Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 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
ADAPTRUM, INC.

Introduction

By public notice dated October 5, 2012[1] the Commission asked for further comment on two issues in the above proceedings:

> (1) whether the Commission should provide for a limited expansion of license eligibility that would permit some wireless microphone and other low power auxiliary station users, which currently operate in the TV broadcast spectrum on an unlicensed basis, to operate on a licensed basis under the Part 74 rules applicable to low power auxiliary stations (LPAS); and
>
> (2) what steps the Commission should take to promote more efficient use of this spectrum by wireless microphones.

Adaptrum, Inc. has been a long term active participant in the TV White Space proceeding, Docket 04-186 and along with other proponent has been greatly impacted by

[1] Public Notice DA 12-1570, October 5, 2012 ("PN")

the policy of letting all present wireless microphone users have unfettered access to interstitial use of TV broadcast spectrum. Adaptrum is a Silicon Valley-based startup company that was founded to commercialize the cognitive radio technology that the Commission has encouraged over the years.

In these comments Adaptrum addresses the public interest implications of continuing the current policies with only minor changes.

Background

In the days of analog NTSC TV broadcasting the UHF taboos[2] that were designed to allow interference-free use of TV receivers with modest performance parameters resulted in use of only one out of every 6 TV channels in a given area. In the Washington DC area, this can be readily seen in the channels in use: 14, 20, 26, and 32 although in DTV these channel numbers do not correspond to the frequency actually being used, rather they are the channels used with analog DTV and have been retained to assist viewers in selecting channels. As long as NTSC was the television broadcasting system there was inevitably a large amount of spectrum that could not be used for full or medium power TV broadcasting and which could be used on a low power basis without interference. Use of this spectrum by Part 74 eligibles was permitted by Subpart H of Part 74 of the Commission's rules but eligibility was strictly limited by the terms of §74.832. The vast majority of the actual users of wireless microphones were not eligible. In the major updating of these rules in Docket 01-75, t Shure, Inc.[3] who has significant

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[2] Hector Davis, A Study of UHF Television Receiver Interference Immunities, July 1987 (http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/reports/TM87.pdf)
[3] Comments of Shure, Inc., FCC Docket 01-75, August 7, 2001 (http://apps.fcc.gov/ecfs/document/view?id=6512762138)

market presence among non-eligible wireless microphone users never stated the need to expand eligibility.

In the Docket 01-75 Report and Order the Commission considered expanding eligibility for another Part 74 device on the same spectrum, Wireless Audio Video Devices and specifically declined to allow them for use in "production of live events".[4] Further it stated

> We are leery about expanding the eligibility of WAVDs beyond the entities already discussed. As stated in the Notice, the production industry and the broadcast industry rely on each other – one to produce content and the other to distribute content – and have a vested interest to operate in a manner that is mutually agreeable.310 Therefore, we will not expand the eligibility for WAVD licenses to entities beyond those proposed.[5]

Nevertheless the large scale use of wireless microphones in this spectrum by non-eligible users continued.

Public Interest Needs

Adaptrum agrees that that a wide variety wireless microphones uses serve the public interest in divergent areas such as live theater, concerts, conference rooms, and receptions such as weddings and should be provided for in the FCC Rules. But the issue here is really whether long term primary access to interstitial TV spectrum by wireless microphone users is an efficient use of spectrum given today's technology and today's ever growing demands on spectrum, and today's spectrum policy concepts. Basically the present status of wireless microphones results in very inefficient use of spectrum not only

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[4] Report and Order, ET Docket No. 01-75, November 13, 2002, at para. 147
[5] *ibid*. at para 149

through inefficient present technology, as discussed in the Notice[6], but also the fact that wireless microphone use is very spare in time and space[7] over the jurisdiction of the FCC resulting in very light use of the spectrum which is effectively denied or severely restricted to other users who could utilized this spectrum more intensely.

The nonbroadcast users of wireless microphones fall in two basic categories: facilities who use them for many different audio channels such as theaters and concerts and users who have needs for a few channels of audio such as conference centers where often the audio quality needs are much less than for professional performances.

Adaptrum urges the Commission to consider new technology approaches that would ultimately allow a gradual relocation of both classes of wireless microphones users out of TV broadcast spectrum to other spectrum where the intermittent use of wireless microphones would not deny the spectrum to other users, rather they would fit in with little impact.

