Before the
Federal Communications Commission
Washington, D.C. 20554

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, and	)	ET Docket No. 14-165
Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	GN Docket No. 12-268

OPPOSITION TO PETITIONS FOR RECONSIDERATION OF THE NATIONAL ASSOCIATION OF BROADCASTERS

February 29, 2016

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OPPOSITION TO PETITIONS FOR RECONSIDERATION OF THE NATIONAL ASSOCIATION OF BROADCASTERS

I. INTRODUCTION AND SUMMARY

The National Association of Broadcasters (NAB)[1] hereby opposes petitions submitted by the Wireless Internet Service Providers Association, Google Inc., Microsoft Corporation, and Carlson Wireless Technologies, Inc. and Cal.net, Inc. seeking reconsideration of the Commission's Report and Order in the above-captioned proceeding regarding unlicensed white space device operation in the television band.[2]

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[1] The National Association of Broadcasters is a nonprofit trade association that advocates on behalf of free local radio and television stations and broadcast networks before Congress, the Federal Communications Commission and other federal agencies, and the courts.

[2] *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;*

NAB continues to support unlicensed operation in the television band as long as such operations must not cause harmful interference to licensed services. NAB opposes certain of the changes petitioners seek to the FCC's rules because they will unnecessarily and unacceptably increase the likelihood for harmful interference to over-the-air television viewers and other licensed operations.

The petitions each seek a substantial relaxation of Commission rules intended to protect licensed operations without a firm technical foundation for the proposed changes. The petitions fail to acknowledge and understand the demonstrated inadequacies of the TVWS database, attempt to end run the Commission's existing rules by eliminating distinctions between fixed devices and portable devices and seek to undermine the Commission's efforts to provide reasonable protections for licensed wireless microphones used to cover breaking news and emergencies. Most importantly, they fail to reflect an understanding of the core premise of TVWS operations; namely, that these operations are opportunistic in nature and must take place in between and around licensed services without causing interference. Pursuing additional opportunities for expanded unlicensed operations should not come at the expense of existing licensed services. NAB addresses each of these petitions in turn below.

II. THE WISPA PETITION

In its petition, the Wireless Internet Service Providers Association ("WISPA") requests that the Commission permit the TVWS database to incorporate transmit antenna directivity

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Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Report and Order, 30 FCC Rcd 9551 (2015) (Report and Order).

to determine TV channels available for fixed white space device use in a given area and allow unlicensed operations to operate from higher elevations with corresponding changes in distance separation criteria.[3] Both of these requests are technically unsound.

In its order, the Commission correctly determined that permitting antenna directivity in fixed white space device installations was inappropriate, reasoning that "there is not sufficient information in the record to show how to enable the use of antenna directivity without causing harmful interference to authorized services."[4] In its petition, WISPA states "to the extent the Commission may be concerned about the accuracy of information on antenna azimuth being accurately incorporated into the database, this is easily resolved through the professional installation requirements."[5] This is a facile and unsupported assertion.

NAB has repeatedly demonstrated that the so-called "professional installation" requirements have failed to ensure the accuracy of information entered in the white spaces database for TVWS devices. Any expansion of the information that may be verified by "professional installation" is wholly unjustified. In particular, correctly taking into account antenna directivity and avoiding interference to authorized services is significantly more complex than merely deciding on typical antenna beamwidths and gains, as WISPA suggests by WISPA.

In practice, the physical installation of an antenna may distort the idealized antenna patterns, resulting in unpredictable coverage and interference. The accuracy of the

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[3] Petition for Partial Reconsideration of the Wireless Internet Service Providers Association, ET Docket No. 14-165, GN Docket No. 12-268 (filed Dec. 23, 2015) (WISPA Petition).

[4] Report and Order at ¶ 67.

[5] WISPA Petition at 5.

measurement of the antenna's position or direction may change over time and with adverse weather conditions. Such operations would require frequent, periodic inspections to ensure that changes have not occurred. Signals from high gain antennas may also reflect off buildings and other objects, causing interference to locations off the main axis of the antenna. Proper and accurate orientation of an antenna is not an appropriate matter for an equipment installer, whether "professional" or not; it requires the expertise of a licensed land surveyor. Further, there is no way to ensure that the directional antenna approved for use with a given device will actually the antenna a user or professional installer elects to use.

Based on the demonstrated inability of "professional installation" to ensure the accuracy of any of the information associated with a device's registration in the TVWS database, the Commission correctly concluded that there is not sufficient information to enable the use of antenna directivity at this time without causing a significant threat of harmful interference to authorized services.

