

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

In the Matter of

Revisions to Rules Authorizing the Operation  
of Low Power Auxiliary Stations in the 698-  
806 MHz Band

WT Docket No. 08-166

Public Interest Spectrum Coalition, Petition  
for Rulemaking Regarding Low Power  
Auxiliary Stations, Including Wireless  
Microphones, and the Digital Television  
Transition

WT Docket No. 08-167

Amendment of Parts 15, 74, and 90 of the  
Commission's Rules Regarding Low Power  
Auxiliary Stations, Including Wireless  
Microphones

ET Docket No. 10-24

**COMMENTS OF MICROSOFT CORPORATION**

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## I. INTRODUCTION AND SUMMARY.

Microsoft applauds the Commission for its continuing efforts to examine how best to promote more efficient wireless microphone use, including its request to refresh the record in this proceeding.<sup>1</sup> Time and again, the Commission has expressed concern that “wireless microphones generally have operated inefficiently.”<sup>2</sup> The costs of prolonging these legacy practices necessarily must be weighed against other important spectrum uses in the UHF band, including unlicensed broadband services made possible by the FCC’s innovative white spaces rules. Widespread use of more efficient wireless microphone technology is critical to meeting the FCC’s goal of addressing skyrocketing consumer demand for wireless services by promoting more intense use of scarce spectrum resources.<sup>3</sup>

The Commission should promote efficient use of spectrum by wireless microphones in three ways. *First*, the Commission should decline to expand eligibility for Part 74 licenses. Expanding eligibility to provide additional spectrum for previously unauthorized microphones would perpetuate use of legacy technologies by removing incentives to use spectrum more

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<sup>1</sup> See *Wireless Telecommunications Bureau and the Office of Engineering and Technology Seek to Update and Refresh the Record in the Wireless Microphones Proceeding*, Public Notice, 27 FCC Rcd. 12,067, 12,072 (2012) (“*Wireless Mic PN*”).

<sup>2</sup> *Id.* at 12,071 (citing *Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band*, Public Interest Spectrum Coalition, *Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition, Amendment of Parts 15, 74 and 90 of the Commission’s Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones*, Report and Order and Further Notice of Proposed Rulemaking, FCC 10-16, 25 FCC Rcd. 643 (2010) (“*Wireless Microphones FNPRM*”); *Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Second Memorandum Opinion and Order, FCC 10-174, 25 FCC Rcd. 18,661 (2010) (“*TV White Spaces Second MO&O*”); and *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, FCC 12-118, 27 FCC Rcd. 12,357 (2012) (“*Incentive Auction NPRM*”).

<sup>3</sup> *Incentive Auction NPRM*, 27 FCC Rcd. at 12,358 ¶¶ 1-2.

carefully, running directly counter to the Commission’s conclusion in the television white spaces proceeding that demand for additional wireless microphone spectrum “must be accommodated through improvements in spectrum efficiency.”<sup>4</sup> *Second*, the Commission should allow unlicensed television white space devices to use the 12 MHz of spectrum currently set aside solely for use by wireless microphones, which similarly discourages development and adoption of new spectrum-efficient technologies. *Third*, the Commission should legitimize the widespread practice of co-channel operation of wireless microphones with incumbent broadcasters in the television bands to accommodate additional wireless microphone use without undermining innovative services in the television white spaces.

**II. THE COMMISSION SHOULD PROMOTE EFFICIENT USE OF TV BAND SPECTRUM BY DECLINING TO LICENSE PREVIOUSLY UNAUTHORIZED LEGACY WIRELESS MICROPHONES.**

**A. TV Band Wireless Microphones Operate Inefficiently.**

In no fewer than three separate proceedings, the Commission has reiterated its concern that wireless microphones “generally have operated inefficiently.”<sup>5</sup> Microsoft strongly agrees with this assessment, and with the Commission’s determination that its policies therefore must emphasize “the importance of more efficient wireless microphone operations.”<sup>6</sup> At their core, these policies should provide incentives for wireless microphone manufacturers to operate efficiently and to share spectrum with other unlicensed devices.

Without the pressure to invest in efficiency-enhancing advances that other manufacturers face, TV band wireless microphone technologies have been stagnant for decades. As the

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<sup>4</sup> *Wireless Mic PN*, 27 FCC Rcd. at 12,071 (citing *TV White Spaces Second MO&O*, 25 FCC Rcd. at 18,674 ¶ 29).

