

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

In the Matters of

Comment Sought on International Comparison
and Consumer Survey Requirements in the
Broadband Data Improvement Act

GN Docket Nos. 09-47

A National Broadband Plan for Our Future

GN Docket No. 09-51

Inquiry Concerning the Deployment of
Advanced Telecommunications Capability
to All Americans in a Reasonable and
Timely Fashion

GN Docket No. 09-137

COMMENTS OF MICROSOFT CORPORATION

NBP PUBLIC NOTICE # 6

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I. INTRODUCTION AND SUMMARY.

The Comments in response to the Commission's Public Notice on Spectrum for Broadband evidence broad agreement that – even accounting for increased spectral efficiency and other factors – more spectrum should be made available for wireless broadband to address growing demand for higher-bandwidth services and applications. Neither the Commission nor any other party to this proceeding can predict with certainty future demand for either licensed or unlicensed spectrum, but based on current trends it is clear that more of both should be made available over time for wireless broadband.

The benefits of spectrum access by licensed carriers have already been well documented in this and other proceedings. Microsoft recognizes the critical role played by licensed operators in delivering wireless broadband connectivity to consumers. Rather than rehash those comments, Microsoft writes in reply to provide a more complete record on the increasing role that unlicensed spectrum plays furthering innovation, including as a test bed for new technologies that ultimately benefit users in both licensed and unlicensed bands.

To ensure the public fully realizes the benefits of unlicensed spectrum access, Microsoft urges the Commission to take three specific actions. First, FCC policy should fully reflect the significant value that unlicensed technologies create today. Second, the Commission should make additional spectrum available for unlicensed use – particularly spectrum below 3 GHz. Third, the Commission should continue to promote efficiency-enhancing breakthroughs, including the use of software defined radios capable of adaptive operations. In the near term, the FCC should advance this goal by resolving

open issues in the white spaces proceeding,¹ and ensuring that spectrum policies established in other proceedings do not impede white space operations.

II. UNLICENSED SPECTRUM SUPPORTS ECONOMIC GROWTH AND INNOVATION.

The Commission's policy of providing consumers access to unlicensed spectrum has been a tremendous success. This policy and the resulting unlicensed bands have created a unique platform and raw material for wireless innovations. The resulting flood of unlicensed technologies has resulted in significant economic growth. Microsoft therefore agrees with commenters that share the Commission's assessment that there have been "numerous innovations in unlicensed spectrum use,"² and we also encourage the Commission to make additional unlicensed spectrum available to ensure the availability of a mix of unlicensed and licensed spectrum.³

A. Access to Unlicensed Spectrum Supports Innovation.

The unlicensed bands have a proven track record of supporting innovation. Technological and business innovations first developed in the unlicensed context have translated to broad consumer benefits. Indeed, the Commission has recognized the "explosive growth" of numerous unlicensed technologies in recent years, including Wi-

¹ See generally *Unlicensed Operation in the TV Broadcast Bands*, ET Docket No. 04-186. See also 47 C.F.R. Section 15 Subpart H.

² See *Fostering Innovation and Investment in the Wireless Communications Market, A National Broadband Plan for Our Future*, GN Docket Nos. 09-51 and 09-157, Notice of Inquiry, at ¶ 45 (Aug. 27, 2009) ("Wireless Innovation NOI").

³ See, e.g., Comments of the Consumer Electronics Association, GN Docket Nos. 09-47, 09-51, 09-137, at 5 (filed Oct. 23, 2009); Comments of Motorola, GN Docket Nos. 09-47, 09-51, 09-137, at 21-22 (filed Oct. 23, 2009); Comments of the Telecommunications Industry Association, GN Docket Nos. 09-47, 09-51, 09-137, at 4-8 (filed Oct. 23, 2009); Comments of the Wireless Internet Service Providers Association, GN Docket Nos. 09-47, 09-51, 09-137, at 6-7 (filed Oct. 23, 2009).

