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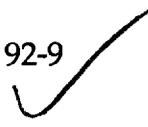
JUL - 8 1992

FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)
)
Redevelopment of Spectrum to)
Encourage Innovation in the)
Use of New Telecommunications)
Technologies)

ET Docket No. 92-9



ORIGINAL
FILE

To: The Commission

Reply Comments of Apple Computer, Inc.

Apple Computer, Inc. ("Apple"), hereby submits its reply comments with respect to the Notice of Proposed Rulemaking ("NPRM") in the above-referenced proceeding.

The NPRM has accomplished its purpose in that the issues facing the Commission have been clarified and a broad consensus for resolving these issues has been revealed. In spite of widely diverse goals among the commenting parties, a consistent and unified theme has emerged: it is now time, and there is a means, to establish a band of frequencies for emerging technologies, as proposed by the Commission.

The key points of agreement, which are discussed more fully below, are that:

- Virtually all parties support the Commission's goal to provide for new technologies.
- Existing microwave users must be able to maintain their current quality of service. New technologies must be able to achieve similarly high quality of service.
- To achieve these quality of service objectives, fixed microwave and user-provided PCS technologies cannot share the same frequencies; separate allocations are required. This means that some existing services will have to relocate to clear frequencies for new services.
- The Commission should require those implementing new technologies to reimburse existing users their reasonable relocation expenses.

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Accordingly, Apple strongly urges the Commission to begin immediately, not fifteen years from now, to clear fixed microwave stations from portions of the 1850 MHz to 1990 MHz band and to allocate a total of 70 MHz of such cleared spectrum, in no less than 10 MHz segments, for Data-PCS and other user-provided PCS technologies.¹ These are low power technologies that will give people access to the radio spectrum for both broadband data communications and narrow-band voice and data communications within a local area without the need for an FCC license or for carrier-imposed airtime charges or service fees.

The FCC, moreover, should create and administer an account, funded by the equipment manufacturers, to reimburse existing microwave users for any reasonable relocation expenses they may incur.² The Commission also should announce a timetable for clearing additional frequencies for both user-provided and carrier-provided PCS.

I. Virtually All Parties Support The Commission's Goals To Provide For New Technologies.

The record of this proceeding, as well as other proceedings before the FCC including the Commission's *en banc* hearing held on December 5, 1991, contains broad support, from a wide variety of interests, regarding the importance of establishing a band of frequencies for new technologies – including both user and carrier-provided PCS. (See Attachment A).

¹ Apple's January, 1991, Petition for Rulemaking (RM 7618) called for the allocation of 40 MHz of spectrum in the 2 GHz range to be used exclusively for a low power, local area radio service to enable high-speed, broadband data communications between and among people using personal computers. Since that time, many other parties have come forward to support Apple's Petition and the concept of radio-based computer networking. Other computer companies have called for more than 40 MHz to be devoted to Data-PCS (see, e.g., Sun Microsystems, Inc., Comments on RM No. 7618, at 7); the IEEE 802 Committee, for example, has called for 70 MHz to be devoted to wireless LANs (at 3-4). Suppliers of future "office PCS" systems, such as cordless PBXs, which are compatible with Data-PCS, have articulated additional spectrum requirements. (see, e.g., ROLM Comments at 11). On balance, then, Apple now believes that 70 MHz are required immediately for Data-PCS and other User PCS technologies, which are described in the comments of the WINForum (at 2-4).

² This proposal runs counter to one of the Utilities Communications Council's ("UTC") arguments in opposing introduction of new technologies on an unlicensed basis, *i.e.*, that there would be no one with sufficient financial interest to provide reimbursement for relocation costs (see UTC Comments at 79).

II. All Parties Agree That Existing Microwave Users Must Be Able To Maintain Their Quality Of Service.

Despite the overheated rhetoric of those representing the existing microwave users, no one, least of all the FCC, has proposed that there be a preemptory shutdown, or degradation of the reliability, of any microwave services. No one even has proposed that there be an arbitrary, uncompensated relocation of existing fixed microwave links, in order to make way for new technologies. To the contrary, virtually every commenting party respects the concerns of existing users of the 1850-1990 MHz band.³

It is now time to put aside the rhetoric and accommodate the valid concerns of the microwave users, while continuing to foster new technologies.⁴

A. The Optimum Way For Existing Users And New Technologies To Achieve Necessary Quality Of Service Is To Use Separate Allocations. Some Services Will Have To Relocate To Clear Spectrum For New Services.

