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

REPLY COMMENTS OF RYAN S. OVERDORF, AN AUDIO-VISUAL PROFESSIONAL EMPLOYED IN HIGHER EDUCATION

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I. INTRODUCTION AND SUMMARY

I write these reply comments to defend and elaborate on the most fundamental point of my comments. Higher education institutions will use both wireless microphones and Television Band Devices (TVBDs). It is vital for those using both devices that the spectrum be shared. My reply comments have not been endorsed by my university and do not necessarily represent the view of either my university or of other AV professionals.

The record reveals a need to clarify what is meant by "professional" status. Some higher education professionals are sound engineers, but many AV professionals come from IT backgrounds. Even those who have not previously been coordinating frequencies (because they relied on the reseller/installer to choose frequency ranges and microphone channels) have or can easily acquire the necessary skills if they choose. Some religious institutions, on the other hand, have been supporting professional microphones with non-professional users and their skills are in question.

While the Commission should not attempt to define professional status, it should structure the application process to discourage non-professional or professional users unwilling to engage in frequency coordination and responsible database use from applying for a Part 74 low power auxiliary station (LPAS) license. Many parties have called for simplifying Form 601. To the extent that simplifying Form 601 means making more it more accessible to the non-technical user, the Commission should resist this impulse.

The Commission should address concerns about irresponsible database use in part by requiring database administrators to implement technological restrictions on request duration (e.g., no more than 10 hours per day) and the number of reoccurrences allowed (e.g., no more than seven days in a row). Making frequent database entries should an expected part of license compliance. While this will raise the cost of database administration, it is a necessary trade-off to ensure spectrum sharing. The Commission should also add new regulations specifying that database misuse can lead to fines and license revocation.

The Commission should not reserve any additional frequencies for wireless microphones beyond what is already specified in the existing Part 15, Subpart H regulations. Additional reservations merely exacerbate the mismatch I discussed in my comments between the available channels on wireless microphone systems users already own and the channels the Commission has already set aside. Many users have replaced functioning equipment in the last year and many more will replace functioning equipment prior to June 12th. New channel set asides do nothing to protect the current user who already invested or is about to invest in new equipment unless by coincidence they purchase the right systems. The benefits gained do not outweigh the costs imposed upon TVBD users.

On the other hand, the Commission should expand Part 74 in spite of TVBD manufacturer objections. TVBD manufacturers and their supporters argue that even limited expansion will preclude TVBD use in major metropolitan areas. I believe that responsible database use will avoid this outcome. Even if, however, the expansion of Part 74 limits consumer demand for TVBDs in New York or Los Angeles, this is an acceptable trade-off in furthering the goal of

spectrum sharing. TVBDs are far more important to smaller urban areas and rural areas, where manufacturers have fewer economic incentives to develop broadband alternatives. Spectrum congestion is far less of a problem in these areas.

The Commission should maintain the spectrum sensing requirements for TVBDs. Eliminating spectrum sensing will allow TVBDs to interfere with active microphone transmitter signals. Part 15 requires unlicensed devices to accept interference. It is not intended to encourage one device to interfere with another device.

The assertion that spectrum sensing grants unlicensed and licensed microphones equivalent rights suggests confusion about how wireless microphones work and how they are used under real world operating conditions. Part 74 LPAS licensees can time shift the protection of their wireless microphone frequencies while unlicensed Part 15 Wireless Audio Device users receive only real time protection. Spectrum sensing won't avoid a frequency if the transmitter is turned off and limited battery life precludes leaving transmitters on when not in use.

The practical effect of unlicensed operation under current Part 15 rules is that frequencies are first come, first served and this is the way it should be. The in service monitoring requirement for TVBDs does not change this because the unlicensed wireless microphone user has to tolerate as much as sixty seconds of interference. Most unlicensed users won't tolerate even six seconds of interference and will react by reprogramming the microphone or turning it off instead of waiting to see if the interference will clear. Even if the Commission determines its current regulations are overprotective of unlicensed wireless microphones, the appropriate remedy is to eliminate the in service monitoring requirement, not to eliminate spectrum sensing.

The current proceeding is itself proof that the Commission must act to inform wireless microphone users by imposing appropriate regulatory requirements on manufacturers and resellers. Users cannot rely on either the microphone manufacturer or the reseller to communicate all of the necessary information. This is less of a problem for the professional who will likely be licensed under Part 74. Professionals will either know this information or can obtain it. It is a serious problem for the unlicensed Part 15 users. By definition they are more reliant on manufacturers and resellers.

The microphone manufacturers educated users about the proceeding and encouraged them to file comments. Unfortunately, they omitted the most important question the users could have answered: whether the user could comply with Part 74. At least twenty-two resellers/installers filed comments. Twenty-one of them failed to address the proposed marketing requirements applicable to them. If resellers cannot address their own interests regarding regulations, how can they assist customers when selecting frequency ranges?

Various parties have asked the Commission to resolve the issues pending in the White Spaces proceeding. The Commission should accommodate them by denying every petition for reconsideration and moving forward with the current Part 15 Subpart H regulations. While not perfect, the Commission's approach represents a better solution to spectrum sharing than any other proposal advanced by any other party.

II. IMPLICATIONS OF DECENTRALIZED WIRELESS MICROPHONE USE

At least eleven other AV and other higher education professionals filed comments in this proceeding.[1] None of them suggested they would be using TVBDs and most of the filings were hostile to TVBD use. I believe, however, that this reflects unfamiliarity with TVBDs. Though ET 04-186 is a hot docket, many wireless microphone users were unaware of the issues until recently.