Fi, Bluetooth, and RFID tracking.⁴ In addition, innovations in the unlicensed bands have led to important advances in technologies used in the licensed bands. For example, orthogonal frequency division multiplexing (“OFDM”)—which the Commission highlights as an example of an efficiency enhancing breakthrough—is a modulation technique first standardized for use in wireless local area networks (“WLANs”) in 1999. Seven years later, OFDM first appeared in the Long Term Evolution (“LTE”) standard, now primarily being used for licensed 4G mobile wireless broadband networks.

But the best is yet to come. Microsoft is confident that the unlicensed bands provide an unparalleled platform that allows application providers and mobile operators to bring even more exceptional technologies to consumers in the years ahead. Experience is showing that mobile operators are benefiting as much as anyone from the ability to shift more wireless data traffic onto unlicensed networks.⁵ Additionally, sufficient access to unlicensed spectrum will be increasingly necessary to promote innovation as technological advances continue to blur the line between licensed and unlicensed spectrum uses.

⁴ Wireless Innovation NOI ¶ 23.

⁵ See, e.g., Mobile Operator Round-Up: AT&T on WiFi, Sales, Signings and government intervention, GOMO NEWS, (Oct. 23, 2009), *available at* <http://www.gomonews.com/mobile-operator-round-up-att-on-wifi-sales-signings-and-government-intervention/>; Lynnette Luna, Operators embracing WiFi, but how far will they go?, FIERCE BROADBAND WIRELESS (Aug. 13, 2009), *available at* <http://www.fiercebroadbandwireless.com/story/operators-embracing-wifi-how-far-will-they-go/2009-08-13>; Kevin Fitchard, The Magic of the Microcell, TELEPHONY ONLINE (Nov. 3, 2009), *available at* <http://telephonyonline.com/connectedplanet/news/magic-microcell-1103/>.

As the Commission recognizes, devices now routinely communicate using both licensed and unlicensed spectrum.⁶ There are numerous handsets and laptops integrating both Wi-Fi and 3G network connectivity, including devices using Unlicensed Mobile Access (“UMA”) protocols to switch seamlessly between licensed and unlicensed networks.⁷ Similarly, devices such as the MiFi offered by Verizon and Sprint extend licensed wireless networks’ connectivity to unlicensed devices. AT&T, for example, recently:

[R]eported its highest-ever number of Wi-Fi connections made on its network in a single quarter. Continuing the record pace of Wi-Fi growth, AT&T customers made 25.4 million Wi-Fi connections in the third quarter — exceeding the 20 million connections made in all of 2008 and nearly equaling the 25.6 million connections made in the first half of 2009.

The record third-quarter brings total AT&T Wi-Fi connections to more than 51 million since the beginning of 2009 — more than double the connections for the full year of 2008. Wi-Fi usage has been increasing significantly each quarter, up from 5.2 million connections in the third quarter of 2008.

The significant increase can be attributed to the rising number of smartphones and other Wi-Fi enabled devices and to the growing number of AT&T customers with Wi-Fi included in their AT&T service plans — both areas where AT&T leads the competition.

For the first time, the number of Wi-Fi connections made by smartphones and other integrated devices in the third quarter surpassed connections from laptops. Sixty percent of all AT&T Wi-Fi connections were made from integrated devices, up from 49 percent in the second quarter.⁸

⁶ Wireless Innovation NOI ¶ 51.

⁷ See Comments of CTIA – The Wireless Association®, GN Dockets No. 09-51 and 09-157, at 23 (filed Sep. 30, 2009).

⁸ See Press Release, AT&T Customers Made Record Number of Wi-Fi Hotspot Connections in the Third Quarter, October 23, 2009, available at <http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27298> (visited Nov. 12, 2009).

