms) Society/Committee:**

[Computer Society - LMSC]

9**(a.1) [NO] Are you aware of any patents relevant to this project? (If YES, attach explanation, or No)**

Since a specific technology has not yet been chosen, we are currently not able to determine if any patents apply. As we select a technology, we will follow IEEE patent procedure, including issuing calls for patents.NO. In the field of modem technology there are patents, but according to IEEE 802 policy an attempt will be made to avoid use of patented techniques, unless significant advantage is proven.

9**(a.2) [NO] Are you aware of any copyrights relevant to this project? (If YES, attach explanation, or No)**

NO

9**(a.3) [NO] Are you aware of any trademarks relevant to this project? (If YES, attach explanation, or** No)

NO

9b**. [YESX] Are you aware of any other standards or projects with a similar scope? (If YES, attach explanation, or No)**

YES

European HIPERLAN Type 1, developed by ETSI

European HIPERLAN Type 2,3 (Wireless ATM oriented) being developed by ETSI

The "Magic WANDand", a Wireless ATM Network Demonstratordemo, being developed by a consortium of European companies under the auspices of ACTS (Advanced. Communications. Technologies and Services. ????)

9c. **[YES] Is this standard intended to form the basis of an international standard? (Yes, or if NO, attach explanation, or Do Not Know)**

YES

9d**. [NO] Is this project intended to focus on health, safety or environmental issues? (If YES, attach explanation, or No, or Do Not Know))**

NO

10**. Proposed Coordination/Recommended Method of Coordination (Coordination is accomplished in any of the following three ways:**
Circulation of Drafts or Liaison Membership or Common Membership.)

US TAG (Circulation of Drafts)
ETSI - RES10 (Circulation of Drafts, Common Membership)

10a. **Mandatory Coordination**
SCC 10 (IEEE Dictionary) Circulation of Drafts
IEEE Staff Editorial Review Circulation of Drafts
SCC 14 (Quantities, Units, and Letter Symbols) Circulation of Drafts

10b. **IEEE Coordination requested by Sponsor:**
(Use additional page if necessary). If you believe your project will require a Registration Authority, please list IEEE RAC (refer to Working Guide).

[US TAG to JTC-1 SC6 (Circulation of Drafts)
ETSI Project Broadband Radio Access Networks (Circulation of Drafts,

Common Membership)]

If coordination is not required, please attach an explanation.

10c. **Additional Coordination Requested by Others. (Leave blank. This will be completed by the Standards Staff).**

11. **Submitted by: (This MUST be the Sponsor Chair or the Sponsor's Liaison Representative to the IEEE Standards Board)**

Signature of Submitter_____

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[

Supplement to a High Speed Wireless LAN PHY PAR

Scope of the Project

To develop a High Speed (about 20 Mbit/s) PHY for use in fixed, moving or portable Wireless Local Area Networks. The PHY will be used in conjunction with the 802.11 Medium Access Control (MAC)

Radio Spectrum Availability

Currently 802.11 supports rates of 1 and 2 Mbit/s rates in the 2.4 GHz ISM band. Since

the inception of 802.11 things have changed both in a regulatory arena and regarding the needs for higher transfer rates.

Specifically, in the US, FCC released 300 MHz in three 100 MHz subbands in the 5 GHz region (ET Docket 96-102) for an unlicensed use with high speed Local Area Network communication services. The structure of the new regulations encourages communication at speeds of about 20 Mbit/s. These rulemakings are evidenced by subpart E - Unlicensed National Information Infrastructure Devices in Part 15.4xx.
In Europe, the CEPT has recommended the use of spectrum in the 5150-5250 MHz band for so called HIPERLAN devices in CEPT Recommendatio T/R 22-06.
Given the regulatory changes (as opposed to 15.247 which was the basis for 802.11's work), it becomes feasible to develop efficient high speed modulation methods to address the 20 Mbit/s speed range. The scope of the proposed PAR is to propose such modem technology and methods as to take advantage of the new regulations. The modem technology will be examined with respect to propagation impairments typical of both indoor and reasonable range outdoor environments. The tradeoffs between spectral efficiency, immunity to interference and implementation complexity will be taken into account to address the need for high aggregate throughput in densely populated environments.