As a professional wireless microphone user, my first reaction upon learning of spectrum reallocation and TVBDs was anger. It was not until I began a more detailed investigation of the issues that I realized TVBDs would also benefit me. One of the reasons I investigated the issues further because I have a specific interest in the law as it relates to my job. My technological skill sets are not unusual in higher education, but that particular combination of skills and interests is. I believe that if my counterparts at other institutions were able to spare the time from their busy schedules to analyze the issues the way I have, they would agree with me that higher education needs both wireless microphones and TVBDs.

Their filings highlight wireless microphone uses I did not mention in my comments.[2] For example, "Bucknell University currently possesses over one hundred and sixty channels of portable and installed wireless devices in operation around our campus. These wireless devices include microphones, intercoms and personal monitoring systems. They are used by academics, theatre, performances, lectures, religious services, athletics and regional and national television broadcasts."[3]

Five Bucknell employee names are attached to the comment, representing three different departments or offices on campus.[4] Although I mentioned different departments in my comments[5], I wanted to briefly elaborate on the implications for licensing higher education institutions. I am one of several individuals or departments responsible for wireless microphones on my campus. I cover one particular graduate school and I am the only permanent staff member with that responsibility for that graduate school.

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[1] Comments of Jeffrey Daddario, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 21st, 2010); Comments of Cedarville University, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 16th, 2010); Comments of Richard Earl, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 18th, 2010); Comments of Mark A. Craig, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 25th, 2010); Comments of the College of the Holy Cross, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 26th, 2010); Comments of Macalester College, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 16th, 2010); Comments of Messiah College, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 19th, 2010); Comments of Miami Dade College, Kendall Campus, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 24th, 2010); Comments of Michael Fletcher, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed March 1st, 2010); Comments of Richard Gleason, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 3rd, 2010); Comments of John Lindberg, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 (filed February 19th, 2010).

[2] *See* Comments of Ryan S. Overdorf, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 5 (filed February 19th, 2010).

[3] Comments of Jeffrey Daddario, at 1.

[4] *Id.*

[5] Comments of Ryan S. Overdorf, at 5.

I stated in my comments, "One meeting per year using seven or more microphones should satisfy the regular use requirement."[6] I want to explicitly state what was present by implication in my comments. If one unit of a university qualifies for a Part 74 LPAS license under my suggested terms, then the entire university should reap the benefits of that license. Each individual or department responsible for wireless microphone support should be able to upload to the database and the university would be accountable for making sure those individuals and departments used the database responsibly. Each individual or department responsible for wireless microphone support should be able to upload all wireless microphone uses to the database, even if only some of those uses utilize multiple vacant TV channels. This would remove the much of the incentive to inflate the number of frequencies needed for a particular event.

In practice, an LPAS license will provide protection for only some higher education wireless microphone uses. The day to day operational realities will dictate that many higher education uses are not uploaded to the database and at particular times will in effect be operated as Part 15 WADs. In my view this is a feature, not a bug because it mitigates any tendency towards overprotection. Universities can protect themselves for the events that matter most yet cannot use their licenses to preclude sharing the spectrum.

For example, current Part 15, Subpart H, regulations provide that TVBDs may operate as long as two days before querying the database.[7] If I upload my microphone usage less than two days prior to the event, I run the risk that my reservation will not be effective. Some event needs won't be known two days in advance. I will have to approach those events and needs as though they were not protected.

The Commission expressed concerns that "licensees may find it impractical to maintain the database with up-to-date information and instead may call for interference protection on all channels on a continuous basis."[8] I have addressed that concern with respect to higher education users, but there are additional protections available by designing the database with the appropriate technological protections.

There are at least two ways to make overbroad reservations more difficult. First, limit the number of hours per day that someone can reserve a particular frequency. Second, limit the number of reoccurrences that someone can specify for any given entry. The Commission may want to gather information regarding usage patterns, but 10 hours could be a reasonable limit for number of hours per day. I do not believe it is unreasonable to ask for weekly uploads. Creating database entries every week becomes an ordinary part of job duties. This will of course raise the cost of database administration, but the extra money can be seen as an investment in spectrum sharing.

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[6] *Id.* at 11.
[7] 47 C.F.R. §15.711(b)(3)(iii).
[8] 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, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24, *Report and Order and Further Notice of Proposed Rulemaking*, FCC 10-16 at ¶132 (rel. January 15th, 2010).

Requiring frequent database uploads to maintain currency will mean that many users will be selective about what they upload and will upload only those events which truly require protection. In the higher education environment, AV professionals are likely to focus on events requiring multiple vacant TV channels.

Some users will find ways around the database protections, but the Commission does not need perfect protection. It need only raise the opportunity costs of doing so enough to discourage most busy professionals from trying. It can, for example, require the database to flag certain behavior (e.g., creating same day reservations at the same location under two different names) and penalize irresponsible use of the database with fines and license revocation.

I will cover real world operations further in the section on sharing the core TV spectrum bands.

III. DISTINGUISHING PROFESSIONAL AND NON-PROFESSIONAL USERS

One of the conclusions that can be drawn from the record is that commenters are using the word "professional" in different ways. Professional sound engineers emphasized their role in producing large events.[9] Broadway theaters,[10] performers unions,[11] and the music industry[12] emphasize that they routinely coordinate frequencies, and one may infer (where not explicitly stated) from their filings that professional sound engineers often perform this coordination.

Professionals in higher education or at religious institutions come from a much wider variety of backgrounds. Some are professional sound engineers.[13] Others, like me, acquired IT or AV experience as students and gained further experience in permanent jobs.[14] In my case, my job began with a small AV component that evolved over time to become my primary duty. I taught myself AV skills to match the needs of the job until I became the AV professional I am today. All eleven comments filed by college and university staff members[15] are from professionals. More than one hundred religious institutions filed comments; about half of those can be positively identified as professionals (either through the comments or through internet searching).