This trend will only continue as consumers increasingly rely on their wireless devices for on-the-go connectivity. Indeed, as a report commissioned by Microsoft submitted in the *National Broadband Plan* docket has concluded, global shipments of devices utilizing both licensed and unlicensed spectrum “will likely double [between 2008 and 2012], perhaps edging out the sales of licensed-only devices.”⁹ Earlier this week, In-Stat released a report estimating that hotspot usage will increase in 2009 by 47 percent, bringing total worldwide connects to 1.2 billion.¹⁰ Accordingly, it is critical that sufficient access to both unlicensed and licensed spectrum be made available to support tomorrow’s technological breakthroughs, and to support devices and applications that will increasingly enable consumers to leverage the benefits of each spectrum access model.

B. Unlicensed Spectrum Creates Substantial Economic Value.

The unlicensed ecosystem encompasses a wide variety of platforms and devices that create significant economic value for Americans. To measure spectrum value in the licensed context, economists often rely on factors such as auction results and the impact of prices on demand to make inferences about producer and consumer surplus. These data points, of course, do not exist for unlicensed spectrum. But as anyone with a Wi-Fi-enabled laptop or handheld can attest, the fact that the economic benefits of unlicensed

⁹ See Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum* at 19 (Sep. 2009) (“Thanki Report”), attached hereto.

¹⁰ See Andrew Berg, *Report: Wi-Fi Hotspot Connects Surge to 1.2 Billion*, *Wireless Week*, Nov. 11, 2009, available at <http://www.wirelessweek.com/News/2009/11/Wi-Fi-Hotspot-Connects-Surge/> (visited Nov. 12, 2009).

spectrum allocations are harder to quantify does not mean that these benefits are not massive.

In response to the Commission’s call for more granular data in the *National Broadband Plan* proceeding, Microsoft submitted the attached paper by Richard Thanki, entitled *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*.¹¹ Thanki examined the U.S. economic value generated by the following unlicensed applications: (1) Wi-Fi broadband access within homes, (2) voice over wireless local area networks and wireless electronic health records in hospitals, and (3) RFID tags for in-store item-level tagging in the clothing retail sector.

Thanki estimates that the annual consumer surplus generated by Wi-Fi in homes in the United States—which accounts for only about 15% of the total projected market for unlicensed chipsets—is between \$4.3 and \$12.6 billion.¹² This translates to a consumer surplus per U.S. household per month of between \$5.40 and \$15.70. Moreover, by increasing the value of consumers’ broadband connections, Wi-Fi may be driving home U.S. broadband adoption by anywhere between 4.3 to 9.8 million additional connected households.¹³ Significantly, Thanki’s estimates do not take into account the value of wireless carriers’ and consumers’ dramatically increasing use of unlicensed Wi-Fi on devices that also provide licensed 3G mobile wireless broadband connectivity.¹⁴ They also do not account for the considerable economic benefits associated with

¹¹ *See generally* Thanki Report.

¹² *See id.* at 27.

¹³ *Id.*

¹⁴ *See, e.g.*, Comments of the Mercatus Center, George Mason University, GN Docket Nos. 09-51 and 09-157, at 6-8 (filed Sep. 30, 2009) (“Mercatus Center Comments”).

business, educational, and other Wi-Fi uses. So Thanki's findings underestimate the economic value of unlicensed technologies.

Wireless local area networks using unlicensed spectrum also create significant economic benefits for healthcare providers. According to Thanki, the projected cost savings generated by use of voice over Wi-Fi and wireless electronic health records in U.S. hospitals have a net present value of \$91 to \$152 billion, or an annualized value of \$9.6 to \$16.1 billion a year between 2009 and 2025.¹⁵ These savings can translate to reduced costs and/or resources reallocated to improving the quality of healthcare for patients.

Finally, Thanki estimates the annual economic value derived from using RFID tags for in-store item-level tagging in the U.S. clothing retail sector to range from \$2.0 to \$8.1 billion per year between 2009 and 2025.¹⁶ The three applications Thanki chose to analyze—Wi-Fi enhancing broadband access in homes, Wi-Fi delivering voice services and wireless access to patient records in hospitals, and RFID tracking inventory in clothing retail stores—together may generate between \$16 to \$37 billion per year in economic value for the U.S. economy over the next 15 years.