With respect to WISPA's request for increased antenna heights, NAB supports the Commission's current limits. The current rules allow TVWS antennas to be mounted approximately 100 feet above the ground and operate at a height of over 800 feet above average terrain. It is completely unclear why this is insufficient for low power unlicensed TVWS operations.

Additionally, any increase in antenna heights would necessarily involve corresponding increases in distance separation limits to protect licensed operations. However, calculating adequate protection distances can be complex. Protection distances need to take to into account both the height of the TVWS transmitting antenna and the height of the TV receiving antenna. Further, increased antenna heights increase the potential for interference to cable

headend receivers, broadcast auxiliary and land mobile receiving facilities, which WISPA does not even address.

To the extent that there may be a few exceptional instances warranting higher antenna heights, these cases can be accommodated through the Commission's existing waiver processes. NAB is willing to work with WISPA and others to facilitate such exceptional operations while ensuring that all viewers and other authorized users are fully protected. At this point, however, a generalized increase in permitted antenna heights is premature and unnecessary.

III. THE MICROSOFT PETITION

In its petition, Microsoft asks that the Commission harmonize the conducted and radiated power limits for low-power devices operating at 40 mW, complaining that the rules treat low power fixed and personal/portable devices differently.[6] Microsoft's assertion that low power fixed devices and personal portable devices have the same interference potential, or that low power fixed devices are even less likely to cause interference, is incorrect.

The Commission's original interference analyses for TVWS personal/portable and fixed devices were based on substantially different technical assumptions for these devices. In its original decision, the Commission assumed personal/portable devices would be used close to the ground and close to a user's body such that signals from such devices would be subject to ground attenuation and body absorption losses, as well as being below of the main beam of a TV receive antenna.[7] None of these factors would necessarily apply to a low

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[6] Petition for Reconsideration and Clarification of Microsoft Corporation, ET Docket No. 14-165, GN Docket No. 12-268, 2, 16 (filed Dec. 23, 2015) (Microsoft Petition).

[7] *Unlicensed Operation in the TV Broadcast Bands*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807, ¶¶ 172-178 (2008) (TVWS Second Report and Order).

power fixed device. The Commission also reasoned that personal/portable devices would presumably be battery powered and would operate using intermittent transmissions, as compared to fixed devices that can operate continuously powered by AC electricity. Under these conditions, the Commission found that a 40mW personal/portable device operating on an adjacent channel within a TV station's contour with a separation distance of at least 16 meters would not cause unacceptable interference to TV viewers.

However, as NAB pointed out in its own petition for reconsideration, a similar analysis for a low power fixed device with an antenna height of 10 meters shows that more than 160 meters of separation would be required, and that such a device located anywhere within a 10,400 square meter area in front of a TV receive antenna would be likely to cause interference to TV viewers located near the edge of a TV station's contour.[8] Microsoft's assertion that the potential interference from fixed devices is equivalent to, or even less than the potential from personal/portable devices, is plainly erroneous; a low power fixed device has an area of potential interference that is *50 times* larger. This analysis, and the potential for interference it demonstrates, is precisely why the Commission did not permit 40 mW low power fixed operations under the original TVWS rules, and neither Microsoft nor the Commission has provided any information or data to justify a change.

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[8] Petition for Reconsideration of the National Association of Broadcasters, ET Docket No. 14-165, GN Docket No. 12-268, 13 (filed Dec. 23, 2015) (NAB Petition). This analysis assumes flat terrain for both the TV receiving antenna and the TV white space device. The method of FCC/OET TM-91-1 (Equation 6) was used, assuming 10 meter antenna heights, 40 mW EIRP, 3 dB cross-polarization mismatch, and no building penetration loss, solving for an interfering field strength of 29 dBuV/m. The 10 meter antenna height limit for the TV white space device is based on height above ground. If the TV white space device were located at an elevated location the interference distances would be significantly larger.

In fact, Microsoft's request appears to be nothing more than an attempt to eliminate the geolocation requirement that currently applies to personal/portable devices. The Commission's rules do not permit "professional installation" for small portable transmitters that can easily be moved from place to place; rather, they require these devices to incorporate automatic geolocation capability. Under Microsoft's approach, there would be *no* functional difference between a 40 mW personal/portable device and a 40 mW fixed device, and the geolocation requirement for personal/portable devices would effectively be mooted.