In order for the developed standard to be applicable geographically as widely as possible, the committee will be authorized to correspond with regulatory bodies worldwide.

IEEE P802.11 has actively corresponded with regulatory bodies worldwide in the past in order to encourage spectrum allocations to allow its standards to be applicable geographically as widely as possible and plans to continue these activities.

Compatibility with 802.11 MAC

The 802.11 PAR mentions that the MAC will be capable of operation in the 1-20 Mbit/s range. The intent of the effort
of this PAR is to examine rates beyond the 20 Mbit/s range. The 802.11 MAC will be reviewed for it's capability to support such rates. In addition, the MAC will be reviewed to examine its capability to support the data, voice and image services intended in the rulemaking.

The 802.11 MAC relies on aThe Clear Channel Assessment (CCA) mechanism in the Physical Layer for avoiding colisions with other transmissions. will be developed to operate with 802.11 MAC. In addition, tThe CCA for the new Physical Layer will be developed to ensure fairness with respect to participating stations and ensure operation in presence of other types of radio devices operating in the environment, according to the spirit of the FCC rulemaking.

The proposed PHY with 802.11 MAC will meet Quality of Service as detailed in 802.11

PAR.

]
Five Criteria

1. Broad Market Potential

A standards project authorized by IEEE Project 802 shall have a broad market potential. Specifically, it shall have the potential for:

a) Broad sets of applicability.
b) Multiple vendors, numerous users.

To support the claim for the broad need for high speed wireless networking, let us quote from the "Need for U-NII Devices and Spectrum" part of the FCC ET 96-102 Docket, which expands on the potential uses of such a technology:

"In the NPRM, the Commission recognized that recent developments in a number of different digital technologies have greatly increased the need to transfer large amounts of data from one network or system to another. For example, technological developments now permit digitization and compression of large amounts of voice, video, imaging, and data information, which can be rapidly transmitted from computers and other digital equipment to other devices within a network. The NPRM stated that these dramatic developments in digital technology have stimulated a need for spectrum to be used for wireless interconnection within and among these networks. The Commission tentatively concluded that providing additional spectrum for unlicensed wideband operation would benefit a vast number of users, including educational, medical, business, and industrial users. Further, the Commission recognized that unlicensed access to this spectrum would permit educational institutions to form inexpensive broadband wireless computer networks between classrooms, thereby providing cost-effective access to an array of multimedia services on the Internet. In addition, the NPRM requested comment on whether new U-NII operations should include longer-range community networks.

... discussion ...

Decision. We find that there is a need for unlicensed wireless devices that will be capable of providing data rates as high as 20 Mbit/sMbits/sec to meet the multimedia communication requirements envisioned by the U-NII proponents. To achieve these high data rates at a reasonable cost, we believe that these devices must use broad bandwidths of up to 20 megahertz each and therefore these devices must have access to a substantial amount of spectrum to accommodate a number of devices within the same area. Further, we believe that accessibility to a substantial amount of spectrum is necessary for these

devices to develop and mature to their full potential. The record in this proceeding supports our belief that recent developments in digital technologies have greatly increased the requirements for transferring large amounts of information and data in relatively short time frames from one network or system to another. Specifically, we note that computers have much faster central processing units and substantially increased memory capabilities, which have increased the demand for devices that can more quickly transfer larger amounts of data. Further, digital equipment is capable of switching and directing large amounts of information within networks. In addition to these technical advances in hardware capability, there has been substantial growth in the use, size, and complexity of digital networks as well. Many of these networks are not only growing internally in the amount and types of data they contain, but are also increasingly being used in combination and interaction with other such networks.

