

the Connectivity for Learning Coalition noted, the very limited power level proposed by the Commission would severely limit the ability of NII/SUPERNet devices to communicate through walls and between floors of a school or library building. This would effectively relegate NII/SUPERNet devices to serving as routers within a single room, leaving unsolved the larger problem of communications among rooms and outside the building, which would defeat the fundamental purpose of the NII/SUPERNet proposal.⁴⁰ With respect to community networking functions, it was generally agreed that higher transmit power levels and freedom to use directional antennas are required in order to overcome background noise and path losses.

For this reason, the Commission should adopt the power levels proposed in Apple's comments: *i.e.*, a transmitter power of 0.1 watt (+ 20 dBm) for personal/portable equipment and 0.316 watts (+ 25 dBm) for fixed equipment, with, of course, the proviso that antenna gain not be restricted for point-to-point, fixed outdoor links.⁴¹

3. The Proposed Listen-Before-Talk Protocol.

Recent allocations of unlicensed spectrum have recognized the value that technical sharing rules can provide in mitigating interference and promoting efficient spectrum use. In light of these benefits, Apple previously generally endorsed the use of a "listen-before-talk" ("LBT") algorithm as a management tool for the NII/SUPERNet band, including for community networks.

⁴⁰ Connectivity for Learning Coalition Comments at 3; see also Joint Comments of Educators at 2, 5 (educators face enormous financial and technical obstacles in distributing communications within campuses and buildings, and the Commission should deal flexibly with the issue of power limits in order not to unnecessarily limit the ability of NII/SUPERNet devices to meet these needs); Mulcay Consulting Associates Comments at 2 (NII/SUPERNet devices will serve a wide variety of market needs requiring quite different technical parameters, and the proposed EIRP limit of -10 dBW is not consistent with the Commission's stated diverse service goals).

⁴¹ To assure that unlimited antenna gain is available solely for fixed, point-to-point links, the Commission could adopt for the NII/SUPERNet band the same restrictions proposed for spread spectrum directional antennas: *i.e.*, that unlimited antenna gain would not be available for point-to-multipoint or omnidirectional systems, transmitters employing multiple directional antennas, or multiple co-located transmitters transmitting the same information. See Amendment of Parts 2 and 15 of the Commission's Rules Regarding Spread Spectrum Transmitters, Notice of Proposed Rule Making, ET Docket No. 96-8, 11 FCC Rcd 3068 (1996).

The “LBT” term, however, has been given a narrow construction in this proceeding. Rather than being used generally to describe a variety of approaches for providing some view of a spectrum band, the term LBT has come to refer to the specific LBT rules, or etiquette, adopted for the unlicensed PCS bands and codified in Subpart D of Part 15 of the Commission’s rules. This etiquette depends upon energy sensing (not information exchange between devices) and requires complex monitoring, “packing,” searching, threshold detection, tradeoffs between transmitter power and received signal characteristics, an array of minimum microseconds and maximum milliseconds (and for some applications up to multiple hours) of required responses and activities, and much more.

Apple concurs with those who oppose adopting an LBT algorithm for the NII/SUPERNet band that is based upon Part 15, Subpart D. However, it may be useful to consider LBT approaches in the larger sense to include procedures beyond real-time, on-channel listening.

By way of example of differing LBT implementations, the essentially LBT-based etiquette applied to the Subpart D “asynchronous” bands requires devices to monitor the desired spectrum for RF energy above a stated threshold for a period of ≥ 50 microseconds and at intervals of ≤ 10 milliseconds.⁴² If the sensed RF level exceeds a stated threshold, the transmitter must defer operation or find another channel that is not occupied. In contrast, the corresponding LBT sensing rules for the Subpart D “isochronous” band require monitoring for a period of ≥ 10 (or 20) milliseconds at intervals of up to 8 hours.⁴³ The proposed “interim etiquette” for the NII/SUPERNet band has requirements similar to those adopted for the Subpart D asynchronous band.⁴⁴

42 47 C.F.R. § 15.321(c)(1) (rules governing the asynchronous unlicensed PCS bands at 1910-1920 MHz and 2390-2400 MHz).

43 47 C.F.R. §15.323(c)(3) (rules governing the isochronous unlicensed PCS bands at 1920-1930 MHz). Another example of an LBT approach is HIPERLAN which, in the form that has been authorized in Europe, is essentially a real-time, on-air LBT-based protocol. Other network implementations that might eventually emerge under a HIPERLAN label (HIPERLAN I, HIPERLAN II, etc.) would not necessarily be based upon LBT and thus could have entirely different service attributes.

