BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	WT Docket No. 00-32
The 4.9 GHz Band Transferred from	)	
Federal Government Use	)	
	)	

Comments of Atheros Communications, Inc.

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SUMMARY

Atheros strongly supports the Commission's goals of ensuring that public safety agencies possess the communications resources necessary to successfully carry out their mission and to establish a regulatory environment in which the public safety community can utilize emerging wireless broadband technologies. These comments are directed to the need for public safety agencies to rapidly achieve the benefits of WLAN and other wireless digital broadband technologies by harnessing the synergies between public safety broadband wireless needs and the existing technologies and devices that populate neighboring spectrum. Adopting a creative and flexible regulatory scheme will capture existing synergies and rapidly convert into reality the promise of this band for public safety.

It is essential that government and government-authorized public safety users have priority use of this band, but public safety entities would benefit and spectrum efficiency would be increased if eligibility to use the 4.9 GHz band were extended on a conditional basis to commercial services and unlicensed devices. The condition is that such use would be permitted only under conditions that ensure the ability of public safety users to automatically and seamlessly preempt any commercial and unlicensed signals without causing delay.

The mechanism for delivering this preemptive capability already exists. In environments with eligible public safety and other types of users, the Enhanced Distributed Coordination Function ("EDCF") proposed for the IEEE 802.11 standard can be utilized to permit prioritized, preemptive use of the radio channel by public safety entities. Equipment with the capability of accomplishing such preemption seamlessly and automatically already exists for use in the 5 GHz U-NII bands and is being recommended for 5.9 GHz DSRC band. Implementation of this technology in 4.9 GHz radios will allow priority for public safety users, and even priorities among various types of public safety users. Commercial and unlicensed users utilizing the band could not impede emergency operations.

The EDCF technique has been shown to support pre-emptive priority access by multiple classes of voice, video, and data traffic. When the spectrum is required and fully utilized by higher priority traffic, lower priority traffic is successfully suppressed from transmitting. When lower priority traffic is transmitting, higher priority traffic may seamlessly interrupt it and start transmitting within 1/100th of a second of a request to do so. This method enables efficient spectrum use by permitting lower priority commercial and unlicensed traffic to yield to higher priority public safety traffic on the same frequency.

Conditionally permitting commercial and unlicensed use will have two important benefits. First, it will drive up production volumes, thereby significantly decreasing the prices for equipment and other products that support 4.9 GHz operation. This will directly benefit public safety users, most of whom must operate subject to serious budgetary constraints that

impede rapid implementation of life-saving wireless technologies. Second, it will serve the public interest by expanding the band's public safety capabilities to permit the fast and reliable dissemination of safety and emergency communications directly to citizens, whose devices could receive public safety messages intended for them even when they could not transmit a response so as to not interfere with the public safety operations. Public safety users also could access infrastructure, such as access points, on neighboring bands and thereby dynamically increase the capacity and reach of their communications.

Atheros recommends that the Commission adopt a channel plan that permits operations based upon 20 MHz channels, which can be subdivided dynamically into 5 or 10 MHz channels as required. Such a plan would address the need of some applications for wider channels for video and other high bandwidth operations, and the need of other applications for narrower channels to preserve battery life and support denser deployments. Under this plan, equipment would be authorized for a maximum channel bandwidth. In addition, type-certified equipment would be required to use the EDCF and the Carrier Sense mechanism to scan for and seek unused spectrum.

This approach will permit flexibility for users and spectral efficiency for different applications that may operate in this band while absolutely protecting public safety operations. Public safety operations would always maintain prioritized, preemptive access to any channel needed. Atheros therefore recommends the adoption by reference of equipment meeting the technical standards of the IEEE 802.11 working group to service public safety and other operations in the 4.9 GHz band. The objective is to ensure interoperability and compliance with the Carrier Sense and Enhanced Distributed Coordination Function requirements described above. Adopting this standard for 4.9 GHz equipment would attain the Commission's twin regulatory goals of priority access by public safety users and maximum spectrum efficiency.