Microsoft also asks that the Commission clarify that indoor routers are fixed devices and clarify that a consumer's moving the device from one point in a house to another is a *de minimis* change that does not require professional re-installation of the device. It claims that a home access point clearly meets the definition of a "fixed device," that is "[a] TVBD that transmits and/or receives radiocommunications signals at a specified fixed location."[9]

In fact, contrary to Microsoft's assertions, a device that can be easily moved whether it be from room to room in a home or from place to place anywhere in the country is no longer a fixed device. Such a device certainly is not consistent with the definition of fixed device that operates from a "*specified fixed location*."[10] Microsoft does not acknowledge that, if its request is adopted, there would be no difference between a consumer's ability to move a device from room to room in her home and her ability to take that same small portable device from New York to California and use the same registration and location information.

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[9] Microsoft Petition at 16-18.

[10] 47 C.F.R. § 15.703(c).

While NAB strongly opposes Microsoft's proposal, we would not object to eliminating the professional installation requirement for routers and similar home devices, provided that those devices include a geolocation capability. Indeed, such a requirement would address all of Microsoft's concerns. Requiring all TVWS devices to include built-in geolocation capability, as is now required only for personal/portable devices, would eliminate the expense of professional installation, provide more accurate device location information, and allow consumers to move a TVWS wireless router or access point *anywhere* – not only within their home but across town or even across the country – while still avoiding interference to licensed operations.

IV. THE GOOGLE PETITION

In its petition, Google correctly observes that the Commission did not provide adequate notice for its new "push" requirement, under which databases must push wireless microphone reservation information to unlicensed devices.[11] NAB agrees that the push requirement is unsupported. More importantly, the rules surrounding the new requirement provide no assurance that white space devices will actually receive such messages and cease to operate on channels registered for use by licensed wireless microphones. However, Google's proposed solution, creating two fast-polling channels, misinterprets the intent of the Commission's new push requirement, and fails to reflect the policy balance the Commission attempted to strike. Google seeks a new requirement that, while less burdensome for Google, will not provide the opportunities or protections the Commission envisioned in adopting its new push requirement.

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[11] Google Inc. Petition for Reconsideration, ET Docket No. 14-165, GN Docket No. 12-268, 7-8 (filed Dec. 23, 2015) (Google Petition).

Previously, licensed microphones used for newsgathering operations could rely on dedicated access to two channels on which TVWS operations was prohibited. In addition, licensed microphones could reserve other available TV channels for pre-planned events, as needed. Google's suggestion of limiting polling to two channels does not provide licensed operations with the same capability and protection they had under the Commission's previous rules or the same capability and protection as the Commission sought to provide with its new push requirement. For example, in discussing the push requirement, the Commission stated:

> Although two vacant TV channels above and below channel 37 are easily identified prior to the incentive auction, we will not know until after the incentive auction how much spectrum will be repurposed and which frequency band will remain allocated to broadcasting services. The transition from broadcasting to wireless services will occur market by market over a period of time, and the now vacant TV channels for microphone use will be phased out as markets transition. This makes it impossible to identify channels in each market for exclusive microphone use after broadcasting facilities transition out of a market and new wireless licensees plan to introduce new services. We conclude that it is better to modify the procedures for microphone users to reserve vacant TV channels for immediate use.[12]

NAB agrees with Google that implementing an as-yet undeveloped push capability in TVWS devices or databases that can meet the needs of licensed wireless microphone users is impractical. However, if the FCC cannot determine what channels to reserve for microphones, it also cannot determine what channels should be reserved for Google's polling proposal.

Additionally, with fewer channels available for licensed microphone operation, the Commission's push requirement is intended to ensure that scheduled microphone reservations can remain protected from interference. Fast polling on only two channels as

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[12] Report and Order at ¶ 93.

Google suggests would provide no protection for such licensed microphone reservations. Permitting TVWS devices to continue to operate for 48 hours where they cannot contact the TVWS database cannot possible protect licensed operations that reserved those channels during the intervening 48 hour time period since the TVWS device last contacted or was able to contact the database.

Further, while unlicensed operations will have dedicated guard band spectrum and other unlicensed bands on which to operate, licensed wireless microphones will have less spectrum available after the auction. Thus, in adopting its push requirement, the Commission intentionally applied this requirement to *all* channels, which would provide protection to licensed wireless microphones on any available channel. Accordingly, if the Commission agrees that its push approach cannot be made to work, and if the Commission adopts a polling approach as suggested by Google, such a polling requirement should apply to all channels – just like the Commission's push notifications.

