

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

In the Matter of	)	
Revisions of Part 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

**COMMENTS OF CISCO SYSTEMS, INC.**

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## SUMMARY

Cisco Systems, Inc., (“Cisco”) strongly supports the efforts of the Federal Communications Commission (“the Commission”) to facilitate the expansion of wireless broadband services by making additional 5 GHz spectrum available for Unlicensed National Information Infrastructure (“U-NII”) devices. Cisco believes that the Commission’s proposals will further the growth of wireless broadband networks – creating numerous benefits for businesses, educational institutions, governments, and individuals. Cisco also supports the Commission’s other proposals to harmonize domestic spectrum allocations with international allocations in the 5 GHz band.

Similarly, Cisco supports the Commission’s proposal to require U-NII devices to include Dynamic Frequency Selection (“DFS”) and Transmit Power Control (“TPC”) so that they can share 5 GHz frequencies with radiolocation and other services. However, the Commission must be careful not to limit the ability of manufacturers to optimize spectrum sharing through technological innovation. Specifically, Cisco believes it is premature for the Commission to consider codifying additional parameters to ensure that DFS works reliably. Such technical details would be best addressed – if at all – only after further testing and development. Cisco also believes that the codification of algorithms and parameters for TPC implementation would be unnecessary and would hamper needed design flexibility.

Cisco supports the Commission’s proposal to create a transition period so that U-NII devices built for the existing 5.250-5.350 GHz band will also incorporate DFS capabilities. But given the challenges involved in developing appropriate compliance testing procedures, the transition period proposed by the Commission is too short.

Indeed, it makes most sense for the end of the transition to be tied to the final acceptance of testing procedures.

Finally, while Cisco is generally supportive of the Commission's proposals to export technical parameters from elsewhere in the 5GHz band to the new allocations, rules that add to manufacturing costs without providing a corresponding benefit – such as the “integral” antenna requirement of Part 15.407(d) and the unique connector requirement under Part 15.203 – should not be imposed on the new allocation. Instead, the Commission should take this opportunity to eliminate those rules.

The bottom line is that Cisco believes the Commission's proposals are generally on target. If adopted, they will foster the further expansion of wireless broadband networks increasing connectivity, creating new services, and fostering competition.

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**COMMENTS OF CISCO SYSTEMS, INC.**

Cisco Systems, Inc., (“Cisco”) strongly supports the proposal in this Notice of Proposed Rulemaking (NPRM) to make additional 5 GHz spectrum available for unlicensed National Information Infrastructure (“U-NII”) devices, including Radio Local Area Networks (“RLANs”). If adopted, this proposal – like the Commission’s initiatives to harmonize Part 15 rules with advances in technology – will play a critical role in the continued success of unlicensed<sup>1</sup> broadband networks.

**Background**

Cisco is a worldwide leader in networking solutions for the Internet and a leading manufacturer of equipment for “unlicensed” wireless services, including devices that operate in the 5 GHz U-NII bands. Cisco also participated in the technical discussions with the government that helped develop the U.S. position on 5 GHz matters for the recent International Telecommunications Union World Radiocommunication Conference (“WRC-03”).

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<sup>1</sup> Cisco believes that, as a legal matter, the use of bands by transmitters that do not require individual authorizations is licensed by rule rather than “unlicensed.” However, for the sake of convention, the term “unlicensed” will be used in these comments.

In its comments to the Commission’s Spectrum Policy Task Force, Cisco encouraged the Commission to provide additional spectrum suitable for unlicensed, low-power devices to deliver wireless broadband services.<sup>2</sup> It also urged the Commission to optimize the use of spectrum set aside for unlicensed broadband wireless applications. Cisco thus recommended that the Commission adopt rules in spectrum identified for “unlicensed” broadband wireless services that ensure an environment where advanced spectrum sharing technology is a requirement – thus diminishing long-term risks (due to interference) to the growth of “unlicensed” broadband networks. Finally, Cisco has advised the Commission to harmonize domestic spectrum allocations with international allocations – when it makes sense to do so. The key proposals in this NPRM accomplish all of these goals and have Cisco’s full support.