<sup>5</sup> *Id.* (citing *Wireless Microphones FNPRM*, *TV White Spaces Second MO&O*, and *Incentive Auction NPRM*).

<sup>6</sup> *Id.*

Commission has observed, “most other radio communications services have shifted from analog to digital technology to improve spectrum efficiency and resistance to interference.”<sup>7</sup> Wireless microphones have not.

Significantly, wireless microphone manufacturers’ long-term practice of flouting the FCC’s rules has made the scale of this problem much greater.<sup>8</sup> The overwhelming majority of wireless microphones were marketed and used illegally prior to 2010,<sup>9</sup> when the Commission issued a waiver of its rules to enable TV band microphones to operate as unlicensed devices under Part 15 of the Commission’s rules.<sup>10</sup> It is important to remember that only a small minority of wireless microphones are eligible for licenses under Part 74 of the Commission’s rules.<sup>11</sup>

Wireless microphone manufacturers nonetheless certified devices that were never intended for broadcast use, such as conference room presentation systems, as Part 74 “low-power broadcast auxiliary” equipment.<sup>12</sup> These manufacturers also marketed Part 74 broadcast microphones to entities that were unlikely to be eligible under the Part 74 wireless microphone

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<sup>7</sup> *Id.* at 12,072.

<sup>8</sup> *See generally* *Complaint of Public Interest Spectrum Coalition (PISC) Against Shure, Inc., Nady Systems, Inc., VocoPro, Audio2000, Sennheiser Electronic Corporation, Audix Microphones, Electro Voice, Hisonic International, Inc., Pyle Audio, et al.*; *Petition To Create a General Wireless Microphone Service (GWMS), Informal Complaint and Petition for Rulemaking* (filed Jul. 16, 2008) (“PISC Petition”); *Comments of the White Spaces Coalition*, WT Docket Nos. 08-166, 08-167 (filed Oct. 3, 2008); *Comments of the Media Access Project, New America Foundation, and Public Knowledge*, WT Docket No. 08-166 (filed Mar. 1, 2010); *Comments of Dell Inc. and Microsoft Corp.*, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed Mar. 1, 2010) (“Dell and Microsoft Comments”).

<sup>9</sup> *See generally* PISC Petition.

<sup>10</sup> *Wireless Microphones FNPRM*, 25 FCC Rcd. at 682 ¶ 81.

<sup>11</sup> The Commission stated that as of January 15, 2010, the Commission had on file only 958 active low power auxiliary station licenses. *Id.* at 649 ¶ 11.

<sup>12</sup> *See generally* PISC Petition.

rules, and for uses that were not permissible, including karaoke and aerobics instruction.<sup>13</sup> These actions allowed manufacturers to gain access to TV broadcast spectrum. Access to this spectrum ensured that manufacturers did not have to share with other classes of devices or comply with rules or standards covering unlicensed bands—meaning that they could avoid the pressure to invest in efficient equipment. If only legitimate broadcast auxiliary equipment had access to the FCC’s special protections, the negative impact of wireless microphones on the FCC’s work to enhance spectrum efficiency would be far smaller.

To be sure, now that the spectrum landscape is changing for wireless microphones, “recent technological advances are enabling more efficient use of wireless microphones.”<sup>14</sup> For example, wireless microphone manufacturer Shure recently released a digital wireless microphone system that can support up to 17 systems on a 6 MHz channel.<sup>15</sup> These developments are long overdue, and only underscore that special spectrum rights for wireless microphones are unnecessary, since spectrum where white space devices cannot operate is capable of supporting many more microphone systems than can be accommodated using legacy technologies. Indeed, this is particularly the case given that, as described below, the Commission can accommodate wireless microphone systems without sacrificing efficiency and innovation in the broadcast bands by legitimizing the widespread practice of co-channel operation with television stations.

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<sup>13</sup> See *id.* at 8-12.

<sup>14</sup> *Incentive Auction NPRM*, 27 FCC Rcd. at 12,435 ¶ 223; see *Wireless Mic PN*, 27 FCC Rcd. at 12,072.