We will admit that wireless microphones with the technology discussed below are not commercially available at present. But the simple reason is that the continued availability of "free" spectrum for wireless microphones under present Commission policies as well as the tolerance for the dated wideband FM – the <u>same 1930s technology</u>

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[6] "As the Commission observed in the Wireless Microphones Further Notice, the majority of wireless microphones that currently operate in the UHF TV bands are frequency modulated analog devices that operate with a bandwidth of up to 200 kHz. Because of a number of factors, including the need to avoid intermodulation interference among the devices, the maximum number of wireless microphones that these analog devices can operate simultaneously in a 6 megahertz TV channel may be as few as six or eight. Accordingly, with the use of these analog wireless microphones, only between 1.2 and 1.6 megahertz of the 6 megahertz TV channel may be used while the remainder is effectively left fallow." PN at p. 5-6

[7] Use is very high in theater districts such as New York's Broadway area for a few hours a day and is high near houses of worship with advanced audio systems for a few hours a week, but this is a tiny fraction of the geographic area of the Commission's jurisdiction.

that the Commission is nearing completion of a 20 year phase out for Part 90 users. Basically, no alternative technology is ever cheaper than free spectrum despite the fact that for almost 2 decades the Commission has had the general policy that commercial spectrum users pay for spectrum access. If Commission leadership requires a reasonable transition to alternative technology in other bands, the US communications electronics industry is more than capable of producing the equipment needed for the resulting market.

For the low number of channel users, we propose two alternatives to the present TV spectrum use. One alternative is using unlicensed ISM band spectrum with the 802.11 TDLS (Tunneled Direct Link Setup)[8] and the other alternative uses FM broadcast spectrum under the long standing provisions of §15.239.

While unlicensed ISM band spectrum use under §15.247 is best known for Wi-Fi and Bluetooth, the present IEEE 802.11 technical standards for Wi-Fi include the ability

> "to automatically create a secure, direct link between them after accessing the Wi-Fi® network, removing the need to transmit data through the access point. In today's Wi-Fi networks, faced with increased traffic and more demanding applications, TDLS links between devices improve overall network performance, reduce latency caused by heavy AP traffic, and avoid interference, thereby improving the user experience."[9]

Chip sets to perform these function are now commercially available and a wireless microphone system could be readily implemented using such chips sets for radio access.

The FM broadcast spectrum alternative has been available in the Commission's

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[8] Wi-Fi Alliance® now certifying Tunneled Direct Link Setup, August 23, 2012 (http://www.wi-fi.org/media/press-releases/wi-fi-alliance%C2%AE-now-certifying-tunneled-direct-link-setup)

[9] *ibid*.

Rules for decades. Perhaps in the analog age this technology had poor performance due to frequency drift and component performance, but with today's digital radio technology including digital tuning, such problems are a relic of earlier generations.

For applications where a large number of channels are needed or where the reliability requirement exceeds what might be expected for unlicensed spectrum we propose as a long term alternative to move these systems out of TV spectrum into licensed CMRS spectrum using technology such as LTE Direct which relies on the LTE Physical Layer to connect proximate peers. [12]

Proponents of the status quo in wireless microphone use will no doubt object that the CMRS carriers will charge for spectrum access which is presently "free". This is true. But this is the general state of US spectrum policy for two decades now. This is also the state of wireless microphone use in the UK where JFMG[13] has been authorized by Ofcom[14] as the manager of all "Programme Making and Special Events" (PMSE) – a UK term that includes wireless microphones - and issues licenses on behalf of Ofcom for a fee.[15]

Theaters and concerts pay for electricity, equipment rental, property and other expenses. Why is it so objectionable to pay for high reliability multichannel spectrum access?

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[12] In some audio applications, temporal latency is a concern. However, digital sound boards (http://www.acousticsbydesign.com/acoustics-blog/analog-vs-digital-sound-boards.htm) are now widely used and a digital-to-digital link between the femtocell and the digital soundboard will keep latency small.
[13] https://www.jfmg.co.uk/pages/about/about.htm
[14] https://www.jfmg.co.uk/pages/licence/pmselicence.htm
[15] https://www.jfmg.co.uk/pages/fees/fees.htm

Conclusions

Adaptrum applauds the FCC for refreshing the record in these proceedings about alternatives for wireless microphone use. However, we urge the Commission to be bolder than minor changes to today's wireless microphone technology and spectrum access and consider the policies that apply to other classes of spectrum users.

While interstitial use of TV spectrum was essentially a zero cost option decades ago when it started, spectrum is in much greater demand now and new technological options are available that will meet wireless microphone needs while not denying spectrum to other usages.

/S/

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Date

Cc: Julius Knapp