Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Parts 2 and 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) devices in the 5 GHz band	)	ET Docket No. 03-122
	)	RM - 10371
	)	
	)	
	)	

Via the ECFS

COMMENTS OF IEEE 802

IEEE 802[1] hereby respectfully offers its Comments on the Notice of Proposed Rulemaking (the "NPRM") in the above-captioned Proceeding.[2]

The members of the IEEE 802 that participate in the IEEE 802 standards process are interested parties in this proceeding. IEEE 802, as a leading consensus-based industry standards body, produces standards for wireless networking devices, including wireless local area networks ("WLANs"), wireless personal area networks ("WPANs"), and wireless metropolitan area networks ("Wireless MANs").

IEEE 802 is an interested party in this Proceeding and we appreciate the opportunity to provide these comments to the Commission.

[1] The IEEE Local and Metropolitan Area Networks Standards Committee ("IEEE 802" or the "LMSC")

[2] This document represents the views of the IEEE 802. It does not necessarily represent the views of the IEEE as a whole or the IEEE Standards Association as a whole.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

IEEE 802 generally supports the Commission's NPRM and offers detailed comments in specific technical areas, particularly with respect to the new "DFS," RADAR detection and avoidance, and "TPC" requirements.

We also comment that the concept of "narrowband U-NII devices" is confusing and seems contrary to the definition of U-NII devices.

Additionally, we comment on issues relating to test procedures for equipment certification and their potential impact on transition periods – something that is of considerable interest and concern to manufacturers.

Finally, we discuss our concern that the proposal in the instant Proceeding falls short of maintaining the band for the use for which it was originally envisioned and made available, falls short of what was contemplated (*and vigorously promoted to the world community as the U.S. position*) in WRC-03 Agenda Item 1.5 in terms of limiting the use of the band to "Wireless Access Systems, including RLANs," and thereby fails to provide an appropriate degree of regulatory status, certainty, and protection from interference that these important applications deserve and will enjoy in Europe and other parts of the world where regulatory agencies intend to follow the guidance of WRC-03 in making a PRIMARY allocation for such applications and services.

INTRODUCTION

1. On January 15, 2002, the Wireless Ethernet Compatibility Alliance ("WECA"), now known as the Wi-Fi Alliance, filed a Petition for Rulemaking (the "WECA Petition") with the Commission, seeking the allocation of 255 MHz of spectrum from 5470-5725 MHz for use by Radio Local Area Networks ("RLANs"). WECA additionally recommended that the Commission adopt the same technical standards as are embodied in the Commission's rules for U-NII devices in the 5250-5350 MHz band.

2. The WECA Petition sought to achieve two major goals. First, the allocation of the aforementioned additional spectrum to meet the future needs of RLANs and, second, to achieve a global harmonization of spectrum allocated for use by RLANs in order to promote economies of scale that would result in lower costs for users of RLAN technology and to facilitate a regulatory regime that would allow the users of portable RLAN client devices to enjoy the significant benefits of freedom of roaming across borders in today's ever more global society and economy.

3. In Europe, the bands 5150-5350 MHz (already available for use by RLANs in the U.S. under the Commission's "U-NII" rules) and 5470-5725 MHz had already been allocated on a *PRIMARY* basis for use by high performance RLANs.[3] Additionally, the need for a globally-harmonized allocation "for wireless access systems, including RLANs" in these specific bands had been recognized by the ITU,[4] and was scheduled for consideration by the World Radiocommunications Conference in 2003 ("WRC-03").[5]

4. At WRC-03, without opposition by a single ITU Member State Administration, the conference adopted a Resolution ("Resolution COM5/16") and corresponding changes to the Table of Frequency Allocations, adding *PRIMARY* allocations to the Mobile Service in the bands 5150-5350 and 5470-5725 MHz, for wireless access systems, including RLANs, as described in ITU-R Recommendation M.1450.[6]

5. IEEE 802 commends the Commission for adopting the instant NPRM, proposing to make the band 5470-5725 MHz available for use by wireless access systems, including RLANs, in the U.S. We will comment in more detail on the Commission's proposals in the following sections of these Comments.

---

[3] *See* ERC/DEC/(99)23

[4] *See* Resolution 736, WRC-2000

[5] *See* WRC-03, Agenda Item 1.5

[6] *See* Final Acts, WRC-03, Resolution COM5/16 and corresponding changes to Article 5 of the ITU Radio Regulations

IN THE NPRM, THE COMMISSION RECOGNIZES AND ACKNOWLEDGES THE NEED FOR THE ADDITIONAL SPECTRUM REQUESTED IN THE WECA PETITION

6. In the NPRM, the Commission states "*We agree with WECA that the spectrum currently available for U-NII devices is insufficient to support long-term growth for unlicensed wireless broadband devices and networks. Ample evidence exists of the enormous growth in the demand for such devices and services.*"[7]

