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

In the Matter of	)	
	)	
Amendment of the Commission's	)	GEN Docket No. 90-314
Rules to Establish New Personal	)	ET Docket No. 92-100
Communications Services	)	
	)	

To: The Commission

COMMENTS OF IEEE 802
LOCAL AREA NETWORK STANDARDS COMMITTEE
on the
NOTICE OF PROPOSED RULEMAKING AND TENTATIVE DECISION

Filed November 9, 1992

The IEEE 802 Local Area Network Standards Committee ("Committee" or "IEEE 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 Local Area Network (LAN) equipment that operates in infrared, ISM, DTS and other parts of the spectrum. These companies and others have been engaged, since July, 1990, in the Committee's effort to develop standards and protocols for wireless LANs.

The Committee applies a unique, singular focus to local networks for data communications. Unlike some of the other services considered in the NPRM, wireless networking is a natural extension of already-mature computer networking technology that has an already-proven vitality, already agreed-upon standards for interoperability, and an enormous installed base. There is no uncertainty about the values to be gained by providing spectrum for wireless LANs; there only remains the urgent imperative for doing so.

SUMMARY

The Committee applauds the expeditious actions that the Commission is taking in the above-referenced Notice of Proposed Rulemaking and Tentative Decision ("NPRM") to implement unlicensed PCS, including the wireless Local Area Networks (LANs) that are the purview of the Committee.

The Committee, however, finds that the Commission's proposed allocation for unlicensed PCS does not fulfill the numerous compelling demands for such services. The initial designation of only 20 MHz — 1910 to 1930 MHz — for both voice and data services is substantially smaller than is required for wireless LANs alone, much less for the expected mixture of services described in the NPRM. Indeed, there is a risk that such a paucity of frequencies may preclude market success and development of wireless LANs, or of developing effective technical standards to permit wireless LANs and the other services to function separately and in concert.

Accordingly, the Committee urges the Commission to allocate additional spectrum, including 70 to 140 MHz for wireless LANs as previously called for by the Committee, in the 2 GHz "emerging technologies bands." If the initial allocation of spectrum for unlicensed services is not so capacious, the Committee asks the FCC to reserve enough spectrum in the current proceeding so as to facilitate supplementing this initial allocation in the near future.

Given the sharp dichotomy between most licensed and unlicensed service issues, the Committee takes no position on most of the questions raised in the NPRM that address licensed PCS. In fact, the Committee urges the Commission to advance the implementation of unlicensed PCS in this proceeding and implement unlicensed services immediately, while the more troublesome issues pertaining to licensed PCS are being resolved.

The Committee also addresses certain of the Commission's proposed technical standards for unlicensed services. These suggestions involve proposed limits on radiated power, power spectral density, frequency accuracy, out of band emissions, and normative spectrum efficiency.

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 develop standards for local and metropolitan area networks that provide information transfer among computers at data rates of 1 megabit per second 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 IEEE 802.11 working group concentrates on wireless LANs . The group was formed in September, 1990, and has since met every two months. More than _____ individuals, representing more than _____ companies, have qualified for voting membership. More than _____ documents have been submitted in the course of these meetings; many of these have been or will be published in domestic and international professional journals including those of the IEEE.

The Committee is addressing high speed, on-premises wireless LANs for transmission of digital information among computing devices because wireless LANs are a natural extension of wired computer networks. These networks bring the benefits of such communications to the growing number of users of mobile and portable computers, as well as enabling immediate, flexible, interconnection of desktop devices. LANs are used to convey a variety of information including numbers, text, sounds and images. Wireless LANs may require no critical backbone or infrastructure to be constructed before they can be used as, for example, many applications involve direct communications among laptop and notebook computers or between such devices and other computer resources. Wireless LANs can be placed into operation as quickly as regulations are implemented and equipment complying with those regulations is manufactured.

The Committee has participated in previous Commission proceedings involving PCS[1], and has consistently, as herein, urged the Commission to allocate a substantial amount of radio spectrum — 70 to 140 MHz — for user-provided wireless local area digital networks.

DISCUSSION

I. 70 To 140 MHz Of Radio Spectrum Will Be Required To Satisfy The Foreseeable Demand For Unlicensed Services, Including Wireless LANs.

The Commission has proposed that only 20 MHz be allocated in the 1850-1990 MHz Emerging Technologies Bands for all unlicensed PCS applications, including cordless telephones, wireless PBXs and wireless data communications between computers within local areas (LANs). Yet the Commission has proposed to allocate 90 MHz for carrier-provided PCS to provide only telco-type voice and very low-speed data services to an equivalent population in similar areas.