<sup>15</sup> Shure ULX-D Digital Wireless Microphone System User Guide (2012), available at [http://www.shure.de/dms/ulxd2/documents/ulx-d-DUAL-QUAD\\_full-system-user-guide\\_EN\\_5012kb.pdf](http://www.shure.de/dms/ulxd2/documents/ulx-d-DUAL-QUAD_full-system-user-guide_EN_5012kb.pdf) (“Shure User Guide”).

**B. The Commission Should Not Expand Eligibility for Additional Categories of Wireless Microphone Users Under Part 74.**

In the 2010 *Wireless Microphones Order*,<sup>16</sup> and in the *TV White Spaces Second Report and Order*,<sup>17</sup> the Commission enabled previously unauthorized wireless microphone users to continue to use the TV bands as Part 15 devices. This solution restricted the amount of spectrum available for innovative broadband devices and undermined the FCC's efforts to enhance spectrum efficiency. However, the Commission determined that this action was needed to strike a balance between promoting innovative spectrum use and accommodating users of legacy wireless microphone systems who had been encouraged by manufacturers to use their products in an unauthorized manner. The Commission should not upset this balance by allowing more wireless microphone users to claim the protections historically provided to "broadcast auxiliary services" under Part 74, Subpart H.<sup>18</sup>

The Commission should not expand eligibility under Part 74 to unlicensed microphones for four reasons: (1) Part 74 expansion would cement existing inefficient technologies and undermine the transition to more spectrum-efficient wireless microphones; (2) rewarding previously unauthorized wireless microphone users and the manufacturers that benefited by flouting the FCC's rules with cost-free, exclusive access to prime TV band spectrum will send a message that parties can benefit by ignoring the Commission's rules; (3) it is not possible to expand Part 74 in a limited way because any expansion of the class of eligible users will result in

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<sup>16</sup> *Wireless Microphones FNPRM*, 25 FCC Rcd. 643.

<sup>17</sup> *Unlicensed Operation in the TV Broadcast Bands*, ET Docket No. 04-186, *Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket No. 02-380, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd. 16,807, 16,862 ¶ 157 (2008) ("*TV White Spaces Second Report and Order*").

<sup>18</sup> See *Wireless Mic PN*, 27 FCC Rcd. at 12,069-71 (seeking comment on whether eligibility for Part 74, Subpart H licenses should be expanded).

a flood of new inefficient use; and (4) even a small increase in the number of licensed users would make white space use infeasible in many urban areas.

Expanding Part 74 would cement existing inefficient technologies and undermine the transition to more spectrum-efficient wireless microphones. Granting licenses to additional wireless microphone users under Part 74 would reward and incent inefficient use of scarce spectrum resources, undermining the Commission’s goal of encouraging more efficient wireless microphones.<sup>19</sup> As the Commission has noted,<sup>20</sup> existing analog wireless microphones are spectrally inefficient, using 1.2 to 1.6 MHz of a 6 MHz TV channel and excluding other users from the remainder of the channel.<sup>21</sup> In contrast, existing digital wireless microphones offered by Shure can accommodate up to 17 channels in a 6 MHz TV channel,<sup>22</sup> resulting in the use of 3.4 MHz of the TV channel. If the Commission expands, rather than reduces, available licensed spectrum to accommodate legacy analog technologies, wireless microphone manufacturers will be discouraged from innovating and developing more spectrum-efficient devices.

Expanding Part 74 eligibility would grant users who currently operate on an unlicensed basis under Part 15—and must meet spectrum efficiency requirements in order to register in the TV band database—database protection under Part 74 without any corresponding spectrum efficiency requirements. In order to register with the TV band database, wireless microphone users at venues for events, productions, or shows where large numbers of wireless microphones are used must include an affirmative statement in their application that they will operate at least 6

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<sup>19</sup> *Wireless Mic PN*, 27 FCC Rcd. at 12,072 (requesting comments on what steps the Commission might take “to require or encourage further development of digital wireless microphones”).

<sup>20</sup> *Id.*

<sup>21</sup> *See Wireless Microphones FNPRM*, 25 FCC Rcd. at 703 ¶ 147.