Apple's January 1991, Data-PCS Petition stated that:

“Data-PCS is a new technology that will provide a completely new service. It is not an extension of or supplement to mobile or portable telephone services. As a new, stand-alone technology, Data-PCS needs a suitable operating environment that ensures robust, high speed, data communications on frequencies *reserved exclusively for its use.*” (emphasis added)⁵

³ Apple is sympathetic to the needs of existing microwave users for reliable data connectivity. Edison Electric, for example, calls for a link reliability factor of 99.995% and cites needs for 99.9993%. Similarly, Apple, in its Petition (at 11), asserted that for computer networks “an error rate of 10^{-8} is a common minimum requirement and still greater integrity is desired for some applications.” This need for reliability was one motivation for Apple to seek a far better interference environment than the ISM bands.

⁴ UTC has not yet put aside the rhetorical approach. It has a valid concern that operation of new technologies on an unlicensed basis on shared frequencies would create interference to microwave facilities, which would be difficult to correct because one could not identify the source of interference from unlicensed devices. UTC's approach is to oppose the development of new technologies on an unlicensed basis. See UTC Comments at 79. Apple's approach is to acknowledge the concern as valid, but to foster the development of new, unlicensed user-provided PCS technologies by authorizing separate frequency allocations for user-provided PCS.

⁵ Attachment B is a compilation of excerpts from comments in this proceeding supporting the conclusion that certain PCS technologies require an allocation of frequencies separate from and exclusive of frequencies used for fixed microwave links.

In the year and a half since Apple's Petition, there have been many proposals for new PCS services that claim not to require existing users to be displaced. These proposals generally are predicated upon so-called avoidance techniques whereby base stations and portable transceivers accessing those base stations can avoid using frequencies used locally by fixed microwave systems.

While some of these narrow-band, frequency-agile "avoidance" proposals are intriguing, the tools employed for such techniques do not work for Data-PCS, whose users must operate without base stations to achieve highly mobile, *ad-hoc* connectivity and, therefore, may be anywhere and on any frequency in the allowed range. In such user-provided PCS systems, no practical avoidance technology has been described and exclusive (*i.e.*, cleared) spectrum must be used.⁶

Apple's Petition also suggested that new frequencies for Data-PCS could be "phased in" in increments of 10 MHz over a several-year period. Unfortunately, Apple's "phasing in" suggestion has been skewed by some current users to mean leaving most existing microwave paths in place, without changing frequency or any other aspect of operation, for a period of five, 10, or 15 years or indefinitely. This type of "phasing in" will not create new technologies bands at all.

B. The Parties Agree That Existing Users' Reasonable Costs Of Maintaining Quality Of Service Under A New Frequency Plan Should Be Compensated By Those Implementing New Technologies.

From the beginning, Apple understood that any frequencies that would be suitable for Data-PCS would have current occupants, who would have to be reimbursed for the reasonable expenses they would incur in relocating to other frequencies. Apple's Petition, therefore, addressed the need to generate moneys to reimburse existing users stating that:

a universal ID assignment scheme could provide a means for manufacturers to collect a fee for spectrum usage from PC users and remit such fees to the Government. ... There is ... substantial precedent for computer users to pay fees for intellectual and other intangible properties, such as software and software updates. See Apple Petition at 27-28; Statement of Apple

⁶ Apple does, however, believe that use of such avoidance techniques by carrier-provided PCS should be explored, so that the overall available spectrum pool for new PCS technologies can be as large as possible.

Computer, Inc., Hearing before House Subcommittee on
Telecommunications and Finance, March 12, 1991, at 8.