Atheros commends the Commission for its work in ensuring that our nation's vital public safety communications needs are met through the reallocation of spectrum in the 4.9 GHz band to enable public safety entities to implement beneficial wireless digital technologies. Adoption of licensing and service rules that permit conditional commercial and unlicensed use of this band, subject to guaranteed priority access for public safety users, will promote and exploit the full potential of this spectrum for the public safety of all Americans.

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Atheros Communications respectfully submits these comments in the above-captioned proceeding to address the licensing and service rules under consideration for the 4.940-4.990 GHz band ("4.9 GHz band").[1]

As the Commission correctly emphasized in the Further Notice, designating the 4.9 GHz band for use by public safety agencies will result in improved service to the public by enabling public safety agencies to use the latest digital wireless broadband technologies. Public safety agencies could use the 4.9 GHz band, for example, to communicate with each other on the scene of an emergency response site and to coordinate scene and command center operations. Atheros directs its comments to the need for a creative and flexible regulatory scheme in order

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[1] In the Matter of the 4.9 GHz Band Transferred from Federal Government Use, *Second Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 00-32, 17 FCC Rcd. 3955 (2002) ("*Second R&O*" and "*Further Notice*").

for public safety agencies to rapidly achieve the benefits of WLAN and other wireless digital broadband technologies.

I. INTRODUCTION

In its *Report and Order*, the Commission allocated 50 megahertz of spectrum in the 4.9 GHz band for fixed and mobile services, except aeronautical mobile service, for use in support of public safety services to provide new broadband applications such as high speed digital peer-to-peer and wireless local area network ("WLAN") technologies for incident scene management. When making this allocation, the Commission expressed the hope that this spectrum would provide public safety responders with the additional spectrum needed to support high-speed digital WLAN capabilities.[2] In the *Further Notice*, the Commission seeks comment on licensing and service rules for the 4.9 GHz band.[3]

Atheros strongly supports the Commission's goals of ensuring that public safety agencies possess the communications resources necessary to successfully carry out their mission and to establish a regulatory environment in which the public safety community can utilize emerging wireless broadband technologies. The need for incident scene communications capability is particularly critical.

Atheros directs its comments to the need for public safety agencies to rapidly achieve the benefits of WLAN and other wireless digital broadband technologies. The benefits

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[2] *Further Notice* at para. 1.

[3] *Id.* at para. 2.

of existing wireless broadband technology are available today, and rollout can begin in a matter of months with the right kind of regulatory framework and incentives. This is possible because many of the applications desired by the public safety community already have been designed and are being introduced in the nearby 5 GHz bands. Harnessing the synergies between public safety broadband wireless needs and the existing technologies and devices that populate neighboring spectrum will accelerate achieving the goals set forth by public safety interests and the Commission. Doing so will benefit all Americans, for all may have future need for emergency response services.

A creative and flexible regulatory scheme is necessary to capture the existing synergies and rapidly convert into reality the promise of this spectrum for public safety. As explained below, unlike the case at 700 MHz, the low power use and short propagation paths of this spectrum range permit efficient spectrum use by authorizing commercial and unlicensed utilization as well as public safety. Existing products can guarantee immediate access for all public safety users whenever required by utilizing technologies already built into the IEEE 802.11 family of standards that is being deployed on the neighboring 5 GHz U-NII bands. These technologies also are being recommended for the 5.9 GHz Dedicated Short Range Communications ("DSRC") band to provide services similar to and even identical to those sought by public safety users in the 4.9 GHz band.[4]

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[4] In the Matter of Amendment of Parts 2 and 90 of the Commission's Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services, *Report and Order*, ET Docket No. 98-95, RM-9096, 14 FCC Rcd. 18221 (1999).

