

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

*In the Matter of*

Commission Seeks Public Comment on  
Spectrum Policy Task Force Report

ET Docket No. 02-135

**COMMENTS OF MICROSOFT CORPORATION**

**MICROSOFT CORPORATION**

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January 27, 2003

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## SUMMARY

Microsoft is a worldwide leader in developing software, applications, and Internet technologies. Its software and applications are increasingly designed to run over broadband “pipes.” Its business therefore depends on bandwidth, because its customers depend on bandwidth.

Microsoft believes that robust, reasonably priced broadband networks are essential to the development of new software, applications and services that improve productivity, enrich personal lives, and deliver benefits to every sector of society and the economy. And Microsoft believes that innovative wireless technologies operating in “unlicensed” bands can play a critical role in bringing broadband services to more Americans than previously thought possible – if the regulatory environment allows it.

For those who believe in the great potential of unlicensed data networks, the Spectrum Policy Task Force Report is good news. The Report acknowledges the incredible growth and innovation in the unlicensed bands, and recognizes the enormous potential of the unlicensed approach for more ubiquitous broadband networks. It calls for flexibility in spectrum regulation and expanded use of the unlicensed approach. And it endorses spectrum etiquettes, smart hardware, increased transmit power in rural areas, and better access to spectrum for experimentation – all of which will increase the likelihood that unlicensed wireless devices will deliver on their potential.

There are, however, several modifications of the Report’s suggestions that, if adopted by the Commission, could increase even further the likelihood that unlicensed devices will become a major element of this nation’s network infrastructure.

- ***Make Primary Allocations for Unlicensed Devices in the Lower Bands.*** Unlicensed devices are, as the Report suggests, perfect for opportunistic and “underlay” uses of individually licensed spectrum. But some spectrum should be allocated on a *primary* basis for unlicensed uses – particularly in the lower bands. Users of such spectrum should be protected from interference caused by out-of-band devices and later-licensed services in the same way that other primary services are. This would provide the perfect medium for the rapid rise of unlicensed last-mile networks.
- ***Optimize Some Unlicensed Spectrum for Reliable Data Networking.*** The current unlicensed bands are optimized for experimentation, and have been an astounding success story. It would now be enormously beneficial to the public for some unlicensed bands – whether underlay, opportunistic, or primary – to be optimized for reliable data networking through the use of spectrum etiquettes and other means to limit unnecessary interference.
- ***Do Not Select Band Managers for the Unlicensed Bands.*** The Commission’s “band manager” proposal is inappropriate for unlicensed bands. By giving band managers control over access to unlicensed bands, the Commission would undermine the very characteristics that make the unlicensed approach attractive in the first place.

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As a company that believes wireless technologies – particularly innovative technologies operating in “unlicensed” bands<sup>1</sup> – will play a critical role in bringing broadband services to Americans, Microsoft believes that the Spectrum Policy Task Force Report is good news.<sup>2</sup> It offers several suggestions that, if adopted by the Commission, could increase even further the likelihood that unlicensed devices reach their full potential.

**I. THE GROWTH OF UNLICENSED BROADBAND NETWORKS CONTINUES TO BE THE SUCCESS STORY OF THE COMMUNICATIONS INDUSTRY**

Last summer, Microsoft (and many others) reported on the “astonishing array of advanced communications equipment” being deployed in the unlicensed bands.<sup>3</sup> And, in the few months since the Commission last sought comment on these issues, unlicensed broadband has continued to spread:

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<sup>1</sup> As a legal matter, the use of these bands is licensed by rule rather than by individual license – the use of the bands is not really “unlicensed.”

<sup>2</sup> *Spectrum Policy Task Force*, Report, ET Dkt. No. 02-135 (Nov. 2002) (“*Report*”).

<sup>3</sup> See Letter from Craig J. Mundie to Edward Thomas at 1 (filed July 8, 2002) (“*Microsoft Letter*”); see also, e.g., Comments of Cisco Systems, Inc. at 3-6 (filed July 8, 2002); Comments of Motorola at 13-16 (filed July 8, 2002); Comments of Kevin Werbach at 4-5 (filed July 8, 2002).