### **Discussion**

Cisco not only supports the Commission’s proposal to permit U-NII devices to use the 5.470-5.725 GHz band but also supports – with a few minor caveats and clarifications – the Commission’s proposed revisions to its 5 GHz U-NII rules. Cisco urges the Commission to adopt expeditiously the appropriate revisions to its rules.

#### **I. Proposed Changes to the Table of Frequency Allocations**

Cisco fully supports the Commission’s proposal to amend the Table of Frequency Allocations consistent with 5 GHz allocation changes adopted at WRC-03.<sup>3</sup> Specifically,

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<sup>2</sup> See Comments of Cisco Systems, Inc., (filed July 8, 2002) responding to the Commission’s *Spectrum Policy Task Force* in ET Docket No. 02-135 (rel. June 6, 2002).

<sup>3</sup> Among other changes to the International Table of Frequency Allocations, WRC-03 adopted primary Mobile allocations (“for wireless access systems, including RLANs”) in the 5.150-5.250 GHz, 5.250-5.350 GHz and 5.470-5.725 GHz bands. See Final Acts of the World Radiocommunication Conference (Geneva, 2003).

the Commission should adopt its proposal to allow U-NII devices to operate in the 5.470-5.725 GHz band. Cisco also supports the Commission's allocation proposal for the radiolocation, earth exploration-satellite and space research services.<sup>4</sup>

Adding the 5.470-5.725 GHz band to the 5 GHz frequencies already available for use by U-NII devices will help address the need for additional spectrum to support the phenomenal growth in the market for wireless broadband networking technology. Further, adding this additional 255 MHz to the existing U-NII spectrum will better enable U-NII devices to successfully co-exist with the Radiolocation, Earth Exploration-Satellite and Space Research services that will also use 5 GHz frequencies. U.S. industry and government engineers – as well as the international community – spent months developing the technical solutions that will now permit a multitude of important services to share 5 GHz frequency bands globally. Those solutions all contemplate the availability of this additional spectrum.

Cisco must, however, sound one cautionary note. Though not really germane to this allocation proposal, the Commission has noted in passing that the 100 MHz set aside for U-NII devices in the upper portion of the 5 GHz band (5.725 – 5.825 GHz) is sufficient for operation of higher power Point to Point or Multipoint systems. But, for systems employing 802.11a (“COFDM”) modulation, this higher power 100 MHz band only provides four non-overlapping channels and is unlikely to be adequate for Wireless Metropolitan Area Networks (“MANs”) or broadband access in all rural areas. Therefore, Cisco believes the Commission should in this or a future rulemaking consider adding the 5.825 – 5.925 GHz band to the high power U-NII band. The lower 25 MHz of

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<sup>4</sup> See *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*, 18 FCC Rcd. 11581 at ¶13 (rel. June 4, 2003) (“NPRM”).

this band is already being used by Part 15.247 high power spread spectrum point-to-point systems, and Cisco believes that the use of mitigation techniques can also protect existing services in this band from interference from U-NII devices.

## **II. Proposed Changes to the U-NII Rules**

In the months before WRC-03, government and private sector engineers worked together to develop technical solutions that would allow U-NII devices to share 5 GHz frequencies with radiolocation and other services. The modeling they performed showed that there were two key solutions to the sharing problem: Dynamic Frequency Selection (“DFS”) and Transmit Power Control (“TPC”).

### **A. Dynamic Frequency Selection**

Cisco supports the Commission’s proposal to require the use of DFS in the 5.250-5.350 GHz and 5.470-5.725 GHz bands.<sup>5</sup> Cisco also supports the DFS detection threshold levels and technical parameters as presented in the proposed rule appendix to the NPRM.<sup>6</sup> These levels and parameters are the same as those adopted as an ITU Recommendation<sup>7</sup> and, as a result, are likely to be adopted globally. It only makes sense for these thresholds to be adopted in the U.S.