<sup>22</sup> Shure User Guide at 3, 26.

to 8 wireless microphones on the 6 MHz channel used for these venues.<sup>23</sup> Part 74 does not require even these modest spectrum efficiency showings before its licensees are eligible for database protection and are able to preclude any unlicensed TV white space device transmissions on a broadcast channel.<sup>24</sup>

Rewarding previously unauthorized wireless microphone users and the manufacturers that benefited by flouting the FCC's rules with cost-free, exclusive access to prime TV band spectrum will send a message that parties can benefit by ignoring the Commission's rules. Any proposed expansion of Part 74 licensees would reward previously unauthorized users with the right to exclude others cost-free, creating a significant moral hazard. It would be a particularly bad policy to reward an industry that for years operated illegally and inefficiently by granting licenses that would perpetuate these inefficiencies. In addition, such a policy will encourage other users in other frequency bands to attempt to create “squatters rights” to scarce spectrum resources. The existing balance—limited eligibility for Part 74 licenses and permissible unlicensed operation under Part 15—adequately protects wireless microphone users without additionally rewarding them for flouting the Commission's rules.

It is not possible to expand Part 74 in a limited way because any expansion of the class of eligible users will result in a flood of new inefficient use. The Public Notice seeks comment on whether wireless microphone license eligibility should be expanded “only for certain users,” such as event type, audience size, or “level of quality of service necessary.”<sup>25</sup> It should not. As

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<sup>23</sup> See 47 C.F.R. § 15.713(h)(9) (requiring certification that registrants are “making use of all TV channels not available to TV bands devices and on which wireless microphones can practicably be used” and noting that registration requests that do not specify that at least 6 to 8 wireless microphones will be used in each channel will not be approved).

<sup>24</sup> See 47 C.F.R. § 74.801-882; 47 C.F.R. § 15.711(a).

<sup>25</sup> *Wireless Mic PN*, 27 FCC Rcd. at 12,070.

the record in this proceeding makes clear, attempting to implement a limited expansion of Part 74 would be unworkable. Even wireless microphone manufacturers concede this point. For example, Shure contends that the “number of seats or dimensions within a facility do not necessarily correlate to the extent and nature of wireless audio use,” and that “wireless audio cannot easily be reduced to a specific purpose.”<sup>26</sup> Therefore, according to Shure, any attempt to “adopt a ‘bright line’ test for license eligibility ... will impose arbitrary cut offs, generate questionable results requiring additional interpretation, and be quickly rendered obsolete by usage and technology trends.”<sup>27</sup>

Shure has shown that there is no way to workably limit any expansion of eligible users, but its proposed answer is simply to make all users eligible. The company ambitiously suggests that the appropriate criterion for eligibility should be whether “audio is an integral part of the performance or presentation.”<sup>28</sup> This, of course, would result in a practically unlimited expansion of Part 74, making the major problem faced by the FCC today much worse tomorrow. Other wireless microphone manufacturers have made similar demands.<sup>29</sup>

In sum, as manufacturers have explained, there is no acceptable way to expand Part 74 eligibility beyond existing categories of users without opening the floodgates to countless wireless microphone users. Thus, Part 74 expansion would be undertaken to the detriment of

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<sup>26</sup> Comments of Shure Incorporated at 3, 8, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed Mar. 1, 2010) (“Shure 2010 Comments”).

<sup>27</sup> Shure 2010 Comments at 7.

<sup>28</sup> Shure 2010 Comments at 6.

<sup>29</sup> *See, e.g.*, Comments of Sennheiser Electronic Corporation at 5, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed Mar. 1, 2010) (any facility with fixed seating and either “an audio amplification system or an occupancy of 50 or more” should be entitled to a license); Comments of Audio-Technica U.S., Inc. at 12, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed Mar. 1, 2010) (anyone eligible for a license under the very broad categories in Part 90 should similarly be eligible under Part 74).

other Part 15 unlicensed devices and the FCC's goal of improving efficiency in the band. The Part 74 rules have always been limited to a few narrow categories of users because they grant such an exceptional right—exclusive use of some of the Nation's best spectrum.<sup>30</sup> The FCC should preserve this balance and not change the eligibility rules.