44 See NPRM, proposed §15.4411(a)(1).

The particular Subpart D LBT implementations were developed specifically for the types of applications anticipated in the 2 GHz unlicensed PCS bands and were optimized for short-range, more limited bandwidth scenarios in which most stations hear one another. Most commenters in this proceeding, including those who took part in generating the Subpart D rules, reject this particular mode of LBT for the NII/SUPERNet band as generally unworkable or, at least, insufficient. In particular, it generally was recognized that stations can cause interference at distances greater than the distances over which they can communicate. Additionally, the classic “hidden node” problem described by Bell Atlantic likely will be the rule for community networks and may be a likely condition for indoor LANs.⁴⁵

In light of the unnecessarily narrow meaning that, increasingly, has been ascribed to the term “LBT,” Apple suggests that conventional LBT — *i.e.*, on-the-air monitoring — be included and analyzed within the broader rubric of “channel assessment.”

The term channel assessment can encompass many practices. Channel assessment can be a process involving microseconds, minutes, hours, weeks or years. Channel assessment can be an instantaneous, technical functionality imbedded in individual stations — for example, the channel assessment approaches used by adaptive frequency-hopping spread spectrum systems — or it can be an administrative system based upon knowledge of local usage obtained, for example, through public and private records or agreed-upon assumptions. As discussed above, Apple proposes that a voluntary, administrative form of channel assessment — and, perhaps, the designation of a restricted class of “designated eligibles” — be used rather than the proposed LBT algorithm for the NII/SUPERNet band.⁴⁶

4. Channelization.

Apple agrees with the commenting parties who opposed efforts to channelize the NII/SUPERNet band or to impose high minimum bandwidth

⁴⁵ Bell Atlantic Comments at 2-3.

⁴⁶ Apple’s proposal for administrative channel assessment approaches would apply only to the non-VHR portions of the NII/SUPERNet band.

requirements on NII/SUPERNet devices.⁴⁷ Within the VHR-only bands, however, it is possible that channelization plans or more informal channelization etiquettes could be developed that would promote efficient spectrum use and system reliability. In such a case, the Commission should not absolutely preclude channelization as long as any such plan is limited solely to the VHR sub-bands.

5. Band Plan.

In its comments, Apple described a proposed band plan for the NII/SUPERNet band. The concerns about sharing expressed in the comments demonstrate that this band plan can do a great deal to overcome the principal concerns associated with introducing NII/SUPERNet devices into the 5 GHz band.

The goal of the band plan is to solve the two first-order problems associated with NII/SUPERNet use of the 5 GHz band: sharing between NII/SUPERNet devices and certain other users of the 5 GHz band and sharing between short-range, broadband NII/SUPERNet devices and other NII/SUPERNet devices. The band plan would address these problems by dedicating certain subsets of the NII/SUPERNet band solely to the operation of VHR systems and, thereby, achieve the following:

- Eliminate concerns about objectionable interference to MSS uplinks and possible future ITS operations by permitting only VHR

⁴⁷ *E.g.*, ITI Comments at 7 (manufacturers and users must have flexibility to adopt different mixes of bandwidth, data rate, power, channel use time, and type of antenna to satisfy different applications); Metricom Comments at 5-9 (opposing rules that mandate or effectively require that NII/SUPERNet devices operate at high bandwidths); Microsoft Comments at 4 (opposing channeling plan, since such a plan would unnecessarily limit design flexibility); Motorola Comments at 10 (the Commission should allow full flexibility to determine channelization on a product-by-product or even a dynamic and variable "bandwidth on demand" basis; any channelization plan adopted at this time could restrict future innovation); BSA Comments at 2 (supporting Commission's proposal not to adopt a channelization plan); 3Com Comments at 4-5 ("the Commission is opening the new frontier for wideband and narrowband, multimedia and text-based, wireless low power devices" and, "[w]ith so many open questions about the future needs for wired and wireless networking capabilities, it seems premature and technically unwise to adopt a specific channeling plan").

systems — *i.e.*, very high rate, low power LANs used within buildings — to operate in spectrum shared with these services; and

- Eliminate concerns about interference to VHR systems from narrower-bandwidth NII/SUPERNet systems, including community networks, by creating sub-bands within which only VHR systems would be allowed to operate.

Apple's proposed band plan would dedicate the 5150-5250 MHz band segment, which will be used by MSS uplinks, and the 5825-5875 MHz segment, which may be used in part for ITS, to VHR operations. Longer-reach and narrower-band systems would be excluded categorically from these sub-bands.⁴⁸ Therefore, 150 MHz of "protected" frequencies would be available exclusively for indoor, very high capacity systems.