The Commission has also proposed that, where multiple devices are under the direction of a central controller, only the central controller be required to have DFS.<sup>8</sup> Cisco fully supports this proposal. Since in many wireless network architectures remote

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<sup>5</sup> See NPRM at ¶20.

<sup>6</sup> See *id.* at ¶24.

<sup>7</sup> See International Telecommunication Union, *Draft new Recommendation ITU-R M. [8A-9B/RLAN-DFS{Doc. 8/152}]-Dynamic frequency selection in wireless access systems including radio local area networks for the purpose of protecting the radiodetermination service in the 5 GHz band*, M. 8/1025, June 2003, available at <http://www.itu.int/rec/recommendation.asp?type=folder&lang=e&parent=R-REC-M.1652>.

<sup>8</sup> See NPRM at ¶22.

devices (such as a laptop) are “associated” under the control of a “central controller” (*i.e.*, an access point), requiring DFS in both the access point and its associated remotes would be redundant. Such redundancy increases both the cost and complexity of the remote units. It also increases the likelihood of network disruption because it increases the false alarm rate for radar detection.

The Commission also noted that DFS threshold levels adopted by ITU are keyed to a 1 MHz bandwidth and, therefore, seeks comment on whether a bandwidth correction factor is necessary for U-NII devices with a receive bandwidth less than 1 MHz.<sup>9</sup> Cisco is unaware of any attempts to model the interference potential of systems using less than a 1 MHz channel, and thinks the Commission should be hesitant to adopt a correction factor in the absence of a widely-vetted analysis.

In addition, the Commission notes that the ability of DFS to reliably detect a radar’s presence depends on the pulse characteristics of the radar. Therefore, it seeks comment on the minimum number of radar pulses and observation time needed for reliable detection of radar signals.<sup>10</sup> The proposed DFS thresholds for a 1-microsecond pulse are so sensitive that a single radar pulse that is not masked by other interference and that exceeds the threshold will be detected by RLANs with very high probability. This is because, like a RLAN packet, a radar pulse is characterized by a power rise at its start, and it is this property that is exploited in a RLAN to maximize sensitivity to incoming packets. In normal operation, a RLAN receiver is on hair-trigger alert to detect packets with high probability at incoming power levels as low as –82 dBm. The probability of detection increases strongly at greater incoming power levels and is very high at the

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<sup>9</sup> See *id.* at ¶21.

<sup>10</sup> See *id.* at ¶23.

proposed DFS threshold levels, which are some 20 dB above the –82 dBm level.

Masking effects, of course, can complicate further analysis. But based on work already completed, Cisco believes that any further refinement of these parameters is best done in the course of developing DFS compliance testing procedures. Codifying these parameters before the work on compliance testing procedures is completed could lead to rules that are overly burdensome or that limit the flexibility for DFS implementations in particular devices. Instead, Cisco recommends that these parameters – once developed – be written into compliance test procedures.

#### B. Transmit Power Control.

In accordance with the outcome of WRC-03, the Commission proposes a requirement that devices operating in the 5.470-5.725 GHz band employ TPC to reduce the potential for impact on EESS and SRS operations.<sup>11</sup> Cisco supports the imposition of a TPC requirement. However, the Commission’s proposal requires additional clarification.

The Commission proposes in the *NPRM* that, “U-NII devices employ a TPC mechanism that will ensure a 6 dB drop in power when triggered.”<sup>12</sup> The proposed *rule*, however, says simply that a TPC mechanism is required. In a separate sentence the proposed rule states: “The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.”<sup>13</sup> As it stands, the text and the proposed rule are unclear.

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<sup>11</sup> See *NPRM* at ¶24.

<sup>12</sup> *Id.*

<sup>13</sup> *NPRM*, Appendix B Proposed Rules, at (h)(1).