Few of these professional higher education or religious institution filings mention coordinating frequencies and one may infer that few of them have been coordinating frequencies themselves.

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[9] *See, e.g.,* Comments of James Stoffo, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 1 (filed February 19th, 2010).

[10] *See e.g.,* Comments of the Coalition of Wireless Microphone Users, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 11 (March 1st, 2010).

[11] *See e.g.,* Comments of the American Federation of Television and Radio Artists (AFTRA), WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 2 (March 1st, 2010).

[12] *See e.g.,* Comments of Live Nation Entertainment, Inc., WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 3 (March 1st, 2010).

[13] *See e.g.,* Comments of Michael Fletcher, at 1(University Sound Engineer at Taylor University); *See* Comments of Jeffery A. Cook, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 1 (filed February 18th, 2010), (Audio Engineer at CrossPoint Baptist Church).

[14] http://www.messiah.edu/offices/conference_services/staff/Jonathan.html (biography of Jonathan Bert, Sound and Lighting Technical Coordinator for Messiah College)

[15] An internet search revealed that comments from South Dakota State University came from college students with no apparent connection to the school's AV department. These have been excluded from the discussion.

Instead, they may have been relying on the reseller to choose the appropriate channels at the time of installation.

The Commission should not, however, infer that professionals in higher education or religious institutions are incapable of doing so. Broadway theaters had to coordinate frequencies just to operate with each other. Until now, that hasn't been true of most colleges, universities, and religious institutions. The same skill sets that allow AV professionals to do their jobs now will enable them to coordinate frequencies. Most are technically competent users capable of complying with regulations that happen to be unfamiliar with Commission regulations.

Shure asks the Commission to "define 'Professional' uses to include uses in which audio is an integral part of the performance or presentation"[16] (language closely tracking ADA requirements for assistive listening systems in new construction[17]) and suggests that this list of uses should include "music concerts, professional sports, live theater, trade shows and business conferences, as well as religious services, educational presentations, collegiate sports, and government meetings."[18]

Shure goes on to say "all entities that would qualify for licensing would likely have engaged a professional facilities, technology, or frequency coordinator who would be responsible for wireless microphone operation at these venues and who would likely be responsible for frequency selection and registration in the geolocation database."[19] Finally, Shure "proposes that such licensed use be limited to Professional uses (as defined above) . . . licensed users by definition will have sufficient technical expertise and staff to comply with the Part 74 requirements."[20]

These statements are contradicted by the record, at least for religious institutions. *Church Production Magazine* (staffed by professional wireless microphone users) filed comments specifically to call attention to the large number of (presumably professional quality, based on the number of channels used) wireless microphones used by non-professional users.[21]

The comments of *Church Production Magazine* are an excellent illustration of what can happen when professional wireless microphone users lack key information about Commission regulations. Virtually every wireless microphone user who filed comments asked to be licensed, yet even Shure does not argue for the licensing of non-professionals. *Church Production Magazine* did not ask for additional "safe harbor" TV channels to protect non-professional users or any other solution that might be an alternative to LPAS licensing. Its comments therefore create (unintended) tension that potentially undermines the comments filed by its readers.

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[16] Comments of Shure Incorporated, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 6 (filed March 1st, 2010).
[17] 28 C.F.R Part 36, Appendix A, § 4.1.3(19)(b) (2009), ("audible communications are integral to the use of the space").
[18] Comments of Shure Incorporated, at 6.
[19] *Id.* at 7.
[20] *Id.* at 13.
[21] Comments of Church Production Magazine, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 1-2 (filed March 1st, 2010).

A second example of unintended consequences is the sample comments originally written by Mark Frink, Editorial Director for *Live Sound International Magazine*.[22] Those comments inspired more than one hundred people to file comments with the Commission. Many of them, unfortunately, did little to personalize their comments, creating some ambiguity regarding how many of them are actually professional sound engineers.

Mr. Frink and the staff of *Live Sound International* read the *Wireless Microphone Further Notice of Proposed Rulemaking* closely enough to notice and advise readers regarding the Commission's portable TVBD channel exclusions and the implications for frequency range selection. Alas, they apparently overlooked the Commission's licensing concerns. The sample comments did not include any information regarding the Commission's regulations on licensing, so none of those commenters addressed their ability to comply with Commission licensing regulations.

One can hardly fault either *Church Production* or *Live Sound International* for their efforts. Their jobs involve production needs for professional sound. They don't often participate in Commission proceedings regarding relevant regulations and it's easy to miss a few sentences in a one hundred page document. Shure, on the other hand, does participate in Commission proceedings regarding relevant regulations and must bear some responsibility for the consequences of what it advises professional wireless microphone users to do.

More than 50 commenters followed Shure's guidelines for filing comments.[23] Most of the guidelines make sense. From the viewpoint of the wireless microphone user, however, no question in the *Wireless Microphone Further Notice* is more important than whether users can comply with existing regulations.

Not only does Shure not provide any guidelines on addressing the Commission's concerns about granting licenses, one would never know there are any license requirements with which to comply. Shure's omission of this information precluded wireless microphone users from demonstrating that they could comply with license requirements. This would have been particularly advantageous for users in higher education and religious institutions, who have not previously found it necessary to coordinate frequencies themselves. I will deal with this issue further when discussing the requirements the Commission should impose on manufacturers and resellers.

Shure makes good products. I use Shure mixers at work. Shure wireless microphones will be on the short list of replacement microphones I consider for purchase. On this issue, however, I believe that Shure did not fully defend the interests of the wireless microphone user.