Adopting regulations that will allow the marshalling of these recent technological advances for the benefit of public safety communications will result in superior broadband services for public safety entities quicker and at far less cost than otherwise possible. The public will greatly benefit from the superior communications available to emergency workers at the site of an emergency; and also from the more intense spectrum usage enabled by this new technology.

II. STATEMENT OF INTEREST

Atheros Communications is a leading developer of networking technologies for secure, high-performance WLANs. As the industry innovator and market-share leader in digital modulation technology, Atheros develops chipsets that deliver broadband wireless connections at speeds of up to 108 Mbps to manufacturers of devices for the office, home, and the road. Atheros technology is being used by many of the world's leading wireless equipment manufacturers, including Agere, ALPS Electric, D-Link, Intel, Intermec, Linksys, Netgear, Philips, Proxim, Samsung, Sony, Symbol, and TDK.

III. DISCUSSION

A. Eligibility to Use the 4.9 GHz Band

1. Eligibility Standards Should Permit Conditional Commercial and Unlicensed Use of the 4.9 GHz Band

The Commission seeks comment on the eligibility criteria for operation of equipment within the 4.9 GHz band, specifically asking whether the strict standards used to define eligibility in the 700 MHz public safety band should be applied to the 4.9 GHz band.[5] If

[5] *Further Notice* at para. 31.

so applied, such standards would limit use of the spectrum to state and local emergency workers and non-governmental public safety providers authorized to provide public safety services by a governmental entity whose primary mission is to protect the safety of life, health or property, and which are not made commercially available to the public. The Commission also asks if commercial use of the band should be permissible, and if such use would be in the public interest.[6]

We believe it essential that government and government-authorized public safety users have priority use of this band, but public safety entities would benefit and spectrum efficiency would be increased if the FCC would extend eligibility to use the 4.9 GHz band on a conditional basis to commercial services and unlicensed devices. The condition should be that such use be permitted only under conditions that ensure the ability of public safety users to automatically and seamlessly preempt commercial and unlicensed signals without delay. The mechanism for delivering this capability is discussed in the Appendix to these comments. Equipment with the capability of accomplishing such preemption seamlessly and automatically already exists for use in the 5 GHz U-NII bands and is being recommended for the 5.9 GHz DSRC band. This equipment may be readily modified for use in the 4.9 GHz band.

Conditionally permitting commercial and unlicensed use will have two important benefits. First, it will drive up production volumes, thereby significantly decreasing the prices

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[6] *Id.* at para. 36.

for equipment and other products that support 4.9 GHz operation. This would directly benefit public safety users, most of whom must operate subject to serious budgetary constraints that impede rapid implementation of life-saving wireless technologies. Second, it would serve the public interest by expanding the band's public safety capabilities to permit the fast and reliable dissemination of safety and emergency communications directly to citizens, whose devices could receive public safety messages intended for them even when they could not transmit a response so as to not interfere with the public safety operations. Public safety users also could access infrastructure, such as access points, on neighboring bands and thereby dynamically increase the capacity and reach of their communications. As discussed *infra,* permitting conditional commercial and unlicensed use of the 4.9 GHz band is feasible technically without causing interference or delay to primary public safety users.

2. **Definition of Public Safety Radio Services**

The Commission seeks comment on whether to use the narrow definition of "public safety radio services" statutorily applied to the 700 MHz public safety spectrum in Section 337(f) of the Communications Act, or instead to use the broader description adopted by Congress in Section 309(j)(2) in exempting public safety radio services from the Commission's authority to auction spectrum.[7] The Commission also solicits comment on whether using the broader statutory definition would create partnership opportunities that might enable increased use of this spectrum and thereby create greater economies of scale and lower prices in the

[7] *See* 47 U.S.C. §§ 337(f), 309 (j)(2).

equipment market.[8] The Commission does express concern with possibly increased and harmful congestion on the band that might result from such increased usage.[9]

