

**Before the  
Federal Communications Commission  
Washington, DC 20554**

In the Matter of	)	
	)	
Promoting Spectrum Access for Wireless Microphone Operations	)	GN Docket No. 14-166
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	GN Docket No. 12-268
	)	
	)	

**COMMENTS  
OF THE CONSUMER ELECTRONICS ASSOCIATION**

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**TABLE OF CONTENTS**

	<u>Page</u>
I. INTRODUCTION AND SUMMARY .....	1
II. THE COMMISSION MUST CAREFULLY BALANCE THE RISKS OF INTERFERENCE TO VHF BROADCASTS WITH THE GAINS FROM EXPANDED WIRELESS MICROPHONE USE. ....	2
A. Expanding the Use of VHF Wireless Microphones Offers Many Potential Benefits, But the Commission Must Also Protect Consumers’ Over-The-Air Television Reception Against Harmful Interference. ....	3
B. Authorizing Higher Power Levels for Licensed Microphones in the VHF Bands Will Require Rigorous Technical Analysis to Ensure Adequate Protection. ....	4
C. Reducing Separation Distances Under a Signal Threshold Approach Will Increase the Risk of Harmful Interference and Add Unnecessary Complexity for Uncertain Gains. ....	7
D. If the Commission Raises Power Limits without Implementing a Tiered Approach, It Must Revisit the Current Separation Distances. ....	10
III. CONCLUSION.....	10

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**I. INTRODUCTION AND SUMMARY**

The Consumer Electronics Association (“CEA”)<sup>1</sup> submits these comments in response to the Federal Communications Commission’s (“FCC” or “the Commission”) September 30, 2014 Notice of Proposed Rulemaking in the above-captioned proceedings.<sup>2</sup>

CEA supports the Commission’s aim of “provid[ing] wireless microphones with access to additional television channels in particular locations without raising interference concerns to

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<sup>1</sup> CEA is the principal U.S. trade association of the consumer electronics and information technologies industries. CEA’s more than 2,000 member companies lead the consumer electronics industry in the development, manufacturing and distribution of audio, video, mobile electronics, communications, information technology, multimedia and accessory products, as well as related services, that are sold through consumer channels. Ranging from giant multinational corporations to specialty niche companies, CEA members cumulatively generate more than \$223 billion in annual factory sales and employ tens of thousands of people.

<sup>2</sup> *Promoting Spectrum Access for Wireless Microphone Operations and Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 29 FCC Rcd 12343 (2014) (“*Wireless Microphone NPRM*”).

television licensees.”<sup>3</sup> Expanding access to spectrum for wireless microphones has the potential to promote more efficient and intensive use of limited radio frequency resources.<sup>4</sup> But expanding wireless microphone operations in the VHF band without creating harmful interference to over-the-air television operations will require the Commission to strike a delicate balance between the needs of wireless microphone users, VHF broadcasters, and the viewers of VHF stations.<sup>5</sup> The Commission must weigh the costs and benefits of expanding access to spectrum for wireless microphone operators and undertake rigorous technical analyses to address potential interference concerns before it decides on any course of action.<sup>6</sup>

## **II. THE COMMISSION MUST CAREFULLY BALANCE THE RISKS OF INTERFERENCE TO VHF BROADCASTS WITH THE GAINS FROM EXPANDED WIRELESS MICROPHONE USE.**

Any action taken by the Commission to increase the VHF spectrum available to wireless microphone users will carry some associated risk of interference to VHF broadcasts. Balancing these tradeoffs will require careful consideration of a number of technical factors, including permitted power levels, separation distances, and receiver sensitivity.

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<sup>3</sup> *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd 6567 ¶ 304 (2014) (“*Incentive Auction R&O*”).

<sup>4</sup> See *Wireless Microphone NPRM* ¶ 4. While the Commission addresses several different bands in this NPRM, CEA addresses only proposed operations in the VHF band and does not address operations in any other bands.

