Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Part 15 of the Commission's Rules	)	ET Docket No. 14-165
for Unlicensed Operations in the Television Bands,	)	RM-11840
Repurposed 600 MHz Band, 600 MHz Guard Bands	)	
and Duplex Gap, and Channel 37	)	

To: The Commission

COMMENTS OF
OPEN TECHNOLOGY INSTITUTE AT NEW AMERICA,
NEXT CENTURY CITIES, GIGABIT LIBRARIES NETWORK,
TRIBAL DIGITAL VILLAGE and PUBLIC KNOWLEDGE

New America's Open Technology Institute, Next Century Cities, Tribal Digital Village, the Gigabit Libraries Network and Public Knowledge (together the Public Interest Organizations, or "PIOs") submit these comments, pursuant to Sections 1.4 and 1.405 of the Commission's Rules, in support of the Petition for Rulemaking ("Petition") filed by Microsoft on May 3, 2019 and noticed by the Commission on May 9, 2019.[1]

The Petition proposes "pragmatic and long-overdue changes"[2] to the TV White Space rules in Part 15 that present the Commission with an opportunity to take important steps to bridge the rural-urban digital divide. Deployments relying on unlicensed spectrum in the TV White Space ("TVWS") channels in dozens of states across the nation demonstrate enormous potential to extend broadband connectivity in rural, remote and hard-to-serve areas. The proposed rule changes reflect in part a welcome compromise between broadcasters and the technology industry aimed at ensuring TVWS technology can be harnessed to bridge the rural

[1] *See* Public Notice, *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, Petition for Rulemaking*, Report No. 3127 (rel. May 9, 2019); Microsoft, Petition for Rulemaking, ET Docket No. 14-165 (May 3, 2019) ("Petition").
[2] Petition at 2.

divide while protecting incumbent broadcasters from harmful interference.[3] The PIOs strongly concur that the modest improvements proposed in the Petition can empower providers to extend higher-speed internet access to more unserved areas where wireline or even fixed wireless broadband relying on higher-frequency spectrum has proven to be unavailing.

I. TVWS Technology has Proven it Can Extend Connectivity to Unserved Americans, Particularly in Rural Areas

There is a deep digital divide that separates those who have high-speed broadband access and those who do not. This divide is particularly harmful to rural and low-income Americans. The Commission's most recent Broadband Deployment Report found that over 21 million Americans do not have access to high-speed broadband. Studies from the Government Accountability Office,[4] Microsoft,[5] and several independent researchers[6] have found that the Commission's Form 477 process for gathering broadband deployment and availability data is prone to overstating the availability of broadband, particularly in rural and underserved areas where census blocks are far larger than in central cities. Alternatives to the flawed Form 477

[3] *See* John Eggerton, "FCC's Pai Praises NAB/Microsoft Progress Toward Consensus," *Broadcasting and Cable* (May 17, 2019), https://www.broadcastingcable.com/news/fccs-pai-white-spaces-item-awaits-broadcast-microsoft-consensus.

[4] Government Accountability Office, "Broadband Internet: FCC's Data Overstate Access on Tribal Lands" (Sept. 2018), https://www.gao.gov/assets/700/694386.pdf.

[5] Microsoft, "United States broadband availability and usage analysis" (accessed on June 6, 2019), https://news.microsoft.com/rural-broadband/#broadband-availability.

[6] Sascha D. Meinrath *et al.*, "Broadband Availability and Access in Rural Pennsylvania," The Center For Rural Pennsylvania (June 2019), https://www.rural.palegislature.us/broadband/Broadband_Availability_and_Access_in_Rural_Pennsylvania_2019_Report.pdf ("By combining 2018 data with a historical archive of an additional 15 million tests from Pennsylvania residents, the research team identified that, since 2014, the discrepancy between ISP's self-reported broadband availability in the FCC's broadband maps and the speed test results collected via the M-Lab platform has grown substantially in rural areas, a trajectory that is not mirrored in urban areas; this may indicate a systematic and growing overstatement of broadband service availability in rural communities.").

methodology are the subject of other proceedings, but the debate itself suggests that the rural digital divide remains persistent.

Rural areas in particular struggle with broadband adoption because of the high costs for both backhaul and last mile buildout. Due to the economic difficulties of building adequate and affordable services in these areas, far too many Americans are left with either no high-capacity fixed terrestrial coverage or at best an option to pay exorbitant prices for satellite internet access that can be less reliable due to weather and inherent latency.

