Appendix A: Proposed Rules

Part 15 of title 47 of the Code of Federal Regulations is proposed to be amended as follows:

PART 15 -- RADIO FREQUENCY DEVICES

1. The authority citation for Part 15 continues to read as follows:

AUTHORITY: Secs. 4, 302, 303, 304, 307 and 624A of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 302, 303, 304, 307 and 544A.

2. Section 15.17(a) of Part 15 is revised to read as follows:

(a) Parties responsible for equipment compliance are advised to consider the proximity and the high power of non-Government licensed radio stations, such as broadcast, amateur, land mobile, and non-geostationary mobile satellite feeder link earth stations, and of U.S. Government radio stations when choosing operating frequencies during the design of their equipment so as to reduce the susceptibility for receiving harmful interference. Information on non-Government use of the spectrum can be obtained by consulting the Table of Frequency Allocations in § 2.106 of this chapter.

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3. Section 15.205(a) of Part 15 is amended by removing the 5.15-5.35 GHz portion from the restricted bands table to read as follows:

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

* * * * *

4. Part 15 is amended by adding a new Subpart E to read as follows:

Subpart E - Unlicensed NII/SUPERNet Devices

§ 15.401 Scope.

This subpart sets out the regulations for unlicensed National Information Infrastructure SUPERNet (NII/SUPERNet) devices operating in the 5.15 - 5.35 GHz and 5.725 - 5.875 GHz bands.

§ 15.403 Definitions.

(a) *Emission bandwidth.* For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an

instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(b) *NII/SUPERNet devices [Unlicensed].* Intentional radiators operating in the frequency bands 5.15 - 5.35 GHz and 5.725 - 5.875 GHz that provide a wide array of wideband, high data rate mobile and fixed communications services to individuals, businesses, and institutions.

(c) *Peak transmit power.* The peak power output as measured over an interval of time equal to the frame rate or transmission burst of the device under all conditions of modulation. Usually this parameter is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used.

(d) *Spectrum window.* An amount of spectrum equal to the intended emission bandwidth in which operation is desired.

(e) *Thermal noise power.* The noise power in watts defined by the formula N=kTB where N is the noise power in watts, k is Boltzmann's constant, T is the absolute temperature in degrees Kelvin (e.g., 295° K) and B is the emission bandwidth of the device in hertz.

§ 15.405 Cross reference.

(a) The provisions of subparts A, B, and C of this part apply to unlicensed NII/SUPERNet devices, except where specific provisions are contained in subpart E.

(b) The requirements of subpart E apply only to the radio transmitter contained in the NII/SUPERNet device. Other aspects of the operation of a NII/SUPERNet device may be subject to requirements contained elsewhere in this chapter. In particular, a NII/SUPERNet device that includes digital circuitry not directly associated with the radio transmitter also is subject to the requirements for unintentional radiators in subpart B.

§ 15.407 General technical requirements.

(a) Under all conditions of modulation, the maximum peak EIRP from an intentional radiator operating under this section shall not exceed -10 dBW. Additionally, power spectral density shall not exceed 0.03 milliwatts in any 3 kHz bandwidth, as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.

(b) Emissions radiated outside of the frequency band of operation shall be attenuated by at least 50 dB below the level of the fundamental emission or to the general radiated emission limits in Section 15.209 of this part, whichever is the lesser attenuation. Equipment manufacturers should note that the provisions of Section 15.205 apply to intentional radiators operating under this section.

(c) The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control or signalling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

(d) The device must comply with IEEE C96.1-1991 (ANSI/IEEE C95.1-1992), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz." Measurement methods are specified in ... (from Section 15.319(i)).

(e) The frequency stability of the carrier frequency of an intentional radiator operating under this section shall be ± 10 ppm over 10 milliseconds or the interval between access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -20 degrees to +50 degrees Celsius at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 degrees Celsius. For equipment that is capable of operating only from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

§ 15.409 Harmful interference.

(a) NII/SUPERNet devices will not be deemed to cause interference to licensed services provided the devices operate in accordance with the output power, out-of-band emissions limits and spectrum etiquette requirements of this subpart and provided the devices are located indoors or employ an outdoor antenna that is mounted no more than 15 meters above the ground.

(b) NII/SUPERNet devices with outdoor antennas higher than 15 meters would be required to cease operation or make some accommodation to eliminate any harmful interference caused to a licensed operation.

(c) NII/SUPERNet devices must accept any interference caused by licensed services.

§ 15.411 Spectrum etiquette.

(a) The intentional radiator must incorporate a mechanism for monitoring the spectrum that its transmission is intended to occupy. The following criteria must be met:

(1) Immediately prior to initiating a transmission, devices must monitor the spectrum window they intend to use for at least 50 microseconds.