- A Nepalese Sherpa is deploying Wi-Fi and satellite technology to provide high-speed connectivity on Mount Everest, where he plans to build the world's highest Internet café.<sup>4</sup>
- A company called Prairie iNet is using unlicensed wireless devices attached to the side of grain silos to operate as a wireless ISP in 150 communities in the Midwest, with 5000 sites. Three-fourths of its customers are residential.<sup>5</sup>
- A neighborhood bordering Stanford University has set up the "College Terrace Internet Cooperative," a free, broadband Internet access network used by students, academics and homeowners.<sup>6</sup>
- Dartmouth College has created a campus-wide wireless network. By installing over 500 antennas, administrators have covered over 200 acres of the campus in a "virtual Internet cloud."<sup>7</sup>
- The New Media Institute at the University of Georgia has established a "wireless cloud" over what will eventually be 24 blocks of downtown Athens.<sup>8</sup>

Unlicensed broadband networks are no longer something promised by technofuturists and "broadband cowboys." They are being deployed now. And some of these deployments explain the excitement being generated about unlicensed spectrum and unlicensed operations. They show that unlicensed spectrum and devices, provided the right regulatory environment, may be ideally suited for the creation of ubiquitous broadband networks.<sup>9</sup>

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<sup>4</sup> See Nancy Gohring, *Because It's There: Putting Everest Online*, N.Y. Times, Jan. 23, 2003, at E1.

<sup>5</sup> See Fara Warner, *Fast Farmers: Prairie iNet is Hooking Up America's Heartland*, Fast Company, Apr. 2001, at 54.

<sup>6</sup> See Mike Cassidy, *Wireless Vision Brings P.A. Neighborhood Together*, S.J. Merc. News, Dec. 24, 2002, at 1C.

<sup>7</sup> See Josh McHugh, *Unplugged U.*, Wired Magazine, Oct. 2002, at 120.

<sup>8</sup> See Marsha Walton, *Wi-Fi: New Ways to Connect On Campus*, CNN.Com, Dec. 16, 2002, available at <http://europe.cnn.com/2002/TECH/science/12/13/coolsc.athenswireless/index.html>.

<sup>9</sup> See, e.g., Nicholas Negroponte, *Being Wireless*, Wired Magazine, Oct. 2002, at 118 ("Everything you assumed about telecommunications is about to change. Large wired and wireless telephone companies will be replaced by micro-operators, millions of which can be woven into a global fabric of broadband connectivity.").

Clearly, unlicensed spectrum has many advantages for broadband applications. All, from the smallest entrepreneurs to the largest corporations, can easily access it. It encourages innovative (and, ultimately, more efficient) use of spectrum. And because unlicensed bands are open to anyone who buys a compliant device and turns it on, a significant proportion of the capital invested in the creation of unlicensed networks may come from individuals and businesses, not from network operators. This means that there is no need to rely on the hope that “if you build it, they will come” – a hope that too few still share. Instead, with proper regulatory tending, unlicensed networks can grow organically, fed by new demand and marginal supply. They may well represent the best hope for a third broadband pipe to the home (and, indeed, for a *first* broadband pipe in rural and underserved areas).

## **II. THE REPORT’S PROPOSALS, IF IMPLEMENTED, WOULD HELP BRING UNLICENSED BROADBAND NETWORKS TO MORE AMERICANS**

The Task Force Report is a positive development for those convinced that unlicensed spectrum is an important part of America’s broadband future. It describes a “commons” approach (corresponding with the Commission’s existing unlicensed rules) as one of only two generally acceptable regulatory regimes.<sup>10</sup> It also cites the benefits of allocating additional spectrum to unlicensed uses,<sup>11</sup> and it acknowledges the potential of unlicensed spectrum for broadband last-mile networks.<sup>12</sup> And crucially, it addresses several specific issues that will be critical to the development of unlicensed broadband.

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<sup>10</sup> See Report at 35 (recommending that the Commission “base its spectrum policy on a balance” of “exclusive use,” and “commons” regulatory models, with only limited use of “command and control” regulation).

<sup>11</sup> See Report at 54-55.

<sup>12</sup> See Report at 13.