The remainder of the NII/SUPERNet band — *i.e.*, 5250-5350 MHz and 5725-5825 MHz, or a total of 200 MHz — would be available for use by all NII/SUPERNet devices, including outdoor systems, narrower-bandwidth devices, an array of community network operations, and VHR systems, as follows:

⁴⁸ By allowing only VHR systems to operate in the 5850-5875 MHz, the band plan also would protect the only unique frequencies available for ultra-low power devices operating under Section 15.249.

PROPOSED BAND PLAN

1. LOWER PORTION OF NII/SUPERNET BAND

5150 MHz	5250 MHz	5350 MHz
VHR-Only Sub-Band	"General Use" NII/SUPERNet Sub-Band	

2. UPPER PORTION OF NII/SUPERNET BAND

5725 MHz	5825 MHz	5875 MHz
"General Use" NII/SUPERNet Sub-Band		VHR-Only Sub-Band

By requiring that only VHR systems be allowed to operate on the portions of the NII/SUPERNet band that will be shared with MSS systems and may be shared with ITS systems, the band plan will protect MSS and ITS operations from objectionable interference. High data rate communications in a limited power environment — two inherent characteristics of VHR operation — create low power spectral densities. This characteristic, combined with attenuation from walls, will ensure that outdoor MSS and ITS systems are shielded from VHR NII/SUPERNet emissions.

As discussed above, dedicating 150 MHz of spectrum solely to VHR devices also will provide adequate protected spectrum within which VHR systems can operate without any negative effects from narrower-bandwidth NII/SUPERNet systems. As a result, it addresses the desire of certain parties to permit only VHR-type operations in all or a portion of the 5 GHz band. Moreover, as noted in Apple's comments, VHR systems would not be excluded from the remainder of the NII/SUPERNet band, although they would not have any regulatory protection from longer-reach or narrower-bandwidth systems

outside the VHR-only bands.⁴⁹ Apple's band plan proposal thus effectively makes the entire 350 MHz of the NII/SUPERNet band available for VHR devices.

B. Additional Sharing Rules Should Be Adopted Through An Open Process.

The vast majority of the commenting parties also agreed that any sharing rules beyond the basic rules proposed by the Commission should be adopted through an open, flexible, industry process and in a timely manner. The Commission should take appropriate steps to assure that this process preserves access for a wide range of possible applications and technologies and is not co-opted to reflect any single vision of the NII/SUPERNet band.⁵⁰ As ITI stated, "[t]he fewer restrictions established *a priori*, the more freedom industry will have to develop innovative products, technologies and applications for high-speed, multimedia, wireless networks."⁵¹

Moreover, as a general rule, industry standards should not be codified in 47 C.F.R. but, rather, should remain outside the formal regulatory process in order to preserve the opportunity for such standards to evolve over time.

In light of the different nature of VHR and non-VHR operations, different processes should be employed for developing sharing rules for the VHR-only

49 Comments filed in response to the NPRM included proposals to use or divide the band by any of a host of factors, including RF technology (*e.g.*, modulation scheme, including spread vs non-spread emissions); service delivered (*e.g.*, voice vs. data vs. multimedia); quality of service required (*e.g.*, guaranteed real-time delivery vs. packet delivery permitting some latency); bandwidth (numerous models): locale or physical coverage (*e.g.*, providing for "quiet zones"); type of user or traffic content (*e.g.*, for education only, or for "commercial and industrial" users only); channel access methodology (*e.g.*, distributed vs. centralized control of traffic); spectrum efficiency (*e.g.*, bps/MHz); and profit opportunity (*e.g.*, subscriber services vs free public services). While many of these approaches have some superficial appeal, they should be rejected as unworkable and unduly complex, particularly given the fact that the way unlicensed devices can be used depends solely on compliance of said devices to laboratory-measurable specifications. Instead, Apple's much simpler proposal to divide the NII/SUPERNet into two bands will provide adequate protection from interference while preserving opportunities for innovation.

⁵⁰ See, *e.g.*, Nortel Comments at 11 (development of sharing rules will require due care and attention to accommodate the wide range of possible applications and technologies that will use the new band).

⁵¹ ITI Comments at 6-7.

and general use bands. In both cases, appropriate steps should be taken to ensure that the development of interference management and band usage practices, particularly those that ultimately will be codified into Part 15, is and remains a process that is open to all interested parties, including representatives of the education, library, health care, and non-profit sectors.⁵² In particular, no potential participant in the standards development process should be forced to join, pay dues to, or become a member of a larger organization in order to have its voice heard.⁵³

User participation will be particularly important in developing rules for the general use NII/SUPERNet band, in which community networks will operate. While industry representatives generally will possess the technical expertise needed to implement technical sharing solutions, they may not fully understand the community networking environment. Only with adequate involvement by potential users can all parties be assured that these solutions will achieve the goals giving rise to the creation of the NII/SUPERNet band.