Further, it is clear from the record that educational institutions, business, industry, and consumers are all looking for ways to begin taking advantage of the innovative technological developments that promise the delivery of multimedia services comprising voice, video, imaging, and data. We agree with the commenters who argue that existing wireline and wireless services, in some cases, may not be able to meet all of the communications requirements and demands that these technological developments bring in a cost-effective manner. The record here shows that U-NII devices may be able to provide cost-effective communications services that will both complement and compete with existing services. For example, the spectrum and associated regulatory structure developed for U-PCS devices were not designed to handle broadband multimedia computer applications. Equipment in the U-PCS bands is limited to a maximum bandwidth of 2.5 megahertz and would not support data rates of 20 Mbit/sMbits/sec or greater as envisioned for U-NII devices. Further, if we were to authorize broadband, high data rate equipment to use the 30 MHz of spectrum available for U-PCS, that spectrum would quickly become congested and would have limited use for the types of operations it is intended to accommodate. Additionally, we believe that as the NII and other telecommunications infrastructures grow, new communications alternatives that are flexible and inexpensive will be needed to assure delivery of information and services to all members of our society, regardless of income or location.

Accordingly, we find that it is appropriate to provide spectrum for wireless unlicensed digital network communications devices to meet the foreseeable communications demands of multimedia network systems resulting from developments of new digital technologies. We believe that this will facilitate rapid and inexpensive wireless access to information resources by educational institutions, business, industry, and consumers. We also believe that making this spectrum available for U-NII devices will further the Commission's mandate, in Section 257(b) of the Communications Act, to promote vigorous competition and technological advancement. For example, allowing unlicensed devices access to the 5.15-5.35 GHz and 5.725-5.825 GHz bands would permit educational institutions to form inexpensive broadband wireless computer networks between classrooms, thereby providing cost-effective access to an array of multimedia

services on the Internet. In addition, unlicensed wireless networks could help improve the quality and reduce the cost of medical care by allowing medical staff to rapidly and inexpensively obtain patient data, X-rays, and medical charts."
. Applications such as education, medical, business, consumer, telecommunication extensions and community Internet access are mentioned.

The applications today tend to be more graphically intensive and include voice and video. The volumes of data involved in medical image transfer are tremendous.

The trend in both the networking and the telecommunication industry to increase the speed of their products and the services they provide creates a market need for the wireless LAN to match the throughput capabilities of the WAN.

US government actively supports wireless access to information, as is reflected by issuing the FCC Report and Order on January 9, 1997, for Docket 96-102. The large potential of the US market alone is reflected in the over 50 commentors' market assessments contained in the responses to the FCC's Notice of Proposed Rule Making. The frequency band allocated in the FCC Docket overlaps with a 5.2 GHz band allocated in western Europe for high speed local networking (the HIPERLAN project). Coordination with worldwide regulatory bodies will be attempted to ensure even wider market potential for the technology to be developed in this Project.

b) Multiple vendors, numerous users.

The significant user demand for high speed wireless networking devices is expressed in the FCC comments above. The hHigh degree of interest expressed by multiple vendors and the history of active participation of multiple vendors in 802.11 PHY standardization process promise that the standard will be accessible to multiple vendors. In addition, semiconductor manufacturers are expected to provide solutions for the emerging standard, making the technology available to multiple system manufacturers.

c) Balanced costs (LAN versus attached stations).

The 5 GHz radio component technology is starting to develop and we believe that the U-NII rulemaking will give a boost to availability of such components.

The modem component technology needed to support 20 Mbit/s operation is of a scale comparable to cable modems or satellite Direct Video Broadcasting. This makes it reasonable to believe that components will be available from several vendors to implement the PHY resulting from the proposed Project.

We believe that the cost of the PHY resulting from this project will be comparable to the

cost of wireless LAN adapters based on current 802.11 technology. The complexity of the PHY operating at 20 Mbit/s should be a few times higher than a solution for the current Direct Sequence Spread Spectrum PHY specification operating at 11 Mchip/s, but taking into account the progress in semiconductor device density the cost should be comparable, once appropriate ASICs are developed.

2.

Compatibility with IEEE Standard 802

IEEE Project 802 defines a family of standards. All standards shall be in conformance with 802.1 Architecture, Management and Interworking.