7. The Commission also states in the NRPM that "*… we tentatively conclude that an additional 255 megahertz should be made available under the U-NII rules to meet the growing demand for new high data rate devices and services and to enable equipment to use spectrum that is harmonized with the European HiperLAN standards.*"[8]

THE BODY OF COMMENT IN REPONSE TO THE WECA PETITION SUPPORTS BOTH THE NEED AND THE FEASIBILITY OF MAKING THE SUBJECT SPECTRUM AVAILABLE FOR USE BY WIRELESS ACCESS SYSTEMS, INCLUDING RLANS

8. In response to the WECA Petition, seventeen comments and ten reply comments were filed. The overwhelming majority of the commenters supported WECA's proposal, citing both the benefits of additional system capacity and the promise of new technologies capable of providing higher data rates than currently available.[9]

9. The primary opposition to the WECA Petition came from the American Radio Relay League ("ARRL"), supported by the Amherst Alliance and Mr. Nicholas Leggett, who collectively expressed concern that wireless access systems, including RLANs, operating in the band 5650-5725 MHz might cause interference to the Amateur Radio Service, which has a *Secondary* allocation in that band.

10. Other commenters, including Roeder[10] and IEEE 802[11] pointed out that amateur use of the band in question is negligible and, therefore, the potential for interference to amateur users is likewise negligible.

---

7 S*ee* the NPRM, at 11.

8 *Id*., at 12.

9 *Id*., at 5.

10 *See* Konrad Roeder comments on the WECA Petition, at 1.

11 See the Reply Comments of IEEE 802 in RM-10371, at 11, 16, 17, and 22.

11. The Commission's own observations also support the conclusion that amateur use of the band in question is extremely limited: "*Our review of ARRL's web site indicates that amateur use of this band is limited to propagation beacons and possibly some limited satellite use*." [12]

12. Furthermore, in the NPRM, the Commission states, "*We observe that amateurs already share the 5.725-5.825 GHz band with U-NII devices and we are unaware of any complaints of interference.*"[13]

13. IEEE 802 would hasten to point out that U-NII devices in the 5.725-5.825 GHz band are allowed to operate with much higher effective radiated powers[14] than the 1 Watt EIRP limit proposed in the instant NPRM.[15]

14. Thus, IEEE 802 would contend that the facts do not support the interference concerns expressed by ARRL et al.

15. We would also point out that, while the Amateur Radio Service has a *Secondary* allocation in the band 5650-5725 MHz, as stated above (at 4), WRC-03, *without opposition by a single ITU Member State Administration*, adopted Resolution COM5/16 and corresponding changes to the Table of Frequency Allocations, adding *PRIMARY* allocations to the Mobile Service in the bands 5150-5350 and 5470-5725 MHz, for wireless access systems, including RLANs, as described in ITU-R Recommendation M.1450.

16. In light of these facts, and a recurring, ongoing history of challenges to the Commission's fundamental authority to authorize Part 15 unlicensed uses by the ARRL, we have serious concerns about the impact on both manufacturers and the community of U.S. users of 5 GHz wireless access systems, including RLANs, that would result from maintaining the current "*less than Secondary*" status of these devices in the Commission's rules, noting that the global community (*with the full support, even encouragement, of the United States*) has recognized the importance of these devices to society and the global economy by making *PRIMARY* allocations specifically for them in the same frequency bands addressed by the instant NPRM.

17. We will address this issue in more detail in a later section of these Comments.

---

12 *See* the NPRM, at 19.

13 *Id.*

14 *See* 47 C.F.R § 15.407 (a)(3), which allows an omnidirectional EIRP of up to 4 Watts, and further allows fixed, point to point systems to operate at 1 Watt transmitter output power with directional antennas of up to 23 dBi gain, resulting in an allowable EIRP of up to 200 Watts.

15 (and additionally imposed in the newly-revised ITU Radio Regulations as a result of the actions of WRC-03)

COMMENTS ON THE ADEQUACY OF SPECTRUM FOR HIGH POWERED USES

18. We note that the Commission states in the NPRM, "*We expect that the 100 MHz of spectrum that is already available at 5.725-5.825 GHz will remain sufficient for higher power operations. We note in particular that operations over longer distances employ directional antennas that allow for high reuse and sharing of the spectrum, which mitigates the need for additional spectrum for these types of operations. We seek comment on this analysis.*"[16]

19. While we fully realize that the power limits for the 5150-5350 and 5470-5725 MHz bands have been set by recent changes to the ITU Radio Regulations, and furthermore that the subject of additional "high power" spectrum in the 5 GHz region is beyond the scope of the instant NPRM, we are not convinced that the Commission's expectation as stated above is necessarily correct.