Apple is prepared to play a leading role, along with other interested parties, in developing rules for the general use NII/SUPERNet band. As discussed in Apple's comments, these rules should be limited, open, and flexible, and should be developed in a relatively short period of time.

With respect to the process for developing sharing rules for the VHR-only bands, Apple respects WINForum's efforts to take on the task of developing sharing rules and believes that WINForum's members have a great deal to contribute to this process. WINForum, however, is a membership and advocacy organization with a relatively narrow common focus that many parties interested in the 5 GHz sharing standards may not share. As a result, and given WINForum's primary interest in very high rate, VHR-type operations, WINForum should participate in the effort to develop rules for the VHR-only sub-bands, but should not control the process.

⁵² See, e.g., Joint Commenters' Comments at 8.

⁵³ Cost-recovery for faxing, copying and other mechanical processes involved in standards, rules, or etiquette development, as contrasted with advocacy, should of course be passed along appropriately to participants in the process.

In addition, while WINForum and Apple each will play an important role in developing sharing standards, the comments indicate that the Commission need not designate a particular industry group and grant that group sole authority to define the technical operating environment for the NII/SUPERNet band. Rather the Commission can follow the model it used in the unlicensed portion of the millimeter wave band; that is, to allow a reasonable time for one or more entities to make recommendations on possible rules and practices. At the close of this fixed period, each entity with a proposal can present that proposal to the Commission, and the Commission can then seek public comment on each such proposal.

IV. SHARING RULES BETWEEN NII/SUPERNET DEVICES AND OTHER SERVICES IN THE 5 GHz BAND SHOULD BE DESIGNED TO PROVIDE SUITABLE PROTECTION TO EXISTING SERVICES BUT SHOULD NOT UNDULY IMPEDE THE DEVELOPMENT OR DEPLOYMENT OF NII/SUPERNET NETWORKS.

A. NII/SUPERNet Devices Can Share Spectrum With Other Services In The 5 GHz Band.

The record in this proceeding provides a sufficient basis upon which the Commission can conclude that sharing with existing and planned 5 GHz services is feasible and, therefore, can proceed to implement the NII/SUPERNet band.

With respect to MSS feeder link operations, Apple concurs that the NII/SUPERNet band should be developed in a manner that provides suitable protection from objectionable interference to this important new satellite service. Apple has achieved this goal by proposing to locate only low-power, short range, exclusively indoor VHR devices in the spectrum shared with the MSS service. The low power of these devices, often spread in an omnidirectional pattern, coupled with the attenuation from building walls will provide effective shielding to the MSS service.⁵⁴ As a result, no further limitations or restrictions on NII/SUPERNet devices are warranted.⁵⁵

⁵⁴ The fact that MSS feeder links are required to share spectrum with HIPERLAN devices in Europe means that these two services will have to develop means of operating without causing objectionable interference to each other. This sharing necessity provides further evidence that, whether or not MSS system designs have changed since

With respect to sharing between NII/SUPERNet devices and intelligent transportation systems (“ITS”) and NII/SUPERNet devices, it would be premature to delay or inhibit the implementation of NII/SUPERNet systems in order to accommodate potential ITS applications.⁵⁶ No party has yet petitioned the FCC for an allocation for ITS; indeed, the Intelligent Transportation Society of America (“ITS America”) states that the 5850-5925 MHz band only “appears” to be a “prime candidate” and that other candidate bands remain under consideration.⁵⁷ Accordingly, sharing issues between NII/SUPERNet devices and ITS devices should be deferred until such time as the Commission proposes an ITS allocation in the 5850-5875 MHz band.

That said, Apple believes that sharing between NII/SUPERNet devices and ITS devices is entirely feasible, particularly if Apple’s proposed band plan is adopted.⁵⁸ Apple’s proposed band plan would shield ITS operations from the types of NII/SUPERNet devices that ITS proponents find objectionable, providing them with an environment characterized by indoor use and very low power, short range operations. Indeed, both FHWA and ITS America agree that sharing between ITS devices and NII SUPERNet devices is feasible as long as the NII/SUPERNet devices are not mobile, operate at relatively low power levels, and are not co-located with ITS devices.⁵⁹

the HIPERLAN sharing studies originally were completed, sharing solutions for VHR-type networks and MSS feeder link systems will be developed and implemented.

