Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

In the Matter of	)	
	)	
Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies	)	ET Docket No. 92-9

To: The Commission

COMMENTS OF IEEE 802
LOCAL AREA NETWORK STANDARDS COMMITTEE

Reference: Document IEEE P802.11-92/41 R1
Filed June 5, 1992

The IEEE 802 Local Area Network Standards Committee ("IEEE Committee" or "Committee") has a vital interest in the Commission's proposal to establish emerging technologies bands in the 2 GHz region of the radio spectrum. The IEEE Committee includes companies that now are delivering wireless LAN equipment that operates in infrared, ISM, DTS and other parts of the spectrum. These companies and others have engaged since September, 1990, in the Committee's effort to develop standards and protocols for wireless LANs.

SUMMARY

The Committee urges the Commission to proceed with all possible speed to allocate frequencies and to implement appropriate regulatory structures to foster development of wireless LANs and other valuable personal communications services ("PCS") at 2 GHz. While the IEEE Committee strongly supports the Commission's objectives in this proceeding, we believe that the timetable and requirements proposed for clearing the existing fixed microwave users from the band will retard the development of valuable new wireless LAN technologies.

The Commission should distinguish between two goals in allocating spectrum for new technologies:

> 1) the desire to create a spectrum reserve to meet the long-term needs for spectrum for new telecommunications technologies, which may be satisfied with the band clearing methods proposed in this proceeding; and
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> 2) the need to meet the immediate spectrum requirements of technologies such as the emerging wireless LAN applications, which will require more urgent action in making a primary spectrum allocation than is proposed in the instant proceeding.

Accordingly, the Committee urges the Commission to allocate a substantial portion of the 70 MHz which the Committee has identified as the immediate spectrum need for implementing wireless LANs, from frequencies in the 2 GHz fixed microwave bands, and to clear them of existing users over a two-year period in order to foster the long-overdue development of new wireless LAN technologies.

INTRODUCTION

The Institute of Electrical and Electronic Engineers (IEEE) is a U.S.-based, international professional organization with more than 320,000 members, recognized throughout the world for its standards-making activities. The Committee is a group within the IEEE chartered to produce standards for local and metropolitan area networks which provide information transfer among computers at data rates of 1 Mbit/s or more, on wire, optical and radio media. The IEEE Committee previously has promulgated standards, such as CSMA/CD or "Ethernet" by the 802.3 working group, the "Token Bus" by the 802.4 working group and the "Token Ring," by the 802.5 working group, which have been adopted worldwide.

The Committee is addressing high speed, on-premises PCS for transmission of digital information (wireless Local Area Networks or LANs) because they are among the most advantageous and immediate applications of wireless connectivity for people using computers. LANs are used to convey a variety of information including numbers, text, sounds and images, typically in packetized forms. Given the increasing demand for greater information flow bandwidths and the dramatic market success of portable computers, there is a substantial un-met need for wireless LANs to provide networking connectivity to people on the move.

The Committee has participated in previous Commission proceedings involving PCS[1], and has consistently urged the Commission to expand the scope of its PCS inquiry to include LAN data communication services[2] and to allocate a substantial amount of radio spectrum — 70 to 140 MHz — for wireless local area digital networks. Additionally, given the significant differences between the operating requirements of user-provided data networks and those of networks optimized for telephony by common carriers, the Committee has pointed out that the allocation for wireless LANs must be exclusive.

At the March, 1992, meeting of the IEEE Committee, the membership agreed without objection to reaffirm and to re-emphasize the positions previously expressed to the FCC and also to advise the Commission of the Committee's additional concerns regarding the Notice of Proposed Rulemaking ("NPRM") in the above-referenced proceeding, as discussed below.

DISCUSSION

I. WIRELESS LANS HAVE DISTINCTIVE SPECTRUM REQUIREMENTS AND OPERATING CHARACTERISTICS THAT MUST BE ACCOMMODATED IN THE EMERGING TECHNOLOGIES BANDS .

A. 70 To 140 MHz Of Radio Spectrum Will Be Required To Satisfy The Foreseeable Demand For Wireless LAN Services.

The IEEE Committee believes that 70 MHz is the minimum RF bandwidth that can accommodate presently foreseeable needs for wireless LANs, and that up to 140 MHz will ultimately be required. The need for 70 to 140 MHz is consistent with expressions by CCIR.[3] It is more than Apple Computer ("Apple") requested in its Petition[4], and several IEEE Committee members have strongly expressed a need for a still larger allocation.[5]

The IEEE Committee recognizes that the total of the new spectrum needs expressed by industry and users exceeds the amount under examination in the

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1 See Comments and Reply Comments submitted by IEEE 802 LOCAL AREA NETWORK STANDARDS COMMITTEE in GEN Docket 90-314, the "PCS NOI;" to RM No. 7618, the "Apple Petition, Data-PCS; "and to the Commission's *en banc* hearing on PCS (December 5, 1991).