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[22] Originally posted on January 30th, 2010 at , http://www.prosoundweb.com/article/wireless_update_2010_june_12_dtv_transition_anniversary_is_700_mhz_deadline; reposted in slightly different form on February 18th, 2010 at http://www.prosoundweb.com/article/from_the_editors_the_time_is_now_save_our_wireless_systems (sites last visited March 19th, 2010).

[23] *Guidelines For User Comments on Proposed FCC Wireless Mic Rules, available at* http://www.sweetwater.com/forums/attachment.php?attachmentid=583&d=1265912283 (last visited March 19th, 2010).

If this information had been available to wireless microphone users, I believe their responses would be split into three categories: those who demonstrated their willingness and ability to comply with regulations regarding frequency coordination and database entries, those who insisted that frequency coordination and database entry regulations should be weakened or eliminated to make license compliance easier, and those who asked for protected channels to avoid the necessity of license compliance. Only the first group, representing willing professionals, should be licensed. Non-professional users should not be licensed. Professionals not willing to comply with current requirements (i.e., those applying for licenses who are nevertheless ignore frequency coordination or are likely to use the database improperly) should not be licensed. Non-professionals and unwilling professionals pose a threat to spectrum sharing if they are licensed rather than unlicensed users.

The Commission must devise ways of distinguishing between these groups. Because there are several different kinds of professional backgrounds that enable one to comply with regulations, the Commission should not attempt to define what a professional is (e.g., by limiting the definition to professional sound engineers).

Instead, it should use the application as an entry barrier to filter out non-professionals and unwilling professionals. In particular, it should add an "essay" question to the application regarding the applicant's skills and knowledge in the operation of wireless microphones (whether on a revised Form 601 and schedules or newly created forms and schedules). In the case of a university application, the applicant must certify that every individual uploading to the database has the requisite professional knowledge. The applicant should also answer an essay question regarding the willingness and ability to comply with regulations. These questions are necessary to ensure that the spectrum is properly shared.

Many parties called for a simplification of the application process. To the extent that this means simply clarifying the technical information required (e.g., Shure's suggestions for the technical information on the microphones themselves[24]), this is a useful suggestion. To the extent it means trying to make the application process accessible to non-technical users (e.g., Shure's suggestion for licensing by rule[25]) this is **not** a useful suggestion.

The record is ambiguous with respect to various parties' intent in asking for a streamlined process. Shure's guidelines recommend that commenters ask the Commission to "Ensure that any rule changes that the FCC adopts will allow <u>you</u> to obtain an FCC wireless microphone license and continue doing what you are doing now."[26] In some cases, commenters appear to have interpreted this literally (i.e., that the only difference between today and tomorrow is a signed piece of paper).

No one can continue doing what they are doing now. The reallocation of spectrum and introduction of TVBDs with accompanying database requirements fundamentally alters operational procedure. Those unwilling to make the adjustment should operate as unlicensed users.

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[24] Comments of Shure Incorporated, at 15, n.38.
[25] *Id.* at 15, n.37.
[26] *Guidelines*, at 1.

For myself, I have already begun the necessary work to coordinate frequencies. I used Google Earth to identify the coordinates for the auditorium where my microphones will be registered. I then mapped the coordinates between the auditorium and every TV broadcast tower in nearby TV markets. I have begun analyzing the New York TV market to better understand the implications of frequency congestion and adjacent channel operation. I am using the Commission's Universal Licensing System (a source of information for identifying licensee identity I inadvertently omitted from my comments) to locate the nearest public safety licensees operating in channels 14-20.

Most if not all AV professionals could perform these tasks. The difference between me and other higher education AV professionals is the awareness of the need to perform these tasks.

IV. SHARING THE CORE TV BANDS

Most of the major parties' comments challenged to varying degrees the idea of sharing the spectrum. I will deal with each party's relevant suggestions in turn.

The Coalition of Wireless Microphone Users (CWMU) asks for three guaranteed safe harbor channels (prohibiting even fixed TVBD operation) in every TV market.[27] Their concession to spectrum sharing is to limit WAD use to just two of the three safe harbor channels (and no operation outside of the safe harbor channels).[28] While I appreciate their willingness to share, the proposed solution is completely unworkable.

First, it is not clear that as many as three safe harbor channels will exist in every market. Collectively, the Broadway theaters are utilizing most channels from 14-51.[29] Many of the TV channels in the New York market are less than the minimum co-channel distance from the theater district. While 47 C.F.R. §74.802(b) contemplates making regulatory exceptions, where the Commission is willing to draw the line makes a difference. Broadway theaters could simply lose the number of microphones still operating in 700 MHz for lack of any other place to accommodate them in the core TV bands (commenter Michael J. Benonis argues for replacing distance with a measurement of signal strength for regulating co-channel operation[30]).

Second, because of the 700 MHz reallocation, professional wireless users are disrupting their ordinary equipment replacement cycles to replace functioning equipment. This may be less of a problem for CWMU members because of their relatively short equipment replacement cycles.[31] Many other users have spent or will spend thousands of dollars replacing equipment before those channels have been determined. They may get five years of use or more before replacing significant numbers of microphones. Unless, by coincidence, they purchase systems operating in the protected channels, they cannot take advantage of those channels. By the time they need to

[27] Comments of CWMU, at 5.
[28] *Id.*
[29] *See*, Ex Parte filing of the Coalition of Wireless Microphone Users (frequency chart), WT Docket Nos. 08-166, 08-167, ET Docket Nos. 04-186 and 02-380 (filed December 2nd, 2009).
[30] Comments of Michael J. Benonis., WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 4 (filed February 21st, 2010).
[31] Comments of CWMU, at 11.

replace equipment, protected channels may not even be necessary. The marginal benefit derived from creating safe harbor channels above and beyond what the Commission has already done does not outweigh the cost to TVBD users.