20. The 5725-5825MHz U-NII "high-power" band is currently used by WLANs (IEEE 802.11a), point to point systems, point to multipoint WAN/local broadband wireless access systems (IEEE 802.16 and other systems), and numerous other Part 15 systems, including cordless phones. We therefore have a general concern that the Commission's expectation that the 100 MHz of the 5725-5825 MHz band will remain sufficient for higher power operations may not be realistic**,** particularly if the band is used by more than one public access or public service operator in the same geographic area.

COMMENTS ON DFS

21. In the NPRM, the Commission proposes to require the use of an interference mitigation mechanism known as Dynamic Frequency Selection ("DFS") to assure the protection of incumbent radar systems in the bands 5250-5350 and 5470-5725 MHz.[17]

22. IEEE 802 concurs with the requirement for DFS, noting that sharing studies done both in the ITU-R and between U.S. industry and NTIA/DoD have shown that DFS, with the thresholds and other parameters specified are, in fact, necessary to assure protection of critical government radar systems with which wireless access systems, including RLANs, will share the bands referenced above (at 18).

---

16 *See* the NPRM, at 18.

17 *Id.*, at 21-23.

23. We also note that WRC-03 adopted changes to the ITU Radio Regulations that require wireless access systems, including RLANs, to implement DFS within the global *PRIMARY* allocation to the Mobile service that is intended for use by such devices. Since the ITU Radio Regulations are a treaty obligation, we believe that the Commission must require the use of DFS in these bands according to Resolution COM5/16 (WRC-03) and the referenced ITU-R Recommendation on DFS characteristics.

24. Regarding DFS, the NPRM states, in part, "*The DFS mechanism* ***detects*** **[emphasis added]** *a radar signal above a minimum DFS detection threshold of –62 dBm for devices with a maximum e.i.r.p. less than 200 mW and –64 dBm for devices with a maximum e.i.r.p. between 200 mW and 1 W averaged over 1 µs. The DFS detection threshold is defined as the received signal strength (RSS) in dBm* ***(or some other metric of received signal format)*** **[emphasis added]**, *referenced to the output of a 0 dBi receive antenna.* ***These signal levels are referenced to a 1 MHz bandwidth.*** **[emphasis added]**"

25. Referring to the ITU-R DFS Recommendation,[18] which is incorporated by reference in Resolution COM5/16 (WRC-03), it can be seen that the requirement is, in part: "*The DFS mechanism should be able to detect interference signals above a minimum DFS detection threshold of –62 dBm for devices with a maximum e.i.r.p. of < 200 mW and –64 dBm for devices with a maximum e.i.r.p. of 200 mW to 1 W*[19] [footnote number changed for correct "flow" in this document] *averaged over 1 µs. This is defined as the received signal strength (RSS) (dBm), normalized to the output of a 0 dBi receive antenna, that is required to be detected within the WAS channel bandwidth."*

26. The mention of "*… some other metric of received signal format"* in the NPRM text (at 21) is, in our view, unclear and inconsistent with the requirements of the DFS Recommendation.

27. Additionally, the last sentence in 21 above, "*These signal levels are referenced to a 1 MHz bandwidth.*" appears to be a misinterpretation.

28. Finally the text of the first sentence uses "*detects*" instead of the "*should be able to detect*" wording of the DFS Recommendation.

---

[18] *See* ITU-R Recommendation M.1652, adopted at RA-03.

[19] (footnote 4 from ITU-R Recommendation M.1652: "*In practice, it may not be necessary for each device to implement full DFS functionality, provided that such devices are only able to transmit under the control of a device that ensures that all DFS requirements are fulfilled.*")

29. In general, recognizing that the NPRM was drafted before the outcome of WRC-03 was known, we would respectfully recommend that the NPRM language be amended, where necessary, to assure complete conformance to the language of the DFS Recommendation and Resolution COM5/16 (WRC-03).

"… A U-NII DEVICE HAVING A RECEIVE BANDWIDTH LESS THAN 1 MHZ" SEEMS CONTRARY TO THE DEFINITION OF "U-NII DEVICES"

30. In the NPRM, the Commission states: "*However, if the RSS is to be measured correctly by* ***a U-NII device having a receive bandwidth less than 1 MHz*** **[emphasis added]**, *a bandwidth correction factor must be taken into account. We seek comment on whether 10*Log (BW/1MHz) (where BW is the U-NII device's bandwidth) should be used as the appropriate correction factor for U-NII devices that have a bandwidth less than 1 MHz.*"[20]

31. The Commission's rules define "U-NII devices" as follows: "*U-NII devices. Intentional radiators operating in the frequency bands 5.15 - 5.35 GHz and 5.725 - 5.825 GHz that use wideband digital modulation techniques and provide a wide array of high data rate mobile and fixed communications for individuals, businesses, and institutions*."[21]

32. Based on the above-referenced definition of a "U-NII device," we believe that referring to a "*U-NII device having a receive bandwidth less than 1 MHz*" is inconsistent and confusing at best. In our view, a device with a receive bandwidth of less than 1 MHz is not employing "*wideband digital modulation techniques"* and would be inherently incapable of *"provide(ing) a wide array of high data rate mobile and fixed communications …"*

33. In light of the fact that the ITU Radio Regulations and Table of Allocations, as amended by WRC-03 clearly intend that the subject bands be used for wireless access systems, including RLANs,[22] and the acknowledged need[23] for this spectrum to accommodate future growth of such systems, we believe that the Commission should reject the concept of "narrowband U-NII devices."