## A. Spectrum Etiquettes

The Report generally endorses the use of spectrum etiquettes and protocols to minimize interference in unlicensed bands. Indeed, it defines the “commons” approach as one “with usage rights that are *governed by technical standards or etiquettes* but with no right to protection from interference.”<sup>13</sup> As discussed below, Microsoft believes that protection from out-of-band and later licensed in-band services would help assure reliable service and network growth in some unlicensed bands. But the Task Force had it right when it recognized the centrality of etiquettes to the success of the unlicensed model in the creation of robust data networks.

## B. Smart Hardware

The Task Force seeks to encourage advanced (or “smart”) hardware that can avoid interference.<sup>14</sup> These include:

- ***Smarter Antennas.*** Already, directional antennas can extend the range and capacity of unlicensed broadband devices – normally service to several dozen people within a few hundred feet of a transmitter – by making a single antenna accessible to a thousand or more people at distances of up to four miles.<sup>15</sup> The Report proposes encouraging smarter antennas to “enhance the uniformity of transmitted signal strength levels through a service area.”<sup>16</sup>
- ***Smarter Receivers.*** The Report proposes to promote “smart receivers” by, for example, promulgating performance standards in certain bands and for certain services.<sup>17</sup>

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<sup>13</sup> *Report* at 35 (emphasis added); *see also id.* at 40 (arguing that future interference problems in the unlicensed bands “can be overcome to some extent through . . . power and emission limits, and sharing etiquettes”).

<sup>14</sup> *See, e.g., Report* at 32.

<sup>15</sup> *See* John Markoff, *Businesses, Big and Small, Bet on Wireless Internet Access*, N.Y. Times, Nov. 18, 2002, at C1.

<sup>16</sup> *Report* at 32.

<sup>17</sup> *See Report* at 5 (“The Commission should consider applying receiver performance requirements for some bands and services, either through incentives, regulatory mandates, or some combination of incentives and mandates.”); *id.* at 31 (describing receiver performance standards in more detail).

- **Smarter Transmitters.** It also proposes to promote “smart transmitters” by increasing the use of automated power and frequency control – including, in the longer term, sensory control mechanisms in conjunction with the “interference temperature” metric.<sup>18</sup>

Smarter hardware is key to unlicensed broadband deployment. Improvements in antenna technologies, for example, will lower unlicensed broadband deployment costs, and expand its reach. Moreover, smart receiver and transmitter development will go hand in hand with the development of improved spectrum etiquettes, which Microsoft believes will be required for future unlicensed data networks. Microsoft thus supports the Report’s recommendations in this area.

### C. Increased Power in Rural and Underserved Areas

The Task Force states that unlicensed providers “should be permitted to increase their power limits in rural areas.”<sup>19</sup> Microsoft agrees that power limits need not be the same in all geographic areas. Indeed, depending on the interference environment, flexible power limits may be appropriate in underserved urban areas, as well as in rural areas. Such flexibility may also be more important in unlicensed bands than in licensed bands.<sup>20</sup> At current power levels, it is still difficult for unlicensed wireless services to reach many areas – even with directional antennas. Wherever an unencumbered interference environment exists, increasing permissible unlicensed power levels is an easy way to maximize broadband deployment. One way to do this is simply to allow different power levels in different geographic areas. A more nuanced approach might take the Report’s concept of “interference temperature” and define “rural” and

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<sup>18</sup> Report at 32.

<sup>19</sup> Report at 55.

<sup>20</sup> See Report at 17, 59 (discussion of increased rural power limits for licensed services).

“underserved” by interference temperature rather than geography. In any case, the concept of non-uniform power levels is a good one that is likely to bring real benefit to rural America.

#### **D. Better Access to Experimental Spectrum**

The Report has two proposals that would make it easier to obtain access to spectrum for experimentation. First, it recommends a “new interface” among the FCC, NTIA, and Interdepartmental Radio Advisory Committee (“IRAC”) members – including a private sector “ombudsman” – to deal with experimental license applications in bands used by the government. Second, it urges the FCC and NTIA to identify and “pre-clear” some frequency-location-time combinations in the transfer bands with low risk of interference to federal systems.<sup>21</sup>

Experimentation has been and will continue to be crucial for wireless innovation. Microsoft urges the Commission to do everything in its power to make experimentation easier, and supports the Task Force’s suggestions to improve experimental licensing procedures. Moreover, even while it believes that some unlicensed bands ought to be optimized for reliable service through the use of spectrum etiquettes, it believes that other unlicensed bands ought to be optimized for experimentation through the imposition of fewer and less restrictive rules – as is the case today with the 2.4 GHz band.