In their separate comments in this proceeding, WINForum and the IEEE 802 Local Area Network Standards Committee explicitly recognized the need to deal fairly and equitably with existing microwave users with respect to their reasonable costs of relocation. The Communications Act, however, does not give any user of radio frequencies an ownership interest in those frequencies, see Sections 301 and 304, despite the propensity of certain existing microwave users to refer to themselves as "incumbents" and claim entitlement to profit for giving up their occupancy of frequencies.

When the public interest requires that existing users vacate their frequencies, the Communications Act explicitly denies them an expectation of compensation or reimbursement, let alone profit. A tax certificate is the most that other spectrum users have garnered when there has been a change in public policy affecting their spectrum use. Some commenting parties have suggested making tax certificates available to microwave users who are forced to relocate. Apple has no objection to that suggestion, but, if the Commission wishes to go beyond tax certificates, only the reasonable expenses of relocation can have any claim of reimbursement. Apple believes that manufacturers of user-provided PCS equipment will provide moneys only for such a reimbursement scheme.⁷

Moreover, as an essential precondition, the FCC must exercise control over the process to assure that only the reasonable expenses of relocation are entitled to reimbursement. This cannot be left to the interested parties alone. What must be done now by both the Commission and the interested parties is twofold:

1. As Apple, the WINForum, the IEEE Committee and other parties have urged, the Commission must set an immediate and firm timetable for the existing users to vacate the frequencies needed for user-provided PCS. (See Apple Comments at 4-6, WINForum Comments at 2, and IEEE Committee Comments at 1, 9.) The Commission then must state that there will be no profiteering allowed and that reimbursement of

⁷ Not surprisingly, a few existing users have advanced substantially inflated costs estimates for relocation. One such cost estimate simply for changing existing users' frequencies from 2 GHz to 6 GHz is \$8,327,176,000 (\$286,000 per site), and does not include "new intermediate microwave repeater sites which may be required or structural modifications to existing towers." See Associated PCN, Exhibits A and B, Prepared by Telecommunications Design Services, Inc.

reasonable costs will be the only basis upon which the existing users will receive money for vacating frequencies in favor of new technologies. At the same time, the Commission must make clear to the proponents of new technologies that reimbursement of the costs of relocation is an essential ingredient of gaining access to the emerging technologies bands.

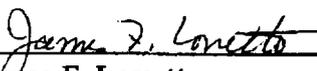
2. Once the Commission establishes these essential ground rules, the parties must engage in a constructive joint effort to minimize the costs of relocation. Innovative frequency relocation schemes, determination and application of proper priorities, implementation of new technological approaches, including radio and antenna hardware, and other means must be explored by the affected industries to deal with valid issues of frequency relationships with path lengths, fade margins and precipitation, and special-site considerations.

IV. Conclusion.

For the reasons stated above, the Commission should move swiftly to conclude this proceeding and take the next step to allocate sufficient spectrum for new technologies.

Respectfully submitted,

Apple Computer, Inc.


James F. Lovette

20525 Mariani Avenue, M.S. 76-2H
Cupertino, California 95014
(408) 974-1418

OF COUNSEL

Henry Goldberg
GOLDBERG & SPECTOR
1229 19th Street, N.W.
Washington, D.C. 20036
(202) 429-4900

July 8, 1992

Attachment A

The following is a compilation of excerpts drawn from the comments of some of the parties to this proceeding, other than members of the WINForum and the IEEE 802 Local Area Network Standards Committee, who support creation of emerging technologies bands for both user-provided and carrier-provided PCS.

Advanced Mobilecomm. Inc.: "(T)he need for the emerging technologies band proposed in the NPRM to provide entrepreneurs the necessary incentives to continue to research, develop and deploy these emerging technologies that have made the Information Age a reality is clear and convincing." (at 4)

Associated Builders and Contractors: "Emerging technologies such as Personal Communications Services (PCS) will provide new opportunities to implement radio systems beneficial to our members and the public they ultimately serve." (at 1)

American Road & Transportation Builders Association: "New emerging communications products are now available that will enhance the services and functions of our members such as portable video, fax, and graphics available in field locations beyond the reach of established common carrier providers. . . . These are just a few of the many examples of how new radio technologies can provide efficiencies and cost savings for our industry in the near future if adequate spectrum is provided." (at 2-3)