Google's assertions that polling on more than two channels would be burdensome is unsupportable.[13] As Google notes, the two specific polling channels would vary from place to place. Therefore, under Google's own proposal, all TVWS devices would need to be capable of implementing this polling capability on every channel – so there should be no additional manufacturing cost involved in making TVWS devices capable of polling on more than two channels. Further, with respect to database costs, because there will likely be significantly fewer vacant channels available in most locations, applying the polling requirement to all channels after the auction will be much more manageable for the TVWS database than it

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[13] Google Petition at 8-9.

would be today. Google's claim that polling would drive up database costs and adversely decrease battery life of devices is specious.[14] The entire TV white space database is less than a couple of hundred kilobytes of data – less than a typical email message. A simple message to determine that a device's existing channel list is still valid, or to provide new channels, should not burden TVWS devices or the database.

V. THE CARLSON/CAL.NET PETITION

Carlson Wireless Technologies, Inc. and Cal.net, Inc. (collectively "Carlson") request reconsideration of the Commission's decision not to allow fixed white space devices to operate at four watts EIRP within three megahertz of an occupied TV station band edge.[15] Carlson argues that the Commission wrongly relied on NAB's analysis that showed that such operation would require a separation of 800 meters would be required under free space conditions to satisfy the ATSC adjacent channel protection ratio.[16] Carlson claims that this analysis is reasonable for an adjacent channel that fully occupies the channel, but not where the white space device occupies just half of the adjacent channel with a three MHz buffer between the ATSC TV receiver and the TVWS transmitter. Carlson acknowledges its theory is untested, but asserts that a three megahertz buffer will require no more than an 11 meter separation distance, which they assert is all that is required for a 40 mW device with no buffer zone in the adjacent channel.[17]

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[14] There are currently no battery powered TVWS devices approved by the FCC. However, even assuming that the query message from a TVWS device took an unrealistically long transmission of 1.5 seconds, this would represent only 0.04% of a day's operation of the device – hardly a major factor in battery life.

[15] Petition for Reconsideration of Carlson Wireless Technologies, Inc. and Cal.net, Inc., ET Docket No. 14-165, GN Docket No. 12-268 (filed Dec. 23, 2015) (Carlson Petition).

[16] *Id.* at 5-6.

[17] *Id.* at 6.

As an initial matter, Carlson is simply incorrect with regard to the separation distance required for a 40 mW device. The Commission's interference analysis allowing operation of personal/portable devices at 40 mW was based on a horizontal separation distance of 16 meters with a slant angle increasing this distance to 18 meters:

> We next consider outdoor TV reception and an outdoor TVBD. As indicated above, at the -84 dBm service threshold, interference could occur whenever an undesired signal is higher than -51 dBm on a first adjacent channel. We again use 16 meters as the horizontal distance between the TVBD and the outdoor antenna and this results in a slant range distance between the two of about 18 meters (60 feet).[18]

The Commission's analysis assumed a threshold for DTV service of -84 dBm and that TV receiver performance would meet the ATSC Recommendation A/74 of 33 dB for the desired-to-undesired (D/U) protection ratio for both upper and lower adjacent channels.[19] The analysis also assumed that there was a 16 meter horizontal distance between the outdoor TV antenna and the TVWS device and, because the TV antenna was assumed to be nine meters off the ground, while the TVWS personal/portable device was assumed to be located close to the ground, the actual separation distance would be increased to a slant angle of 18 meters. The Commission also assumed that a personal/portable device near ground level "would be outside of the main receive pattern of the TV antenna, so instead of receiving 10 dBd gain, the device's signal might only receive -2 dBd gain."[20] Finally, the Commission assumed 3dB of polarization mismatch. Based on all of these factors, the Commission concluded that a personal/portable unlicensed device operating at 40 mW on

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[18] TVWS Second Report and Order at ¶ 174.

[19] The ATSC Recommendations are more stringent than the Commission's DTV planning factor values and permit interfering signals from TVWS devices to be 5 to 7 dB higher than interference from other TV stations.

[20] TVWS Second Report and Order at ¶ 174.

an adjacent channel would "provide *adequate* protection against TV interference."[21] However, the Commission also concluded that "from our analysis above, we are concerned that if those devices were to operate at higher power the likelihood of interference to TV service would increase significantly."[22]

The Commission's analysis, and it conclusion that higher power will significantly increase the likelihood interference, is correct. The increase in power from a 40 mW transmitter to one that operates at four watts is 20 dB. In addition, since a four watt fixed TVWS device likely would be located on a building or other structure up to 30 meters above ground, interfering signals from the fixed device would fall in the main beam of the TV receive antenna, and therefore be subject to the 10 dBd gain of the TV receive antenna rather than -2 dBd gain assumed for a 40 mW device at one meter above ground. This is an additional difference of 12 dB. Thus, in simplest terms, Carlson suggests that a 32 dB increase in the strength of the interfering signal from the TVWS device can be accommodated by a three megahertz offset from the adjacent channel. That is, the improvement in performance of a DTV receiver is at least 32 dB for a four watt fixed TVBD signal at three megahertz from the adjacent channel band edge when compared to a 40 mW personal/portable signal that fully occupies the adjacent channel.[23] NAB's testing refutes Carlson's assertions.