There is already a growing recent history showcasing how TVWS are able to bring Americans in hard-to-serve areas broadband services:

- **A 2017 joint initiative by the Appalachian Regional Commission and Garrett County, MD** is leveraging TVWS technology to bring broadband access to 3,000 rural and unserved households and small businesses in remote areas was declared a total success and a model effort by Maryland Gov. Larry Hogan in 2017.[7]
- **Rise Broadband**, **the nation's largest WISP and a major CAF recipient**, is deploying broadband in rural areas by leveraging TVWS at 470-698 MHz after seeing strong results from initial testing.[8] Rise recently placed TVWS gear on its first three towers in rural Illinois, and has reported that all of the lab and field testing it has conducted has revealed

[7] *See* Office of the Governor, "Governor Larry Hogan Announces Successful Rural Broadband Launch in Garrett County," Press Release (Oct. 12, 2017), http://governor.maryland.gov/2017/10/12/governorlarry-hogan-announces-successful-rural-broadband-launch-in-garrett-county/. A feasibility study by Garrett County"s economic development office "concluded that a public-private partnership using fixed wireless technology (TV White Space (TVWS) and other unlicensed spectrum) is the best solution for the rugged, remote areas of Garrett County." Garrett County, Office of Economic Development, "Rural Broadband Expansion – Home," https://www.garrettcounty.org/broadband.

[8] Monica Alleven, "Rise Broadband encouraged by TV white space, 60 GHz speeds," *FierceWireless* (March 20, 2019), https://www.fiercewireless.com/wireless/rise-broadband-encouraged-by-tv-white-space-60-ghz-speeds.

that it can provide speeds faster than 25 mbps download by 3 mbps upload.[9] Rise also found that using TVWS allows the company to provide high-speed broadband at greater distances.[10] "We like what we're seeing and hearing thus far in TV White Space," Jeff Kohler, co-founder and chief development officer of Rise, told *FierceWireless* in an interview about the potential of TVWS for rural deployments.[11]

- **Microsoft's Rural Airband Initiative** is an ongoing project that has already built partnerships with commercial ISPs, school districts and other providers in 16 states to harness TVWS technology. Airband leverages TVWS in combination with other technologies (including 4G, fiber and high-capacity fixed wireless backhaul) to bring high-speed broadband to underserved and unserved areas and serve 1 million rural consumers who lacked access previously.[12] Through the Airband initiative, Microsoft has committed to investing in the upfront capital projects required to provide high-speed broadband to 3 million people in rural areas by 2022.[13]
- **A Virginia TVWS program aimed at closing the homework gap**, an initiative supported by the Mid-Atlantic Broadband Communities Corp., Microsoft, and the Virginia Tobacco Region Revitalization Commission, is providing broadband internet access at home to thousands of students who lack internet access by extending their school's networks using TVWS in Charlotte and Halifax counties in southern Virginia.[14]

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[9] *Ibid.*
[10] *Ibid.*
[11] *Ibid.*
[12] Brad Smith, "The rural broadband divide: An urgent national problem that we can solve," Microsoft Blog (Dec. 3, 2018), https://blogs.microsoft.com/on-the-issues/2018/12/03/the-rural-broadband-divide-an-urgent-national-problem-that-we-can-solve/.
[13] Brad Smith, "A rural broadband strategy: connecting rural America to new opportunities," Microsoft Blog (July 10, 2017), https://blogs.microsoft.com/on-the-issues/2017/07/10/rural-broadband-strategyconnecting-rural-america-new-opportunities/.
[14] Microsoft Reply Comments, GN Docket. No 16-142, June 8, 2017, at 3.

- **The Gigabit Libraries Project** awarded grants for nine projects in 2017 to harness TVWS to "support remote fixed and portable library access points at new locations in their communities."[15] The grants went to utilizing technology to support underserved libraries and communities in Lansing, MI; Otsego, MI; Marquette, MI; State College, PA; Millinocket, ME; Milledgeville, GA; Beatrice, NE; Huron, SD; and Toppenish, WA.[16] GLN has received ongoing support from the federal Institute of Museum and Library Services (IMLS).
- **A Microsoft partnership with the Department of Veterans Affairs is** specifically targeting veterans in rural areas as part of its Airband initiative. Microsoft committed to offering "capital, technology expertise and training resources" in that effort.[17]
- **An agribusiness TVWS project**, supported by Microsoft, seeks to leverage TVWS connectivity to advance precision agriculture. The project secured an experimental license for the project from the Commission in March 2017.[18] John Deere has also supported the testing of TVWS to improve remote sensing and precision agriculture.
- **The Air-U deployment at West Virginia University**, initiated by New America's Wireless Future Program, showed that TVWS can be used at low cost to provide Wi-Fi connectivity outdoors to public areas on campuses lacking in connectivity and that have characteristics rendering conventional Wi-Fi difficult due to distance from backhaul (in this case, the sprawling WVU, which has a 2-mile-long campus tram loop).