(2) The monitoring threshold must not be more than 32 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth of the device.

(3) If no signal above the threshold level is detected, a transmission burst may commence in the monitored spectrum window. Once a transmission burst has started, an individual device or a group of cooperating devices is not required to monitor the spectrum window provided the intraburst gap timing requirement specified below is not exceeded.

(4) After completion of a transmission, an individual device or cooperating group of devices must cease transmission and wait a deference time randomly chosen from a uniform random distribution ranging from 50 to 750 microseconds, after which time an attempt to access the band again may be initiated. For each occasion that an access attempt fails after the initial inter-burst interval, the range of the deference time chosen shall double until an upper limit of 12 milliseconds is reached. The deference time remains at the upper limit of 12 milliseconds until an access attempt is successful. The deference time is re-initialized after each successful access attempt.

(5) The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and shall have a maximum reaction time less than 50xSQRT(12.5/emission bandwidth in MHz) microseconds for signals at the applicable

threshold level but shall not be required to be less than 50 microseconds. If a signal is detected that is 6 dB or more above the threshold level, the maximum reaction time shall be 35xSQRT(12.5/emission bandwidth in MHz) microseconds but shall not be required to be less than 35 microseconds.

(6) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

(7) Devices that have a power output lower than the maximum permitted under the rules may increase their detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

(b) The transmission burst duration from one device or group of devices acting cooperatively shall be no greater than 10 milliseconds. Any intraburst gap between cooperating devices shall not exceed 25 microseconds.

(c) All systems of less than 25 MHz emission bandwidth shall start searching for an available spectrum window within 30 MHz of the band edge at 5150, 5350, 5725, or 5875 MHz while systems of more than 25 MHz emission bandwidth will first occupy the center half of the band. Devices with an emission bandwidth of less than 10 MHz may not occupy the center half of the band if other spectrum is available.

APPENDIX B: INITIAL REGULATORY FLEXIBILITY ANALYSIS

Pursuant to Regulatory Flexibility Act of 1980, the Commission finds as follows:

A. Reason For Action: We find that there is a need for additional unlicensed spectrum for intentional radiators. This rule making proceeding is initiated to obtain comment regarding proposals to make spectrum in the 5 GHz band available for such purposes and to amend the Part 15 rules to add the technical requirements necessary to permit sharing between new unlicensed devices and incumbent operations.

B. Objective: The objective of this proposal is to provide adequate unlicensed spectrum for wideband applications, and to provide for the technical rules necessary for spectrum sharing and efficiency.

C. Legal Basis: The proposed action is authorized by Sections 4(i), 303(c), 303(f), 303(g) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 303(c), 303(f), 303(g) and 303(r). These provisions authorize the Commission to make such rules and regulations as may be necessary to encourage more effective use of radio as is in the public interest.

D. Description, Potential Impact, and Number of Small Entities Affected: This proposal may provide new opportunities for radio manufacturers and suppliers of radio equipment, some of which may be small businesses, to develop and sell new equipment. We are unable to quantify other potential effects on small entities. We invite specific comments on this point by interested parties.

E. Reporting, Record Keeping, and Other Compliance Requirements: None.

F. Federal Rules That Overlap, Duplicate, or Conflict With This Rule: None.

G. Significant Alternatives: If promulgated, this proposal will provide additional unlicensed spectrum. We are unaware of other alternatives which could provide sufficient spectrum in the immediate future. We solicit comment on this point.

APPENDIX C: CONCLUSIONS OF ANALYSIS OF SHARING BETWEEN NGSO MSS UPLINK AND HIPERLANS

International Telecommunications Union Radiocommunication Study Groups, Document 4A/66-E, page 158, 10 February 1995.

Part 2 - Analysis of Sharing Between NGSO MSS Uplink and HIPERLANs

1. Introduction

The feasibility of spectrum sharing between NGSO MSS feeder systems and HIPERLAN systems which may operate in the mobile service in the 5 GHz range has been investigated by TG 4/5. A further study has been made using typical parameters for the HIPERLANs provided by TG 8/3 to TG 4/5 and two characteristic NGSO mobile satellite systems: the LEO-D system which operates at relatively low altitudes and uses wideband modulation (CDMA) and the LEO-F system which uses high altitude satellites and more conventional narrow-band modulation.