The unlicensed user-PCS services identified by the Commission as meriting only 20 MHz include a wide variety of voice and data services. While wireless PBXs are not the area of primary competence or emphasis of the Committee, businesses and institutions need both wireless PBXs and wireless LANs, and some do not even make sharp distinctions between these functions. Both PBXs and LANs may serve many individuals within a small physical area — often the same individuals in precisely the same area. Both can be placed in operation for the user's own benefit, rather than that of a carrier or other third party service provider, and both can be accessed without airtime charges or tariffs.

High densities of users in a small area must have assurance of an adequate quality of service, including being able to obtain a communications channel when needed without encountering excessive busy conditions. These high user densities, and the composite bandwidth requirements of these users, translate directly to a need for substantial spectrum as well as for prudent microcellular frequency reuse.

It is therefore appropriate that the Commission consider both wireless LANs and cordless PBXs in the same proceeding, but the Committee emphasizes that the bandwidth requirements for high-data-rate wireless LANs need special attention to assure that at least

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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).

the critical minimum of spectrum for this application is made available on a timely basis. Compared with either carrier PCS or wireless PBXs, the high rates of data transfer that are characteristic of computer-to-computer communications require substantially more bandwidth than the combined potential traffic of a similar population of voice users. Wireless LANs, which will become even more vital as the marketplace employs portable computers, will carry by far the largest information load.

Wired Ethernet and Token Ring are two of the most popular computer networking standards, used to interconnect millions of computers. These networks transfer data at rates of ten and sixteen megabits per second respectively. In many businesses, educational institutions and industrial concerns, a single network of such capacity is inadequate today and multiple cables and much higher speed networks are being deployed. To provide the wireless equivalent of the data-handling capacity of such cable networks could require upward of 100 megahertz RF bandwidth, and additional such increments of spectrum must be used to facilitate microcellular frequency reuse . Constraining wireless networking to data transfer rates of only a fraction of their wired counterparts by allocating anything less would not recognize or respond to the demonstrated demand for wireless connectivity.

The Committee has, from the inception of its activities, concluded that there is an immediate need for at least 70 MHz of spectrum for wireless LANs, with a future requirement of up to 140 MHz. This is a real need, not a starting point for negotiations, and it is amply validated by the present practices of today's computer users.

The IEEE Committee recognizes that the total of the new spectrum needs expressed by industry and users exceeds the amount under examination in the NPRM.[2] If the Commission cannot allocate at least 70 MHz for unlicensed services at the outset, the Committee urges the Commission to allocate a substantial portion of that bandwidth immediately, and reserve additional such frequencies from diversion to other, some speculative, applications. It must also identify now those frequencies that would be made available to accommodate the expansion of wireless LANs, and to set out the terms and conditions for such expansion.

2 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.

II. The Spectrum Requirements Of Wireless LANs Have Generally Been Reflected In The Commission's Actions, With The Exception Of The Amount Of Bandwidth Required.

In many respects, the Commission has been responsive to the spectrum regulation requirements and operating characteristics of wireless LANs.

o 1. The Commission has recognized that wireless LANs can be deployed advantageously on an unlicensed basis. Schools, businesses, individuals and institutions who provide their own computer network services will be the most immediate beneficiaries of this unlicensed band.

An unlicensed regime with minimal regulation is highly likely to encourage technological innovation, an objective especially valued by the IEEE. By addressing a fertile regulatory environment and contemplating defined interference limits ~~(especially when compared with the ISM bands which has, until the Commission's NPRM, been the only domain in which the Committee could contemplate operations)~~, the Committee can proceed confidently to develop proper and effective protocols and standards.

While other organizations may effectively establish overall guidelines for frequency usage that could facilitate coexistence or suggest minimal rules to the Commission, only the IEEE Committee has the dictum, the charter and the expertise to develop standards that will provide for true interoperability among devices from a variety of manufacturers.

o 2. The FCC has shown it is well aware of the needs of manufacturers to implement new wireless LAN technologies on a worldwide basis to facilitate their widespread use and to enhance U.S. competitiveness. 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 optimum frequencies (albeit not yet in adequate measure) in the midst of the 1850-1990 MHz band for wireless LAN technologies. As a result of the Commission's decision, some embodiments of these high-capacity LANs will be able to interact with unlicensed wireless PBXs in the same frequency band, and potentially can bridge to voice PCS networks in the U.S. and abroad.

The Committee respectfully suggests that by establishing a substantial industrial base of wireless products to serve the U.S. market, U.S. manufacturers will be able to compete effectively in world markets. The Commission can further this effort by implementing an allocation from the outset of at least the same magnitude and perhaps even the same frequencies as have been allocated in Europe in the 1850-1990 MHz band.[3]

o 3. The Committee previously expressed concern that the Commission was not moving quickly enough to clear existing microwave users from the emerging technologies bands. The equitable transition and conflict-resolution process set out in the NPRM for identifying and clearing spectrum for unlicensed operation holds great promise for meeting current needs for wireless LANs. The Committee strongly endorses the concept of beginning the process for clearing spectrum for unlicensed operation on a "zero transition" timetable, permitting unlicensed services to be deployed immediately as soon as the necessary conditions have been met and without waiting for resolution of the many complex issues surrounding the implementation and regulation of licensed PCS.