*Even a small increase in the number of licensed users would make white space use infeasible in many urban areas.* Finally, because of the stringent protections afforded to Part 74 wireless microphone licensees, even a small increase in the number of licensed users would make white space use infeasible in many urban areas. Large numbers of wireless microphone operations, particularly at large events or microphone-heavy performing venues, are likely to occur in heavily populated areas where demand for white space devices is great.<sup>31</sup> As a result, expanding eligibility to even one additional class of users could deny the public access to otherwise available white spaces spectrum in several urban areas.<sup>32</sup> An expansion of Part 74 eligibility would therefore undermine the ability of white space devices to advance the FCC's goal of expanding broadband service, particularly in areas where demand for such service is likely to be highest.<sup>33</sup>

Rather than expand eligibility for Part 74 licenses and reward previously unauthorized users with what amounts to exclusive use of valuable spectrum, the FCC should permit these devices to continue to operate on an unlicensed basis under Part 15 and should encourage the adoption of digital technology and spectrum-sharing technology as outlined below.

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<sup>30</sup> See *Wireless Microphones FNPRM*, 25 FCC Rcd. at 696 ¶¶ 124-25.

<sup>31</sup> *Id.* at 699 ¶ 134.

<sup>32</sup> Dell and Microsoft Comments at 11-12 (citing Dell, Inc. and Microsoft Corp., Consolidated Opposition to Petitions for Reconsideration, ET Docket Nos. 04-186, 02-380 at 9-10).

<sup>33</sup> *Wireless Microphones FNPRM*, 25 FCC Rcd. at 679-80 ¶ 77.

### **III. THE COMMISSION SHOULD ACCOMMODATE WHITE SPACE DEVICE USE IN THE CHANNELS RESERVED FOR LEGACY MICROPHONE SYSTEMS.**

Under the Commission’s existing rules, white space devices must avoid the first vacant channels immediately above and below Channel 37 in order to accommodate legacy wireless microphone systems.<sup>34</sup> As a result, tens of millions of consumers are deprived of 12 MHz of extremely valuable spectrum that could otherwise be used for broadband services. This spectrum is used instead by a far smaller group of legacy wireless microphone users, resulting in a “very inefficient use of valuable spectrum.”<sup>35</sup> This represents a huge loss of utility—exactly the kind of inefficient spectrum use that the FCC is working hard to eliminate.

Exclusive spectrum rights for previously unauthorized microphones perpetuate the use of inefficient technologies and are flatly inconsistent with the Commission’s goal of “preserv[ing] and improv[ing] the use of the unused spectrum in the broadcast television bands for unlicensed operations.”<sup>36</sup> Accordingly, such spectrum rights should be changed as soon as possible. Microsoft therefore urges the Commission to make the “two channels currently designated for exclusive wireless microphone use available for white space devices.”<sup>37</sup>

If the Commission adopts this approach, wireless microphone users will retain many frequency options. Microphone users will have access to (1) the two channels currently designated for their exclusive use (as described above); (2) other white spaces in the broadcast band; (3) other frequency bands including Part 90 frequencies, the 900 MHz band, the 2.4 GHz band; and, as discussed below, (4) co-channel operation with television channels.

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<sup>34</sup> See 47 C.F.R. §15.707(a).

<sup>35</sup> See *Wireless Mic PN*, 27 FCC Rcd. at 12,072.

<sup>36</sup> *Incentive Auction NPRM*, 27 FCC Rcd. at 12,437 ¶ 227.

<sup>37</sup> *Id.* at 12,361 ¶ 9.

Additionally, seeing the writing on the wall, some major wireless microphone manufacturers are now developing—and in some cases already offering—more spectrally efficient digital wireless microphone systems. These developments demonstrate that microphones are capable of operating more efficiently so that the FCC need not continue to design its rules assuming that microphone users need as much spectrum as in the past. As the Commission observed in its Public Notice to refresh the record in this proceeding, both Shure and Sennheiser offer high-quality digital microphone systems that can support 12 to 15 systems on a single 6 MHz channel.<sup>38</sup> In fact, Shure’s new ULX-D digital wireless microphone system can accommodate 17 active transmitters on one 6 MHz channel or—in “high density mode”—*up to 47 active transmitters in one 6 MHz channel* with “no audio quality degradation.”<sup>39</sup> This system was recently used at the 2012 Democratic National Convention, where according to Production RF Technician James Stoffo, “the density was on par with the Super Bowl.”<sup>40</sup> Lectrosonics,<sup>41</sup> AKG,<sup>42</sup> ClearOne,<sup>43</sup> and Mipro<sup>44</sup> also offer or will soon offer digital wireless