2. Conclusions

The following conclusions have been reached based on calculations, data and assumptions annexed to this document:

i) MSS satellites of either system would not be affected by the deployment of HIPERLANs, even in very large numbers - e.g. 50 million nodes over the area seen by a satellite would not affect the reception of MSS feeder signals at MSS satellites.

ii) HIPERLANs could be affected by the ground stations of either MSS system notably in the immediate vicinity of the ground station sites. Typically the required separation distances will be of the order of 3 to 10 km for indoor usage and 16 to 50 km for outdoor usage. Roughly 99% or more of all HIPERLAN usage is projected to be indoors. For outdoor HIPERLAN usage, consideration of terrain profiles and/or local shielding will reduce these distances considerably, this depends on local factors. Since HIPERLAN systems are likely to be unlicensed, HIPERLAN users may be advised of any appropriate siting considerations in order to minimize the risk of interference.

Therefore, considering:

a) that HIPERLANs may be widely deployed but are likely to be concentrated in larger centres of population;

b) that MSS ground stations will be deployed in limited numbers;

c) that MSS ground stations will be sited away from industrialized and urban areas;

d) that only 1% of HIPERLAN usage is expected to be outdoors.

It is concluded that sharing is feasible between HIPERLANs and NGSO MSS feeder-link Earth stations, provided the distances of the order mentioned above are maintained between the HIPERLAN systems and the NGSO MSS feeder-link Earth stations.

SEPARATE STATEMENT
OF
COMMISSIONER SUSAN NESS

Re: *Amendment of the Commission's Rules to Provide for Unlicensed NII/SUPERNet Operations in the 5 GHz Frequency Range*

The rulemaking we are initiating forcefully demonstrates how wise spectrum management can deliver valuable new services to American homes, schools, businesses, and other institutions.

The radio spectrum is a precious national resource. Responsible stewardship of the spectrum is a primary mission of this Commission. As part of that stewardship, I believe setting aside some portion of the spectrum for shared, unlicensed use is of demonstrable benefit. Today's Notice heralds a new generation of unlicensed devices, with great potential for innovation, economic growth, and international trade.

Unlicensed devices include a growing array of products that improve the quality of life. Cordless telephones, garage door openers, security and alarm systems, electronic toys, and baby monitors are some of the most notable examples of unlicensed devices found in the home or in the car.

Unlicensed devices are also increasingly essential to businesses. Remote meter reading, medical patient monitoring, inventory control systems, and antipilferage systems are already widely deployed. Literally billions of dollars have already been invested in the development of unlicensed devices, and the benefits have been considerable.

But the future holds still greater promise.

Based on the WINForum and Apple Computer proposals which led us to initiate this rulemaking, I believe unlicensed devices using radio spectrum above 5 GHz can play a vital role in meeting established and incipient needs for communications offering mobility, flexibility, versatility, and economy.

Especially enticing are the prospects for wireless local area networks to connect classroom computers to each other -- and to the world beyond. Low-power radio technology can serve as a low-cost, high-bandwidth, on-ramp to the Information Superhighway for the leaders and workers of tomorrow. Such an application would be directly responsive to the wishes of Congress, as reflected in Sections 254(b)(6), 254(c)(3), 254(h)(2) of the Communications Act of 1934, as amended, and Section 706 of the Telecommunications Act of 1996. Health care providers and their patients may also be among the main beneficiaries of this kind of technology.

What is more, unlicensed devices are consistent with the objectives of reinventing government. The costs, fees, and delays of licensing can be avoided; equipment authorization can be streamlined, reducing time to market. Minimal technical standards to prevent harmful interference can leave maximum opportunities for innovation. A modest enabling gesture by government can give dozens or even hundreds of entrepreneurs incentives to translate good ideas into useful products.

I am especially enthusiastic about the proposal tendered by WINForum for short-haul transmissions. The plan is sufficiently concrete that we can easily foresee how the promised benefits can be realized. The HIPERLAN experience proves the feasibility of spectrum sharing with mobile satellite services. International commonality maximizes the market base over which product development costs can be spread. Enabling simultaneous operation of multiple units at 24 Mbps will support computing, video, and multimedia applications, thereby meeting the needs of Information Age users.

I am also intrigued by the Apple long-haul proposal, which contemplates low-cost broadband links from homes to schools and libraries. It may also solve some of the special problems of providing broadband service in rural areas. The use of higher power levels, however, requires that we proceed more cautiously. How do we prevent interference to the wireless LANs and other low-power unlicensed devices that will be sharing the same frequencies? Also, at what point do the characteristics of a service make it more appropriate for provision on a licensed basis? These and other questions remain to be answered.

Because of the need for compatibility, I believe manufacturers of unlicensed products using shared frequency bands have strong marketplace incentives to develop a workable spectrum etiquette. As in the case of unlicensed PCS at 2 GHz, a spectrum etiquette may minimize the potential for interference while providing maximum flexibility for technological innovation and spectrum efficiency. I hope commenting parties will assist us in thinking through this issue.

Overall, I believe we are on a course that will bring substantial benefits, with no intrusive governmental intervention. This is responsible spectrum management -- and good public policy.