Thanki's analysis is quite conservative. It does not include the economic value associated with Bluetooth, RFID beyond the U.S. retail clothing sector, cordless phones, telemetry, monitoring, sensor networks, and other applications. In light of the widespread adoption of these technologies, it would not be unreasonable to assume that these applications deliver economic value of a similar magnitude to household Wi-Fi, wireless local area networks in hospitals, or the retail clothing RFID applications

¹⁵ See Thanki Report at 30.

¹⁶ See *id.* at 34.

described above. Thanki's analysis also did not account for the incredible economic potential that could be derived from using spectrum below 1 GHz for unlicensed applications.¹⁷ Indeed, Thanki concludes that the historical lack of unlicensed spectrum allocations below 1 GHz has "adversely affected the development of longer-range, more reliable and ultra low-power unlicensed applications."¹⁸

The Commission has long recognized that certain frequency bands are more desirable than others.¹⁹ Indeed, the Commission's *Wireless Innovation NOI* specifically notes that "[i]nnovators have to consider the physical properties of different frequency bands ... which differ over the range of the radio spectrum"²⁰ when developing services and applications. The amount of spectrum under 3 GHz available today for unlicensed use is only about 120 MHz.²¹ Of that only 26 MHz of unlicensed spectrum is currently available below 1 GHz. This shortage highlights the importance not only of moving ahead with the proceedings needed to bring the TV Band White Spaces to consumers, but also the need to allocate additional unlicensed spectrum bands below 3 GHz.

III. MICROSOFT'S RESEARCH AND DEVELOPMENT EFFORTS HIGHLIGHT POTENTIAL INNOVATIONS IN UNLICENSED SPECTRUM.

Microsoft agrees with the Commission that research and development are key generators of innovation and, ultimately, investment in new wireless applications and

¹⁷ See generally Part IV below.

¹⁸ See *Thanki Report* at 44.

¹⁹ See *Wireless Innovation NOI* ¶ 26.

²⁰ *Wireless Innovation NOI* ¶¶ 25-26.

²¹ See Comments of Verizon Wireless, GN Docket Nos. 09-47, 09-51, 09-137 at 10 (filed Oct. 23, 2009). As a practical matter, the TV White Spaces are not yet available for unlicensed use and, even assuming the Commission resolves outstanding issues (discussed below), widely variable amounts of spectrum will be available depending on market conditions.

services.²² For its part, Microsoft spends approximately \$9.3 billion on R&D each year. While Microsoft’s research encompasses a broad range of information and communications technologies, we are increasingly interested in spectrum utilization as a result of the Commission’s willingness to support efficiency-enhancing technologies, including those that use vacant television band spectrum.

Some commenters attempt to portray unlicensed spectrum as an ancillary “complement” to licensed technologies that promises little innovation beyond short range communications.²³ Microsoft’s research demonstrates that this is not the case. Microsoft has conducted extensive studies since 2003 demonstrating that mesh networking in the 2.4 GHz spectrum band using Wi-Fi would advance broadband deployment.²⁴ Specifically, Microsoft’s research has concluded that, for a typical suburban topology such as those located outside of Seattle, Washington, only 5 to 10 percent of the households in a community would need to participate to create a viable mesh network, even assuming that each participating node in the network would have a range equal only to the range of a current off-the-shelf 2.4 GHz Wi-Fi device (typically between 100 to 250 meters outdoors).²⁵

²² See Wireless Innovation NOI ¶ 14.

²³ See, e.g. Mercatus Center Comments at 6-8.

²⁴ See ex parte letter of Microsoft Corp., GN Docket Nos. 09-51 at 16-17 (filed Sep. 21, 2009) (“Microsoft Sep. 21 ex parte”). See also Wireless Innovation NOI ¶ 51 and n. 57 (seeking comment on different wireless networking approaches, including mesh networking).

