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

In the Matter of	)	
	)	
Promoting Investment in the 3550-3700 MHz Band;	)	GN Docket No. 17-258
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	)	

To: The Commission

REPLY COMMENTS OF OPEN TECHNOLOGY INSTITUTE AT NEW AMERICA And PUBLIC KNOWLEDGE

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Table of Contents

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New America's Open Technology Institute and Public Knowledge (together the "Public Interest Organizations" or "PIOs"), hereby submit these Reply Comments in response to the Notice of Proposed Rulemaking ("*NPRM*") in the above-captioned proceeding.[1] The Commission should concur with the vast majority of parties filing comments and reject any change to the existing Priority Access licensing rules governing the new Citizens Band Radio Service ("CBRS"). The PAL changes proposed in the NPRM, which track Petitions for Rulemaking filed by CTIA[2] and by T-Mobile USA, Inc.,[3] amount to an industrial policy that would tailor licensing rules to closely fit the mobile carriers' wide-area business model and needlessly foreclose localized, innovative and potentially competing new users and uses by a broad range of enterprise, industrial, rural broadband and public sector users.

[1] *Promoting Investment in the 3550-3700 MHz Band; Petitions for Rulemaking Regarding the Citizens Broadband Radio Service*, Notice of Proposed Rulemaking and Order Terminating Petitions, 32 FCC Rcd 8071 (2017) ("*NPRM*"). *See also* 82 Fed. Reg. 56193 (Nov. 28, 2017).
[2] *See* CTIA Petition for Rulemaking, GN Docket No. 12-354 (filed June 16, 2017) ("CTIA Petition").
[3] *See* T-Mobile Petition for Rulemaking, GN Docket No. 12-354 (filed June 19, 2017) ("T-Mobile Petition").

Executive Summary

New America's Open Technology Institute and Public Knowledge (hereinafter "OTI & PK") once again urge the Commission to retain the current CBRS licensing rules and to proceed expeditiously to open the band for GAA use and, as soon as feasible, PAL assignments. The Commission should not fundamentally redefine Priority Access Licenses (PALs) and adopt an industrial policy that refashions PALs to tightly fit the business model of national carriers, thereby foreclosing potential competitors to, or substitutes for, the offerings of the largest mobile carriers. The Commission should instead adhere to the statutory objectives of Section 309(j) and trust market forces by retaining the rules the agency adopted unanimously in 2015. Larger license areas, long-term licenses and non-competitive renewal would convert the CBRS band from a flexible, small cell band that facilitates the widest possible variety of users and use cases, including rural broadband customized local enterprise solutions, into yet another band designed for the sole use and benefit of three or four national mobile carriers.

The record in this proceeding overwhelmingly demonstrates that the Commission should ultimately reject the proposed changes to the CBRS priority licensing framework. Roughly 9 out of every 10 commenters oppose the changes, particularly with respect to licensing areas and non-competitive renewals. While opposition to license areas as large as Partial Economic Areas (PEAs), 10-year terms and non-competitive renewal without build-out requirements spans many industry sectors – from rural and small wireless ISPs, to enterprise wireless, content providers and consumer advocates – support for CTIA's proposed changes to PALs is, not surprisingly, limited to the largest mobile carriers and a few of their largest suppliers (e.g., Qualcomm, Ericsson, Nokia), and the trade associations they dominate (e.g., Telecom Industry Association 5G Americas). The other stakeholders across the wireless

ecosystem recognize the effort to rewrite the PAL rules for what they are: A proposed spectrum industrial policy fashioned to benefit a single business model at the expense of the economy and the public interest more broadly.

The CBRS concept of making spectrum available on a "localized" and "targeted" basis is user- and industry-neutral. As the *CBRS Order* stated, the policy goal most consistent with Section 309(j) is to make PALs available and affordable to the largest possible number of users, including WISPs providing rural broadband, private "neutral host" LTE networks, office complexes, factories customizing machine-to-machine networks, utilities, airports, shopping malls, and sporting arenas. Unfortunately, a Commission decision to change the PAL rules by adopting far larger licensing areas (PEAs or counties), 10-year terms and non-competitive renewal would inevitably preclude all of these users, effectively reserving the PALs for three or four large, incumbent mobile carriers that are unlikely to build out a ubiquitous small cell network beyond the high-traffic areas in the top 100 MSAs.