<sup>5</sup> CEA uses the term “wireless microphones” to refer to wireless microphones and other related wireless audio devices, including those authorized under the rules applicable for “low power auxiliary stations,” in the same sense that this term is used by the Commission in the *Wireless Microphone NPRM*. See *id.* ¶ 5.

<sup>6</sup> CEA has separately submitted comments to the *Part 15 NPRM*, which, among other things, proposes rules for *unlicensed* wireless microphones and licensed microphone operations in the duplex gap. See *Amendment of Part 15 of the Commission’s Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37*, Notice of Proposed Rulemaking, 29 FCC Rcd 12248 (2014) (“*Part 15 NPRM*”).

**A. Expanding the Use of VHF Wireless Microphones Offers Many Potential Benefits, But the Commission Must Also Protect Consumers' Over-The-Air Television Reception Against Harmful Interference.**

Wireless microphones provide valuable benefits to consumers by enabling live broadcasts and enhancing event productions in settings as varied as theaters, music venues, film studios, conventions, corporate events, houses of worship, and internet webcasts.<sup>7</sup> Enabling greater use of wireless microphones in the VHF bands will benefit the recently expanded base of users eligible to operate wireless microphones under Part 74 and reduce costs of production.

At the same time, however, broadcasters on VHF channels (channels 2-13) already face significant challenges to delivering broadcast services to consumers, and the Commission should avoid exacerbating these challenges. DTV reception in both high- and low-VHF bands is susceptible to interference from a wide variety of sources, both man-made and natural.<sup>8</sup> In particular, the low VHF channels (channels 2-6) are generally less desirable due to interference caused by ordinary consumer electrical appliances.<sup>9</sup> As a result, broadcasters have favored UHF channels where they are available.<sup>10</sup> Moreover, VHF broadcasters must compete not only with UHF broadcasters, but also with cable, satellite, and over-the-top (“OTT”) providers. Any

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<sup>7</sup> See *Wireless Microphone NPRM* ¶ 1.

<sup>8</sup> See, e.g., *VHF Reception Panel*, FCC Broadcast Engineering Forum (June 25, 2010), available at <http://www.fcc.gov/events/broadcast-engineering-forum> (discussing problems and options for improving VHF reception).

<sup>9</sup> See, e.g., Harry Jessell, *VHF: Now Everything You Know is Wrong*, TV News Check (June 26, 2009), available at <http://www.tvnewscheck.com/article/33407/vhf-now-everything-you-know-is-wrong>; Harry Jessell, *FCC Plan Makes VHF a Very High Priority*, TV News Check (Dec. 2, 2010), available at <http://www.tvnewscheck.com/article/47448/fcc-plan-makes-vhf-a-very-high-priority>.

<sup>10</sup> See, e.g., *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Fifteenth Report, 28 FCC Rcd 10496 ¶ 150 (2013) (“*Fifteenth Video Programming Report*”) (“At the end of 2012, there were 1,028 commercial UHF stations, 358 commercial VHF stations, 288 noncommercial UHF stations, [and] 107 noncommercial VHF stations [in the United States.]”).

additional harmful interference poses a serious threat to their continued viability and to consumers' ability to receive these broadcasts.

In addition, an increased risk of VHF interference could negatively affect the upcoming 600 MHz incentive auction. As part of the 600 MHz incentive auction, the Commission seeks to encourage broadcasters to bid for reassignment from a UHF to a VHF channel, or from a high-VHF to low-VHF channel.<sup>11</sup> If the technical rules for wireless microphones fail to ensure reliable VHF operations free of interference, broadcasters may be deterred from bidding to relocate to VHF. Thus, inadequate protection for VHF channels risks reducing the amount of spectrum made available for mobile broadband use.