⁵⁵ Contrary to L/Q Licensee’s claim, L/Q Licensee Comments at 10-11, there is no Commission policy against spectrum sharing between a licensed service and unlicensed devices. In the unlicensed PCS context, the Commission decided that a particular licensed service (fixed microwave) could not share spectrum with a particular unlicensed service (nomadic Data-PCS devices). This decision, however, does not stand for the larger proposition claimed by L/Q Licensee, any more than the decision that licensed PCS systems could not share spectrum with fixed microwave operations stands for the proposition that two licensed services can never share spectrum. Indeed, in the Commission in other contexts — such as the 900 MHz band — has authorized sharing between licensed and unlicensed services.

⁵⁶ NPRM at ¶ 35.

⁵⁷ ITS America Comments at n.3.

⁵⁸ Apple concurs with FHWA that the shared NII/SUPERNet band is not appropriate for safety-critical operations or operations requiring guaranteed channel access and, therefore, ITS operations cannot be satisfied by NII/SUPERNet devices. See FHWA Comments at 1, 3.

⁵⁹ FHWA Comments at 2; ITS America Comments at 2. While FHWA and ITS America argue that the FCC should adopt a peak EIRP of -10 dBW (0.1 watt) for NII/SUPERNet devices, the technical study upon which this conclusion is based does not take into consideration the attenuation effect of building walls. See FHWA Comments,

B. The Commission Should Not Delay Or Restrict The Development Of NII/SUPERNet Devices By Adopting Overly Restrictive Standards To Protect Other 5 GHz Users From Interference.

Several existing and potential future users of the 5 GHz band contend that the Commission should delay any further action in this proceeding until specific sharing rules have been developed that, essentially, guarantee that incumbent users will not suffer objectionable interference from NII/SUPERNet devices.⁶⁰ These parties, however, seek to impose an unreasonable and unprecedented burden on NII/SUPERNet deployment, and their requests should be rejected.

Requiring full development of an inter-service sharing etiquette or “proof” of non-interference prior to proceeding further or permitting deployment of NII/SUPERNet would be inappropriate, impractical, inconsistent with FCC decisions in authorizing other new services, and overly conservative in light of NII/SUPERNet devices’ very low power, extensive indoor operation, and exclusive indoor operation within the VHR sub-bands.

In the MSS context, for example, a great deal of regulatory progress was made before important sharing issues — such as sharing with GLONASS systems and radio astronomy users — were resolved, and in some cases those issues were not been completely dealt with prior to adoption of a Report and Order authorizing the MSS service. In light of its long history of seeking to accommodate new uses that promote spectrum efficiency and the public interest, the Commission should not permit those who have already obtained access to spectrum to “shut the door” behind them by creating overly restrictive roadblocks in new users’ way.

Attachment at § 5.0. For this reason, the somewhat higher base power level proposed by Apple and others could be adopted for NII/SUPERNet devices without adversely affecting potential sharing with ITS devices if, as proposed by Apple, ITS devices share spectrum solely with indoor VHR systems. In addition, if only VHR devices share spectrum with possible ITS devices, the Commission need not reach ITS America’s request that outdoor links be licensed, ITS America Comments at 2, or the FHWA’s request that outdoor links be limited to “designated eligibles,” FHWA Comments at 2-3.
⁶⁰ See Comsat/ICO Comments at 1-2, 5; Cylink Comments *passim*.

V. THE DEVELOPMENT OF A RELIABLE, SECURE, AND FLEXIBLE NII/SUPERNET BAND WILL PROMOTE THE DEVELOPMENT AND USE OF NII/SUPERNET TECHNOLOGIES AND IS FULLY CONSISTENT WITH BOTH THE COMMUNICATIONS ACT AND COMMISSION PRECEDENT.

Those who oppose Apple's proposal to regulate NII/SUPERNet devices under a "Part 16" model place form over substance, ignoring the Commission's substantial discretion to craft rules that will promote efficient spectrum use and the development of new technologies and claiming that the Communications Act cannot accommodate measures designed to create a stable, known environment within which unlicensed devices can operate.

The Part 16 model merely would recognize NII/SUPERNet devices' use of the spectrum in Part 2 of the Commission's rules, establish clear rules under which they will share spectrum with other services, and express an intention not to introduce other new services into NII/SUPERNet spectrum without due regard to the effect such a change would have on existing and future NII/SUPERNet usage. In so doing, the Part 16 approach would provide the certainty required for manufacturers and users to design and deploy networks and recognize the unique benefits this new service will provide.⁶¹ Moreover, it would provide additional certainty to other existing users of the 5 GHz band by setting forth, at the outset, clear rules under which NII/SUPERNet devices will operate.