All LLC and MAC standards shall be compatible with ISO/IEC 10039, MAC Service Definition at the LLC/MAC boundary. With the LLC Working Group there shall be one LLC standard, including one or more LLC protocols, with a common LLC/MAC interface.

The compatibility with IEEE 802 requirements will result from the use of 802.11 MAC, which itself was developed to be compatible with those requirements.

Within a MAC Working Group there shall be one MAC standard and one or more Physical Layer standards with a common MAC/Physical Layer interface.

The new PHY will operate with the existing 802.11 MAC.

Each standard in the IEEE Project 802 family of standards shall include a definition of managed objects which are compatible with OSI systems management standards.

The new PHY will be developed with managementmanagenent features similar to those of currently existing PHYs of the 802.11 standard.

3. Distinct Identity

Each IEEE Project 802 standard shall have a distinct identity. To achieve this, each authorized project shall be:

a) Substantially different from other 802 Projects

The proposed Project is a supplement to a 802.11 project, which is the only Wireless LAN project within 802. The PHY to be developed within the proposed Project is distinct from the present 802.11 Project in that it addresses a new unlicensed frequency band and achieves significantly higher throughput and system capacity speed due to different regulatory restrictions in the new band.

b) One unique solution per problem (not two solutions to a problem).

The PHY layer to be developed in this project leverages the 802.11 MAC protocol which has been commercially implemented and is readily known and available from a broad number of vendors. The only project with a similar scope (a high speed wireless LAN) is the ETSI project HIPERLAN type 1. HIPERLAN type 1 products are believed to be in development, but no deployment has occurredoccured yet.

The only project with a similar scope (a high speed wireless LAN) is the ETSI project HIPERLAN type 1.This proposed PHY standard will be the only 802 compatible standard to provide for high performance (circa 20 Mbit/s) asynchronous wireless data communications in a local area network utilizing distributed coordination. In addition, time bounded services are implemented utilizing a centrally coordinated function. Both of these provisions are supported in the 802.11 MAC. The proposed project is distinctly different from the HIPERLAN type 1 standard because it leverages a MAC protocol which has been commercially implemented and is readily known and available to a broad number of vendors. The new PHY layer standard will extend the 802.11 wireless LAN specification.
The proposed PHY will extend the 802.11 standard which has already achieved the status of a draft ISO standard.

The proposed Project will try to improve on HIPERLAN in terms of throughput by creating a PHY with lower overhead.

The proposed PHY will extend the 802.11 standard which already achieved the status of a draft ISO standard.
In addition, this PHY layer standard will extend the 802.11 wireless LAN specification.
c) Easy for document reader to select the relevant specification.

The proposed PHY standard will be a supplement to the existing 802.11 standard and will be formatted as a separate clause, making it easy for the reader to select the relevant specification.
4.
The proposed Project is distinct from the present 802.11 Project in that it is not restricted by CFR47 15.247 rules. As a result, usage of spread spectrum techniques in no longer required, and wider bandwidths are allowed. These factors enable significantly higher data rates.

This proposed PHY standard will provide for high performance (circa 20 Mbit/s) asynchronous wireless data communications in a local area network utilizing distributed coordination. In addition, time bounded services are implemented utilizing a centrally coordinated function. Both of these provisions are supported in the 802.11 MAC. In addition, this PHY layer standard will extend the 802.11 wireless LAN specification.

Technical Feasibility

For a project to be authorized, it shall be able to show its technical feasibility. At a minimum, the proposed project shall show:

a) Demonstrated system feasibility.

The system level feasibility of the 802.11 project in general was verified by design and in initial implementation of systems conforming to it. The new PHY to be developed will take advantage of system level features of 802.11 to maintain it's robustness.

b) Proven technology, reasonable testing.

The main components of technology of the PHY to be developed have precedents proving the feasibility of it.

Radio Technology: The technical feasibility of the 5 GHz radio part is already proven by existing 5.7 GHz products. The requirements from a radio of a High Speed PHY are not significantly different from today's ISM systems at 5 GHz.

