IEEE 802™

Local and Metropolitan Area Network Standards Committee
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To: Magalie Roman Salas, Esquire,
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From: Vic Hayes,
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Dear Ms. Salas,

In response to the questions of the Federal Communications Commission (the "Commission") in the Further Notice of Proposed Rule Making and Order (the "Notice"), document FCC 01-158, in the proceedings of ET Docket No. 99-231 the IEEE Project 802™, Local and Metropolitan Area Networks Standards Committee ("IEEE 802") offer its comments.

IEEE 802 welcomes the proposed actions of Commission to improve the sharing capabilities of spread spectrum devices, to permit new digital transmission technologies and to widen the 5.8 GHz band.

IEEE 802 supports, in principal, the improved sharing capability in the form of the adaptive hopping proposal and it believes that waivers should be issued on those rules before the Order is released.

IEEE 802 supports the introduction of the new digital transmission technologies, but note with concern that the rules as proposed do not provide sufficient qualifications to provide the necessary sharing capabilities.

1 Introduction of the IEEE 802

IEEE 802 operates under the rules of the Institute of Electrical and Electronics Engineers, Inc. (IEEE™) and the IEEE Standards Association (IEEE-SA). It is formally known as the Local and Metropolitan Area Networks (LAN/MAN) Standards Committee. IEEE 802 is sponsored by the IEEE Computer Society. This response was prepared by the Regulatory Ad-Hoc Group chaired by Vic Hayes at the July IEEE 802 meeting and was subsequently approved by the IEEE 802 Sponsor Executive Committee after due circulation and review by each of its three wireless Working Groups. A brief description of IEEE 802 and each of its three Working Groups dealing with wireless technologies follows below.

1.1 IEEE 802 Charter and History

IEEE 802 has the basic charter to develop and maintain networking standards and recommended practices, using an open and accredited process, and to enable and advocate them on a global basis.

IEEE 802 was formed in February 1980 and has met at least three times per year as a Plenary body ever since that time. IEEE 802 has grown from a participation of 500 individuals in the 1990s to over 1000 individuals in the Plenary sessions in 2001.

Products of IEEE 802 include the IEEE 802.3 Ethernet standards, IEEE 802.5 Token Ring standards and the IEEE 802.11 Wireless LAN standards. These all have been adopted by the ISO/IEC Joint Technical Committee 1 (JTC1) as International standards.

1.2 IEEE 802.11

IEEE 802.11, the Standards Working Group for Wireless Local Area Networks, is responsible for developing Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) based Wireless Local Area Network (WLAN) standards within IEEE 802. IEEE 802.11 was formed in July 1990 and has produced the ISO/IEC 8802-11:1999 (IEEE 802.11:1999) standard with two supplements. With supplement 802.11b, manufacturers can build devices for operation at data rates of 11 million bits per second (11 Mbit/s) using radio at 2.4 GHz. These devices can be used in the home, the enterprise and at public places such as conference areas, hotels and airports to surf the Internet or connect to the Enterprise Intranet.

With supplement 802.11a, devices can be built operating at between 6 Mbit/s and 54 Mbit/s using radio in the 5 GHz band.

This Working Group uses its own product during its conferences 6 times a year. Radio access points, radio PC cards in the laptops of the members, a file server and a fast Internet connection enable the members to work efficiently and paperlessly[1]. Following the successful use of this technology by 802.11, it has been adopted by other IEEE 802 Working Groups and subsequently by the Plenary as a whole.

This Working Group has 5 projects, 1) 802.11e: to enhance to WLAN standard with improved Quality of Service capabilities, 2) 802.11f: to write a Recommended Practice for an Inter-Access Point Protocol, 3) 802.11g: an enhanced physical layer for data rates over 20 Mbit/s in the 2.4 GHz band, 4) 802.11h: to enhance the standard with dynamic channel selection and transmit power control, and 5) 802.11i: to enhance the standard with improved security capabilities. A study group is proposing a project to arrive at a single global 5 GHz standard.

At the beginning of the July 2001 meeting, 802.11 had 260 members and 200 observers. Those individuals were sponsored by 80 companies.