The development of a U.S. WRC-03 position on DFS trigger levels included consideration of TPC when modeling how RLAN systems might affect radiolocation services. Noting that TPC was already planned for most RLAN systems,<sup>14</sup> the DFS modeling assumed an average 3 dB drop in power due to TPC (referenced to a maximum EIRP of 1 watt). In other words, in the course of normal operation (with TPC), and without any non-system trigger, radar systems would see at least an average 3 dB drop in RLAN energy compared to an environment where RLANs constantly operate at maximum EIRP. Therefore, the Commission’s goal should be to create an RLAN environment that, when “viewed” by radar, should appear – on average – to be 3 dB below 1-watt EIRP.<sup>15</sup>

There are a variety of ways to accomplish this. One is to require, as reflected in the rule appendix, TPC for every device authorized. This approach would certainly result in a 3 dB drop or more in the “RLAN radiated power” environment. However, another – and better – approach would be to require the requisite reduction in power due to TPC only in systems with an EIRP of 500 mW or more. The latter approach is more flexible and could reduce unnecessary circuitry and cost in lower power devices. This, of course, would result in lower consumer costs and faster adoption of wireless broadband devices. Consequently, Cisco proposes that the Commission clarify its proposal and rule to permit devices certified for use in systems with an EIRP of 500 mW or less to forego TPC.

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<sup>14</sup> Manufacturers have every incentive to employ TPC to limit power to the minimum necessary to maintain a high-quality, reliable broadband link. Using more power than needed creates power consumption problems, raises system self-interference issues, and restricts the ability to optimize frequency reuse.

<sup>15</sup> Though the pre-WRC U.S. technical investigations were primarily concerned with protecting radars, it is widely recognized that a reduction in RLAN energy attributable to TPC also benefits the space services.

Cisco also urges the Commission *not* to specify specific algorithms and parameters for transmit power control mechanisms. Manufacturers have great incentives to employ TPC in their broadband systems and are already doing so. They have already developed a variety of algorithms and architectures to implement TPC. It would be both unnecessary and unwise for the Commission to codify specific TPC parameters.

C. Test Procedures.

Even now, NTIA is working with private sector and government engineers in an open and informal process to develop and propose compliance testing procedures that will ensure that future U-NII devices meet the Commission's proposed DFS requirements.<sup>16</sup> Cisco hopes the test procedures resulting from this process will allow manufacturers to demonstrate that their devices are capable of detecting radar signals at the appropriate threshold as codified in the Commission's future rules.

However, it is critical that test procedures not be more burdensome than necessary to protect radiolocation. If they are, the burden will fall not only on the manufacturers who will be forced to spend unnecessary time and money on testing, but also on consumers -- since higher production and compliance certification costs are often translated into higher consumer costs.

It is premature to propose specific test procedures. But the Commission must carefully review, in the context of eventual FCC compliance procedure rules, any bench

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<sup>16</sup> It is expected the government-industry group will produce a DFS test plan and schedule and that NTIA will submit this material into the record of this proceeding.

testing proposals that may be proposed, and should also draw upon the results of planned field-testing before adopting final rules on compliance test procedures.<sup>17</sup>

D. Transition Period for U-NII Equipment Operating in the 5.250-5.350 GHz Band

The Commission proposes that the DFS requirements for 5.250-5.350 GHz U-NII equipment become effective for devices submitted for certification beginning one year from the date of the Federal Register publication of the Report and Order in this proceeding. Further, the Commission proposes that all 5.250-5.350 GHz U-NII devices that are imported or shipped in interstate commerce comply with DFS requirements two years after the above-referenced date.<sup>18</sup>

Cisco believes the Commission should lengthen the transition period, both because suitable compliance testing procedures have not yet been designed, and because pre-WRC product designs are just entering distribution. Moreover, and critically, lengthening the transition period will not have an adverse impact on radiolocation or other services.

The proposed requirement for U-NII devices to implement DFS to protect other services is a new one. As noted, studies to develop appropriate compliance testing procedures to ensure DFS capabilities in U-NII devices are just beginning. To date, such studies have revealed little more than that the process to derive sensible, efficient test procedures will be complicated and time-consuming. It is anticipated, for example, that field trials will not commence until mid-2004 and that subsequent analysis of the trial results and feedback into compliance recommendations would consume much of the

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<sup>17</sup> Participants in the NTIA process are developing bench testing procedures as well as planning actual field testing to determine what tests are really needed to confirm devices' compliance with proposed DFS requirements.