Atheros agrees with the Commission's tentative finding that the broader definition of "public safety radio services" contained in Section 309(j)(2) would be appropriate and would help to more readily achieve the benefit of equipment efficiencies of scale. To the extent the broader definition and the resulting increased usage would result in congestion on the band, such congestion would be limited given the system capacity that would be afforded by use of digital modulation radios and the local propagation characteristics of signals in this band.[10]

Analysis conducted in support of the DSRC rulemaking supports the ability of several hundred users to employ the Carrier Sense mechanism of digitally modulated radios to use the same spectrum by contending for and sharing radio channels. In environments with eligible public safety and other types of users, the Enhanced Distributed Coordination Function proposed for the IEEE 802.11 standard can be utilized to permit prioritized, preemptive use of the radio channel by public safety entities. Implementation of this technology will allow priority

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[8] *Further Notice* at para. 34.

[9] *Id.*

[10] Digital modulation radios can provide up to 27 Mbps of bandwidth per 10 MHz of spectrum from small, portable transmitters. These specifications are achieved in current commercial products in the 5 GHz U-NII bands and proposed per ASTM E2213-02 Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems for the 5.9 GHz DSRC band. This amount of bandwidth can support up to 18 video streams per 10 MHz of spectrum

for public safety users, and even priorities among various types of public safety users. Commercial and unlicensed users utilizing the band could not impede emergency operations.[11]

3. Conditional Commercial and Unlicensed Use of the 4.9 GHz Band Can Be Implemented Effectively

The Commission requests comment on whether it should explore "innovative and non-traditional means of employing public safety use of the (4.9 GHz) band," including secondary commercial use, and seeks comment on how such an approach could be implemented.[12]

As discussed *supra*, commercial and unlicensed uses of the band would serve the public interest by driving up the volume and driving down the price of 4.9 GHz equipment; and also by exploiting the full capabilities of the 4.9 GHz band for public safety purposes to provide the general public with fast and reliable access to public safety information through the receiving capability of their equipment.

To effectively implement such a plan, the principal condition for commercial and unlicensed equipment must be that equipment be type-certified to be preempted by equipment used for primary public safety users and other emergency operations. Currently available IEEE 802.11 standard commercial equipment is capable of utilizing the Enhanced Distributed Coordination Function to support eight levels of prioritized, preemptive use of the radio channels. Using this standard, one potential approach would be to reserve the highest four levels of priority to various emergency and non-emergency types of public safety services. Type-

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[11] This approach is not affected by whether users are fixed or mobile.

[12] *Further Notice* at para. 36.

certification for commercial equipment could be restricted to the middle three levels of access, with one's license type determining the priority level at which one may contend for access to the spectrum. The lowest priority level could be used for unlicensed operation.

Under this approach, whenever higher priority level traffic requires spectrum, radios operating at a lower priority level would not be capable of transmitting. Inasmuch as radios are always capable of listening, this approach leads to both efficient use of the 4.9 GHz band and to the availability of a large number of products in the field capable of receiving public safety warnings and other messages. Importantly, this same standard commercial equipment also has built-in 128-bit Advanced Encryption Standard ("AES") encryption, as defined by the National Institute of Standards and Technology ("NIST"). This high level encryption has been designed into IEEE 802.11 products to prevent unintended interception of highly sensitive business communications, but also can be used to prevent unauthorized reception of public safety communications when public reception is not desired.

B. Fixed Operations Other Than Point-To-Point Must Be At Comparable Power Levels

The Commission seeks comment on whether licensees should be permitted to use the band for fixed operations in order to support the licensees' flexible use of the 4.9 GHz band and to encourage innovation of future 4.9 GHz technologies that could benefit public safety.

Permitting fixed operations on the 4.9 GHz band would have no effect on mobile operations, so long as the Enhanced Distributed Coordination Function is used with all equipment and the radiated transmit power is comparable to the other operations in the band, or

alternatively, that directional antennae are required for fixed use. If high power, point-to-multipoint fixed operations with an omnidirectional antenna were permitted to transmit in the vicinity of low power, battery-operated mobile operators, the former's transmissions could interfere with the latter's signal. For this reason, Atheros urges that, for fixed operations, the Commission adopt rules requiring that operations other than point-to-point be at power levels comparable to mobile operations.