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<sup>38</sup> *Wireless Mic PN*, 27 FCC Rcd. at 12,072 & n.26-27; Steve Harvey, *Wireless Mic Users Challenged by New Spectrum Limits*, TV Technology, Apr. 16, 2012, <http://www.tvtechnology.com/news/0086/wireless-mic-users-challenged-by-new-spectrum-limits/213016>; *Sennheiser launches Digital 9000 wireless system*, Sept. 10, 2012, [http://www.sennheiserusa.com/press\\_releases\\_09102012](http://www.sennheiserusa.com/press_releases_09102012) (last visited Jan. 10, 2013).

<sup>39</sup> Shure User Guide at 3.

<sup>40</sup> *Shure Wireless Rocks Democratic Convention*, Sept. 19, 2012, <http://www.shure.com/americas/news-events/press-releases/shure-wireless-rocks-democratic-convention> (last visited Jan. 10, 2013).

<sup>41</sup> Lectrosonics’ IFBT4 (among other Lectrosonics products) utilizes Digital Hybrid Wireless technology. The IFBT4 was designed for use in broadcast, motion picture, theater, and stage applications. It operates in the 537 to 951 MHz range. *IFBT4 Frequency Agile IFB Transmitter: Technical Data*, available at <http://www.lectrosonics.com/t4-data-sheet>. Digital Hybrid Wireless technology was used by referees at the 2011 NFL Pro Bowl, and was adopted by the Neptune Theatre, Atlantic Canada’s largest professional theater, whose Lectrosonics system can accommodate up to 24 wireless mics. See *Lectrosonics Wireless Technology Behind 2011 NFL Pro Bowl Referee Calls*, Mar. 2011, <http://www.lectrosonics.com/Press-Releases/lectrosonics-wireless-technology-behind-2011->

microphone systems that operate in the TV bands. In addition, one company is reportedly working on a system that would allow up to 150 channels in a 6 MHz channel using extremely narrowband analog technology.<sup>45</sup> Outside the TV bands, digital wireless microphone technologies are also commercially available, and are being used for live performances,<sup>46</sup> meetings and presentations,<sup>47</sup> and in live sporting events.<sup>48</sup> Allowing unlicensed use of the

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nfl-pro-bowl-referee-calls.html (last visited Jan. 10, 2013); *Neptune Theatre Selects Lectrosonics Wireless*, <http://www.lectrosonics.com/Press-Releases/neptune-theatre-selects-lectrosonics-wireless.html> (last visited Jan. 10, 2013).

<sup>42</sup> AKG's DMS700 Digital Wireless Microphone system operates within the UHF band from 548 MHz to 865 MHz and can accommodate up to 32 channels. *DMS700 V2 Multichannel Setup Guide*, Jan. 2012, at 43-47, available at [http://www.ake.com/mediendatenbank2/psfile/datei/63/DMS700\\_Sch499d658db1bc1.pdf?pid=1116&id=1116&nodeid=2&\\_language=EN](http://www.ake.com/mediendatenbank2/psfile/datei/63/DMS700_Sch499d658db1bc1.pdf?pid=1116&id=1116&nodeid=2&_language=EN).

<sup>43</sup> ClearOne Communications' WS800 and WS840 Digital Wireless Microphone Systems (which will soon be available to consumers) operate in multiple RF bands (902 to 928 MHz, 710 to 740 MHz, 603 to 630 MHz), and have the ability to daisy-chain up to a 32-channel system to support large venues. *WS800 Wireless Microphone System: Available Soon!*, [http://www.clearone.com/products\\_wireless\\_microphone\\_system](http://www.clearone.com/products_wireless_microphone_system) (last visited Jan. 10, 2013).

<sup>44</sup> MIPRO's ACT-Series wireless microphone systems operate in the 482 to 602 MHz UHF frequencies. *Products, ACT-82a Wideband Dual-Channel Digital Receiver*, [http://www.mipro.com.tw/link/2\\_1\\_1\\_1\\_act82a.htm](http://www.mipro.com.tw/link/2_1_1_1_act82a.htm) (last visited Jan. 10, 2013).