1.3 IEEE 802.15

IEEE 802.15, the Standards Working Group for Wireless Personal Area Networks, is responsible for developing standards based on Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) or other access methods for short distance wireless networks. IEEE 802.15 first met in July 1999. The group has four projects: 1) 802.15.1: a WPAN standard for Bluetooth™, 2) 802.15.2: a co-existence guideline for license exempt devices, 3) 802.15.3: a High rate WPAN standard and 4) 802.15.4: a low rate WPAN standard.

At the beginning of the July 2001 meeting, 802.15 had 60 members and, 60 observers building membership. Those individuals were sponsored by 40 companies.

1.4 IEEE 802.16

IEEE 802.16, the Standards Working Group for Broadband Wireless Access Networks (or Wireless Metropolitan Area Networks), is responsible for developing standards and recommended practices to support the

[1] At its May 2001 meeting, for instance, 350 members could get the documentation in a matter of seconds from the file server or from the Internet. Without the network, hard copies would have needed to have been ordered,

development and deployment of fixed broadband wireless access systems. IEEE 802.16 first met in July 1999. The groups' 802.16.2 "Recommended Practice for Coexistence of Fixed Broadband Wireless Access Systems" was approved for publication in July 2001. The group has four projects: 1) 802.16: Air Interface for 10-66 GHz, 2) 802.16a: amendments to the MAC layer and an additional PHY layer for 2-11 GHz licensed frequencies, 3) 802.16b: amendments to the MAC layer and an additional PHY layer, license-exempt frequencies, with a focus on 5-6 GHz and 4) 802.16.2a: enhancements to the Recommended Practice for coexistence amongst 802.16 and 802.16a devices.

Following the July 2001 meeting, 802.16 had 161 members and 56 observers. Those individuals were sponsored by over 120 companies.

2 Comments

2.1 Adaptive Hopping

IEEE 802 applauds the Commission's initiative to reduce interference between frequency hopping spread spectrum systems and other systems in the 2400-2483.5 MHz band, such as those specified by IEEE 802.11 and IEEE 802.15. The goal of the proposed modifications to FCC Part 15.247 requested by the Joint Petitioners[2] was, and is, to persuade the FCC to minimize the potential for unnecessary interference between occupants of the 2400-2483.5 MHz band in a way that is best for all its occupants, present and future, by seeking a modification of Part 15.247 of the FCC's rules to make the use of adaptive frequency hopping techniques practical and technically feasible in the 2400-2483.5 MHz band.

There are a number of major, distinct classes of communications devices presently operating in, or being targeted at, that band: IEEE 802.11b/g, Bluetooth™ (IEEE 802.15.1), IEEE 802.15.3, IEEE 802.15.4, HomeRF™, and some 2.4 GHz cordless phones, in addition to microwave ovens, which, while not communications devices, can present potentially significant sources of interference.

distributed and collected, normally requiring a lead time of at least 4 hours if a high speed copy machine was available on premises, or 8 hours if the copies had to be ordered from a copy service.

[2] See paragraph 5 of the Notice, *Joint Petition For Clarification or, in the Alternative, Partial Reconsideration*, submitted on October 25, 2000, by 3COM, Apple Computer, Cisco Systems, Dell Computer, IBM, Intel Corporation, Intersil, Lucent Technologies, Microsoft, Nokia Inc., Silicon Wave, Toshiba America Information Systems, and Texas Instruments.

The intent of IEEE 802 is to enable "low power, narrowband FH devices," such as Bluetooth™, to elect to reduce their number of hopping channels from the current minimum of 75 hopping frequencies to some reduced hopset of <75 by employing intelligent, adaptive hopping algorithms to significantly improve their ability to coexist with IEEE 802.11b/g, IEEE 802.15.3, IEEE 802.15.4, and other "static, wideband" systems, as well as eliminating problems with interference from microwave ovens.

The use of such intelligent, adaptive hopping algorithms will enable such frequency hopping devices to recognize the presence of, and intelligently avoid interference from and to, other occupants of the band.

There are large numbers of IEEE 802.11b devices already fielded (and those numbers will continue to grow rapidly by all projections). Furthermore, IEEE 802.11g, IEEE 802.15.3 and IEEE 802.15.4 will begin to be deployed in the relatively near future, and projections indicate that tens to hundreds of millions of Bluetooth devices will be fielded in the next few years. Therefore, it is imperative that everything possible be done to enhance the ability of Bluetooth and those other occupants of the 2400-2483.5 MHz band to coexist.

