

July 1997 Doc: IEEE P802.11-97/7959r32.4 GHz Extensions PAR Proposal page 1 [John Fakatselis](#) [Harris semiconductor](#) [Naftali Chayat](#),BreezeCom **PAR Proposal for High Speed extensions in 2.4 GHz band** [John](#)[Fakatselis](#) [Naftali Chayat](#), SG Chair

What follows is a proposal for a PAR for High Speed extensions for the 2.4 GHz band. This revision is an initial proposal by Chair, processed during SG meeting of 9 July 1997 (r1) and a correction by a chair(r2).

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)
 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:

[Supplement to STANDARD for Telecommunications and Information Exchange Between Systems - LAN/MAN Specific Requirements - part 11: Wireless Medium Access Control (MAC) Method and Physical Layer (PHY) specifications : Higher Speed Physical Layer (PHY) extensions in the 2.4 GHz band]

I hereby acknowledge my appointment as Official Reporter (usually the W.G. Chair) to the (Name of Working Group)
[P802.11 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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[semiconductor](#) [BreezeCom](#) Name **Vic Hayes** Name [**Vic Hayes**] Date [**xx-xxx-1997**] Title [**802.11 Chair**]
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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

802.11 -1997 or Noc. 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 December 1999]6. Scope of Proposed Project (*What is being done* including the technical boundaries of the project?)**[To develop a higher speed PHY extension to 802.11 operating in the 2.4 GHz band.]**7. Purpose of Proposed Project [*Why is it being done*, including the intended user(s) and benefits to that user(s)]

[To extend the performance and the range of applications of the 802.11 compatible networks in the 2.4 GHz band by increasing the data rate and overall network throughput achievable by such devices. This technology will be

beneficial for improved access to fixed network LAN and internetwork infrastructure (including access to other wireless LANs) via a network of access points, as well as creation of high performance ad hoc networks.]

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

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9(a.1) [YES] Are you aware of any patents relevant to this project? (If YES, attach explanation, or No) IEEE Patent procedure will be followed.

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

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

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

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

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

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.)

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)]

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).

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2.4 GHz Extensions PAR Proposal page 4 [John Fakatselis](#)~~Naftali Chayat~~, [Harris semiconductor](#)~~BreezeCom~~ 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**] Title [**IEEE 802 LMSC Sponsor Chair**] Date [**xx-xxx-1997**] Company [**Texas Instruments**]

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PAR

Scope of the Project

Compatibility with 802.11 PHYs

The scope of this project is to develop a higher speed PHY extension to 802.11 operating in the 2.4 GHz band, taking advantage of the provisions for rate expansion that are in place on the approved standard.

The 802.11 MAC defines a mechanism for operation of stations supporting different data rates in same area. The current 802.11 standard already defines the basic rates of two rates - 1 Mbit/s and 2 Mbit/s for both Frequency Hopping (FH) and Direct Sequence (DS) PHYs. The two rates are supported by having same header for both rates with length and rate information passed in the header at the lowest ("basic") rate; then the body of the packet is transmitted at the rate chosen and with corresponding modulation method.

The header structure of the two PHYs already supports passing rate information up to 4.5 Mbit/s (in 0.5 Mbit/s increments) for FH and up to 25.5 Mbit/s (in 0.1 Mbit/s increments) for DS. The proposed PAR targets to further develop the provisions for enhanced data rate capability of 802.11 networks.

The 802.11 MAC incorporates already interpretation of this information and computation of expected packet duration even if the specific station does not support the rate at which the packet was sent. The 802.11 MAC is compatible and will accommodate the higher PHY rates.

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 802.11 MAC will be reviewed for its capability to support rates up to about 10 Mbit/s targeted by the extended modulation methods. No changes are expected on the protocol structure of the 802.11 MAC due to the extension of the PHY rate. The current 802.11 MAC is designed to be compatible and to adapt under a multirate PHY environment.

Data rate

The data rates targeted by this project are at least 3 Mbit/s for FH PHY and at least 8 Mbit/s for DS PHY.

Radio Spectrum Availability

The proposed extensions will operate in the already allocated 2.4 GHz ISM band, in which 802.11 is already defined. IEEE P802.11 will correspond with regulatory bodies worldwide in order to assure that the proposed extension will be applicable geographically as widely as possible.]

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2.4 GHz Extensions PAR Proposal page 6 John FakatselisNaftali Chayat, Harris semiconductorBreezeCom Five Criteria

Broad Market Potential

The market potential of the Higher Speed 2.4 GHz 802.11-compatible LANs builds upon the market potential of the 802.11 itself. It will be possible to upgrade existing networks to a higher speed for selected users or in selected areas. The existence of such possibility will also have a positive effect on the confidence of the public in 802.11 standard and in its longevity. The 802.11 membership supportive of this PAR includes a broad range of wireless industry players. Among the supporting members are individuals employed by companies with significant presence in the wireless infrastructure markets. Aironet, BreezeCom, Lucent and Symbol are a sample of such companies which alone have a significant market share in the wireless markets.

Compatibility with IEEE Standard 802

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

Distinct Identity

The proposed Project is an extension of the existing 802.11 Project. The rates targeted by the extended PHY are at least 3 Mbit/s for FH and at least 8 Mbit/s for DS, as opposed to 1 or 2 Mbit/s achievable by current 802.11 PHYs.

The high rate PHY will be distinct. The high rate PHY modulation requires a new specification document defining it. Approval of this PAR will lead to this distinct specification for the high rate extension versus the existing 1 and 2 Mbps DS and FH PHYs.

~~While it can be argued that the modulation method extensions which are compatible with existing PHYs should be dealt within a framework of 802.11 maintenance, our position is that the new modulation methods are beyond corrections to the existing standard and should be dealt within a separate Project framework.~~

Technical Feasibility

Modulation Methods: There are several modulation methods being discussed as candidates. For FH, an ad hoc study group for higher speed FH PHY reviewed a 3 Mbit/s modulation method. This modulation method is field proven (it is incorporated at the moment as a proprietary extension in BreezeCom products).

As for Direct Sequence, an initial proposal by Harris and a press release by Lucent Technologies indicate that a combination of phase keying with M-ary code keying are capable of achieving at least 8 Mbit/s (11 Mbit/s in Harris' proposal) rate. Both companies claim that their technology is both feasible and acceptable to FCC.

A similar system was described by Micrilor, involving bi-orthogonal signaling with code keying and polarity keying. A version of this modulation method was approved by FCC.

The example technologies exist today in a form of prototypes or in some cases as FCC certified products.

Radio Technology: The requirements of a High Speed PHY in 2.4 GHz band are not significantly different architecturally from today's ISM systems. Somewhat tighter specifications may be required for some components.

Range and Cell Size: The increased data rates will need to be traded for shorter range. Specific assessment is dependent on the rate and modulation method. These trade off studies will be evaluated upon approval of the PAR.

Economic Feasibility

The fundamental Radio architecture given the modulation schemes reviewed remains the same. The digital signal processing aspects of the modem are expected to require most of the definition. Even though the signal processing will be distinct, it is not expected to lead at significantly different pricing structures.

The main changes in implementing the new modulation methods are new modem ASICs and somewhat more stringent requirements on the radio, but the majority of the product contents remains unchanged. The cost of products implementing the extensions is expected to be comparable to that of current 802.11 adapters.

The installation of extended devices is same as regular 802.11 devices. The infrastructure cost (Access Points) is expected to be almost the same with the exception of cost incurred by somewhat smaller cell size than with lower rate 2.4 GHz equipment. Upgrading an existing network to a higher speed can be performed selectively in areas with a demand for higher instantaneous rate.