In particular, there is overwhelming opposition in the record from consumer advocates and a broad range of technology, cable, industrial, enterprise, rural broadband and other companies to the Commission's proposal to change the size of PALs from census tracts to PEAs. OTI and PK agree with the vast majority of commenters who argue that PALs as large as PEAs, or even counties, would preclude a wide range of productive use cases, depress investment, and harm rural broadband providers in particular. Maintaining census tract areas will maximize deployment opportunities for providers of more localized quality of service networks in spectrum protected from interference. The record shows that hundreds of small, rural ISPs will ramp up investment and deployment in unserved and underserved areas, but only if they have sufficient spectrum. In contrast, increasing the license areas to PEAs will favor the largest carriers at the

expense of the competitive and innovative providers and services that the inherently small cell CBRS band was intended to support.

The big mobile carriers also fail to put forward any credible cost-benefit analysis that could justify reversing course on the established rules for PAL licensing. The cellular industy's argument that PEA-sized licenses would spur more investment – and by a diversity of providers – is highly unlikely, as the record shows. PALs as large as counties or PEAs *might* increase investment by one or more national mobile carrier – and perhaps even from big cable companies relying on carriers as MVNOs – but it would deter investment from the vast majority of small providers and other potential users.

There is substantial agreement in the record that the current PAL rules based on census tracts and limited-term licenses will facilitate a more liquid and efficient secondary markets. A wide variety of non-national carriers investing in the CBRS band agree that it is highly unlikely that either partitioning or leasing of spectrum would significantly address the preclusive impact of large PALs the size of either PEAs or counties in a fashion that meets the needs of industrial, enterprise or rural providers.

If the Commission does choose to enlarge the geographic areas and lengthen the terms for PALs, while also making them non-competitive for renewal, the agency must impose strict and geographic performance requirements for license holders. Increasing the size of PALs to PEAs would require the Commission to implement strict build-out requirements, an unnecessary regulatory intervention since PAL holders under the current rules are already able to aggregate up from census tracts.

If the Commission incorporates any of the proposed changes to the PAL license terms, the agency should also propose strict geographic build-out requirements based on areas no

smaller than census tracts. The major carriers claim that large PAL areas are necessary to avoid the risk of a "coverage gap" with respect to a wide-area deployments. The Commission should therefore require PAL holders to deploy in every census tract and return any census tract not served after the initial license term.

Finally, the record supports public disclosure of anonymized CBSD registration data as necessary to optimize productive use of the CBRS band. The Commission's existing rules, which protect confidentiality while requiring the licensing database administrator (SAS operators) to make information about the radio environment available to stakeholders, strikes the "right balance" between licensees' desire for confidentiality as well as the GAA users' and the public's needs to understand how the airwaves are being used. Under current procedures, GAA operators can use *anonymized* CBRS deployment data to determine which channels are available, in order to plan their networks. The current CBRS rules already protect sensitive information, and the successful operation of the 3.5 GHz framework hinges on the public availability of some information.

I. THE RECORD OVERWHELMINGLY OPPOSES THE NPRM'S PROPOSED INDUSTRIAL POLICY FAVORING ONE INDUSTRY SEGMENT AND EXCLUDING ALL OTHER USERS AND INNOVATIVE USE CASES

A. Most Parties Agree Large PAL Areas are Inefficient and Will Exclude Most Enterprise, Industrial, Rural ISP and Other Localized Users and Uses

The Commission should not fundamentally redefine Priority Access Licenses (PALs) and adopt an industrial policy that refashions PALs to tightly fit the business model of national carriers, thereby foreclosing potential competitors to, or substitutes for, the offerings of the largest mobile carriers. The Commission should instead adhere to the statutory objectives of Section 309(j) and trust market forces by retaining the rules the agency adopted unanimously in 2015. Larger license areas, long-term licenses and non-competitive renewal would convert the CBRS band from a flexible, small cell band that facilitates the widest possible variety of users and use cases, including rural broadband customized local enterprise solutions, into yet another band designed for the sole use and benefit of three or four national mobile carriers.

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1. The Record Shows Large PAL Areas Will Depress Investment and Exclude Site-Based Licensees and Rural ISPs that Require Interference Protection

There is overwhelming opposition in the record from consumer advocates and a broad range of technology, cable, industrial, enterprise, rural broadband and other companies to the Commission's proposal to change the size of PALs from census tracts to Partial Economic Areas (PEAs). OTI and PK agree with the vast majority of commenters who argue that PALs as large as PEAs, or even counties, would preclude a wide range of productive use cases, depress investment, and harm rural broadband providers in particular.[4] Maintaining census tract areas will maximize deployment opportunities for providers of more localized quality of service networks in spectrum protected from interference.[5] In contrast, increasing the license areas to PEAs will favor the largest carriers at the expense of the competitive and innovative providers and services that the inherently small cell CBRS band was intended to support.