34. For this reason, we respectfully suggest that the reference to such devices and bandwidth correction factors be deleted from the NPRM text and not be considered further.

---

[20] *See* the NPRM, at 21.

[21] See 47 C.F.R § 15.403 (i)

[22] See Resolves 1, Resolution COM5/16 (WRC-03), which reads as follows: "that the use of these bands by the mobile service is for the implementation of WAS including RLANs as described in Recommendation ITU-R M.1450;"

[23] S*ee* the NPRM, at 11, Resolution 736 (WRC-2000), and Agenda Item 1.5 (WRC-03).

IN SYSTEMS WHERE MULTIPLE DEVICES OPERATE UNDER A CENTRAL CONTROLLER, ONLY THE CENTRAL CONTROLLER SHOULD BE REQUIRED TO IMPLEMENT THE RADAR DETECTION FUNCTION OF DFS

35. In the NPRM, the Commission states "*For systems, where multiple devices operate under a central controller, we propose that only the central controller be required to have DFS capability*."[24]

36. We concur fully with this proposal because in such an "infrastructure" network, the DFS functional requirement is that the "cell" consisting of a central controller (an "Access Point" or "AP" in RLAN terms) and some number of associated "client devices" avoid co-channel operation which would interfere with a radar system.

37. Since, in such a network, the client devices are "associated with," and may be controlled by, an AP that is capable of controlling the client devices' access to the media (the radio channel), it is only necessary that APs perform the radar detection function in order to assure that the system behaves appropriately in terms of avoiding co-channel interference to radar systems.

38. As long as the AP is able to perform the radar detection function and assert control over its associated client devices, the system requirement will be met.

39. Since there are typically a number of client devices associated with an AP in such systems, APs are better able to bear the additional cost involved in implementing the radar detection function.

40. Likewise, since there are multiple (often many) client devices associated with each AP, it is important to minimize the cost of client devices in order to lower the total system cost that users must bear.

41. Finally, since APs are generally connected to an AC power source, power consumption is much less of an issue than in client devices, which need to minimize their power consumption in order not to have an adverse effect on the battery life of the "host" device (e.g., a notebook computer, PDA, etc.) This factor also bodes in favor of centralizing the radar detection function in the AP or central controller.

[24] *See* the NPRM, at 22.

DFS IN SYTEM ARCHITECTURES THAT LACK A CENTRAL CONTROLLER

42. The NPRM also observes that "*We recognize that there may be devices or architectures developed, where remote devices are not under the control of a master device."* and seeks comment on whether such devices should be required to implement DFS.[25]

43. Current, and anticipated, usage patterns indicate that a vast majority of users of the type of devices in question operate using a central controller mode (AP/client mode), and it is the rare exception when devices operate in a mode where there is no central controller. Also given that devices operating without a central controller are virtually always portable devices with limited power capability and size limitations, it is our opinion that the aggregate amount of potential interference energy would be severely limited.

44. Again, we fully support the concept that in a centrally-controlled network architecture with an AP/central controller, only AP should be required to do radar detection.

45. We also note that this proposal is fully in conformance with the requirements of ITU-R Recommendation M.1652.

46. Vis a vis systems operating in a non-centrally-controlled mode, at least two options exist, neither of which is mutually exclusive:

- Limit EIRP to a sufficiently low level in all bands (10 mW???) that DFS would not as a practical matter be required, noting that utilization of this mode will be far less frequent, and of a much more transitory nature, than "infrastructure mode" where a DFS-capable central controller (AP) would be present, and further noting that this mode of operation is typically conducted between devices within very close range of each other, so lower power would be operationally acceptable.

- Limit this mode of operation to the 5150-5250 MHz band, where DFS is not required and additionally limit the allowable EIRP to a lower value than the general 200 mW regulatory limit for this band (10 mW???)

47. Under current Commission rules, this would technically preclude outdoor use of this mode of operation in the 5150-5250 MHz band and could result in a minimal amount of accidental outdoor use.

48. However, the effects of such accidental outdoor use by 1% of the total population in the footprint of an MSS satellite, at 200 mW EIRP, on the MSS feeder links were taken into account in ITU-R sharing studies which concluded in ITU-R Recommendations S.1426, S.1427, and M.1454.

[25] See the NPRM, at 22.