<sup>18</sup> See *NPRM* at ¶26.

remainder of 2004. It would make no sense at this time, therefore, to set a hard DFS compliance date with so much uncertainty surrounding the test procedures.

Moreover, as the Commission observes in the NPRM, U-NII devices with no DFS capability are already deployed and operating.<sup>19</sup> In addition, many manufacturers have non-DFS products in the pipeline that were designed and slated for production before DFS for protecting radiolocation became a key consideration.

In light of these factors, Cisco believes that a more prudent approach would be to key the transition periods to the availability of appropriate compliance testing procedures. While this will delay the implementation of DFS beyond the dates proposed in the NPRM, it will pose no danger to radiolocation or other services. The interference risk to other services from U-NII devices comes, of course, from ubiquitously deployed devices – – not from a relative handful. Postponing implementation of the DFS requirement for the relatively few devices that will be sold in the next several years will not cause injury to other services and will allow time for development of appropriate compliance testing procedures.

#### E. Technical Requirements for the 5 GHz U-NII Bands

Cisco also supports, with just two exceptions, the Commission's proposal to apply other technical parameters in the 5.250-5.350 GHz band to the 5.470-5.725 GHz band. This proposal is consistent with the range of technical parameters adopted for this band by WRC-03.

A key to the success of 2.4 GHz broadband wireless systems has been their reasonable cost for consumers, educational institutions, governments, and businesses.

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<sup>19</sup> *See id.*

Cost will, of course, also play an important role in the success or failure of 5 GHz broadband wireless systems. There are, however, FCC regulations now applicable to 5 GHz devices that add to manufacturing costs without providing a corresponding benefit. The Commission should not import these rules into the new U-NII bands. It would make more sense to take this opportunity to eliminate these rules from the current bands.

One such regulation is the requirement in Part 15.407(d), of an “integral” antenna for a system operating in the 5.150-5.250 GHz band. There is a general industry consensus<sup>20</sup> that the restrictions in this band on antenna gain and transmit power – along with the prohibition on outdoor use – are sufficient to provide protection to MSS. This general consensus is correct. The integral antenna requirement, in practice, does not provide any additional protection to these services. It should now be eliminated rather than imported into the new U-NII band.

The requirement of a unique connector under Part 15.203 should also be eliminated for U-NII systems rather than imported into the new band. In the age of e-commerce when once difficult-to-find items may be quickly located and easily bought, the need constantly to upgrade a connector to keep it truly “unique” – or to restrict its re-engineering – is both cost prohibitive and impractical. Under the Commission’s rules, the requirement that certified antennas only be used with the system is mandatory whether there is a standard or non-standard connector.<sup>21</sup> That requirement, standing alone, provides sufficient protection against harmful interference.

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<sup>20</sup> See Comments of CISCO and ITI (filed Oct. 18, 2002) responding to FCC 02-266, *The Commission Seeks Public Comment in the 2000 Biennial Review of Telecommunications Regulations Within the Purview of the Office of Engineering and Technology* (rel. Sept. 26, 2002).

<sup>21</sup> See 47 C.F.R. §§ 15.203 and 15.204.

## Conclusion

It is no secret that, in the United States, a wireless broadband revolution is upon us. This revolution has been spawned, in large part, by “unlicensed” broadband devices that can be deployed easily and economically by both businesses and consumers. But this revolution is spreading beyond the United States and it is spreading fast. With this NPRM, the Commission is taking a positive step towards facilitating deployment of 5 GHz wireless broadband networking not only in the United States, but also globally. If the Commission’s primary proposals are adopted, it will have created a domestic environment at 5 GHz that aligns almost perfectly with the international environment. For obvious reasons, this will provide enormous benefits to U.S. industry, to U.S. consumers and to the global broadband environment.

Respectfully submitted,

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