With regard to the Commission's proposal to regulate 4.9 GHz services within a new subpart of Part 90 of its Rules,[13] Atheros recommends that since substantially similar DSRC operations also are expected to operate under Part 90 of the Commission's rules, similar regulations should be adopted for public safety use so that equipment may be built and both bands be used under a uniform set of requirements. Corresponding requirements, including incorporation of the Enhanced Distributed Coordination Function and EIRP limits, should be reflected in Part 26 for commercial equipment and Part 15 for unlicensed equipment.

C. Channel Plan

The Commission seeks comment on what type of channel plan would be best for the 4.9 GHz band, citing earlier suggested plans designed for commercial use of the band but possibly also applicable to public safety uses. The Commission also asks if the band would require segmenting and if coordination should be required if fixed operations are permitted.[14]

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[13] *Id.* at para. 41.

[14] *Id.* at paras. 43 and 44, respectively.

Atheros recommends that the Commission adopt a channel plan that permits operations based upon 20 MHz channels, which can be dynamically subdivided into 5 or 10 MHz channels as required.[15] Such a plan would address the need of some applications for wider channels for video and other high bandwidth operations, and the need from other applications for narrower channels to preserve battery life and support denser deployments. Commercially available U-NII and planned DSRC equipment already support dynamic changes of channel bandwidth to enable a variety of different applications in a spectrum-efficient manner. Under this plan, equipment would be authorized for a maximum channel bandwidth. In addition, prior to transmission, type-certified equipment would be required to use the Carrier Sense mechanism to scan for and seek unused spectrum. Transmissions subsequently would occur on a dynamically selected specific frequency.

This approach will permit flexibility for users and spectral efficiency for different applications that may operate in this band while protecting public safety operations. Public safety operations would always maintain prioritized, preemptive access to any channel needed.

Coordination of fixed and mobile services would not be required under this Carrier Sense approach. If fixed services were operated at the lower commercial or unlicensed levels of priority, higher-priority mobile public service needs that enter their area would always

[15] Such a plan also would correspond to the proposed allocations of the 4.900-5.000 and 5.030-5.090 GHz bands in Japan for licensed operation of NWA (nomadic wireless access such as mobile PCs and PDAs) and FWA (fixed wireless access) services. The plan being adopted in Japan calls for a basic allocation based on 20 MHz channels, but also permits operation using 5 or 10 MHz channels.

preempt the fixed services. When multiple mobile services happen to be using the same dynamically allocated channel enter the same area, the higher-priority public safety operations would always preempt lower priority traffic, thereby prompting the latter to dynamically select a different frequency. Coordination of fixed and mobile operation, therefore, principally would be to limit the number of fixed operators that may transmit in any given area.

Finally, we note that the Commission declined to pair the 4.9 GHz and 3.65 GHz bands, citing a lack of synergies.[16] There would be a material benefit to limited paired use of the 4.9 GHz and 5.9 GHz bands for public safety applications. Unlike pairing with the 3.65 GHz band, pairing with the 5.9 GHz DSRC band would be synergistic because of shared requirements and technologies with the nearby 5 GHz U-NII bands. Products will be available for testing in 2002 that could readily be operated in all three of these bands.

D. A Restricted Blanket Licensing Scheme Would Best Serve Mobile Licensing Based on Assignments of Priority Level and Channel Bandwidth

In the *Further Notice*, the Commission lays out a number of licensing scheme alternatives for mobile services, and tentatively concludes the best licensing scheme should allow "maximum flexibility" for use in geographically dispersed areas, including emergency and incident scenes "which are not determinable in advance."[17] The Commission seeks comment on these schemes, which include: state licensing, blanket licensing, regional planning committees, and band managers.

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[16] *Second R&O* at para. 11.