²⁵ Microsoft Sep. 21 ex parte at 16. A viable mesh network, in this case, can be conceived of as a network containing at least 25 participating nodes with each node having at least two points of connection to the Internet to safeguard against random link failures.

The use of white spaces spectrum below 1 GHz will unlock even more powerful innovations. This is true for two reasons. First, the substantially better propagation characteristics of spectrum below 1 GHz permit each node of a wireless network to take advantage of dramatically improved range—approximately three to five times greater than a Wi-Fi network node— using otherwise identical operating parameters.²⁶ This range increase, in turn, can expand the network coverage area by a factor of nine. Second, spectrum below 1 GHz is better able to penetrate walls and other structures, making a white spaces-based network viable for users operating indoors who are less likely to receive a usable signal at higher frequencies.

Microsoft has recently completed design and initial implementation on Microsoft’s Redmond, WA campus of one of the first white spaces-based networks using an experimental license issued by the Commission earlier this year.²⁷ This “White-Fi” network trial includes a new adaptive spectrum assignment algorithm to handle the spectrum variation and fragmentation unique to the white spaces environment. By using this algorithm, the network is able to adaptively configure itself to operate in the most efficient part of the available white spaces. Microsoft is eager to apply the lessons learned in developing this network prototype, which successfully demonstrates the feasibility of Wi-Fi-like networking in the UHF white spaces, to commercial applications—and, more generally, the promise of unlicensed spectrum to unleash exciting new innovations.

²⁶ See *id.* at 17. See also P. Bahl, *et al.*, *White Spaces Networking with Wi-Fi like Connectivity*, Microsoft Research, at 2 (Aug. 2009), available at <http://research.microsoft.com/pubs/80952/whitefi.pdf>.

²⁷ See generally *id.*

IV. THE COMMISSION SHOULD CONTINUE TO PROMOTE EFFICIENCY-ENHANCING BREAKTHROUGHS BY RESOLVING ISSUES RELATED TO THE WHITE SPACES PROCEEDING.

Microsoft shares the Commission’s view that innovation plays a crucial role in promoting more efficient spectrum use.²⁸ Microsoft agrees with Motorola that the best way to encourage development of devices and techniques that improve efficiency, in the near term, is to resolve open issues related to the white spaces proceeding.²⁹

The white spaces rules take only a “cautious and conservative” first step toward unlocking the potential of unused TV band spectrum. The techniques developed for the white spaces will enable more efficient use of the designated frequencies immediately—even commenters in this proceeding that generally do not favor spectrum sharing have pointed to the white spaces as a band where such techniques are feasible.³⁰ But these innovations will also lead to advances in software defined radios more generally, and support innovation even in licensed bands.³¹ Completing the remaining proceedings related to the TV white spaces is therefore necessary to advance the FCC’s goal of furthering wireless innovation both in the critical TV band and across currently available frequencies.

²⁸ See Wireless Innovation NOI ¶ 32.

²⁹ See Comments of Motorola, GN Docket Nos. 09-47, 09-51, 09-137, at 21-22 (filed Oct. 23, 2009)

³⁰ See, e.g., Comments of AT&T Inc., GN Docket Nos. 09-51 and 09-157, at 76 (filed Sept. 30, 2009).

³¹ *Unlicensed Operations in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices, Below 900 MHz and in the 3 GHz Band*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd. 16807, 16808-10 ¶¶ 1-3 (2008) (“White Spaces Order”).