Ameritech: "By its designation of the 1.8 to 2.2 GHz band for emerging technologies, the Commission takes another positive step in support of those national interests." (at 5)

Baltimore Gas and Electric Company: "In an age of proliferating information services, many of which obviously will be utilized over the radio airwaves, it is vital to establish a spectrum reserve for emerging technologies. An Emerging Technology Band will provide the necessary bandwidth for manufacturers, inventors and entrepreneurs to develop new applications such as PCS, satellite video systems, worldwide radio networks, and other wireless services that can be used by many businesses in the future." (at 2)

Cox Enterprises, Inc.: "Based upon its research and industry participation, Cox believes that PCS holds the promise of revolutionizing the way people communicate. Mobility of communications unquestionably has

become a highly desirable, if not yet an essential, means of communication." (at 2)

The Coastal Corporation: "Coastal recognizes the potential need for adequate radio spectrum to accommodate the development of new radio communication services. Coastal agrees also that where, as in the present situation, there is no readily available "virgin" spectrum to accommodate new services, the Commission must consider reallocating spectrum currently in use for existing services." (at 5)

CBS Inc.: "CBS supports the Commission's proposal in this proceeding to reallocate a total of 220 MHz of spectrum between 1.85 and 2.20 GHz.....for use by emerging telecommunications technologies, such as personal communications services, data PCS, a generic mobile satellite service, a digital audio broadcasting service, and low Earth orbit satellites." (at 1)

Citizens Utilities Company of California: "CUC supports the Commission's objective to provide adequate spectrum in a reasonable time frame for the development and implementation of new innovative technologies and services to the American public. ...CUC believes that wireless telecommunications services will see explosive growth and increased demand over the next decade." (at 2)

Cylink: "Adoption, by the FCC, of the proposed spectrum--1850-1990 MHz--for PCS will accelerate the provision of PCS to the American public and provide U.S. telecommunications manufacturers with a domestic market upon which to build a global wireless business in competition with European and Asian competitors." (at 7)

CTIA: "CTIA supports the allocation of frequencies to PCS." (at 3)

EDS Corporation: "EDS is one of the world's leading providers of information technology services. As noted by the Commission, technological advancements have opened possibilities for the development of a broad range of new radio communications services, including new mobile services. The development of these advancements, however, is being hindered by the lack of available spectrum." (at 1-2)

Fleet Call, Inc.: "Advances in digital signal processing technology have created a virtual cornucopia of innovative mobile and personal communications service possibilities. The availability of sufficient spectrum capacity, however, is an essential factor in convincing manufacturers and capital providers to commit to the research, development and perfection of these advanced communications technologies." (at 5)

International Mobile Machine Corporation: "We agree and propose the Commission identify data PCS spectrum within 220 MHz currently being discussed for emerging technologies." (at 9)

McCaw Cellular Communications, Inc.: "Wireless PBX systems, enhanced residential cordless telephone services, and wireless data networks (wireless LANs) have generated a high degree of interest by both consumer and manufacturers." (at 22)

Motorola: "(T)he Commission must make its number one priority swift completion of all regulatory actions required to make private and public PCS a reality. . . . Creation of Emerging Technologies such as new Personal Communications Services (PCS) is the next step in a successful history of wireless communications offerings. Timely finalization of spectrum allocations for these will create new jobs, spur investment, provide necessary tools for U.S. businesses to succeed in an increasingly competitive global economy, help governmental entities to meet increasing demands of protecting the public with limited resources, and offer the public new levels of convenience." (Executive Summary; at 4)

North American Telecommunications Association: "In particular, with respect to wireless office systems NATA can attest that the lack of available spectrum has had, in the Commission's words, "a chilling effect on the incentives for manufacturers and financial institutions to develop and fund new communications research." (at 2)

National Telecommunications and Information Administration: "NTIA agrees with the Commission that new services such as personal communications services (PCS), wireless PBX's (private switchboards), wireless data networks, mobile satellite services, and low-Earth orbit satellites, should have access to spectrum for their operations." (at 5)