[17] *Supra* note 1 at para. 46.

For the reasons discussed below, a restricted version of the blanket licensing option would best serve the Commission's goals and implement a licensing approach based on assignments of priority level and channel bandwidth. Under a Restricted Blanket Licensing plan, mobile operation in the 4.9 GHz band would be permitted by eligible entities without a license for a particular frequency, but would be limited to operation at specific, designated priority levels to permit proper operation of the Enhanced Distributed Coordination Function. This approach is analogous to that used in the 700 MHz band, and ensures proper coordination and access to the airwaves by emergency response agencies. The Enhanced Distributed Coordination Function, as standardized by the IEEE 802.11 working group and discussed in the Appendix, varies the data frame spacing and timings for different classes of high- speed wireless data communications so as to permit higher priority traffic preemptive access to the airwaves. This suppresses transmissions by lower priority fixed or mobile transmitters when higher priority incidence-response traffic is present and transmitting. Accordingly, lower priority traffic would be capable of transmitting when higher priority traffic is not transmitting, or by switching to other, less utilized frequencies. This function has been implemented in commercially available equipment and alleviates administrative and coordination burdens associated with traditional licensing.[18]

This approach is largely self-managing through automatic scheduling of different priorities of wireless traffic by the equipment itself. In addition, individuals in charge at an

[18] Under this approach, fixed operations would be affected by decreased data throughout and increased latency in the presence of multiple, high priority incidence-response transmitters. The fixed operations would only be prevented from operating if incidence-response requires all available spectrum in the area, in which case no licensing or access approach could provide functionality to the fixed operations while meeting the needs of incidence-response.

incident scene may manage traffic by broadcast of a standardized MIB (Management Information Base) that causes certain traffic to function at priority levels other than that assigned prior to arrival at the incident scene. We propose that equipment built and marketed for unlicensed operation in this band pursuant to Part 15 of the Commission's Rules be locked at the lowest level of priority. Traffic from such equipment always would be suppressed by the presence of higher-priority public safety traffic, thereby preventing interruptions of essential emergency communications on the band.

E. Fixed Licensing

The Commission also seeks comment on a licensing scheme for fixed use of the 4.9 GHz band by the public safety community, and tentatively concludes to license fixed use pursuant to Part 27, Part 90 or Part 101 of its Rules, similar to the licensing of private radio users, including public safety, in other fixed microwave bands.[19]

Based upon the ability of the equipment to protect sensitive public safety communications through automatic protocols embedded in the equipment, described above, Atheros recommends that fixed operators in the 4.9 GHz band be assigned priority and channel bandwidth licenses under an approach identical to that of mobile operators.

F. Best Frequency Capability Can Mitigate In-Band Interference, Including Interference by Navy CEC Operations in the Lower 4.9 GHz Band

The Commission seeks comment on the extent to which the Navy's Cooperative Engagement Capability ("CEC") operations, which operate immediately below the 4.9 GHz band, will cause interference to public safety services operating in the lower portion of the 4.9

[19] *Supra* note 1 at para. 57.

GHz band. The Commission solicits comment on technical rules that could be applied to 4.9 GHz band licensees to minimize such interference.[20]

As a general matter, Atheros recommends the Commission require that equipment operating in the 4.9 GHz band have a preemptive ability in real-time equal to that provided by the specified capabilities of the IEEE 802.11 standard to determine the best available frequency for operation, instead of operating only at particular fixed frequencies. This capability is currently used by WLAN equipment to select the best frequencies for operation. Use of such a system would have a spreading effect over the entire band on the introduction of radio frequency noise to other users. Use of this technology also would meet the Commission's obligations with respect to radio astronomy stations under footnote US311. Using this technology would reduce the effect of U.S. Navy CEC operations on public safety operations as the technology would result in the public safety traffic being automatically shifted to the frequencies least affected by the presence of CEC traffic.