TVBD users should not, however, be overprotected. The Commission should expand Part 74 in spite of the objections of Dell and Microsoft[32], the Public Interest Spectrum Coalition (PISC)[33], and Spectrum Bridge.[34]

Dell and Microsoft argue that expanding Part 74 would "*could completely deny the public access to otherwise available white spaces spectrum in several urban areas*" [emphasis in the original]. I have several responses to this claim. First, as I noted above, frequency crowding can deprive the public the benefits of using wireless microphones or listening to performances that depend on their use. All devices operating in the core TV bands and their benefits are limited by spectrum availability. The spectrum should nevertheless be shared between public safety radios, TVBDs, and wireless microphones. Second, responsible database usage will ensure that frequencies are not in constant use. The worst case scenario is that there may be no frequency availability at certain times of the day.

Even if the worst case scenario comes true and the result is sharply limited consumer demand for TVBDs in New York or Los Angeles, the Commission should nevertheless expand Part 74 LPAS eligibility. Providing national broadband access is an important goal. As the Commission's own *National Broadband Plan*[35] makes clear, however, TVBDs are only one means of accomplishing this goal.

The population concentration that makes major metropolitan residents attractive customers for Dell and Microsoft will also make them attractive customers for the "countless innovators using unlicensed technologies"[36] admired by Dell and Microsoft who are willing to develop alternative wireless broadband products outside of the core TV bands (perhaps Dell and Microsoft themselves). TVBD use will be much more easily shifted than wireless microphone use. No one is dependent on TVBDs today whereas thousands are dependent on wireless microphones. TVBDs are most important in smaller urban and rural areas where spectrum crowding is much less of a problem.

Dell and Microsoft argue (in reference to Broadway theaters) that "relying for years on unauthorized spectrum access to support a business model is nothing short of negligent and the Commission should not shift the burden of correcting this problem to the American public by imposing additional restrictions on commercial wireless broadband access."[37]

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[32] Comments of Dell Inc. and Microsoft Corp., WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 3 (filed March 1st, 2010).
[33] Comments of Media Access Project, the New America Foundation, and Public Knowledge, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 3 (filed March 1st, 2010).
[34] Comments of Spectrum Bridge, Inc., WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 3 (filed March 1st, 2010).
[35] *Connecting America : The National Broadband Plan* available at http://www.broadband.gov/plan/ (last visited March 20th, 2010).
[36] Comments of Dell Inc. and Microsoft Corp., at 4.
[37] *Id.* at 10.

The business plans for TVBDs have their own flaws. Spectrum Bridge acknowledges "there are numerous incumbent television stations in major metropolitan areas" and asserts that "access to larger markets will be essential to realize the economies of scale that will make white spaces equipment and technology affordable for urban and rural users alike."

One of the more interesting things to emerge from the record is that number of current Part 74 LPAS licensees is likely to be far less than the number of those currently eligible for LPAS licenses. Even if the Commission does not expand Part 74, the number of licensed microphones will go up significantly. If the Dell and Microsoft business plan depends on economies of scale created by access to New York and Los Angeles, they will face serious challenges even in the absence of a Part 74 expansion.

Wireless microphone use is easily observable at concerts, houses of worship, hotels and convention centers, stadiums, theatrical productions, etc. The Commission's own *TV White Spaces Notice of Proposed Rulemaking* acknowledges wireless microphone use in theaters.[38] "Wireless Microphone Operations" has its own heading in the *TV White Spaces Notice* table of contents,[39] yet it was more than four years before PISC filed its complaint against the manufacturers.[40]

Regardless of whether Dell and Microsoft assumed they could get everyone moved or simply overlooked the occupation of the white spaces, the Commission should not compensate them for their lost profits by imposing unacceptable operating conditions on unlicensed wireless microphones operating in the core TV bands. If the end result is unaffordable prices for TVBD use in rural areas, the Commission could consider subsides or other solutions.

Dell and Microsoft assert that "the spectrum sensing requirement would create de facto broad expansion of Part 74 at the expense of innovative white space operations." The assertion that spectrum sensing extends the equivalent of Part 74 protections reflects confusion about both the technical aspects of wireless microphone systems and real world operating conditions for wireless microphones. Removing spectrum sensing would also lead to an inappropriate outcome under Part 15.

The database allows the LPAS licensee to time-shift protection of microphone usage. The WAD user receives the protection of spectrum sensing only in real time, when the microphone is on. The Commission is obviously aware of the difference between wireless microphone transmitters and wireless microphone receivers (most receivers are Part 15 devices, most professional transmitters are Part 74 devices). Nevertheless, the differences are worth discussing to illustrate the implications (I inadvertently blurred the distinction myself in my comments).

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[38] Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, ET Docket Nos. 04-186, 02-380 *Notice of Proposed Rulemaking*, FCC 04-113, at ¶ 38 (Rel. May 25, 2004).

[39] *Id.* at 1.

[40] Complaint of Public Interest Spectrum Coalition (PISC) Against Shure, Inc, Nady Syslems, Inc., VocoPro, Audio2000,Sennheiser Electronic Corporation, Audix Microphones, Electro Voice, Hisonic International, Inc., Pyle Audio, *et al*. and Petition to Create a General Wireless Microphone Service (GWMS), WT Docket No. 04-356, *Informal Complaint and Petition for Rulemaking* at 36 (rec. July 16th, 2008).