Northern Telecom Inc.: "Northern Telecom estimates that 230 MHz of spectrum will eventually be required for terrestrial PCS applications, and believes that the Commission's proposal to allocate spectrum for emerging technologies can accommodate that need." (at 3)

OCOM Corporation: "OCOM strongly supports the goal of making spectrum available for the use of emerging technologies. Indeed, OCOM may eventually apply for these licenses." (at 2)

PCN Services of New York, Inc.: "The American public simply cannot afford to wait fifteen years for the introduction of new technologies such as PCS." (at 27, n. 39)

Public Safety Microwave Committee: "PSMC supports efforts to promote new communications technologies and believes that some new technologies, such as private PCS networks, could have important public safety applications." (at 3)

Telocator: "Telocator supports the Commission's proposed rulemaking as a first step towards a spectrum allocation for emerging personal communications services." (at 1)

Time Warner Telecommunications Inc.: "The importance of PCS and the vast global market that will exist for PCS products and services have been generally recognized, and countries throughout the world have moved quickly to position themselves to compete successfully in this market." (at 6)

Telephone and Data Systems, Inc.: "TDS, through its subsidiaries, holds in excess of three hundred 2 GHz common carrier point-to-point microwave authorizations, which are potentially subject to displacement under the Commission's current proposals. . . . TDS strongly supports the Commission's initiatives to make available additional spectrum for emerging technologies, particularly PCS. The Commission should proceed as rapidly as possible to provide adequate spectrum for the family of PCS services." (at 2-3)

United States Telephone Association: "The Commission should seek to license frequencies in the 2 GHz band for use by new services which will benefit the public interest. PCS, for instance, should be intended for use by a large portion of the general public. Therefore, at a minimum, new services requiring spectrum in the 2 GHz band should be widely deployed, affordable, high quality, capable of implementation within a reasonable time frame and spectrum efficient." (at 9)

Virginia, Maryland and Delaware Association of Electric Cooperatives: "At the outset, the VMDAEC would like to state that it is not opposed to the development of new technologies. We recognize and support the proven need for emerging technologies such as personal communications networks." (at 1)

Public Service Telephone Company: "As an initial matter, Public Service applauds the Commission's efforts (as reflected in the NPRM) to provide suitable frequency spectrum, in an expeditious manner, for this purpose." (at 3)

Attachment B

The following is a compilation of excerpts drawn from the comments of some of the parties to this proceeding, other than members of the WINForum and the IEEE 802 Local Area Network Standards Committee, who support Apple's conclusion that certain PCS technologies require an allocation of frequencies separate from and exclusive of frequencies used for fixed microwave links.

Atlantic Electric states that "Our initial review suggests that large scale attempts to use new technologies on a co-primary basis with fixed microwave will result in interference with the fixed microwave system when the new technology applications experience large volume use." (at 10)

GTE has said that they have "seen no convincing proof that co-primary operation on the same frequencies in the same geographic area, with high traffic loads is technically feasible (i.e., the "stealth overlay")." (at 25)

Motorola noted that "(n)on-licensed user provided services without any infrastructure may not be feasible on a shared basis with fixed microwave because users may roam anywhere and to any building height without regard to location of microwave receivers. . . . Accordingly, we conclude that if the Commission relies on sharing as a total solution, PCS growth will be severely limited, interference potential to existing OFS microwave systems will be increased, and the potential growth of existing microwave systems sharing spectrum with PCS will in reality, be greatly restricted. Genuine re-accommodation of microwave systems to alternative bands as discussed in the previous section of these comments is a more appropriate approach." (at 18-19)

NYNEX "does not believe these tests compel the conclusion that systems using a variety of new technologies can permanently share spectrum on a co-primary basis with the incumbent users without interference problems." (at 9)

Northern Telecom states that "Spectrum sharing on a co-primary basis, in the medium and long term, with other users that are not PCS would result in an inefficient use of spectrum and would diminish the value of PCS to the general population and American industry." (at 9)