G. Technical Standards for Mobile Equipment

With an eye toward facilitating the introduction of new technologies and achieving potential regulatory goals, such as incident scene interoperability and accommodation of peak demand during multiple emergencies, the Commission seeks comment on whether to establish technical standards for mobile equipment operating in the 4.9 GHz band, and if so, what standards to specify in its Rules.[21]

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[20] *Id.* at para. 61.

[21] *Id.* at para. 63.

Atheros recommends the adoption by reference of equipment meeting the technical standards of the IEEE 802.11 working group to service public safety and other operations in the 4.9 GHz band. The objective is not to establish performance or quality standards, which the Commission rightly has allowed to be set by marketplace forces,[22] but to ensure interoperability and compliance with the Carrier Sense and Enhanced Distributed Coordination Function requirements described *supra,* and in Appendix I. Adopting this standard for 4.9 GHz equipment would attain the Commission's twin regulatory goals of priority access by public safety users and maximum spectrum efficiency.

The IEEE 802.11 working group standards already have been implemented by a variety of manufacturers in commercially available equipment that operates on proximate frequencies. This equipment includes the additional operational factors (such as both *ad hoc* and access point operations) under consideration. Although the principal goal of specifying the IEEE 802.11 standard is to ensure appropriate functionality, Atheros notes that the standard also sets performance standards already adhered to by manufacturers of commercially available equipment. The establishment of final and appropriate rules (*i.e.*, the designation of priorities) may be done in formal consultation with public and private agencies, as currently is being done in the rulemaking that addresses rules for the 5.9 GHz DSRC band.

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[22] *See Id.* ("As a general rule, the Commission has traditionally disfavored the specification of performance or quality standards for equipment, leaving the selection of technology entirely within the realm of the licensee.")

H. Broadband Technologies

1. Adoption of the IEEE 802.11 Standard Will Result in Lower Prices, Increased Functionality and U-NII Interoperability for 4.9 GHz Public Safety Equipment

The Commission seeks comment on the suitability of IEEE 802.11 and BRAN HiperLAN2 broadband standards for WLAN use in the 4.9 GHz band, The Commission also solicits comment on the viability in this band of U-NII technology used in the 5 GHz U-NII bands.[23]

As of July 2002, over 25 manufacturers of commercially available 5 GHz IEEE 802.11a equipment have, or will have within this calendar year, the capabilities of ensuring interoperability and compliance with the Carrier Sense and Enhanced Distributed Coordination Function requirements. By contrast, it is unclear when equipment meeting the HiperLAN2 standard will be commercially available. Adoption of the IEEE 802.11 technologies designed for the 5 GHz U-NII band will yield several important benefits. First, it will facilitate development of economies of scale that will quickly result in reduced equipment costs for the public safety community, thereby fostering rapid adoption and realization of its attendant benefits. Second, it will enable 4.9 GHz public safety equipment to also take advantage of "Hot Spot" Internet access and other commercial communications services in the U-NII bands.

Finally, since the draft rules for the DSRC band at 5.9 GHz also specify IEEE 802.11 technologies, the Commission could expect the availability of interoperable equipment for public safety uses that would operate at *both* 4.9 and 5.9 GHz *as well as* in the U-NII bands,

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[23] *Id.* at para. 65.

further extending the usefulness of each of these bands for public safety and driving equipment costs downward. Equipment capable of being modified for this purpose will be available this year. Moreover, all currently available IEEE 802.11a equipment must meet the security needs of commercial enterprises, and therefore already incorporate 128-bit AES encryption engines. Rather than imposing additional cost for additional security features, use of commercially available U-NII technologies will reduce cost because it already includes security technology more advanced than that used by most wired communications technologies.