49. Since any aggregate interference to MSS feeder links that would result from accidental outdoor use would scale directly with EIRP, this lower (10 mW) EIRP limit would result in tolerable levels of aggregate interference into MSS feeder links, even if 20% of the population were to simultaneously operate outdoors in this mode of operation – an extremely unlikely event.

THE REQUEST FOR COMMENT ON "IDENTIFYING REMOTE UNITS THAT OPERATE ONLY UNDER THE CONTROL OF A CENTRAL CONTROLLER" IS UNCLEAR

50. The NPRM further invites comment on how to identify remote units that operate only under the control of a central controller.[26]

51. It is unclear to us for what purpose this identification is necessary. Is if for test/certification purposes, labelling purposes, or for some other reason?

52. From our perspective, devices will "know" their capabilities and will behave accordingly. If the Commission can provide clarification as to the purpose of this question, we would be happy to formulate a response.

COMMENTS ON RADAR DETECTION QUESTIONS

53. The NPRM seeks comment on the minimum number of pulses and the observation time required for reliable detection of radar signals by the DFS mechanism.[27]

54. It is unclear if this request relates to the Channel Availability Check mode of DFS, the In Service Monitoring mode, or both. Each has different characteristics, but the fundamental requirements for radar detection and other DFS performance parameters are specified in ITU-R Recommendation M.1652.

55. The minimum number of pulses required for reliable detection of radar signals by the DFS mechanism is likely to be implementation dependent and need not/should not be codified in the Commission's rules, in order to avoid constraining the future development of innovative approaches that may provide superior performance.

56. The required observation time is, in essence, related to the probability of detection and the amount of WAS/RLAN traffic on a channel (how many inter-packet gaps are inherently available for listening during the in service monitoring mode). These facts were taken into account in the ITU-R and industry/U.S. government sharing studies that resulted in the development of ITU-R Recommendation M.1652.

---

[26] See the NPRM, at 22.

[27] *See* the NPRM, at 23.

57. Furthermore, we believe that these issues may substantially relate to test procedures for equipment certification and we will comment further on that subject in a separate section later in these Comments.

TRANSMIT POWER CONTROL

58. In the NPRM, the Commission proposes to require Transmit Power Control ("TPC") in the band 5470-5725 MHz.[28]

59. We support this proposal, noting that this requirement is also embodied in the ITU Radio Regulations modifications enacted by WRC-03, and further note that the newly modified ITU Radio Regulations also require the use of TPC in the 5250-5350 MHz band.[29]

60. The text of the NPRM states that "*TPC will allow the transmitter to operate at less than the maximum power for most of the time*."[30]

61. However, we believe that it would be more accurate and appropriate to state that "*TPC will allow the transmitter to operate at less than the maximum power in many situations*."

62. The reason for this distinction is that the ability to reduce power via TPC, while maintaining reasonable performance, is not a time factor, but rather a location/propagation/cell size factor. Over a large population of devices it is highly probable, statistically, that the goal of an overall average power reduction of 3 dB, to provide additional mitigation of interference potential to the EESS and SRS will be achieved, and that is the primary purpose of TPC.

63. The text of the NPRM further states that "*Because TPC equipped devices adjust their transmit power to the minimum necessary to achieve the desired performance, the average interference power from a large number of devices is reduced, the power consumption is minimized and network capacity is increased*."[31]

64. This text appears to us to present some issues with respect to serving as the basis for specific rules/requirements for two reasons:

- First, "desired performance" is lacks definition;
- Second, it must be remembered that the primary goal of the TPC requirement is to achieve, on average, over the total population of devices, a 3 dB mitigation of the potential for interference to the EESS and SRS.

---

[28] *Id.*, at 24.

[29] See Resolution COM5/16 (WRC-03)

[30] *See* the NPRM, at 24.

[31] *Id.*

65. Thus, the phrase "… *adjust their transmit power to the minimum necessary to achieve the desired performance* …" could easily be misconstrued into a requirement that would actually result in significant, unnecessary system performance degradations.

66. The reason for this is rooted in the way that most systems of the type intended to be deployed in this band actually work.

67. Because of the Carrier Sense Multiple Access Collision Avoidance ("CSMA/CA") protocol that is employed, it is highly undesirable to have situations when the client devices associated with an AP cannot "hear" each other.

68. The reason for this is that, before transmitting (between each packet transmitted in the system), each device monitors the RF channel to determine if it is occupied or not. If the channel is occupied, other devices will defer for a random amount of time (within certain limits), monitor the channel again, and if the channel is still occupied, defer again for another random interval. This cycle is repeated until the channel is sensed as unoccupied by the device that has randomly selected the shortest deferral period. At that time, that device will begin transmission of its packet, causing other devices to sense the channel as occupied.

69. Thus, if a particular device is located such that its propagation loss to the AP is much less than that of the other devices associated with the AP, it could, in theory, reduce its power much more than the other devices and still maintain acceptable communications with the AP.