[15] Gigabit Libraries Network, "Winners of 'Beyond the Walls' Awards Announced," Press Release (May 9, 2017), http://giglibraries.net/BeyondTheWallsAnnouncement.
[16] *Id*. See also "Libraries TV White Space Project Wins $250,000 Grant," Telecompetitor (Oct. 20, 2016), http://www.telecompetitor.com/libraries-tv-white-space-project-wins-250000-grant/ .
[17] Joan Engebretson, "Microsoft, Veterans Affairs Partner on Rural Broadband," Telecompetitor (May 23, 2019), https://www.telecompetitor.com/microsoft-veterans-affairs-partner-on-rural-broadband/.
[18] *Id*..; see also Microsoft Corporation, Application for New or Modified Radio Station Under Part 5 of FCC Rules, File No. 0136-EX-CN-2017 (submitted Mar. 3, 2017).

II. The Commission Should Expedite Adoption of a FNPRM that Proposes and Seeks Comment on the Petition's Proposed Changes to the TVWS Rules

The PIOs support the full range of rule changes proposed in Microsoft's Petition. One indication that these rule updates can be enacted and put to work for rural America on an expedited basis is that the National Association of Broadcasters ("NAB") has already expressed support for several of the reforms and has likewise endorsed a FNPRM to adopt these policies. NAB supports the proposals to permit higher radiated power limits in less congested areas, to permit the operations of fixed TVWS devices at up to 500 meters above average terrain (with certain protections in place), to permit the operation fixed TVWS services on movable platforms (such as school buses and farm equipment) within geofenced areas, and to permit the use of TVWS for narrowband Internet of Things connectivity.[19] While the PIOs believe the Commission should ultimately go further to update and strengthen the utility of TVWS technology, these changes alone would empower rural providers, schools, farms, and utilities to extend connectivity in high-cost areas where the business case for other forms of fixed wireline or even wireless service have proved daunting.

First, the PIOs support the Petition's proposal to increase the EIRP limit for WSDs that operate in less congested areas. Permitting fixed WSDs to operate at a maximum EIRP of 42 dBm in less congested areas is a modest change that allows TVWS operators to cover more customers with a given amount of investment, a critical factor in the availability and affordability of rural broadband. An option for higher power would not increase administrative costs, or diminish interference protections for incumbents, since it would simply change a parameter used

[19] Notice of Ex Parte Communication of the National Association of Broadcasters, ET Docket Nos. 16-56, 14-165 (March 21, 2019), available at https://ecfsapi.fcc.gov/file/10321690718368/Letter%20re%20white%20spaces%20FNPRM%20and%20geolocation%20-%20revised.pdf.

by the geolocation database (the White Space Databases, or "WSDB") to calculate which channels (if any) are available to use at a higher power limit in less congested areas.

Second, the PIOs support Microsoft's proposal to allow fixed WSD operations in the first adjacent channel at a power level above the current, overly-protective 40 mW limit. This revision is critical now that the TV incentive auction has greatly reduced the number of contiguous vacant channels, even in rural areas, a problem exacerbated by the Commission's failure to ensure that displaced stations requiring a new channel were located to minimize the loss of contiguous TVWS spectrum available for broadband. Under current rules a contiguous block of three vacant channels is required to operate at a power sufficient to provide fixed broadband connectivity, thereby foreclosing opportunities to use TVWS technology to bring broadband to unserved and underserved communities.

Allowing fixed WSDs to operate at higher powers on first adjacent channels, as Microsoft proposes, would put fallow spectrum to work for the purpose of bridging the digital divide. Tests in South Africa and Ghana have found that a WSD operating at 4 W EIRP can operate on a first adjacent channel to an over-the-air television broadcaster *without* causing harmful interference. Although the Ghanaian trial looked into the potential effects on analog television broadcasts, the South African trial reviewed both analog and digital television broadcast stations.[20]

Third, the PIOs support the Petition's proposal to increase the height above average terrain (HAAT) limit in less congested areas. This proposal, to increase the Height Above Average Terrain (HAAT) limit in less congested areas, comes with a low risk for interference. Because the proposal would require coordination for operations above 250 meters HAAT, it

[20] M.T. Masonta, L.M. Kola, A.A. Lysko, L. Pieterse and M. Velempini, "Network Performance Analysis of the Limpopo TV White Space (TVWS) Trial Network," *IEEE Africon 2015*, 14-17, at 2 (Sept. 2015).

should not increase risk of harmful interference to television viewers.[21] Like increased power, the WSDB will simply factor this into its calculation of the allowable HAAT for channels available at a particular location. The geographies where the WSDB verifies a higher HAAT is permitted will generally be in rural or remote areas where operators often can only provide even basic broadband service by locating a WSD base station at higher elevation, in some cases because it's the only practical location (e.g., along the ridge of a steep hillside).