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[21] *Id.* at ¶ 177 (emphasis added).

[22] *Id.* at ¶ 176.

[23] The actual improvement needed to eliminate adjacent channel interference would be almost 43 dB. The D/U ratios for adjacent channel protection from ATSC Recommendation A/74 are 33 dB for both upper and lower adjacent channels. The DTV service threshold is -84 dBm. The Commission therefore found that interference could occur whenever an adjacent channel TVBD signal is -51 dBm or higher. Assuming an antenna separation of 16 meters (approximately 50 feet), the Commission's original analysis indicated that a four watt EIRP TVWS device would produce an interfering signal

NAB purchased TVWS devices from Carlson and other manufacturers to learn more about the operation of these devices in general.[24] TVWS devices operate on existing TV channels and cannot operate with a three 3 MHz offset. Similarly, current TV sets cannot operate and receive DTV signals on TV channels with three MHz offsets. In light of these limitations, NAB conducted extensive laboratory testing to accurately reflect the impact of a 3 MHz offset. Using the TVWS devices NAB purchased from Carlson and other manufacturers, NAB performed testing to characterize the emissions from those devices. We then used laboratory signal generators to simulate the operation of the TVWS devices at 3 MHz from the edge of the adjacent channel into the TV receiver.

NAB tested five recent model DTV receivers that represent the general population of TV sets currently in use and one coupon-eligible set-top box. The receivers were tested at three signal levels: TOV+3dB, weak (-68 dBm) and moderate (-53 dBm). The median improvement in performance with a three MHz offset of these receivers ranged from 3.44 to 5 dB across the three signal levels on the lower adjacent channel and ranged from 2.875 to 5.79 dB across the three signal levels on the upper adjacent channel. The median of the average improvement values for the receivers across the three signal levels was 4.08 dB on

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level of -8.1 dBm or 42.9 dB higher than needed to cause interference. The Commission stated "this essentially means that adjacent channel interference from a fixed TVBD could occur almost anywhere within a station's service area." *Id.* at ¶ 72.

[24] Contrary to Carlson's assertion that NAB had agreed to perform joint lab testing, the parties had no agreement to conduct joint testing to study the 3 MHz spectral separation issue nor would such testing have been possible in the manner Carlson describes. While NAB has worked cooperatively with Carlson and other TVWS manufacturers, and we hope to continue to do so in the future, this claim is inaccurate.

the lower adjacent channel and 4.85 on the upper adjacent channel – nowhere close to the the 32 dB improvement needed to provide equivalent performance to a 40 mW device.[25]

NAB has recently discussed with Carlson the results of this testing. We hope to continue to work with Carlson and other manufacturers to explore ways of protecting licensed services from existing and expanded TVWS device operation.

VI. CONCLUSION

The Commission's order modifying its rules for unlicensed operations already includes a number of decisions that lack a firm technical foundation and unacceptably raise the potential for harmful interference to licensed services. The Commission should not compound these errors by further relaxing its rules in the manner sought by the petitions discussed above. We urge the Commission to deny these petitions.

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[25] With a 3 MHz offset, the transmitted energy in the adjacent channel is reduced by half, which would suggest a 3 dB improvement. Previous tests by the FCC showed that the improvement from moving 2.5 MHz was approximately 1 dB. The approximately 4 dB improvement (3 dB + 1 dB), therefore, is consistent with these previous FCC tests as suggested by NAB in its comments in this proceeding. This test data also calls into question the Commission's rule changes permitting 100 mW fixed device operation with a 3 dB offset. To be equivalent to a 40 mW personal portable device, the TV receiver adjacent channel improvement from a 3 MHz offset would have to be more than 12 dB to make up for the difference in antenna gain of the TV receiver.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I, Susan Baurenfeind, certify that on this 29th day of February, 2016, I have caused a true and correct copy of the foregoing Opposition to Petitions for Reconsideration to be served via first class mail, postage paid, upon:

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