70. However, if the device's transmit power is reduced too much, the other devices will be unable to detect the fact that it is transmitting to the AP (they will be unable to correctly determine whether the channel is occupied or not), resulting in some other device(s) sensing the channel as unoccupied when, in fact, it is occupied.

71. In such cases, the other device will transmit (if it also has data to transmit at the time), resulting in a packet collision, corrupting the packets from both devices and necessitating the retransmission of both devices' packets.

72. This situation undesirably degrades network performance (throughput and latency) and, in systems that are heavily loaded, can result in a "cascade" of collisions and retransmissions that can dramatically reduce throughput and increase latency for all users, and as a result, decreasing the efficiency of spectrum utilization.

73. This bodes against a requirement that devices always be required to reduce their power more than is necessary to achieve the required 3 dB mitigation of the potential for interference to the EESS and SRS, on average, over the total population of devices.

74. When one considers the large numbers of devices of this type to be deployed, it is easy to see that the required 3 dB mitigation, on average, of the potential for interference to the EESS and SRS will be achieved by requiring that devices be capable of reducing their EIRP by 6 dB.

75. Even if all devices were designed to transmit at the regulatory maximum EIRP at their highest power setting, the variable physical distribution of devices and propagation distributions in real world, practical network installations will inherently result in many devices being able to reduce their EIRP by 6 dB and a more modest number of devices needing to transmit at their highest available EIRP.

76. Since the majority of devices in most networks are battery powered, portable client devices, system designers have every incentive to design their networks with "cell" sizes that result in those devices being able to transmit at their lower EIRP setting, at most locations, most of the time, in order to maximize the battery life of the "host" device (e.g., notebook computer, PDA, etc.)

77. In fact, this incentive to maximize the battery life of the host device is so strong that the vast majority of devices will have a maximum EIRP capability well below the regulatory limit, which will provide additional margin to assure that the 3 dB mitigation requirement is easily met over the entire population of devices.

78. Thus, we believe that the Commission's proposal to require devices to employ a TPC mechanism that will ensure a 6 dB drop in power (from maximum) when triggered to be entirely adequate and appropriate.

THE "TRIGGERING MECHANISM" FOR TPC WILL BE IMPLMENTATION DEPENDENT AND SHOULD NOT BE CODIFIED IN THE COMMISSION'S RULES

79. Historically, the Commission has, laudably, gone to considerable lengths to make sure that its rules do not unduly constrain the development of new technologies and techniques. This issue as a perfect example of a situation where that philosophy can, and should, be applied.

80. To specify a particular "trigger mechanism" for TPC, e.g., Received Signal Strength Indication ("RSSI"), for example, is an unnecessary requirement that will constrain receiver architectures unnecessarily.

81. While some manufacturers may decide to use RSSI, others may find that, due to their development of different receiver architectures, packet error rate monitoring or some other technique of determining when it is possible for a device to reduce its EIRP to be more practical or advantageous in terms of implementation cost, power consumption, or other factors.

82. Thus, we recommend that the Commission strive to specify *behavior*, rather than implementation details, because the behavior is what is required and manufacturers should be free to produce innovative solutions to achieve that required behavior.

83. This approach will spur competition to produce innovative technologies that reduce costs, power consumption, etc. – all to the benefit of the users of such devices.

BECAUSE OF THE NATURE OF THE TPC REQUIREMENT, TIMING IS NOT A CRITICAL ISSUE AND TPC TIMING SHOULD NOT BE "OVER SPECIFIED"

84. Since, as discussed above, the primary goal of TPC is a 3 dB mitigation of the potential for interference to the EESS and SRS, on average, over the total population of devices, the TPC function need not have a particularly fast response time requirement.

85. Over the entire population of devices, many will be relatively stationary (e.g., a person sitting at a desk, or at a table in a conference room during a meeting) and thus their propagation environment will not be rapidly changing over extreme ranges, with only a fraction of devices operating in a more dynamic propagation environment.

86. Because of the statistical nature of TPC's required net result in real world environments, over a very large population of devices, we believe that a regulatory requirement for a TPC activation time of something on the order of 30 seconds would be entirely adequate and would not impose an unnecessary burden on device manufacturers.

87. Having said that, we also believe that the strong incentives to reduce device power consumption will inherently drive manufacturers to implement TPC activation times that are, in fact, faster than this proposed regulatory requirement. Never the less, we believe that any regulatory requirement should not be "over specified" because that could limit design choices, unnecessarily increase device costs, or produce other unintended negative consequences.

DEVICES THAT OPERATE 3 dB OR MORE BELOW THE REGULATORY EIRP LIMIT NEED NOT BE REQUIRED TO IMPLEMENT TPC

88. Devices that have a maximum EIRP capability that is 3 dB or more should not be required to implement TPC at all because they inherently will "contribute their 3 dB of interference mitigation" to the total interference power seen by the EESS and SRS.