2 See Response of IEEE 802 LOCAL AREA NETWORK STANDARDS COMMITTEE in GEN Docket 90-314.

3 International Radio Consultative Committee

4 RM No. 7618 at 20. Apple requested a minimum of 40 MHz for Data-PCS. In testimony before the Commission's *en banc* hearing on PCS (December 5, 1991), Dr. David Nagel, Apple's Senior Vice President, asserted that "(g)iven the present demand for frequencies, however, and given the fact that Data-PCS is truly a new technology, 40 MHz is all that Apple felt that we could ask for at this time. That was a political decision, not a scientific one nor, indeed, an upper limit."

5 See, *e.g.*, Sun Microsystems, Inc., Comments to RM No. 7618, at 7.

NPRM.[6] If the Commission cannot allocate at least 70 MHz for this purpose promptly, the Committee urges the Commission to allocate a substantial portion of that bandwidth immediately, to identify now the frequencies that would be available to accommodate the expansion of the wireless LAN band, and to set out the terms and conditions for such expansion.

B. The Spectrum Requirements Of Wireless LANs Must Be Accommodated Both In The Short Term And In Any Reserves Established For Emerging Technologies.

In considering the creation of spectrum reserves to accommodate emerging technologies, the IEEE Committee strongly urges the Commission to be responsive to the spectrum requirements and operating characteristics of wireless LANs. This, however, is not merely a matter for future allocation: as the IEEE Committee has urged in the PCS proceeding, General Docket 90-314, the growing demand for wireless LANs warrants the Commission's immediate attention to the allocation of channels and development of a regulatory regime that will encourage the further development of wireless digital local networks. The anticipated demand for such networks and the advancing state of technology developments suggest an immediate need for up to 70 MHz of spectrum, with a future requirement of up to 140 MHz necessary to meet the needs for wireless LANs.

If adopted as proposed, the NPRM will provide an excellent basis for establishing the necessary incentives for technological development over the next decade. This is true particularly for technologies whose operating characteristics will allow for sharing frequencies with the incumbent microwave users or whose carrier economics allow for direct payments to incumbents to clear their existing frequencies. It will not, however, provide developers of wireless LAN technology with a timely allocation of spectrum that is needed today.

As discussed below, the Commission's proposal for identifying and clearing the spectrum reserve will be neither quick enough, nor practically achievable, for developers and consumers of wireless LANs. It is therefore critical that the Commission find immediate solutions to the spectrum requirements of wireless LANs being developed by IEEE Committee members and others. The Commission should immediately identify and allocate a substantial portion of the 70 MHz, which the Committee has stated is necessary to meet current needs for wireless LANs. The Commission also should specify in this proceeding the frequencies that will be available to accommodate the future expansion of the wireless LAN band beyond the initial allocation and should set out the terms and conditions for such expansion.

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6 The subject NPRM refers to unfulfilled requests for spectrum for new services and technologies which total 376 MHz. See Docket ET 92-9 at ¶4.

C. Wireless LANs Require A Spectrum Allocation That Is Exclusive To Wireless Data Uses And A Regulatory Structure Different From Those Adopted For Carrier-Provided Services.

The technical attributes of wireless LANs are distinctly different from, and technically incompatible with, those of voice-optimized public networks. For example, computers connected by networks commonly require high signaling rates orders of magnitude higher than those required for voice telephony, and indeed no carrier-provided voice PCS network has been proposed that will offer adequate rates. Wireless digital local networks, moreover, require significantly greater error-free service than voice networks.

Additionally, a characteristic of most computer traffic is that it is "bursty" in nature and it may tolerate some degree of delay in route. Therefore, it can share a common channel with a substantial amount of like traffic from other computers. This contrasts with voice services, which typically hold a channel for the duration of a transaction in order to guarantee timely delivery and thus cannot equitably share with bursty data traffic.

Computer networks, wired and wireless alike, are accessed and shared by multiple users, each of whom operates in accordance with specific protocols.[7] Defining the protocols for such access, use, and sharing is the primary charter and objective of the Committee. Computer network protocols based upon standards promulgated by the Committee divide data into short packets of information, and provide a certain amount of fairness or negotiation for the way the packets are sent through the network.

Unless the Commission provides spectrum for wireless LANs on a primary and exclusive basis, advantageous, spectrum-efficient protocols optimized for effective computer communications cannot be developed and applied. Absent any demonstration that voice PCS networks can accord computing devices the capabilities of wireless LANs, including a fair, guaranteed quality of service in a shared medium, or that wireless computer-optimized LANs can meet the entire needs for voice delivery, a separate and exclusive spectrum allocation for wireless LANs is a *sine qua non* for successful widespread deployment of wireless LAN technologies.