Most wireless microphone receivers do not transmit signals. Those that do are sending signals back to the transmitters. Whatever incidental signals might escape a receiver, they are highly unlikely to meet the signal detection threshold of a TBVD (the resulting false positives could render the TVBD unusable). In other words, the wireless microphone transmitter must be on for the TVBD to detect the microphone. The four to eight hour battery life precludes leaving the microphone transmitter in an "always on" state.

TVBDs are required to monitor the frequency on which they operate once every sixty seconds, and cease operation if they detect a wireless microphone signal.[41] While this appears to give wireless microphones an advantage, the advantage is less significant than it appears.

Consider two different operational contexts. First, even if I become licensed under part 74, there will still be last minute unscheduled setups of wireless microphones. I may be turning on the microphone transmitter moments before the start of an event. As an AV professional, I have sufficient awareness of the causes of interference that I could wait to see if it clears. In that situation, however, I am under pressure to turn up the volume immediately. I can't do that if there's a crowd in the seats and interference on the microphone. It is far quicker just to reprogram the microphone.

Second, if I'm operating as an unlicensed user, I may turn on my microphone transmitter 20-30 minutes prior to the start of the event (more than that starts to impose significant battery costs). This is more than enough time to allow channels to clear. Then the speaker approaches the lectern or table, begins cross-talk with others on stage, and turns the microphone off until he or she is ready to begin speaking (taping the switch in the "on" position creates its own problems, telling the speaker not to turn it off doesn't work). The transmitter then releases its hold on the frequency and the process of checking for a clear frequency begins again.

The practical effect of spectrum sensing is to create a "first come, first served" approach to acquiring frequencies for TVBDs and unlicensed wireless microphones. This is a good approach under Part 15 and a good approach to spectrum sharing. Should the Commission decide that 60 seconds is nonetheless overprotective of wireless microphones, eliminating the in service monitoring requirement is a more appropriate way than eliminating spectrum sensing to further the first come, first served approach and balance the interests of the wireless microphone user and TVBD user.

Using a first come, first served approach will require unlicensed users to be comfortable reprogramming their microphones. Moving forward, this will be a required skill for the operation of wireless microphones. The procedure is detailed in most if not all user manuals. Some non-professional users may choose not to operate wireless microphones at all. Others may want to learn enough to become professionals and obtain licensing under Part 74. The Commission should issue consumer publications to assist this second group.

Eliminating spectrum sensing is not an appropriate means of sharing the spectrum and may result in either TVBD users, wireless microphone users, or both violating the regulatory prohibition

[41] 47 C.F.R. 15.711(4)(c)(4)

against causing harmful interference.[42] Whether TVBDs will interfere with wireless microphones (or vice-versa) is hotly debated in this proceeding, but there is no question of at least one result of eliminating the requirement. A TVBD signal will be able to occupy the same frequency as an active wireless microphone transmitter signal.

If Mr. Benonis is correct in his calculations of power spectral density (if, e.g., his assumption regarding TVBD signal distribution is correct), the wireless microphone is in no danger of receiving interference from the TVBD.[43] Of course, if Mr. Benonis is correct, spectrum sensing may be necessary to protect the TVBD from the wireless microphone. Dell and Microsoft's support of eliminating the spectrum sensing requirement implies they would disagree with Mr. Benonis.

In either case, the Commission should not permit TVBDs to operate on frequencies occupied by active wireless microphone transmitter signals. It should not require removal of unlicensed wireless microphones from the core TV bands because there is no place else for them to them to go on June 12th, 2010.

Dell and Microsoft argue that geolocation and spectrum sensing should be added to new wireless microphones.[44] While I have no objection to this in principle, Dell and Microsoft fail to demonstrate that such an approach is currently feasible. Dell and Microsoft support this because it will force a move to digital technology. Unfortunately, Dell and Microsoft cannot demonstrate that digital technology is currently a feasible option for most wireless microphone users.

The microphone manufacturers respond to these suggestions in various ways. Audio-Technica argues that current battery technology cannot support geolocation and spectrum sensing.[45] Shure argues that current battery technology cannot support digital processing,[46] that digital technology does not reduce the need for bandwidth,[47]that digital compression produces too much latency[48], and that digital modulation is actually more susceptible to interference.[49]

Dell and Microsoft provide no technical analysis to anticipate and address these points. Instead, they highlight products from digital microphone manufacturers' web sites.

They cite five examples of digital microphones. The first,[50] third[51], and fourth[52] examples are specialized ENG, IFB, or other news/film production microphones that have no relevance outside of those uses. The second example looks promising, but is too expensive for me and

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[42] 47 C.F.R. 15.5(5)(b).
[43] Comments of Michael J. Benonis, at 5.
[44] Comments of Dell Inc. and Microsoft Corp., at 8.
[45] Comments of Audio-Technica, U.S., Inc., WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 7 (filed March 1st, 2010).
[46] Comments of Shure Incorporated, at 28.
[47] *Id.*
[48] *Id.*
[49] *Id.*
[50] http://www.sony.co.uk/biz/view/ShowContent.action?logicalname=dms-DWL%20landing-1107&site=biz_en_GB (last visited March 20th, 2010).
[51] http://www.zaxcom.com/transmitters.htm (last visited March 20th, 2010).
[52] http://www.lectrosonics.com/wireless/digital/d4/d4.htm (last visited March 20th, 2010).

similarly situated users.[53] The fifth example offers only five channels, not enough channels for most uses.[54]

I am not opposed to buying digital microphones. If I found one that I could afford and met my needs I would add it to the list of possible replacement systems and do a direct comparison and technical analysis of analog vs. digital microphone systems. Unfortunately, one may not exist or be created prior to June 12th.