The Part 16 model is fully consistent with the Communications Act and Commission policy. A number of parties pointed in their comments to specific statutory bases, each of which provides sufficient authority for the Part 16

⁶¹ See, e.g., Connectivity for Learning Coalition Comments at 6 (Commission should "promote and protect" the operation of Part 15 devices that provide the range and power levels required by the education and library communities); Nortel Comments at 8 (a "Part 16" approach will provide some assurance that NII/SUPERNet users will not be displaced, encouraging manufacturers to invest the resources necessary to undertake the research, development, and manufacture of equipment for this service); ITI Comments at 6 (given the nature of NII/SUPERNet applications, the Commission should consider affording these devices heightened protection from interference not currently available under Part 15); CEMA Comments at 6-8 (the uncertainty inherent in traditional Part 15 operation could restrain investment of otherwise available dollars in the development of NII/SUPERNet devices; to address this risk, the Commission should upgrade the status of NII/SUPERNet devices).

approach.⁶² Moreover, creating a viable, reliable NII/SUPERNet band will promote the Commission's responsibilities under the Communications Act, including its mandate under Section 303(g) to study new uses for radio and encourage the larger and more effective use of radio in the public interest and under Section 254(b) of the Telecommunications Act of 1996 to make quality services available at just, reasonable, and affordable rates, to assure that advanced telecommunications and information services are available in all regions of the nation, to provide access to low-income consumers and those in rural, insular, and high-cost areas of a type and at rates comparable to those available in urban areas, and to guarantee schools, health care providers, and libraries access to advanced telecommunications services.⁶³

For these reasons, the adoption of appropriate "Part 16" protections, akin to those adopted for the Data-PCS and unlicensed millimeter wave bands, is both sound policy and fully within the Commission's authority.

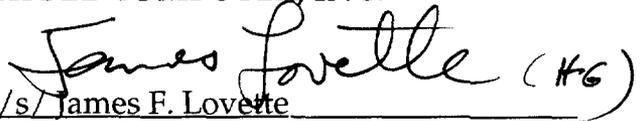
⁶² E.g., CEMA Comments at 8-9 (Commission can employ for NII/SUPERNet devices the model used in creating the "Family Radio Service"); Nortel Comments at 14-15 (NII/SUPERNet devices fall outside of Section 301's licensing requirement due to their low power and non-interfering operations; in addition, the Commission's "necessary and proper" authority and authority to define the "citizens band radio service" not subject to individual licenses provide authority to exempt NII/SUPERNet devices from licensing if licensing otherwise would be required).

⁶³ See Joint Commenters' Comments at 2-3.

CONCLUSION

For the reasons stated in these reply comments, in Apple's original comments in response to the NPRM, and in Apple's other pleadings in this proceeding, Apple urges the Commission promptly to finalize rules permitting the deployment of unlicensed NII/SUPERNet technologies — including unlicensed community networking devices — in the 5150-5350 MHz and 5725-5875 MHz bands.

APPLE COMPUTER, INC.


/s/ James F. Lovette

James F. Lovette
Principal Scientist, Network Outreach
Apple Research Laboratories
APPLE COMPUTER, INC.
Three Infinite Loop, MS: 301-4J
Cupertino, California 95014
(408) 974-1418
jlovette@apple.com

James M. Burger
Senior Director, Government Affairs
APPLE COMPUTER, INC.
1667 K Street, N.W., Suite 410
Washington, D.C. 20006
(202) 466-7080

niiband-feedback@research.apple.com

OF COUNSEL

Henry Goldberg
Mary J. Dent
GOLDBERG, GODLES, WIENER & WRIGHT
1229 Nineteenth Street, N.W.
Washington, D.C. 20036
(202) 429-4900

August 14, 1996

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Reply Comments of Apple Computer, Inc., was sent by first-class mail, postage prepaid, this 14th day of August, 1996, to each of the following:

Lucille M. Mates
Betsy Stover Granger
140 New Montgomery Street, Room 1526
San Francisco, California 94105
Counsel for Pacific Telesis Group

Margaret E. Garber
1275 Pennsylvania Avenue, N.W.
Washington, D.C. 20004
Counsel for Pacific Telesis Group

James G. Pachulski
1320 N. Court House Road, Eight Floor
Arlington, Virginia 22201
Counsel for The Bell Atlantic Telephone Companies

J. Ron Cross, Chairman
Wireless Information Networks Forum
1200 19th Street, N.W., Suite 300
Washington, D.C. 20036-2401

Christopher D. Imlay
Booth Freret & Imlay, P.C.
1233 20th Street, N.W., Suite 204
Washington, D.C. 20036
Counsel for The American Radio
Relay League, Incorporated