<sup>45</sup> Harvey, *supra* note 38.

<sup>46</sup> Line 6's XD-V digital wireless microphone systems operate in the 2.4 GHz band. David Weiss, *Line 6 Launches XD-V Series Digital Wireless Microphone Systems*, Mar. 31, 2012, <http://www.sonicscoop.com/2012/03/31/line-6-launches-xd-v-series-digital-wireless-microphone-systems/> (last visited Jan. 10, 2013). Line 6 notes that its XD-V75 wireless microphone system is appropriate for professionals and live events, "allow[ing] professional touring bands or larger productions to use up to 14 systems simultaneously." *The XD-V75 Family*, <http://line6.com/xd-v75/features> (last visited Jan. 11, 2013). Several professional artists who use Line 6's digital wireless microphones are featured on Line 6's website. See *Digital Wireless: Artists*, <http://line6.com/wireless-microphone/artists.html> (last visited Jan. 11, 2013).

<sup>47</sup> Audio-Technica's Ultra Wideband Wireless Microphone System operates in the 6 to 10 GHz range and accommodates up to 14 channels. Audio-Technica states that this system is "[d]esigned for conferences, courtrooms, corporate events and more." *SpectraPulse® Ultra Wideband (UWB) Wireless Microphone System*, [http://www.audio-technica.com/cms/wls\\_systems/e7dd603ca6147a97/index.html](http://www.audio-technica.com/cms/wls_systems/e7dd603ca6147a97/index.html) (last visited Jan. 10, 2013).

channels will foster widespread adoption of these spectrum-efficient technologies that are already available in the marketplace, and encourage manufacturers to continue to develop more spectrum-efficient devices.

Allowing unlicensed use of the reserved channels will also incentivize companies to adopt new spectrum-sharing technologies. New technologies would permit white space devices and wireless microphones to share spectrum without any audible interference to wireless microphones, resulting in much more efficient use of the two channels currently reserved only for wireless mics. For instance, a study from Microsoft finds that a prototype developed by the company would allow white space devices and microphones to co-exist in a 6 MHz channel, regaining up to 90% of the spectrum in single microphone scenarios and over 70% of the spectrum in many multiple-microphone environments.<sup>49</sup> These are encouraging developments that the Commission should be promoting.

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<sup>48</sup> For example, the SEC and Big Ten are evaluating unlicensed wireless microphone systems that operate in the 900 MHz or 2.4 GHz ranges for use at live sporting events. See Holly Rowe, *Officials to wear wireless mikes*, Aug. 29, 2012, [http://espn.go.com/college-football/story/\\_/id/8314421/sec-officials-wear-wireless-microphones-thursday-game-south-carolina-gamecocks-vanderbilt-commodores](http://espn.go.com/college-football/story/_/id/8314421/sec-officials-wear-wireless-microphones-thursday-game-south-carolina-gamecocks-vanderbilt-commodores) (last visited Jan. 10, 2013); *VOK-REF Communication system for referees and team sports officiating*, <http://www.vokkero.com/en/solution/10-refereeing> (last visited Jan. 10, 2013); *CoachComm Playbook 2012* at 2-3, available at [http://www.coachcomm.com/html/CC\\_Digital\\_playbook2012\\_TP/index.html#/1/](http://www.coachcomm.com/html/CC_Digital_playbook2012_TP/index.html#/1/). The Vokkero system was used by Field Hockey referees during the National Women's Championship. *Testimonials: Refereeing*, <http://www.vokkero.com/en/testimonials/v/steve-horgan-national-referee-and-technical-director-6> (last visited Jan. 18, 2013). Coachcomm's systems have been used by the last seven Bowl Championship Series champions. *Tempest FX*, CoachComm.com, <http://www.coachcomm.com/communication/headsets/tempest-fx> (last visited Jan. 18, 2013) (relevant information at minute 00:32-40 of video).

<sup>49</sup> George Nychis et al., *Reclaiming the White Spaces: Spectrum Efficient Coexistence with Primary Users* at 1, available at <http://research.microsoft.com/en-us/um/people/moscitho/publications/conext2011.pdf>.