Dell and Microsoft make good products. I use and will continue to use them both at work and at home. In all likelihood I will be buying TVBDs from them. In the present situation, however, they do not represent the interests of the user using both wireless microphones and TVBDs.

Public safety organizations filed comments to argue that unlicensed microphones should be prohibited from operating on channels 14-20 nationwide on the basis that wireless microphones may be moved after they are sold.[55] This is a very good example of the frequency uncertainty in this proceeding. Unless you live in certain metropolitan areas, channels 14-20 are a good choice under the regulations for unlicensed wireless microphones. If the Commission grants the petitions of APCO and NPSTC, however, channels 14-20 would be useless for those microphones. If I bought microphones in that range tomorrow, I might have to replace them again when the final rules are issued for this proceeding.

I offer no opinion on whether unlicensed wireless microphone use in channels 14-20 should be banned in the metropolitan areas where public safety operates on those channels. The Commission should not, however, make the prohibition nationwide. The chance of microphones operated by non-professionals moving around is very low.

V. KEEPING WIRELESS MICROPHONE USERS INFORMED

I have already discussed my issues with the microphone manufacturers' (and Shure in particular) omission of key information regarding Commission regulations when encouraging wireless microphone users to file comments. The situation with resellers/installers is even worse.

Twenty-two commenters (including one in my area) indicated they sold and installed equipment. Twenty-one of them (including the one in my area) did not even mention the Commission's proposed requirements applicable to resellers.[56] Most resellers are technically competent, but they appear to lack knowledge of even those Commission regulations or proposed regulations that directly impact them. This calls into question their ability to choose frequency ranges for their customers, because this requires knowledge of applicable Commission regulations.

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[53] http://www.prosoundweb.com/article/recent_wireless_technology_series_inside_the_akg_dms_700 (last visited March 20th, 2010).
[54] http://line6.com/xdr955/ (last visited March 20th, 2010)
[55] *See* Comments of APCO, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 2 (filed March 1st, 2010); . Comments of The National Public Safety Telecommunications Council (NPSTC), WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 1 (filed March 1st, 2010)
[56] *Wireless Microphone Further Notice*, at ¶ 144.

My own experience with a reseller and frequency selection is even worse than some. Many users purchased microphones operating in 700 MHz; I purchased microphones operating in 700 MHz channels that already auctioned off for my area. Had I known then what I know now, I would have objected to being sold microphones that operated in those channels.

(I previously stated that my interference issues had been due to TV broadcast interference.[57] I knew that there had been several 700 MHz auctions. I discovered after writing my comments, however, that I had been mistaken about some of the dates. It may have been licensee testing causing the interference.)

In my comments, I stated, "Even AV professionals place some reliance on the reseller to guide them to an appropriate purchase."[58] I want to elaborate on my statement.

Moving forward, the ability to coordinate frequencies will be a necessity and my earlier statement should not be construed to mean that higher education AV professionals lack those abilities. My statement reflects the realities of higher education. AV professionals are often responsible for many different areas. Wireless microphones are only one element of my AV responsibilities. Because their jobs are less specialized than their counterparts producing the Super Bowl, they have often relied on the reseller/installer for tasks like choosing microphone frequency ranges or setting microphone channels.

Those of us that pursue Part 74 LPAS licensing must choose to take on those tasks for ourselves. I accept responsibility for my error and I do not argue that the Commission should act to protect me and my counterparts from ourselves. Becoming licensed under Part 74 includes taking on the responsibility for answering these questions.

Instead, I write to emphasize the position of the unlicensed Part 15 user. Even professionals capable of complying with Part 74 regulations have been harmed by relying on manufacturers and resellers. Professionals can adjust by reducing their reliance on other parties. Part 15 users may not be able to do this.

This proceeding demonstrates the limitations of relying on the manufacturer or reseller to provide the wireless microphone user with necessary information, particularly the user who will be operating unlicensed wireless microphones under Part 15. I reiterate my call for the Commission to impose a consumer alert regarding frequency ranges.[59] The Commission must require manufacturers and resellers to provide important information that they may be unable or unwilling to provide.

Ironically, the resellers themselves may be placing inappropriate reliance on the manufacturers. In arguing against the imposition of marketing requirements, the primary defense of any manufacturer is that it does not sell to end users; it sells only to resellers who need not be licensed.

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[57] Comments of Ryan S. Overdorf, at 10.
[58] *Id.* at 14.
[59] *Id.*

The Commission can avoid this problem by imposing obligations on the manufacturer with respect to the reseller. Anyone selling wireless microphones certified only under Part 74 directly to the end user must verify that the user has an active LPAS license. Manufacturers should not be able sell to a reseller unless the reseller can demonstrate it sells the manufacturer's products to end users in compliance with Commission regulations.

The manufacturers obviously knew their products were being used by ineligible users. The manufacturers performed a disservice to wireless microphone users in two ways. First, they should have been more active in getting the Commission to authorize existing wireless microphone uses. If Part 74 expansion had occurred fifteen years ago, the PISC informal complaint would have never been filed. Second, they should have stopped selling 700 MHz microphones at least five years before the scheduled broadcaster migration out of the 700 MHz band. If the primary users were being evicted, why would anyone believe the secondary users would be allowed to stay? If I had been sufficiently aware of frequency issues in 2003, I would have refused to purchase 700 MHz microphones because of the eviction risk.

Despite the manufacturers' disservice to the user, I chose not to support the PISC petition. After I became aware of the issues in the wireless microphone proceedings, I wrote a report for my supervisor analyzing the consequences for operating our wireless microphones. One of the questions to be answered was whether the institution should file its own complaint in support of the PISC informal complaint (If the answer had been yes, I would have made a recommendation to my supervisor, who could endorse it and send it to the Dean, etc.). During my investigation three things became apparent.