D. Individual User Licensing Is Not Appropriate For Wireless LANs.

The full development of wireless LANs requires a distinct regulatory environment. The emergence and market success of portable computers has created an immediate un-met need for mobile connectivity to computing and

7 A protocol in this context is "a set of rules governing information flow in a communications system". G. Held, "Data and Computer Communications," p. 175 (Wiley, 1989)

information resources and among peers using similar devices, especially in the local area where information bandwidth demands can require a copious network capacity. Unlike voice PCS networks, which will be licensed to a common carrier or other service provider to cover wide areas, the geographical and power limitations of wireless LANs will allow them to operate on an individually unlicensed basis, similar to the manner in which Part 15 devices operate.

Schools, businesses, individuals and institutions who provide their own computer network services will be the most immediate beneficiaries of an unlicensed band. These users cannot be required to obtain a license in order to take immediate advantage of the opportunity to establish self-provided applications such as wireless LANs. That opportunity opens at the instant that the Commission makes available frequencies for user-provided applications.

Compatibility among network users, as well as intensive and efficient sharing of the spectrum resource among users, achieved in other contexts through licensing, can in the case of wireless LAN users, be achieved through industry and standards groups. The IEEE Committee has a twelve year history of successfully developing voluntary standards for compatibility and interoperability among products designed and sold by numerous manufacturers. Although lacking the imprimatur of law, such standards provide rational operating environments while avoiding encumbrances upon individual users. Further, an unlicensed regime is more likely to encourage technological innovation, especially when fostered by the IEEE.

The Committee acknowledges that there may be alternatives to an unlicensed regime, such as class licenses granted to manufacturers on a non-exclusive basis, which could achieve similar objectives for users. The IEEE Committee, however, cannot support any licensing concept that establishes exclusive or preclusive control of frequency use in a geographic area by third-party carriers or service providers. Rather, wireless LANs users must be able to configure and connect computing devices spontaneously, at any location, without license fees or airtime charges or confronting usage restrictions imposed by third-party licensees.

II. THE NPRM HAS IDENTIFIED A SUITABLE FREQUENCY BAND BUT DOES NOT CREATE ACCEPTABLE CONDITIONS FOR IMPLEMENTATION OF NEW WIRELESS LAN TECHNOLOGIES.

The IEEE Committee strongly supports the purpose and objectives of the NPRM as they relate to the development of a future reserve to meet the long term demands and needs of emerging technologies. The Committee is concerned that the Commission has not given sufficient weight to the unique needs and operating characteristics of wireless LANs in developing methods for achieving

access to the 2GHz frequencies. These needs and characteristics, as set out above, should shape the manner in which the 2 GHz frequencies are reallocated for emerging wireless LAN technologies. In particular, the Commission's proposal does not go far enough to assure that adequate amounts of spectrum, cleared of existing microwave users, will be available in a timely manner to meet wireless connectivity needs that are already acute.

A. Use Of The 2 GHz Band For Emerging Wireless LAN Technologies Will Facilitate Their Widespread Use And Will Enhance U.S. Competitiveness.

The FCC is well aware of the needs of manufacturers to implement new technologies on a worldwide basis. The Commission also understands that users of wireless technologies need to have those technologies as mobile as possible, which often may entail the transiting of borders and hemispheres. In this regard, the Commission has chosen the appropriate frequency band for wireless LAN technologies.

Ideally, high-capacity wireless LANs should be able to interact with wireless PBX and with voice PCS networks in the U.S. and abroad, as data-handling functions are added or expanded in these networks' capabilities. As equipment improves, frequency- and mode-agile wireless devices that can be used with both PCS and wireless LANs will be developed. The Commission should facilitate the development of such technology earlier and more economically by allocating nearby, if not contiguous, frequency bands for voice PCS and wireless LANs in the 2 GHz band.

Internationally, as DECT[8] and other European and Japanese PCN schemes unfold, there are clear patterns suggesting that provision for wireless LANs in the 1850-1990 MHz band is the ideal, rather than the other frequencies examined in the NPRM[9]. The Committee also encourages consonance within the scope of the FPLMTS[10] designation and footnote adopted at WARC '92, which bears on global frequency usage. All measures that the Commission can take to support international mobility, as well as export sales, will enhance the intrinsic values of wireless LANs. Allocation of frequencies in the 2 GHz band is an important such measure.

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8 CEPT, the pan-European telecommunications entity, has allocated 1880-1900 MHz for Digital European Cordless Telecommunications, an in-building voice and data connectivity function. An additional contiguous 30 MHz has been set aside for possible expansion of the DECT frequencies as the demand develops.

9 2110-2150 and 2160-2200 MHz.