89. To impose a TPC requirement on such devices could unnecessarily increase the cost and power consumption of low power devices that, by definition, meet the required goal of TPC.

90. Therefore, we believe that the Commission need not, and should not, require that such devices necessarily implement TPC functionality.

91. Manufacturers may choose to implement TPC in such devices, due to considerations such as design commonality with higher powered devices, the desire to reduce device power consumption, or other technical or economic motivations, but they should not be required to do so for the reasons outlined above.

GENERAL COMMENTS ON TEST PROCEDURES

92. In the NPRM, the Commission states: *"We seek comment on appropriate test procedures needed to ensure compliance with the DFS and TPC requirements proposed in this proceeding. We note that the operational requirements for DFS are well defined in the applicable industry standards."*[32]

93. We would also observe that specific DFS operational requirements are contained in ITU-R Resolution M.1652.

94. The Commission also seeks comment on TPC test requirements: *"We observe that while TPC has been agreed to as a general requirement, its operational details are still under development. Therefore, we particularly seek comment on the means by which devices can be tested for compliance with TPC requirements to implement reduced power without placing unnecessary restrictions on device design."*[33]

95. Generally, we believe that a demonstration of the ability of a device that is required to implement TPC to reduce its output power under software/firmware control by at least 6 dB should be adequate.

96. As discussed above, the TPC requirement is not, fundamentally, extremely critical on a single device basis, but rather on a statistical basis over the total population of devices that are required to implement TPC. (Noting that devices that operate with EIRPs of at least 3 dB below the regulatory limit should not be required to implement TPC, though some may.)

MEASUREMENT TECHNIQUES ARE ADEQUATE FOR PRESENT-DAY DEVICES

97. The Commission also seeks comment "*…on the extent to which devices under development that may have unique or novel transmission waveforms may require special measurement instrumentation settings (e.g., integration times) that differ from those used for measuring compliance for existing U-NII band devices.*"[34]

---

[32] See the NPRM, at 25.
[33] *See* the NPRM, at 25.
[34] *Id.*

98. Current WAS/RLAN equipment, at least according to the IEEE 802 family of standards, was designed to comply with currently specified measurement techniques. Should future standards development projects contemplate transmission waveforms that might require the use of different measurement techniques, we will consult with the Commission's Office of Engineering and Technology for guidance.

SPECIFIC COMMENTS AND RECOMMENDATIONS ON TEST PROCEDURES

99. A joint industry/U.S. government 5 GHz Project Team has been established, under the auspices of NTIA to address the testing issues involved in DFS and TPC in order to assure that adequate test procedures are developed to provide the required protection of incumbent users of the subject bands, including critical U.S. government radar systems.

100. We are aware that there will be significant industry participation in this activity, and we assume that appropriate Commission staff members will also participate.

101. The intent and goal of this group is to cooperatively develop test methodologies and plans that will satisfy the needs of both industry and government users of the subject bands, with the expectation that the Commission will adopt the resulting test methodologies and plans.

102. Because the bands in question were allocated regionally on a *PRIMARY* basis in Europe by the ERC (99)23 Decision several years ago, *and that decision imposed both DFS and TPC requirements*, a significant body of work on radio conformance testing has already been done under the auspices of ETSI, with participation by both industry members and regulators.

103. This work, embodied in ETSI EN 301 893 V1.2.2 (2003-06), which is, in our opinion quite complete and mature (the version listed is expected to be approved as of August 1, 2003 and published by August 15, 2003), will be input to the 5 GHz Project Team as a baseline starting point, with the expectation that this will speed the process and, hopefully, result in common testing requirements between the U.S. and European administrations.

104. Therefore, we strongly recommend that detailed issues relating to test procedures be addressed in that venue and input to the FCC's public comment process when completed.

COMMENTS ON TRANSITION PERIODS

105. In the NPRM, the Commission proposes transition periods for both the 5250-5350 and 5470-5725 MHz bands to allow a reasonable opportunity for manufacturers to complete design, implementation, and certification of new equipment that will comply with the requirements for DFS and TPC functionality.[35]

106. Since the band 5470-5725 MHz is a "new" spectrum for wireless access systems, including RLANs, in the U.S., the proposal that the rules therefore would take effect on the effective date of the new rules seems entirely reasonable and appropriate.

107. However, the transition periods proposed for the 5250-5350 MHz band, where equipment is currently authorized and shipping under the current rules, which do not require DFS or TPC functionality, raise some potentially serious issues.

108. Specifically, the proposal that *" … the DFS requirement for the 5.250-5.350 GHz band [become?] effective for U-NII equipment that is certified after one year from the date of publication of the Report and Order in this proceeding in the Federal Register*."[36] may present an insurmountable hurdle for manufacturers, due to the fact that we believe that the full implementation of detailed test procedures may potentially lag behind the Report and Order.