**B. Authorizing Higher Power Levels for Licensed Microphones in the VHF Bands Will Require Rigorous Technical Analysis to Ensure Adequate Protection.**

Despite these potential pitfalls, the Commission has an opportunity to put relatively under-used VHF spectrum to more efficient use in much of the country by raising the permissible power levels for wireless microphones. Doing so will require a rigorous technical analysis of interference risks, as described more fully below. While always the foundation of any Commission rule, rigorous technical analysis is especially important in this situation given the lack of third-party data regarding permissible power levels for wireless microphones or the pragmatic separation distances between wireless microphones and over-the-air television stations.

The Commission's proposed tiered approach to power levels based on separation distances – authorizing operations at 50 mW or less outside of four kilometers and higher power

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<sup>11</sup> See *Incentive Auction R&O* ¶ 27.

operations at greater distances – offers a promising approach for promoting co-existence between wireless microphones and VHF television operations.<sup>12</sup> At present, licensed wireless microphones can operate at power levels up to 50 mW in the VHF bands at a separation distance of four kilometers or greater.<sup>13</sup> The Commission could authorize power levels of up to 100 mW<sup>14</sup> or even 250 mW, as is authorized in the UHF band<sup>15</sup> and as the Commission is considering in the VHF Band,<sup>16</sup> assuming adequate separation distances. This type of tiered approach is a relatively simple framework; simpler, for example, than the “culling distance” approach the Commission has proposed for the much more capital-intensive LTE deployments. Such a tiered approach would promote greater use of wireless microphones and would be highly workable.<sup>17</sup>

As an alternative to the proposed geographic separation approach, the Commission could authorize higher power levels based on greater frequency separation. Such an approach could

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<sup>12</sup> See *Wireless Microphone NPRM* ¶ 78.

<sup>13</sup> See 47 C.F.R. §§ 74.861(e)(1)(i), 74.802(b)(1).

<sup>14</sup> For example, personal/portable devices may operate in TV whitespaces at 100 milliwatts when not adjacent to an occupied channel. See *Unlicensed Operation in the TV Broadcast Bands and Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Third Memorandum Opinion and Order, 27 FCC Rcd 3692 ¶ 29 (2012) (“*TV Whitespaces Third MO&O*”).

<sup>15</sup> See 47 C.F.R. § 74.861(e)(1)(ii).

<sup>16</sup> See *Wireless Microphone NPRM* ¶¶ 76, 78 (proposing conforming current 50 mW power limits for LPAS devices in VHF band with higher 250 mW power limits for LPAS devices in UHF band).

<sup>17</sup> See, e.g., *Office of Engineering and Technology Releases and Seeks Comment on Updated OET-69 Software*, Second Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 13071, Appendix E, Proposed OET Bulletin No. 74: Longley-Rice Methodology for Predicting Inter-Service Interference to Broadcast Television from Mobile Wireless Broadband Services in the UHF Band (2014) (“*OET-74*”) (discussing a “culling distance” framework allowing wireless operators a variety of methods to deploy while protecting DTV contours from interference).

mirror the Commission's approach to devices operating in television whitespaces, which allows personal/portable devices to operate at 100 mW in channels not adjacent to a TV service, but only 40 mW in channels adjacent to a TV service.<sup>18</sup> The Commission could also pursue a combined approach by adopting tiers for both geography and frequency separation, offering a further degree of flexibility.

Whatever the precise approach the Commission elects to intensify spectrum use in the VHF bands, however, the Commission should base its rules on laboratory testing of some subset of television receivers actually deployed in the United States. To identify sufficiently protective power levels and separation distances, for example, the Commission should conduct laboratory testing using a sample of actual DTV receivers with performance reflective of existing receivers in use and a sample of interference sources that represent the modulated waveform generated by actual wireless microphones. This testing should be based upon the ATSC A/74 Receiver Performance Guidelines<sup>19</sup> and should include a realistic, but worst-case, number of interfering source signals within a six-megahertz DTV channel. The testing should evaluate the required desired-to-undesired signal ratios for several DTV receiver power levels and wireless microphone frequency plans. The worst-case results of this testing should be used to calculate separation distances for proposed wireless microphone power levels using free space propagation models to identify distances sufficient to reduce the risk of harmful interference to tolerable levels.