A. The Commission Should Resolve Open Issues Regarding White Space Device Operating Parameters.

Microsoft agrees with Google that the Commission can further innovation by moving quickly to resolve open issues related to petitions for consideration in the white spaces proceeding.³² As Microsoft and others have explained in that proceeding, the Commission needs only to make certain minor, but necessary, rule adjustments to allow effective use of the white spaces.³³ In particular, the Commission should add a class of white space device that does not require spectrum sensing, but rather relies on the geolocation and database mechanisms set forth in the Commission's rules.³⁴ The Commission should also provide greater flexibility for white space devices to access vacant spectrum, including removing certain restrictions on operation below 512 MHz and transmissions near cable head ends.³⁵

The Commission also should reject calls to overturn its decision to open up access to the white spaces on an unlicensed basis, whether for wireless backhaul or other applications.³⁶ The Commission has appropriately considered both licensed and

³² Comments of Google Inc., GN Docket Nos. 09-51 and 09-157, at 9-10 (filed Sep. 30, 2009).

³³ *See generally* Petition for Reconsideration of Dell, Inc. and Microsoft Corp., ET Docket No. 04-186 (filed Mar. 19, 2009); Consolidated Opposition to Petitions for Reconsideration of Dell, Inc. and Microsoft Corp., ET Docket No. 04-186 (filed May 8, 2009); Dell, Inc. and Microsoft Corp. Reply in Support of Petition for Reconsideration, ET Docket No. 04-186.

³⁴ *See* 47 C.F.R. Section 15 Subpart H; *See also* Comments of Google Inc. at 9-10 (advocating geolocation-only devices).

³⁵ Petition for Reconsideration of Dell, Inc. and Microsoft Corp. at 5-9.

³⁶ *See, e.g.,* Comments of The Rural Telecommunications Group, Inc., GN Docket Nos. 09-51 and 09-157, at 6 (filed Sep. 30, 2009); Comments of Sprint Nextel Corp., GN Docket Nos. 09-47, 09-51, 09-137, at 14-16 (filed Oct. 23, 2009); Comments of T-Mobile USA, Inc. GN Docket Nos. 09-51 and 09-157, at 28 (filed Sep. 30, 2009).

unlicensed use of the TV band spectrum, and concluded that the public should receive the benefits of licensed use (through the 700 MHz auction) and unlicensed use (through the white spaces). Moreover, as the record in the white spaces proceeding amply reflects, a fixed, point-to-point network proposed by some licensed use advocates is not an efficient use of “beachfront” TV-band spectrum, particularly since such use necessarily will preclude unlicensed operations.³⁷

B. Overprotecting Legacy Wireless Microphone Systems Will Impede White Space Innovations and Reward Unauthorized Operation.

Verizon Wireless and others correctly point out that the Commission should resolve issues surrounding unauthorized use of Part 74 wireless microphones and proceed to clear the 700 MHz band of all wireless microphone operations, including the small number of authorized microphone operations.³⁸ Microsoft software, including Windows software running on smartphones and netbooks, plays a critical role in licensed wireless operations, and Microsoft is eager to help usher in the benefits of next generation networks using this spectrum. However, clearing the 700 MHz band also directly impacts the white spaces, as many wireless microphone users—overwhelmingly unauthorized—presumably will seek to relocate to spectrum that will be used for white spaces operations.

The Commission should take two actions in order to ensure that TV-band wireless microphones do not render white space use infeasible. First, as Microsoft and others have explained elsewhere, existing rules intended to protect even the relatively small

³⁷ Consolidated Opposition to Petitions for Reconsideration of Dell Inc. and Microsoft Corp. at 18.

³⁸ Comments of Verizon Wireless, GN Docket Nos. 09-47, 09-51, 09-137, at 21-22 (filed Sept. 30, 2009). *See also* Comments of the White Spaces Coalition, WT Docket Nos. 08-166, 08-167 (filed Oct. 3, 2008).

number of *authorized* wireless microphones operating in the TV bands are significantly overprotective, and should be improved.³⁹ For example, Microsoft earlier this year commissioned Shared Spectrum Company to undertake a program of measurements and analysis to examine the level of protection that would be necessary to accommodate wireless microphone systems operating under real-world conditions.⁴⁰ This report concluded that, for devices relying on geolocation technologies, radii for the “keep out zone” in which white space devices may not operate in proximity to licensed microphones could be conservatively set at 130 meters.⁴¹ For devices relying on spectrum-sensing technology, the threshold at which microphones should be detected could be reduced by several dB.⁴²