III. Coexistence And Interoperability Among Disparate Applications Can Be Achieved Through The Committee's Professional Activities.

The Committee has stated that:

"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. . . . (A) separate and exclusive spectrum allocation for wireless LANs is a *sine qua non* for successful widespread deployment of wireless LAN technologies."[4]

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3 CEPT, the pan-European telecommunications entity, has allocated 1880-1900 MHz for Digital European Cordless Telecommunications (DECT), which provides in-building digital voice connectivity along with a limited data networking capacity. An additional contiguous 30 MHz has been set aside for possible expansion of the DECT frequencies as the demand develops.

4 *Citation to be completed*

The Commission has indicated in its NPRM that, instead of segmenting an unlicensed band by applications, it prefers to allocate a frequency range for a mix of services including wireless LANs and cordless PBXs, and has referred to the possibility that an industry group could help resolve interference issues within that unlicensed band. It is not inconsistent with the Committee's position to endorse the idea of a "spectrum etiquette" for users of the overall frequency band. Such an etiquette could help assure sufficient reliable access for wireless LANs to an adequate portion of the spectrum domain, most likely on an exclusive basis, on terms serving the technological requirements of LANs.

Taking its signal from the NPRM, the Committee is prepared to further its efforts or support efforts of other professional and industry groups to achieve coexistence among unlicensed spectrum users. Going beyond mere coexistence, however, the IEEE Committee has a twelve year history of successfully developing voluntary standards for interoperability among products designed and sold by numerous manufacturers. Although lacking the imprimatur of law, standards such as those generated by the Committee, developed within a flexible regulatory structure, can offer unmatched benefits to developers, manufacturers and users alike.

IV. Technical Issues

The Committee is continuing to develop positions on the several technical specifications or guidelines expressed in the NPRM. In general, the Committee feels that any technical imperatives should reflect conditions which optimize the use of the unlicensed band for the operations contemplated and do not impose unrealistic technical requirements on unlicensed devices.

The Committee believes the NPRM, as written, reflects undue regard for protecting the fixed point microwave stations now operating in the band. The Committee however believes this is an unwarranted and limiting constraint which, if imposed, could prevent deployment of these unlicensed applications. In the general case, there is no realistic means of permitting co-primary sharing between mobile computing devices and fixed microwave stations on a basis that guarantees unconditionally that the operations of the latter will not be affected.

Based therefore upon the assumption that the band usage can be optimized for the services that will occupy it, the Committee offers the following responses to specific technical issues.

1. The Commission's proposal for a spectrum efficiency formula to be applied to band usage is, we believe, at least premature and possibly may be unmerited. Spectrum efficiency can be evaluated on many different bases, some of which may not be quantifiable within the equipment authorization function. While the IEEE Committee favors the development of spectrum efficient technologies, the Committee recommends that no measure of spectrum efficiency be included in the regulations.

2. The Committee agrees with the principle of adaptive (RF) power control.[5] However, we recommend that a threshold power level, e.g. 10 dB below the maximum authorized power level, be selected, above which adaptive power control is required, and below which adaptive power control is not required. Low power devices, incapable of exceeding the specified power levels, should not be burdened with such a requirement.

3. The Committee addresses wireless LANs conveying data at rates from 1 to 20 megabits per second. Such data rates inherently require relatively wide RF bandwidths. As emphasized above, the proposed allocation for unlicensed operation is inadequate, and this limitation bears directly upon merits of channel partitioning schemes. In this context, the Committee has not yet reached conclusions regarding channelization, but it appears unlikely that either of the Commission's proposals will prove to be satisfactory.

4. The Committee believes that the proposed 1 part/million frequency tolerance of 15.253 (c) is neither realistic nor necessary. Instead, we believe that the regulations on frequency tolerance in conjunction with other specifications only should dictate that the devices meet the final out-of-band emissions specifications.

5. We recommend that out of band emission levels must be referenced to the maximum authorized power, not the actual radiated power.

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[5] NPRM at §15.253(d)(4)

6. We agree with the specification on maximum power spectral density as appears to be the intent of the NPRM[6] However, we recommend an explicit measurement means that numerically smoothes the inevitable measurement peaks (or correspondingly, that allows a suitable peak-to-average ratio that accounts for natural peaks in the emission envelope).

7. The Committee agrees in principle that the absolute power levels expressed in the NPRM are in the ranges appropriate for wireless LAN applications. However, we recommend that attention be paid to achieving a more uniform power spectral density among wireless LANs and applications employing a disparate range of bandwidths.

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

Respectfully submitted,

IEEE Project 802
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6 NPRM at §15.253(b)