109. If this scenario were to come to pass, the instant proposal would result in a period where manufacturers would be unable to obtain new equipment certifications.

110. Therefore, we would recommend a transition period keyed to the availability of Commission-approved test procedures, rather than the publication of the Report and Order in the Federal Register.

111. Likewise, the proposal for a two year period, during which manufacturers would be permitted to ship previously certified products,[37] should, in our opinion, also be keyed to the availability of Commission-approved test procedures, rather than the publication of the Report and Order in the Federal Register.

112. While the proposed two year period allows an additional year for shipping previously certified products, compared to the one year period after which new certifications would require compliance with the new rules, that two years may not be fully available due the lag in certification of new products, as alluded to above (at 108).

---

35 *See* the NPRM, at 26.

36 *See* the NPRM, at 26.

37 *Id*.

113. Finally, we note the statement "*We believe that most affected products will be redesigned within this three-year time frame and that compliance with this proposal would not cause an unreasonable burden on industry*." in the NPRM,[38] and find it confusing, in that we don't understand what is meant by a "three-year time frame." We would request that the Commission clarify this issue.

114. Therefore, we respectfully request that the Commission carefully consider the timing of transition periods for both new equipment certifications and sales of previously certified equipment in light of these concerns.

FREQUENCY ALLOCATION/LICENSING BY RULE VS. OPERATION UNDER PART 15 WITH "LESS THAN SECONDARY" REGULATORY STATUS

115. As mentioned earlier in these Comments, IEEE 802 has serious concerns about the future impact on both industry and users of maintaining wireless access systems, including RLANs, in a "*less than Secondary*" regulatory status, rather than making an actual frequency allocation for such devices in the 5150-5350 and 5470-5725 MHz bands and treating such systems as "Licensed by Rule." (Clearly, for these types of devices, individual licensing is totally impractical.)

116. Wireless access systems, including RLANs – particularly those built in compliance with the relevant members of the IEEE 802 family of standards – have become exceptionally important to society and the U.S. economy – to the point that we believe that they deserve the same level of regulatory status domestically as they will enjoy in other parts of the world as a result of the adoption of a global, PRIMARY allocation to the Mobile service in the 5150-5350 and 5470-5725 MHz bands, "*for the for the implementation of WAS including RLANs as described in Recommendation ITU-R M.1450*."[39]

117. Such systems are currently, and will increasingly be, in daily use in mission-critical applications in enterprise networks throughout business, industry, healthcare systems, educational institutions, public safety, and homeland security, as well as in the fast-growing home network sector of the market.

118. The fact of the matter is that these systems are the only means available to the user community that can deliver the combination of mobility and high data rates that their uses require.

---

[38] *Id.*

[39] See Resolves 1, Resolution COM5.16 (WRC-03)

119. While RLAN sales alone are projected to reach $5-6 billion dollars by the year 2005 or 2006 (depending on which analyst's data you have the most confidence in), the economic benefits to society through increased productivity, mobility, and the low cost of installation of such systems simply dwarfs the revenue that the industry generates through the sale of the equipment itself.

120. Clearly, under the ITU Radio Regulations, as modified by WRC-03 to make the allocation, and any reasonable FCC rules that would be adopted, wireless access systems, including RLANs, are obligated to protect, and may not claim protection from interference from incumbent users such as critical government radars. Industry has never disputed this reality.

121. However, we believe that it is an ***entirely*** different matter to leave such an important economic driver, *and the services it provides to literally millions of users in the U.S.*, vulnerable to interference from, and recurrent challenges to its fundamental right to operate, because of alleged interference to, a *Secondary* service such as the Amateur Radio Service, particularly in light of the preponderance of evidence before the Commission that amateur use of the shared band is vanishing small.

122. We are also perplexed by inconsistency of the Commission's proposal to keep these devices in "less than Secondary" regulatory status with respect to the United States' international policy, in light of the fact that the United States' position at WRC-03 was one of aggressively active support for the adoption of a global, PRIMARY allocation in the ITU Radio Regulations for these devices.

123. Therefore, we respectfully request that the Commission thoughtfully and seriously reconsider this aspect of its proposal in this Proceeding and make a PRIMARY allocation to the Mobile service in the domestic table of frequency allocations - dedicated for use by wireless access systems, including RLANs - in conformity with the position that the United States advocated to the global community at WRC-03.

Respectfully submitted,

/s/
Paul Nikolich
Chair, IEEE 802
18 Bishops Lane
Lynnfield, MA 01940
(857) 205-0050
p.nikolich@ieee.org

/s/
Carl R. Stevenson
Chair, IEEE 802.18 Radio Regulatory TAG
4991 Shimerville Road
Emmaus, PA 18049
(610) 965-8799
carl.stevenson@ieee.org