### **III. THE COMMISSION CAN DO EVEN MORE TO ENCOURAGE THE GROWTH OF UNLICENSED BROADBAND NETWORKS**

The Task Force Report is a good start on improving the Commission’s already laudable approach to unlicensed spectrum. There are, however, areas where

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<sup>21</sup> See Report at 61, 68.

modifications to the report would do even more to allow unlicensed broadband to flourish.

**A. Make Primary Allocations for Unlicensed Devices in the Lower Bands**

Opportunistic use and underlay are important methods for providing additional spectrum for unlicensed devices – which, as they become ever more intelligent, are ideally suited to take advantage of temporarily used spectrum and “underlays.”<sup>22</sup> There are many potential uses for spectrum below an “interference temperature,” and Microsoft strongly agrees with the Task Force that this spectrum should “presumptively” be made available for unlicensed uses.<sup>23</sup>

But, as the Task Force itself acknowledges, the full potential of unlicensed wireless networks will not be realized through opportunistic use and underlay alone.<sup>24</sup> The Report recommends that the Commission “expand[] the use of both the exclusive use and commons models throughout the radio spectrum” and states that “it appears that additional spectrum is needed for unlicensed devices.”<sup>25</sup> These recommendations are consistent with Microsoft’s view. Microsoft believes – and it appears that the Spectrum Task Force agrees – that some spectrum should be allocated for the primary use of unlicensed devices.

Unfortunately, with respect to *where that spectrum should be located*, the Report is perhaps too timid. It suggests that new unlicensed spectrum should generally be found above 50 GHz, while “in the lower portion of the radio spectrum, particularly bands

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<sup>22</sup> See Report at 40 (discussing the “underlay” approach).

<sup>23</sup> *Id.*

<sup>24</sup> See Report at 54.

<sup>25</sup> Report at 37, 54.

below 5 GHz, the Commission should focus primarily, though not exclusively, on using the exclusive use model.”<sup>26</sup> Because only lower bands permit longer-range propagation, limiting primary unlicensed operation to the upper bands necessarily means fewer unlicensed broadband networks that are available for easy consumer access. Such an approach would needlessly curtail the very applications promising the greatest public benefits. Simply put, arbitrary limits on additional lower-band unlicensed spectrum would be unwise and unnecessary.

In addition, Microsoft believes the Commission could be bolder in thinking about the rules that apply to primary allocations for unlicensed services. Specifically, spectrum set aside for the primary use of unlicensed services should also incorporate some interference protection for those services. The very nature of unlicensed devices is that they do not receive interference protection *from each other*. Thus, it is routinely said that unlicensed devices are entitled to no interference protection whatsoever. That is true today, but it need not – and should not – always be true.

There is no reason why users of unlicensed devices in any band allocated primarily for the unlicensed services should not be entitled to reasonable protection from out-of-band interference, as well as from later-approved licensed services. Such protection would surely be helpful for unlicensed broadband networks, because it would affect the risk assessments conducted by those considering the use of unlicensed networks in these bands. One can reasonably assess the risk of interference from other unlicensed users – interference that unlicensed devices are engineered to avoid. One

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<sup>26</sup> *See Report* at 38-39. The Task Force does state, however, that “[t]his does not mean . . . that only higher band spectrum should be subject to a commons approach.” *Id.* at 40.

cannot, however, reasonably assess the risk of interference from a later-approved licensed service, or from an out-of-band device.

Certainly the concept of interference protection for unlicensed users is not novel. The 2003 World Radio Conference is considering making a primary allocation at 5 GHz for mobile devices including RLANs<sup>27</sup> – an allocation expected by all to be implemented through unlicensed networks. If such an allocation were made, unlicensed devices operating in the band would, under international rules, be entitled to protection from interference from other services, just as a traditionally licensed service would be.<sup>28</sup> Such an approach would be equally appropriate domestically.