I. Power Limits

Finally, the Commission seeks comment on whether to adopt a power limit for mobile broadband equipment deployed for public safety uses on the 4.9 GHz band, and if so, what that level should be.[24]

Atheros believes Motorola's proposed 1-watt transmitter power limit with 20-dB maximum antenna gain is appropriate for these operations. In fact, many local area operations are expected to operate at 100 mW with 6-dB antenna gains, as is typical for U-NII band WLAN operations. The power range from 100 mW to 1W is low enough to limit the effect of higher power transmitters jamming lower-powered ones and typically will provide several hundred meters of coverage in an outdoor environment. The higher 1-watt power limit will provide for coverage in larger incident-response zones or those with more radio artifacts, such as large indoor environments.

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[24] *Id.* at para. 66.

IV. CONCLUSION

Atheros commends the Commission for its work in ensuring our nation's vital public safety communications needs are met through the reallocation of spectrum in the 4.9 GHz band to enable public safety entities to implement beneficial wireless digital technologies. Adoption of licensing and service rules that permit conditional commercial and unlicensed use of this band, subject to guaranteed priority access for public safety users, will promote and exploit the full potential of this spectrum for the public safety of all Americans.

Respectfully submitted,

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APPENDIX I

Mechanism to Ensure Preemption by Public Safety Services of Commercial Services and Unlicensed Devices

The draft 802.11e supplement[25] to the IEEE 802.11 standard specifies enhancements for quality of service (QoS) that may be used to allow multiple classes of traffic to co-exist on the same frequency, and to provide for certain classes of traffic to preempt other classes. While the 802.11e supplement is still in draft form as of July 2002, certain pertinent elements such as the Enhanced Distributed Coordination Function("EDCF") were demonstrated in public forums as early as the July 2001 IEEE 802 meeting, and have been implemented in currently available commercial products.

The original intent of the EDCF mechanism was to allow traffic with certain time-critical latency and throughput requirements, such as voice or video, to preemptively access the wireless medium even in the presence of lower-priority traffic, such as best-effort Internet data. This mechanism meets the requirements of the time-critical traffic by ensuring that higher-priority traffic can both transmit and suppress the transmissions of lower-priority traffic within 1/100th of a second of a request to do so. Lower-priority traffic would continue to be suppressed until all higher-priority traffic has finished transmitting.

This mechanism utilizes the Carrier Sense Multiple Access with Collision Avoidance ("Carrier Sense") technology used by all IEEE 802.11 products. Carrier Sense

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[25] Draft Supplement to Standard for Telecommunications and Information Exchange Between Systems – LAN/MAN Specific Requirements – Part 11: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Medium Access Control (MAC) Enhancements for Quality of Service (QoS), IEEE Std 802.11e/D3.0 (May 2002).

requires any station wishing to transmit to first sense the medium to determine if another station is transmitting. Upon initiating a transmission, a station may only transmit for a limited amount of time (up to approximately 4/1000th of a second) before it must allow other stations an opportunity to transmit. Conversely, all stations, upon sensing that another station is transmitting, must wait for that station to cease transmitting and wait an additional period of time known as the Arbitration Interframe Space ("AIFS," approximately 34/1,000,000th to 295/1,000,000th of a second) before attempting to transmit. Different classes of traffic are assigned different priorities through variations in the allowable range of AIFS time. Higher-priority traffic always has a lower AIFS range, and thus would pre-empt lower-priority traffic.

The EDCF technique is analogous to allowing different speakers in a debate the ability to speak only when no one else is speaking. When someone is speaking, they may do so for only a limited time and all others must wait. Upon the completion of one's speech, only the highest priority speakers may contend for the floor, then the next highest priority speakers may do so, and so on.

The technique has been shown to support preemptive priority access by multiple classes of voice, video, and data traffic. When the wireless medium is required and fully utilized by higher-priority traffic, lower-priority traffic is successfully suppressed from transmitting. When lower-priority traffic is transmitting, higher-priority traffic may seamlessly interrupt it and start transmitting within 1/100th of a second of a request to do so. This method may be used to enable efficient spectrum use by permitting lower-priority commercial and unlicensed traffic to both co-exist and yield to higher-priority public safety traffic on the same frequency.