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<sup>18</sup> See *Part 15 NPRM* ¶ 20.

<sup>19</sup> See Advanced Television Systems Committee, Inc., *ATSC Recommended Practice: Receiver Performance Guidelines, Document A/74:2010* (April 7, 2010), available at [http://www.atsc.org/cms/standards/a\\_74-2010.pdf](http://www.atsc.org/cms/standards/a_74-2010.pdf) (“ATSC A/74 Guidelines”).

Rules that do not rest on laboratory testing designed to identify a range of separation distances between wireless microphones and DTV channels sufficient to prevent harmful interference would represent little more than guesswork, and would ultimately impede the broader aims of spectrum policy. Inadequate separation distances or frequency separations will not protect consumers' ability to receive over-the-air television broadcasts against harmful interference, while overly-protective separation distances or frequency separations will inhibit efficient use of limited spectrum resources. Laboratory testing will be required to strike the optimal balance between protection and efficiency, and should therefore form the foundation of any final rule.

**C. Reducing Separation Distances Under a Signal Threshold Approach Will Increase the Risk of Harmful Interference and Add Unnecessary Complexity for Uncertain Gains.**

The Commission also explores the possibility of reducing separation distances by allowing wireless microphone operations whenever a DTV signal falls below a given threshold strength. Under the proposed approach, the threshold levels below which wireless microphones could operate would extend inside of DTV contours.<sup>20</sup> Although intriguing in principle, the Commission's threshold-strength proposal raises two significant concerns.

First, the only proposed DTV signal threshold that the Commission has received,<sup>21</sup> when expressed across a six megahertz channel, is significantly higher than the minimum A/74 guideline for DTV receiver sensitivity.<sup>22</sup> DTVs receiving at a level in accordance with the A/74

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<sup>20</sup> See *Wireless Microphone NPRM* ¶ 82.

<sup>21</sup> See *id.* ¶ 83.

<sup>22</sup> See *ATSC A/74 Guidelines*, 12.

guideline are thus likely to successfully receive a signal.<sup>23</sup> Contrary to the stated intention of the proposed approach, therefore, the suggested threshold level is *not* one “which would indicate that the over-the-air TV signal [is] unlikely to be received.”<sup>24</sup> Instead, allowing wireless microphones to operate conterminously with television operations at the proposed threshold creates the potential for harmful interference to over-the-air television signals that consumers would otherwise receive.

Second, the proposed signal-threshold approach creates a layer of potentially unworkable complexity for gains that are speculative, at best. Setting a signal threshold involves making numerous assumptions about the deployment, design, and configuration of television receivers and wireless microphone transmitters. Anyone proposing a signal-threshold approach must make assumptions about the morphology of the deployment area, whether microphones are used indoors or outdoors, and precisely how the DTV antenna is configured, including the height of the antenna above ground level and the gain of the antenna deployed. The signal threshold will vary considerably depending on the assumptions used for these and related criteria. If the Commission were to assume VHF television viewers use small, indoor antennas, for example, the signal threshold would be set very high and would allow many new wireless microphone uses into the band. Unfortunately, adopting this set of assumptions would pose a significant risk of harmful interference to any DTV user with an antenna configuration superior to those assumptions. For example, viewers in less densely-populated areas, particularly at the edge of

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<sup>23</sup> Indeed, a study commissioned by CEA found that the median signal sensitivity of 12 recent-model DTV receivers was -86.2 dBm over 6 MHz, better than the A/74 minimum guidelines. See Gary Sgrignoli, *A Report to the Consumer Electronics Association Regarding Laboratory Testing of Recent Consumer DTV Receivers With Respect to DTV & LTE Interference* 35 (May 22, 2014), attached to Letter from Julie M. Kearney, Vice President, Regulatory Affairs, CEA, to Marlene Dortch, Secretary, FCC, GN Docket No. 12-268, ET Docket No.14-14 (May 22, 2014).