Fourth and relatedly, the Commission should seek comment on whether directional antennas and sectorization for fixed P2MP deployments should also be authorized. WSDB can easily calculate and coordinate a sectorized P2MP deployment scenario to avoid harmful interference to incumbents while simultaneously serving a particular hamlet or other targeted area needing service. This could be defined as a value-added service provided by the WSDB's for an additional fee. The technical ability of a WSDB to coordinate a sectorized fixed wireless deployment at a variable height and/or power greater than the current rules is well established.

Fifth, the PIOs agree the Commission should create a new class of narrowband WSDs specifically crafted to support the Internet of Things (IoT), with appropriate technical and operational rules to protect licensees. While the Commission could not have anticipated the use of TVWS for narrow-band IoT a decade ago, when it promulgated the original rules, it is clear today that use cases including agribusiness, utilities and environmental sensing could greatly benefit from NB-IoT on unlicensed spectrum with TV band propagation characteristics. Because of the clear economic benefits and low risk of interference, the Commission should invite comment on Microsoft's proposal to create a new class of NB-IoTs designed to use TVWS.

Sixth, the PIOs believe the Commission should enable geofenced fixed WSD operations in less congested areas. The Commission's rules currently empower personal and portable WSDs

[21] *See* Petition at 11-15.

to operate on available channels within a geofenced area that has been pre-determined by a WSDB to avoid harmful interference to incumbents.[22] A similar framework for fixed devices within a geofenced area should be considered by the Commission. These geofenced operations can particularly benefit use cases and innovation related to farming, ranching, education, telehealth (e.g., monitoring) and other industries operating in rural and remote areas. A successful test of geofenced operations has brought broadband connections to students taking long school bus routes in rural areas.[23] While Microsoft proposes a specific approach to ensuring that movable higher power WSD operate only within the geofenced area, the Commission should also seek comment on other approaches to ensure licensees are protected from harmful interference.

Finally, the PIOs strongly support the authorization of terrain-based propagation models as an option for calculating allowable channels, power and HAAT at a particular location. Under current rules, WSDBs protect TV viewers within standardized and static contours calculated using the relatively simple and very conservative (both unrealistic and often overly protective) FCC Curve propagation model that considers only the average height above terrain in a given direction, while taking no specific account of basic geographic features (e.g., mountains, dense forests lakes), nor of trees, buildings or other "clutter" that more sophisticated GIS models use.[24]

In contrast, as the Dynamic Spectrum Alliance's recent comprehensive report on Automated Frequency Coordination explains, "Ofcom's TVWS rules, promulgated later and with the benefit of more granular pixel-based simulations of TV signal strength, permits more accurate database calculations and hence both more bandwidth for WSDs and more protection

[22] 47 C.F.R. § 15.711(d)(5).
[23] Petition at 22-26.
[24] *See Automated Frequency Coordination: An Established Tool for Modern Spectrum Management*, Dynamic Spectrum Alliance, at 23 (March 2019), available at http://dynamicspectrumalliance.org/wp-content/uploads/2019/03/DSA_DB-Report_Final_03122019.pdf.

for viewers."[25] Propagation loss due to real-world terrain (e.g., hills, mountains, forests) has been studied extensively and is now well understood. A geolocation database informed by real-world GIS datasets does not need to make generic, worst-case assumptions about terrain.[26] WSDBs have the computational power to calculate actual path loss based on the characteristics of the devices being used, the protected receiver, and the actual physical path between the two. We urge the Commission to seek comment on whether more real-world propagation models should be authorized as at least an option for WSDB calculation of allowable transmit grants.

CONCLUSION

For all of the reasons stated herein, the PIOs believe the Petition demonstrates "sufficient reasons" for the Commission to adopt a further notice of proposed rulemaking. Our groups urge the Commission to expedite the adoption of a FNPRM that seeks comment on the proposals, thereby promoting more available and affordable broadband connectivity in rural and hard-to-serve areas, as well as for NB-IoT and other unlicensed innovation.

Respectfully submitted,

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[25] *Ibid.*

[26] In his book on the technical characteristics of three-tier spectrum sharing managed by a Spectrum Access System, Preston Marshall notes that the lack of real-world granularity inherent in relying solely on the propagation model used in the current TVWS rules (based on Longley-Rice terrain modeling) that defines static exclusion zones around TV station transmit sites, is seen by comparing a more sophisticated GIS mapping of Manhattan. The current TVWS terrain-based model depicts the island as it was in 1600 – without buildings or even trees – while in reality, particularly for terrestrial use at higher frequencies, an actual RF propagation view of Manhattan is dominated by scatter loss from physical obstacles that could accommodate dense deployments of low-power devices without interference to incumbents in a number of bands. *See* Preston Marshall, *Three-Tier Shared Spectrum, Shared Infrastructure, and a Path to 5G*, at 104-105 (Cambridge Univ. Press, 2017).