Second, efforts to allow unauthorized TV-band microphone users to operate in compliance with FCC rules should not result in the vast majority of these users being granted the status of a television broadcaster. As Microsoft and others have explained in detail in the 700 MHz wireless microphone proceeding, aggressive and misleading marketing by Shure and other manufacturers has resulted in widespread unauthorized use of Part 74 “broadcast auxiliary” wireless microphones by individuals who play no role in broadcast content production.⁴³ Microsoft agrees with the 700 MHz auction winners and

³⁹ *See, e.g.* Consolidated Opposition to Petitions for Reconsideration of Dell, Inc. and Microsoft Corp. at 2-4.

⁴⁰ *See generally* Microsoft *ex parte*, The Impact of Man-Made Noise On Protection Requirements For Wireless Microphones, ET Docket No. 04-186 (filed Oct. 26, 2009).

⁴¹ *Id.* at 14.

⁴² *See id.*

⁴³ *See generally* Comments of the White Spaces Coalition, WT Docket No. 08-166 (filed Oct. 3, 2008).

public interest groups that these individuals reasonably relied on the actions of manufacturers, and therefore should not be punished for operating devices without Commission authorization.⁴⁴ Indeed, Microsoft specifically supports proposals to accommodate many currently unauthorized wireless microphone uses in the white spaces by enabling those devices to legally operate as unlicensed devices pursuant to Part 15 rules.

What the Commission should *not* do, however, is expand protections for licensed broadcast auxiliary wireless microphones, including by expanding white spaces “keep out” zones established through a geolocation database, for large classes of currently unauthorized microphones. This action would render the white spaces completely unusable in many urban areas, making investment in the technology significantly less attractive for Microsoft and other technology companies.⁴⁵ This lack of investment would, in turn, significantly drive up development and deployment costs even in rural areas where microphones are not present in great numbers.

These issues have been briefed in substantial detail in the white spaces and 700 MHz wireless microphone dockets.⁴⁶ In the context of this proceeding, Microsoft only adds that, unlike almost any other wireless service identified in the *NOI*, TV band wireless microphone users and manufacturers cannot point to a track record of innovations that have resulted in increased spectral efficiency over the many years they

⁴⁴ *Id.* at 2.

⁴⁵ *See* Wireless Innovation *NOI* ¶ 11 (seeking comment on the Commission’s role in encouraging innovation and investment).

⁴⁶ *See, e.g.*, Comments of the White Spaces Coalition, WT Docket No. 08-166 (filed Oct. 3, 2008); Reply Comments of the White Spaces Coalition, WT Docket No. 08-166 (filed Oct. 20, 2008); Consolidated Opposition to Petitions for Reconsideration of Dell Inc. and Microsoft Corp., ET Docket No. 04-186 (filed May 8, 2009).

have operated. Indeed, TV band wireless microphones still require the same amount of bandwidth to operate that they did when the service was first authorized over thirty years ago.⁴⁷ The Commission should not foreclose access to spectrum that could enable exciting new wireless broadband applications to accommodate inefficient legacy uses that overwhelmingly operate contrary to the Commission's rules.

V. CONCLUSION.

Microsoft looks forward to providing tools to help consumers meet their increasing wireless needs, and to continuing research and development that will enable more efficient and innovative spectrum uses. Microsoft urges the Commission to make more licensed *and* unlicensed spectrum available for wireless broadband and to resolve outstanding issues necessary to make unlicensed operations in the TV white spaces a reality.

Respectfully submitted,

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⁴⁷ For example, by wireless microphone advocates' own admission, it takes 15 six MHz TV channels – a full 90 MHz – to deploy 49 narrowband microphones at a single New York location. *See* Opposition of the Coalition of Wireless Microphone Users to Petitions for Reconsideration, ET Docket No. 04-186 (filed May 8, 2009).