

High Speed Study Group PAR Proposal

Naftali Chayat, SG Chair

What follows is a proposal for a PAR, as finalized during the meetings of the study group meetings during 11-13 March 1997 and revised in the closing plenary on 13 March 1997..

IEEE STANDARDS PAR FORM

(1/96)

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 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 802.11

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

Name Vic Hayes

Date xx-xxx-1997
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5. Describe this project: (Choose ONE from each group below)

a. Update an existing PAR
 Yes or 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
 Supplement to an existing standard
 Yes standard number/year_____ or No

c. 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 (circa 20 Mbps) 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)

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 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) [] Are you aware of any patents relevant to this project?
(If YES, attach explanation, or No)

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) [] Are you aware of any copyrights relevant to this project?
(If YES, attach explanation, or No)

NO

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

NO

9b. [X]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 Wand", a Wireless ATM demo being developed by a consortium of European companies under the auspices of ACTS (Adv. Comm. Tech. ????)

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

YES

9d. []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).

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_____

Name Jim Carlo (802 chair)
Title etc.
Date
Company
Address
City
State
Zip
IEEE Member Number
Telephone
Fax
E-Mail

Supplement to a High Speed Wireless LAN PHY PAR**Scope of the Project**

To develop a High Speed (circa 20 Mbps) 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

Currently 802.11 supports rates of 1 and 2 Mbps 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 for unlicensed use 300 MHz in three 100 MHz subbands in the 5 GHz region (ET Docket 96-102) for a use with high speed Local Area Network communication services. The structure of the new regulations encourages communication at speeds of about 20 Mbps. These rulemakings are evidenced by subpart E - Unlicensed National Information Devices in Part 15.4xx.

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 Mbps 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.

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.

Compatibility with 802.11 MAC

The 802.11 PAR mentions that the MAC will be capable of operation in the 1-20 Mbps range. The intent of the effort of this PAR is to examine rates beyond the 20 Mbps range. The 802.11 MAC will be reviewed for its 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 Clear Channel Assessment (CCA) mechanism in the Physical Layer will be developed to operate with 802.11 MAC. In addition, the CCA 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

Broad Market Potential

To support the claim for the broad need for high speed wireless networking, let us quote the FCC ET 96-102 Docket, which expands on the potential uses of such a technology. 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.

High 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.

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 Mbps 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 Mbps should be few times higher than a solution for a DS 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.

Compatibility with IEEE Standard 802

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.

Distinct Identity

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 is 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 Mbps) 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

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

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.

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

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 will 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. The overall cost of a 5 GHz high speed LAN adapter should be marginally higher than the current 802.11 adapter.

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 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 ISM type network.