2.1.1 Earlier adoption of adaptive hopping and method therefore

As IEEE 802 has noted above, there are already many devices in the field that deserve limitation of interference from hopping devices. The Commission, however, did NOT allow early adoption with waivers, such as the Commission did for digital transmission systems. It would be advantageous if adaptive hopping could also be permitted under a waiver to the existing rules. This would allow Bluetooth implementers to proceed with interference avoidance measures without waiting for the full NPRM processing.

2.2 Digital Transmission Systems

In paragraph 15 to paragraph 18, the Commission discusses the introduction of non-spread-spectrum digital transmission systems. The Commission proposes in paragraph 16 to change the rules in the current spread spectrum bands at 915 MHz, 2.4 GHz and 5.7 GHz in such a way that the new digital transmission system would be required to meet the same technical requirements as modified in this proceeding. IEEE 802 whole-heartedly supports the goal of the Commission to provide flexibility and certainty to promote the introduction of new and non-interfering products into the bands without the need for rules changes. However, as shown in the following sections, the

Commission needs to include an additional rule to prevent the new digital transmission systems from causing unacceptable levels of interference.

2.2.1 Power spectral density levels of digital transmission systems

In paragraph 17 the Commission requests comment on whether digital transmission systems should be allowed the same power levels as direct sequence spread spectrum systems[3].

The current direct sequence spread spectrum rules require the digital signal to be spread by a pseudo random code. Such operation has the characteristic that the power is spread over a wider frequency band than for normal modulations. The effect is that the power spectral density of the transmitted signal is remarkably lower than the power spectral density without spreading. All proposals in paragraph 15 of the Notice are based on digital transmission with the same characteristics. For instance, all modulations in compliance with the direct sequence spread spectrum specifications (1, 2, 5.5 and 11 Mbit/s data rate) in the IEEE 802.11 standard would have, if they were to use the full transmit power level of 30 dBm, a peak power spectral density of 20 dBm/MHz and a 23 dB bandwidth of 22 MHz.

If the Commission's current proposal for the new digital transmission systems with the same power level limits as specified for direct sequence spread spectrum systems were adopted, then this would permit systems with a peak power spectral density of 8 dBm/3 kHz (that is equivalent to 33 dBm/MHz). A peak power spectral density of 33 dBm/MHz is 13 dB more than what is currently practiced for direct sequence spread spectrum systems. Accordingly, the proposed digital transmission systems could heavily interfere with all currently deployed direct sequence spread spectrum systems.

To prevent new systems from causing unacceptable interference to other devices in the 2.45 GHz band, the IEEE 802 proposes that the Commission introduce, in addition to the existing requirement of 8 dBm/3 kHz, a new requirement in dBm/MHz to limit the peak power spectral density.

[3] See beginning of paragraph 17 of the Notice: The rules for Part 15 spread spectrum systems limit maximum peak output power to 1 watt. In addition, the rules for direct sequence systems limit peak power spectral density conducted to the antenna to 8 dBm in any 3 kHz band during any time interval of continuous operation

2.2.2 Alignment of the rules in 15.247 with the U-NII rules

The Commission seeks comment[4] on whether the same result would be achieved by amending the U-NII rules to include the 915 MHz and 2.4 GHz bands. IEEE 802 supports this proposal, provided that the Commision expresses the power spectral density in the same unit (dBm/MHz) as in the U-NII rules and the level is specified comparable to the levels currently generated by devices approved under the direct sequence spread spectrum rules.

IEEE 802 supports the proposal of the Commission to extend the upper limit of the U-NII band from 5.825 GHz to 5.850 GHz. IEEE 802 does not expect any detrimental impact from this change.

[4] See paragraph 18 of the Notice

3 Summary

In summary, IEEE 802 welcomes the proposed actions of the Commission to improve the sharing capabilities for spread spectrum devices with the adaptive hopping proposal, and would like to see the implementation enabled immediately by means of waivers. IEEE 802 also welcomes the new rules for digital transmission technologies, but would like to add a qualification to the rules so that the spectral power density would be specified in units of dBm/MHz. IEEE 802 supports the proposal by the Commission to widen the 5.8 GHz band by 25 MHz.

Respectfully,

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