<sup>24</sup> See *Wireless Microphone NRPM* ¶ 82.

DTV contours, would typically use high-gain antennas mounted on high masts or rooftops. These viewers would experience harmful interference far more readily than the viewers who use small, indoor antennas as assumed for calculating the threshold. Conversely, if the Commission were to assume that all viewers use high-gain antennas typical of viewers in less densely populated areas, then the adopted signal threshold would be very low, which would minimize any potential increase of wireless microphone uses in the areas where new operations would be permitted.

Assuming that the Commission sets a reasonably low value for a signal threshold to minimize the possibility of harmful interference, the benefits from enabling wireless microphone operations within a DTV station's broadcast contour are likely to be minimal because, generally speaking, the locations where such a low signal threshold will be met are likely to be near the edges of the contour. In many cases, these areas will be sparsely populated and other spectrum is likely available for microphone use. There may be exceptions to this general rule, where, for example, the area near a contour edge is densely-populated, but these areas are likely to be in the minority. This limited subset of areas could be handled through a waiver process, rather than requiring a new, complex and potentially unworkable rule.

The combination of high complexity, increased risk of interference, and minimal gains to wireless microphone users indicates that the Commission should not take an unnecessary risk by adopting a threshold approach. Whatever their imperfections, separation distances for wireless microphone use are simple to implement and effective at preventing interference. While in other more capital-intensive and higher-revenue contexts, such as LTE deployment, a more complex approach may offer tremendous benefits,<sup>25</sup> introducing such a complex methodology in this case

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<sup>25</sup> See, e.g., OET-74.

will add considerable costs in exchange for limited, if any, returns in the form of more intensive spectrum use.

**D. If the Commission Raises Power Limits without Implementing a Tiered Approach, It Must Revisit the Current Separation Distances.**

The relative lack of data on wireless microphone interference means that any increase in permissible power levels, in the absence of a tiered approach, would require revisiting the existing separation distances. The current four-kilometer separation distance<sup>26</sup> is untested for unlicensed microphones operating at either 50 mW or 250 mW, which has led the Commission to seek comment on appropriate power levels and separation distances in that context.<sup>27</sup> If the Commission decides to consider increasing the current power limits for licensed microphones, it should similarly revisit the current separation distance of four kilometers and, as described above, conduct appropriate technical analyses to ensure harmonious co-existence between licensed microphone and VHF broadcast operations.

**III. CONCLUSION**

In seeking to promote licensed wireless microphone operations, the Commission must protect consumers' ability to receive over-the-air VHF television from harmful interference. By rigorously analyzing – and testing – the potential interference from wireless microphones to VHF broadcasts, the Commission can promote co-existence of both services. Indeed, the Commission's proposal to authorize higher power levels for microphones based on greater separation distances under a tiered approach could promote the use of licensed wireless

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<sup>26</sup> See 47 C.F.R. § 74.802(b).

<sup>27</sup> See *Part 15 NPRM* ¶ 156. (“[T]he proposed four kilometer separation distance . . . was calculated using a power level of 4,000 milliwatts. . . . Should we assume a lower power level? If so, what is the appropriate power level and separation distance?”).

microphones, as could a tiered approach based on frequency separation, or some combination of the two. However, reducing separation distances below the proposed four kilometers would risk interference to VHF broadcasts and consumers' ability to receive them. Likewise, the Commission's proposal to authorize wireless microphone operations when the DTV signal falls below a threshold level would introduce unneeded complexity with little concomitant benefit. If the Commission nonetheless elects to increase power levels without implementing a tiered approach, instead relying on a DTV signal threshold or some other measure, it must revisit separation distances and conduct the technical analyses discussed above to protect VHF broadcasts.

Respectfully submitted,

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