10 Future Public Land Mobile Telecommunication Systems

B. A Requirement To Share Frequency Bands With Fixed Microwave Services, Or Buy Out Incumbent Users, Will Prevent Full And Timely Deployment Of Wireless LAN Technologies.

1. Frequency-Agile Overlay Schemes Proposed For PCS Carrier Networks Do Not Provide For The Full Range Of Wireless LAN Applications.

The NPRM proposes a lengthy period for incumbents to remain in the 2 GHz bands without any change in their operations. In order to circumvent limits that could be imposed on new services, proposals have been made whereby new PCS services could be overlaid on the fixed microwave frequencies by employing, at any given place or time, only those specific frequencies not used locally by fixed microwave services.[11] The schemes proposed to date, however, entail base stations with identifiable, fixed locations, such as used by carrier-provided PCS.

Without commenting on whether the proponents of such systems can provide sufficient safeguards to satisfy fixed microwave users, these approaches do not apply generally to wireless LANs. Many wireless LAN applications do not require or employ fixed base stations in fixed locations. In fact, spontaneous access to computing resources and *ad hoc* networking are characteristic of emerging applications for portable computers, the fastest growth sector for the industry.

Fixed-point microwave links essentially never share a channel. A transmitter/receiver combination uses a particular frequency band(s) assigned to and licensed for a particular location and geographic path. A substantial physical protection zone against other users is established. When the channel is not required for conveyance of information, it remains idle: it is *not* made available for other users. Moreover, there is no provision for interaction with other users.

Requiring a computer network to "share" a channel with an incumbent such as a fixed point microwave link that does not, in fact, have the need, ability, or motivation to share it, is a contradiction in terms. Accordingly, frequency bands for unlicensed wireless LANs must be cleared of fixed microwave users.

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11 Several reports show that there is an adequate supply of unused frequencies available in the 2 GHz bands for PCS systems in many locations, albeit not the same frequencies at all locations. See "Frequency Agile Sharing Technology ('FAST') Report on Spectrum Sharing," American Personal Communications (July 1991); NTIA Report 91-279, "Spectrum Usage Measurements in Potential PCS Frequency Bands," September 1991; "Spectral Zone Coordination: Fast Track to PCN," Impulse Telecommunications Corp., April 1992; "Experimental License Progress Report," Telesis Technologies Laboratory, February 1992, and others.

2. There Is No Practical Mechanism By Which Spectrum Incumbents Can Be Bought Out To Provide Spectrum For User-Provided Applications.

The Commission has proposed in its NPRM that parties seeking to operate new services negotiate relocation or transition costs with the incumbents in the designated emerging technologies bands. The Commission's statement consistently uses the term "new licensees" to describe parties who might engage in that negotiation.[12]

As noted above, the IEEE Committee emphasizes that the new technologies bands must not be limited to "licensees" or service providers. Among those taking advantage of the new technologies of wireless LANs, there will be no licensee, as such, to derive revenue from spectrum usage and thus to engage in the buyout process as envisioned by the Commission.

The Committee has shown that it is essential that spectrum be cleared of incumbent microwave users for unlicensed applications and is prepared to address reasonable means for achieving that goal.

C. A Decade Or More For Implementation Of The Emerging Technologies Bands Is Unreasonable.

The IEEE Committee believes that the Commission's proposal to allow present fixed-point microwave users to continue, and even expand, protected operation in the subject bands for an extended period of time is contrary to the goals of establishing the emerging technologies bands, and particularly, to satisfying the already acute need for new wireless LAN technologies.

The Commission's proposal has unleashed opposition from the incumbents, who are not amenable to sharing the 2 GHz frequencies with new services, based at least in part on concerns about their quality of service. The IEEE Committee is equally apprehensive that new services, if forced to comply with severely limiting preconditions, will not use the new frequencies because they cannot function effectively in the band.

Given that sharing with fixed-point microwave services on a co-primary and non-exclusive basis is not feasible, the 10 - 15 year transition set out in the NPRM is far too long for the Committee and others to have to wait for cleared frequencies to implement wireless LAN technologies. In the computer and other high-technology industries, product life-cycles evolve quickly, and state-of-the-art

12 See, *e.g.*, at ¶26 in NPRM.

advances take place at a much higher rate. If the Commission is to provide a resource which supports continuing U.S. pre-eminence in the computer industry, the Commission must find a much faster way to authorize wireless LANs than the schedule outlined in the NPRM.

Accordingly, the Committee urges the Commission to allocate a substantial portion of the 70 MHz which the Committee has identified as the immediate spectrum need for implementing wireless LANs, from frequencies in the 2 GHz fixed microwave bands, and to clear them of existing users over a two-year period in order to foster the long-overdue development of new wireless LAN technologies.

The Committee welcomes further dialogue with the Commission on the subjects addressed in these Comments, and we stand ready to respond to your questions.

Respectfully submitted,

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