First, the manufacturers had not violated Commission regulations because no regulations contemplated their actions. In other words, the manufacturers had exploited a loophole (a loophole the Commission is likely to close). PISC was asking the Commission to reinterpret its equipment certification regulations as marketing regulations and the Commission had never done so. PISC never even argued that the regulations created an implied duty to verify license eligibility.

Second, certain conditions specific to us (e.g., the age of the microphones) raised the question of whether we would benefit even if PISC was successful. The Commission would have had to set some eligibility requirements.

Third, PISC's petition for its General Wireless Microphone Service lacked any technical analysis for its choice of frequency range. The lack of support for its own position combined with the un-rebutted challenges of the microphone manufacturers suggested unfamiliarity with the operating conditions for wireless microphones. Getting the microphone manufacturers to pay for our move was of no benefit if there was nowhere to move.

My report stated that the PISC complaint was unlikely to be successful and unlikely to benefit us if it was successful. Therefore the university should not file a complaint in support of PISC.

PISC's more recent filings have not changed my mind. Their filing in this proceeding does not even mention the General Wireless Microphone Service. They continue to argue that

manufacturers have violated Commission regulations that do not yet exist while overlooking an actual regulatory violation about to happen. If the Broadway theaters are granted LPAS licenses tomorrow, they will immediately fail (assuming no accommodation with the Commission) to fulfill their obligations under 47 C.F.R. §74.832(f) to comply with the co-channel distance requirements under 47 C.F.R. §74.802(b).

PISC's argument is better characterized as a policy argument appealing to the moral hazard: If the Commission allows wireless microphone use to continue as is, the benefit to manufacturers and resellers would encourage others to do the same. I am not completely unsympathetic to this argument. My inappropriate reliance on manufacturers and resellers will cost my institution $5,000 or more, with no assurance moving forward that I can continue to operate wireless microphones successfully (especially considering the recommendations in the *National Broadband Plan* for further reallocation of the TV bands).[60]

I do not, however, think that the moral hazard is strong in this case. First, the Commission is now on notice and is likely to be more vigilant in closing other loopholes. Second, this is an unusual set of circumstances and may not reoccur in the future.

VI. REVISITING THE LICENSE TERM AND LPAS REQUIREMENTS

In my comments, I suggested creating potentially qualifying classes.[61] By "potentially qualifying class" I mean classes defined under 47 C.F.R. §74.801 and included as eligible licensees under 47 C.F.R. §74.832(a). I believe that Sennheiser's suggestion of tracking the ADA requirements[62] may be useful for identifying these classes, as well as Shure's suggestion regarding statutorily defined non-profits.[63] I reiterate that the Commission should add additional requirements to 47 C.F.R. §74.832 for the minimum number of microphones (seven, the only number supported by a technical analysis in the record), minimum frequency of use (annually), and new questions on the application (as discussed in a previous section).

In my comments, I suggested "The Commission could set an initial license term of five years for all new licensees. Many users will be purchasing replacement equipment and applying for licenses at approximately the same time. A five year period corresponds roughly with the real world lifespan of the equipment."[64]

Five years is the number I would assign for the purposes of an equipment life cycle assessment; the point at which I start losing significant numbers of microphones through attrition. It also answers the question, "If future reallocations result in another migration, what is the minimum number of years of use needed to justify an equipment purchase today?"

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[60] *National Broadband Plan*, at 88 ("Recommendation 5.8.5: The FCC should initiate a rulemaking proceeding to reallocate 120 megahertz from the broadcast television (TV) bands")
[61] *Id.* at 11.
[62] Comments of Sennheiser Electronic Corporation, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 6 (filed March 1st, 2010).
[63] Comments of Shure Incorporated, at 6.
[64] Comments of Ryan S. Overdorf, at 16.

Several commenters noted the hardship they had experienced in replacing their 700 MHz microphones.[65] While I stand by my recommendation, another reallocation five years from now would impose significant hardships.

VII. CONCLUSION

As the *National Broadband Plan* illustrates, pressures on spectrum use will continue to increase. Regardless of whether the use of spectrum is licensed or unlicensed and whether the devices using the spectrum are licensed or unlicensed, there should be a fundamental commitment to spectrum sharing that allows existing uses to be maintained while encouraging new uses to be developed.

The various parties have been fighting over the white spaces for more than seven years. There are seventeen petitions for reconsideration pending in the White Spaces proceeding. I would change some things if I were writing the Commission's rules, but the Commission's approach to the White Spaces proceeding is an acceptable compromise that advances the goal of spectrum sharing for those using both wireless microphones and TVBDs. The Commission should deny every petition for reconsideration and move forward with the current Part 15 Subpart H regulations.

The Commission should expand Part 74 to include institutions of higher education among the entities eligible for licensing. It should amend Part 74 to require the simultaneous use of seven wireless microphones at least once per year. It should distinguish between professional and non-professional users by amending the Part 74 application requirements to require a demonstration of technical knowledge and willingness to comply with regulations. It should also issue a consumer alert regarding microphone frequency ranges as part of any new marketing and labeling requirements imposed on manufacturers and resellers.

It should also expedite its consideration of and decisions about all other issues in the *Wireless Microphone Further Notice*.

I thank the Commission for taking time to read my reply comments.

Respectfully submitted,

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[65] *See, e.g.*, Comments of BreakPointe Community Church , WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 1 (filed February 22nd, 2010); Comments of Dorset Sound & Communications, LLC, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24 at 1 (filed February 19th, 2010).