#### **B. Optimize Some Unlicensed Bands for Reliable Data Networking**

Microsoft believes that some unlicensed spectrum – whether an underlay, opportunistic use, or a primary allocation – should be optimized for reliable data networking.<sup>29</sup> Optimizing some unlicensed spectrum for data networking will make it easier (and more cost effective) to develop networks reliable enough for widespread usage. This, in turn, will result in more widespread broadband deployment.

Optimizing some unlicensed spectrum for reliable data networking is easily accomplished through a regulatory regime that requires devices to be capable of two-way packet data communication and to observe media access rules that minimize interference, maximize spectrum efficiency, and ensure equitable access to all users. These media

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<sup>27</sup> See WRC-03 Agenda Item 1.5. Those devices operating pursuant to such a primary allocation would still be required to protect military users of the band.

<sup>28</sup> The Commission also considered providing interference protection to unlicensed devices at 5 GHz, but decided not to do so because at the time there was not sufficient evidence it was necessary. See *Amendment of the Commission's Rules to Provide for Operation of Unlicensed NII Devices in the 5 GHz Frequency Range*, 12 FCC Rcd. 1576, 1614 (1997).

<sup>29</sup> Just to be clear, Microsoft does not advocate changing the nature of the 2.4 GHz band where unlicensed devices and services have been so successful.

access rules need be no more than somewhat stricter interference rules and spectrum etiquettes than apply in the current unlicensed bands, which are optimized for experimentation, not reliable networking.<sup>30</sup> Microsoft thus strongly supports the Report's recognition that spectrum etiquettes have an important role to play in unlicensed bands.<sup>31</sup>

To be clear, Microsoft is not asking for a technology-specific allocation or technology-specific regulation. Rather, it advocates the same regime that currently exists in the 2.4 GHz band, but with spectrum etiquettes more appropriate to reliable data networking. Such an approach would, perhaps, limit pure experimentation in these “networking” bands – but there is nothing wrong with this. It is entirely appropriate for the Commission to optimize some unlicensed bands for reliable service and to optimize others for experimentation. The Commission has an array of regulatory “flavors” available to it with respect to unlicensed spectrum, and should not be afraid to use more than one flavor.

### **C. Do Not Select Band Managers for the Unlicensed Bands**

With no elaboration, the Task Force Report states that, “[f]or new unlicensed bands, access should be controlled by a new type of band manager or frequency coordinator selected by the FCC.”<sup>32</sup> This appears to be based on a Working Group

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<sup>30</sup> Such etiquettes are particularly important in the lower bands, where radio signals travel farther and unlicensed receivers will “detect” more signals than those operating at higher frequencies.

<sup>31</sup> *See Report* at 40 (“[I]f scarcity eventually does arise in particular spectrum bands in the future, then the commons model may need to evolve to address the problem. Because there is no price mechanism in the commons model to use as a tool for allocating scarce resources among competing users, there is always the risk that free access will eventually lead to interference and over-saturation, *i.e.*, the ‘tragedy of the commons.’ *These problems can be overcome to some extent through . . . power and emission limits, and sharing etiquettes.*”) (emphasis added).

<sup>32</sup> *Report* at 54.

proposal for the Commission to hold auctions for “band/protocol managers.”<sup>33</sup> Such entities would, among other things, “be given the authority to prescribe the protocols to be used by the unlicensed devices in the band and the ability to approve the manufacture and sale of all such devices for a specific period of time.”<sup>34</sup> In other words, the band manager would decide who gets access to the band and who does not. And it would charge prospective users for the right to use the spectrum.<sup>35</sup>

This is, essentially, a proposal to replace spectrum parks with walled communities. It is one of the Report’s few truly bad ideas. One of the principal benefits of unlicensed spectrum, and the major distinction between unlicensed spectrum and all other regulatory models, is that *the spectrum is available to all*.<sup>36</sup> The fact that anyone can use the spectrum simply by buying a compliant device – without getting anyone’s permission, and without paying anyone for the privilege – encourages incremental, efficient deployment decisions.<sup>37</sup> Under the band manager proposal, however, this would all change, and unlicensed spectrum would no longer be in any real sense “unlicensed.”