PCN Services of New York, Inc. ("PCNS-NY) , a LOCATE company with substantial interests both as a current fixed microwave user and as an emerging new-technology PCS supplier, presents a particularly compelling discussion and evidence. PCNS-NY forthrightly stated that "Use Of The 2 GHz Band On A Co-Primary Basis Is Not Feasible." "If relocation is not accomplished prior to the operation of the new service, existing users and the new licensees will share the band for a pre-determined period with equal rights to the band. Sharing of the band on a co-primary basis is not feasible and not acceptable to the majority of existing 2 GHz users. In negotiations with existing users, PCNS-NY has been informed uniformly by these existing users that they cannot tolerate any interference. Despite hopeful claims of sharing technologies, no sharing technique has yet been proven to meet that standard. When presented with the option to relocate to higher frequencies at no cost or to share spectrum with new services, existing users have consistently advised PCNS-NY of their strong preference for relocation because of their strong belief that existing and new systems will inevitably interfere with each other." (at 30-31)

Tacoma Public Utilities and Los Angeles Department of Water and Power say in twin filings that they understand "that certain proponents of spectrum reserve are claiming that PCN can share the fixed microwave bands through the use of spread spectrum or other techniques. (Each company) is skeptical of these claims, and urges the Commission to consider alternate bands." (at 2)

Pacific Telesis reported that its "spectrum sharing field measurements indicated that spectrum sharing may be more feasible with a narrow band (< 5MHz) PCS system than with a broadband system." (at 8) [Apple points out that Data-PCS will in many cases be a broadband system.]

Association of American Railroads states that "the Commission's vague proposals to permit frequency "sharing" and to allow microwave existing users to operate on a co-primary basis with PCS and other new services during a transition period are equally premature." (at 5)

Public Safety Microwave Committee "is deeply concerned that the Commission has not yet fully explored the potential that (co-primary operation) creates for disruption of vital public safety communications operations. ...The lives of public safety officers and the public are, quite literally, on the line. Therefore, these public safety operations cannot tolerate even the slightest level of interference. . . . PSMC has yet to see any hard evidence that

mobile operations such as PCS can coexist with fixed microwave operations in the 2 GHz bands without causing interference. . . . Until more is known, wholesale reallocation of the 2 GHz band (to permit co-primary operation) would be reckless and premature." (at 22-23)

Questar Corporation similarly emphasizes that "(t)he sensitive operations now conducted in this spectrum cannot tolerate any objectionable-level interference. Loss of signal at a critical moment could result in catastrophic consequences for the public. " (at 9)

Time-Warner, reported that "(i)n an effort to minimize the cost and disruption involved in relocating fixed facilities to higher frequencies, various innovative sharing techniques and technologies have been proposed. Nevertheless, based on TWT's analysis of the many spectrum studies, its understanding of the performance characteristics of installed microwave equipment, and the demand expected for PCS services, TWT believes that it will not be possible for both services to co-exist indefinitely in all areas.. Studies purporting to substantiate other conclusions may be based on overly optimistic and/or technical faulty assumptions." (at 11, n. 15)

Southwestern Electric Power Company provides perhaps the clearest portrayal of the situation and the way it must be addressed, by reporting that "(t)he NPRM proposes a licensing category of CO-PRIMARY between PCS users and existing microwave users, and requested comments on this status. The NPRM does not define this term, but the implications are obvious. If neither licensee is PRIMARY and interference does occur, neither party has the power to quickly force the other party to resolve the issue. Our telecommunications needs are critical for the safe and reliable operation of our power system, we would have to resolve interference issues quickly. Therefore we view co-primary as functionally equivalent to secondary, in that we would be forced to make any changes required to eliminate interference. As such, we view a co-primary status as unacceptable for our needs." (at 2-3)

Comsearch. said that "(t)he results of our modeling and measurements compel us to draw an important conclusion: spectrum sharing between emerging technologies and existing users in the 1.85-2.20 GHz bands is indeed feasible; however, proper engineering and frequency planning are paramount." (at 1) **Telocator** similarly said that "(w)ith careful frequency coordination and cooperation from the microwave user community, sharing will be possible." (at 12)

Fleet Call, Inc., expressing similar views in a positive fashion, says that
“(t)he proposed reallocation must assure new emerging technology
service providers of sufficient spectrum on an interference-free
basis to justify the investment required to implement personal and
other mobile communications innovations. (at 8)