Modulation Methods: There are several modulation methods, such as GMSK (Gaussian Minimum Shift Keying) and OFDM (Orthogonal Frequency Division Multiplexing), which are sound candidates for a High Speed Wireless LAN PHY technology. The decision on the method which is best for the task is expected to be a convergent process rather than an amorphous research project.

Modem Technology: The increased processing requirements of the digital modem part are in line with the progress in ASIC technology. There are demonstrations of modem technologies which we believe to be of comparable complexity, such as XDSL, cable modems, satellite DVB modems, etc.

c) Confidence in reliability.

The modulation techniques to be considered fortor this project will inherently address the multipath and fading properties of the wideband radio propagation channel. The properties of such channels are extensively covered in literature and enable a design to cope with it. The reliability at the system level will be augmented by the possibilityposibility to have an overlap in cell coverage.

The reliability of 5 GHz systems benefits relatively to 2.4 GHz systems from an absence of interference from microwave ovens.
5. The tenfold increase in data rate, compared to 2 Mbps ISM device, is expected to reduce the cell radius by an estimated 40% (assuming fourth power propagation law). In

addition, the 5 GHz band does not experience interference from microwave ovens.

Economic Feasibility

For a project to be authorized, it shall be able to show economic feasibility (so far as can reasonably be estimated), for its intended applications. At a minimum, the proposed project shall show:

a) Known cost factors, reliable data.

The economic feasibility of the proposed Project draws on the feasibility of 5 GHz radio technology available today and of our expectations of modem complexity. Once 5 GHz MMICs proliferate, the cost is expected to drop to that comparable to today's 2.4 GHz technology. Some cost penalty may be incurred by tighter filtering requirements at the band edges, as FCC requires. Test equipment for higher frequency range may cost more, incurring some additional penalty on product cost. The modem ASICs will be somewhat more expensive than current 2.4 GHz modems.

b) Reasonable cost for performance.

The overall cost of a 5 GHz high speed LAN adapter should be marginally higher than the current 802.11 adapter. The somewhat higher cost is justified given the tenfold increase in speed relative to current 802.11 networks.

c) Consideration of installation costs.

The installation of 5 GHz devices at the stations is not different from a 2.4 GHz LAN, and has almost no associated cost. The infrastructure cost (Access Points) is expected to be higher, due to smaller cell radius (by an estimated 40%)size than with lower rate 2.4 GHz equipment. Taking into account the higher rate of the proposed PHY, the overall cost/performance ratio should improve over 2.4 GHz LANsISM type network.

SeptemberJulyMarch 1997 Doc: IEEE P802.11-97/886531r42

Five Criteria (5 GHz band) as approved High Speed SG PAR Proposal Ppage 21139121276
Task group a802.11 study groupNaftali Chayat, BreezeCom

PAGE \# "'Page: '#'

Comment made by Pat: I think it is appropriate to add comments about the availability of this spectrum for this use outside the US since it is my understanding that that is one of the advantages of this band.
PAGE \# "'Page: '#'
Comment made by Pat: I think it is appropriate to add comments about the availability of this spectrum for this use outside the US since it is my understandingunderdtanding thatthatt that is one of the advantages of this band.
PAGE \# "'Page: '#'
Comment made by Pat: Rather than this predictive statement (I am not sure who will be authorizing this and if it is already authorized, I do not know how you can make this statement) I suggest the following:

IEEE P802.11 has actively corresponded with regulatory bodies worldwide in order to encourage spectrum allocationsallocatins to allow its standards to be applicable geographically as widely as possible and plans to continue these activities.

PAGE \# "'Page: '#'
The scope and purpose statements do not indicate such intent! The purpose specifically mentioned 20 Mbit/s and Physical layer. If MAC extensionsextentions are planned, you need to say it in scope!

PAGE \# "'Page: '#'
Pat does not know what CCA is, she wrote: What is Clear Channel Assessment? How can a Physical layer, yet undefined contain a mechanism? You need to set context. Or do you mean to say you will be requiring any proposal to have a CCA?

to order at 8.24