**IV. UHF BAND WIRELESS MICROPHONES SHOULD BE ELIGIBLE TO OPERATE CO-CHANNEL WITH REMAINING BROADCASTERS BECAUSE THIS WOULD PROMOTE EFFICIENT SPECTRUM USE WITHOUT UNDERMINING INCUMBENT OPERATIONS.**

Finally, the Commission should enable wireless microphones to operate co-channel with broadcasters. As the FCC notes, it has sought comment in the Incentive Auction NPRM on reducing the co-channel separation distance between television and wireless microphones.<sup>50</sup> Developments in the white spaces proceeding confirmed that co-channel operation of wireless microphones is commonplace. The Commission's rules should legitimize this longstanding practice, which will promote efficient spectrum use without harming incumbent broadcasters.

The Incentive Auction NPRM seeks comment on appropriate operating parameters under which co-channel operations could be permitted.<sup>51</sup> The best way to determine these parameters is to invite wireless microphone users to submit information about their current co-channel uses without fear of an enforcement action. It is indisputable that co-channel operations are occurring, and are widespread. This point was amply illustrated during the field tests performed by the FCC during the white spaces proceeding. On two separate occasions, in midtown Manhattan and at FedEx Field in Landover, MD, wireless microphone operators transmitted on the same channels as occupied television stations while in the presence of FCC engineers.<sup>52</sup> In fact, one of the channels used by wireless microphones at FedEx Field was the very channel used to carry the high definition broadcast of the football game taking place that day.<sup>53</sup>

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<sup>50</sup> *Wireless Mic PN*, 27 FCC Rcd. at 12,068 n.9.

<sup>51</sup> *Incentive Auction NPRM*, 27 FCC Rcd. at 12,436 ¶ 225.

<sup>52</sup> Letter from Edmond Thomas, Senior Technology Policy Advisor, White Spaces Coalition, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 04-186 (filed Aug. 19, 2008).

<sup>53</sup> *Id.* at 2.

In addition, the wireless microphone industry has recently told the FCC that wireless microphones which operate on VHF television channels are not typically available.<sup>54</sup> This further underscores that co-channel operation takes place routinely. For example, in New York City's theatre district, two UHF channels in addition to the two channels currently reserved for wireless microphones are available, which translates to 24 to 32 available wireless microphone frequencies, assuming that legacy systems maximize the use of each TV channel. But given that even a single theatre operating on Broadway requires up to 40 frequencies during a performance,<sup>55</sup> and a musical may require up to 75,<sup>56</sup> literally thousands of co-channel operations occur every day.

The Commission should call for data about these operations and, given the lack of interference complaints, legitimize the vast majority of them. Doing so will enable *de facto* channel reservations for Part 15 microphones without harming innovative broadband services, as white space devices will not operate on these channels.

## V. CONCLUSION.

The Commission's wireless microphone rules play an important part in the FCC's ongoing work to address spectrum scarcity by improving spectral efficiency. Microsoft therefore

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<sup>54</sup> See Public Notice, Office of Engineering & Technology & Wireless Telecommunications Bureau Announce Nationwide Launch of Unlicensed Wireless Microphone Registration System, ET Docket No. 04-186 (rel. Dec. 6, 2012) ("It is our understanding at this time, through feedback from the wireless microphone industry, that as a practical matter there is very little professional quality equipment available in the VHF spectrum (Channels 2-13). Accordingly, we will not require that applicants use available VHF channels before requesting registration because such use is not generally 'practicable' at this time.").

<sup>55</sup> Ex Parte Comments of the Broadway League, ET Docket No. 04-186, at 3 (filed Jun. 10, 2008).

<sup>56</sup> *Whites Spaces on the Great White Way*, The League of American Theatres and Producers at 1, available at [http://www.broadwayleague.com/editor\\_files/White%20Spaces%20Position%20Paper.pdf](http://www.broadwayleague.com/editor_files/White%20Spaces%20Position%20Paper.pdf).

urges the Commission to promote the efficient use of spectrum by wireless microphones in three ways. First, the Commission should not expand eligibility under Part 74. Second, the Commission should accommodate white space device use in the two channels currently reserved for wireless microphones. And, third, the Commission should legitimize the co-channel operation of wireless microphones with incumbent broadcasters in the TV bands.

Respectfully submitted,



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