Ray Starsman
Director of Systems Integration
ITS of America
400 Virginia Avenue, S.W., Suite 800
Washington, D.C. 20024-2730

Joseph S. Paykel
Media Access Project
2000 M Street, N.W.
Washington, D.C. 20036
Counsel for Joint Commenters

Cheryl A. Tritt
Charles H. Kennedy
Morrison & Foerster, LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888
Counsel for ICO Global Communications

Nancy J. Thompson
COMSAT International Communications
6560 Rock Spring Drive
Bethesda, Maryland 20817
Counsel for COMSAT Corporation

Stephen L. Goodman
Halprin, Temple, Goodman & Sugrue
East Tower, Suite 650
1100 New York Avenue, N.W.
Washington, D.C. 20005
Counsel for AirTouch Communications

Leonard Robert Raish
Fletcher, Heald & Hildreth, P.L.C.
1300 N. 17th Street, 11th Floor
Rosslyn, Virginia 22209
Counsel for Harris Corporation-Farion Division
Counsel for Northern Telecom Inc.

John Primeau
President
NACEPF
1223 Mineral Spring Avenue
North Providence, Rhode Island 02904

William F. Adler
Vice President & Division Counsel
Globalstar
3200 Zanker Road
San Jose, California 95134

Leslie A. Taylor
Guy T. Christiansen
Leslie Taylor Associates
6800 Carlynn Court
Bethesda, Maryland 20817
Counsel for L/Q Licensee, Inc.

William D. Wallace
Crowell & Moring
1001 Pennsylvania Avenue, N.W.
Washington, D.C. 20004
Counsel for L/Q Licensee, Inc.

Cathleen A. Massey
Vice President, External Affairs
Douglas I. Brandon
Vice President, Exterbak Affairs & Law
AT&T Wireless Services, Inc.
1150 Connecticut Avenue, N.W.
Washington, D.C. 20036

Howard J. Symons
Sara F. Seidman
Mintz, Levin, Cohn, Ferris, Glovsky
& Popeo, P.C.
701 Pennsylvania Avenue, N.W., Suite 900
Washington, D.C. 20004
Counsel for AT&T Corp

Jeff Abramowitz
President
WLANA, Inc.
409 Sherman Avenue
Palo Alto, California 94123

Andrew Blau
Director, Communications Policy
Benton Foundation
1634 Eye Street, N.W., 12th Floor
Washington, D.C. 20006

Audrie Krause
Executive Director
Computer Professionals for Social Responsibility
P.O. Box 717
Palo Alto, California 94302-0717

Andy Oram
Moderator
CPSR Cyber Rights Working Group
c/o Robert Cannon
2358 N. Vernon Street
Arlington, Virginia 22207

Richard B. Bleicher
Senior Attorney
Lucent Technologies Inc.
219 Mt. Airy Road
Basking Ridge, New Jersey 07920

David B. Jeppsen
Director and Attorney
Federal Public Affairs
Lucent Technologies Inc.
1120 20th Street, N.W., 10th Floor
Washington, D.C. 20036

Fiona J. Branton
Director, Government Relations
and Regulatory Counsel
Information Technology Industry Council
1250 Eye Street, N.W., Suite 200
Washington, D.C. 20005

Colleen L. Boothby
Thomas M. Lynch
Levine, Blaszak, Block & Boothby
1300 Connecticut Avenue, N.W., Suite 500
Washington, D.C. 20036-1703
Counsel for Information Technology
Industry Council

Henry M. Rivera
Larry S. Solomon
Gregg A. Rothschild
Ginsburg, Feldman and Bress, Chtd.
1250 Connecticut Avenue, N.W.
Washington, D.C. 20036

Robert B. Kelly
Katherine S. Poole
Kelly & Povich, P.C.
1101 30th Street, N.W., Suite 300
Washington, D.C. 20007
Counsel for ITS America

Frank R. Jazzo
Kathryn A. Kleiman
Fletcher, Heald & Hildreth, P.L.C.
1300 North 17th Street, 11th Floor
Rosslyn, Virginia 22209
Counsel for 3Com Corporation

Dave Hughes
Principal Investigator
NSF Wireless Field Test Project
2502 West Colorado Avenue, Suite 203
Colorado Springs, Colorado 80904

George A. Hanover
Joe Peck
Consumer Electronics Manufacturers
Association
2500 Wilson Boulevard
Arlington, Virginia 22201

Joseph P. Markoski
Marc Berejka
Squire, Sanders & Dempsey
1201 Pennsylvania Avenue, N.W.
P.O. Box 407
Washington, D.C. 20044
Counsel for Consumer Electronics
Manufacturers Association

Michael Mulcay
President
Mulcay Consulting Associates
10081 United Place
Cupertino, California 95014