Certainly none of the justifications for band managers found in other contexts applies to unlicensed spectrum. For example, the Commission has said band managers “create incentives for efficient spectrum use” by theoretically allowing one entity – the

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<sup>33</sup> *Report of the Unlicensed Devices and Experimental Licenses Working Group*, FCC Spectrum Policy Task Force, at 17 (rel. Nov. 15, 2002) (“*Working Group Report*”).

<sup>34</sup> *Id.*

<sup>35</sup> *See id.*

<sup>36</sup> *See, e.g.*, Yochai Benkler, *Overcoming Agoraphobia: Building the Commons of the Digitally Networked Environment*, 11 Harv. J. L. & Tech 287, 338 (1998) (contrasting command and control and exclusive use approaches with unlicensed approach).

<sup>37</sup> *See, e.g.*, Kevin Werbach, *Open Spectrum: The New Wireless Paradigm*, New America Foundation, Spectrum Series Issue Brief #8 at 2 (Oct. 2002), available at <http://www.newamerica.net/index.cfm?sec=programs&pg=article&pubID=1002&T2=Article>.

band manager – to internalize the benefits of efficiency.<sup>38</sup> But, in the real world, *nothing* creates incentives for efficient spectrum better than well-devised unlicensed spectrum policies.<sup>39</sup> Whether the rules for an unlicensed spectrum band are designed to optimize experimentation or reliable service, all the evidence suggests that putting barriers between innovators and deployment can only slow both innovation and deployment. The Commission has also said that band managers allow spectrum users flexibility, promote a diverse user base, and allocate spectrum more dynamically than can the Commission.<sup>40</sup> These three justifications, however, simply make no sense in the unlicensed context, where (both under the current unlicensed rules and under more stringent etiquette rules), there are few constraints on who uses spectrum or how they do so.

A supposed attraction of the band manager approach, perhaps, is that it would get the Commission out of the business of setting interference rules. But this is one thing the Commission does well, and there is no reason to believe that private decision-making would be better than government decision-making. Nor would it, in fact, save the Commission much work. For opportunistic or underlay unlicensed spectrum, the Commission would have to set the interference rules, since an “underlay band manager” would have no incentive to protect licensed users. And setting interference rules for

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<sup>38</sup> *Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended*, 15 FCC Rcd. 22709, 22729 (2000) (“*Section 309(j) Order*”) (citing Gregory L. Rosston & Jeffrey S. Steinberg, *Using Market-Based Spectrum Policy to Promote the Public Interest*, 50 Fed. Comm. L.J. 87, 109 (1997)).

<sup>39</sup> The Task Force argues that technological innovation has made regulatory changes possible. *See Report* at 13. But the opposite is also true: changes in the Commission’s regulatory policies have led to technological advances.

<sup>40</sup> *See Section 309(j) Order*, 15 FCC Rcd. at 22729; *see also Amendments to Parts 1, 2, 27, and 90 of the Commission’s Rules to License Services in the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands*, 17 FCC Rcd. 9980, 10020 (2002) (expanding the use of band managers in hopes of achieving increased flexibility).

opportunistic or underlay unlicensed spectrum will be far more difficult than doing so for primary allocations of unlicensed spectrum. If the Commission will have to handle the difficult cases, there is little reason to create a band manager to handle the easy cases. While the Commission's deregulatory instincts are laudable, installing band managers in unlicensed bands is not a good idea.

### **CONCLUSION**

The Commission, by implementing an already good Report with a few minor adjustments, can create the regulatory conditions that would allow – and even encourage – widespread deployment of unlicensed broadband networks. In doing so, the Commission could help jumpstart the kind of broadband deployment that Chairman Powell has described as the “central communications policy objective in America today.”<sup>41</sup>

Respectfully submitted,

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<sup>41</sup> *State of Competition in the Telecom Industry: Hearing Before the Senate Comm. on Commerce, Science, and Transportation*, 108<sup>th</sup> Cong. (2003) (written statement of Michael K. Powell, Chairman, FCC), available at <http://commerce.senate.gov/~commerce/press/03/powell011403.pdf>.