Burton G. Tregub
Vice President, Strategic Programs
Cylink Corporation
910 Hermosa Court
Sunnyvale, California 94086

Linda C. Sadler
Manager, Regulatory Affairs
Rockwell International
1745 Jefferson Davis Highway, Suite 1200
Arlington, Virginia 22202

Christine M. Johnson
Director, ITS Joint Program Office
U.S. Department of Transportation
Federal Highway Administration
400 Stewart Street, S.W.
Washington, D.C. 20590

Stuart E. Overby
Assistant Director, Spectrum Planning
Motorola Inc.
1350 I Street, N.W., Suite 400
Washington, D.C. 20005

Leonard S. Kolsky
Vice President and Director
Global Telecommunications Relations
Motorola, Inc.
1350 I Street, N.W., Suite 400
Washington, D.C. 20005

Jack Krumholtz
Law and Corporate Affairs Department
Microsoft Corporation
5335 Wisconsin Avenue, N.W., Suite 600
Washington, D.C. 20015

Stanley M. Gorinson
Amy L. Carlson
Preston Gates Ellis & Rouvelas Meeds
1735 New York Avenue, N.W.
Washington, D.C. 20006
Counsel for Microsoft Corporation

Chandos A. Rypinski
President
LACE, Inc.
655 Redwood Highway, #340
Mill Valley, California 94941

Larus Corporation
1560 Berger Drive
San Jose, California 95112

John G. Lamb, Jr.
Northern Telecom, Inc.
2100 Lakeside Boulevard
Richardson, Texas 75081-1599

Mike Cheponis
President
California Wireless, Inc.
4880 Stevens Creek Boulevard, #104A
San Jose, California 95129

Robert J. Miller
Gardere & Wynne, L.L.P.
1601 Elm Street, Suite 3000
Dallas, Texas 75201

Cynthia Johnson
Government Affairs Manager
Hewlett-Packard Company
900 17th Street, N.W., Suite 1100
Washington, D.C. 20006

Jon M. Peha
Assistant Professor
Electrical and Computer Engineering Department
Carnegie Mellon University
Pittsburgh, Pennsylvania 15213-3890

Harlan S. Abrahams
Smart & Thevenet, P.C.
1700 Broadway, Suite 1800
Denver, Colorado 80290
Counsel for SuperNet, Inc.

Thomas Loran
Executive Director
High Plains Rural Health Network
218 East Kiowa
Fort Morgan, Colorado 80701

William B. Wilhelm, Jr.
Swidler & Berlin, Chartered
3000 K Street, N.W., Suite 300
Washington, D.C. 20007-5116
Counsel for Business Software Alliance

Terry Lee
President
611 West Sixth Street, Suite 3201
Los Angeles, California 90017

David G. Stoddard, CEO
US Net Incorporated
3316 Kilkenny Street
Silver Spring, Maryland 20904

Arthur Zysk
President
New Jersey Internet
2713 Route 23 South
Newfoundland, New Jersey 07435

Russell Nelson
521 Pleasant Valley Road
Potsdam, New York 13676

Mark Allyn
1161 21st Avenue E.
Seattle, Washington 98112

Carey Richard Murphey, PhD
Department of Physiology & Biophysics
University of Texas Medical Branch
Galveston, Texas 77555-0641

Greg Anderson
Belen Consolidated Schools
520 N. Main Street
Belen, New Mexico 87002

Ron Grandmaison
G-SCT-2 (US Coast Guard)
Washington, D.C. 20593

Michael Shadlen, MD, PhD
Department of Physiology & Biophysics
University of Washington
Box 357290
Seattle, Washington 98195-7290

Steven Orzack
The Fresh Pond Research Institute
64 Fairfield Street
Cambridge, Massachusetts 02140

Chad Schmidt
215 State Street, Suite 815
Muskogee, Oklahoma 74401

- * Eric Klinker
<klinker@serapis.nrl.navy.mil>
- * Dru Nelson
<dnelson@four11.com>
- * Tony Loro
<classvtony@oro.mail>
- * Anthony Yen
<Anthony.Yen@tkg.com>

- * Hal hal
<hal@global2000.net>
- * David Dyk
<stevend@wolfe.net>
- * Jason Philbrook
<root@dns.midcoast.com>
- * Russell Nelson
<nelson@crynwr.com>
- * Joe Greco
<jgreco@solaria.sol.net>
- * James Evans
<jrevans@amfrontier.net>
- * Mike Renfro
<mwr@midtenn.net>

Dawn Hottinger

/s/ Dawn Hottinger
Dawn Hottinger

* Via Electronic Mail