Smaller providers should be incentivized to purchase PALs to deploy in underserved communities or to boost capacity and productivity in targeted locations, including school and business campuses, industrial plants, sporting venues, conference centers, hotels, airports and other critical infrastructure. Instead, the Commission proposes an industrial policy that will *preclude* all of these use cases. Enlarging the license areas to PEAs, or even to counties, will deter investment from smaller companies and effectively reserve the 3.5 GHz band as added

[4] *See, e.g.*, Microsoft Comments; Charter Comments; Comcast Comments; DSA Comments; NCTA Comments; Next Century Cities; Ruckus Wireless Comments; WISPA Comments; Google Comments; NTCA Comments; All Points Broadband Comments; Starry Wireless Comments; Cantor Telecom Comments; Motorola Solutions Comments. All comments cited herein were filed in GN Docket 17-258 on Dec. 28, 2017 unless otherwise indicated.

[5] Motorola Solutions Comments at 4.

capacity for the largest carriers who are highly unlikely to deploy intensively outside of inner urban and other high traffic (and high ARPU) areas that represent a fraction of any PEA.[6]

Our groups agree with Google that increasing the license areas for PALs to PEAs would "reduce the overall utility of the spectrum by effectively barring rural broadband providers, industrial IoT operators, venue owners, and other non-traditional licensees from the PAL market, and concentrate the remaining benefits in a small group of large carriers."[7] DSA similarly argues: "PEA-sized PALs, which can span hundreds of square miles and cover millions of people, would be too expensive and highly inefficient to acquire for entities seeing to cover campuses, hotels, warehouses, schools, or rural communities with small cell networks."[8]

OTI and PK agree with General Electric that increasing the size of license areas to PEAs would threaten the IIoT-related economic growth and leave interested parties without dedicated, licensed spectrum for self-provisioned private LTE networks.[9] These private networks would support next-generation applications and services, but as GE argues, "GE and its customers would likely be unable to obtain the required wireless connectivity from traditional carriers on a cost-effective basis, given carriers' continued focus on consumer-based services. As a result, IIoT investment, innovation, and deployment would likely be delayed and reduced."[10]

The largest carriers are guaranteed to benefit from an increase of PAL sizes to PEAs, as only national providers have an existing and significant wireless network present throughout an

[6] See GE Comments at 28 ("A shift to PEA-based PALs, meanwhile, would also reduce spectrum efficiency at 3.5 GHz. Large commercial mobile operators would use PEA licenses to densify existing mobile networks and add capacity in urban and other high-traffic locations… Thus, these companies are likely to waste licensed CBRS spectrum across much of their PEAs, in the process preventing potentially efficient uses of this band.").
[7] Google Comments at 12.
[8] DSA Comments at 13-14.
[9] See General Electric Comments at 30.
[10] *Id.*

entire PEA to be in a position to invest in expensive new licenses.[11] As Google argues, "Designing auction rules specifically to favor one class of bidders over all others is inconsistent with modern Commission spectrum policy, reinstituting the logic of the 'beauty contest' era."[12] The crux of the argument for favoring larger carriers in 3.5 GHz—to help build 5G networks—is an insufficient defense of increasing PALs to PEAs particularly because it is based on unknown predictions of how mobile 5G services will develop.[13] As the Dynamic Spectrum Alliance notes, "Given that 5G is still an evolving concept, larger PALs are inconsistent with even the notion that the band will be 5G focused."[14]

Increasing the license areas for PALs would also have the adverse effect of forcing higher upfront costs for potential license bidders, which would lead to many would-be licensees from declining to participate in auctions at all and pushing out the very providers who would offer competitive and innovative wireless services.[15] Next Century Cities lays out the problem well:

> With 416 PEAs, the average cost of a PAL, assuming a nationwide channel valuation of $1 billion and understanding the 3.5 GHz Band is not currently organized into nationwide channel blocks, would be approximately $2.4 million. Conversely, with over 70,000 census tracts, a PAL's average cost at the census tract level in this scenario would be approximately $14,000.[16]

The enormously higher price for a PAL the size of a county or PEA will disparately impact rural carriers, since rural areas will be wrapped up into the same PEAs as the far more highly-valued spectrum in the urban areas.[17] By increasing the size of PALs to PEAs, the Commission would essentially be gifting licenses to the major incumbent, nationwide carriers at

[11] Charter Comments at 3.
[12] Google Comments at 13.
[13] *Id.*
[14] DSA Comments at 14.
[15] Google Comments at 17.
[16] Next Century Cities Comments at 6.
[17] *Id.*

the expense of competitive providers seeking to bring service to underserved regions and locations.[18] The Commission should not be in the business of choosing winners and losers in a burgeoning market for competitive services.[19]

The record clearly demonstrates that rural ISPs and consumers will be the ones primarily hurt by PEA-sized PALs. As DSA, WISPA, NTCA, RWA and other commenters document, rural service providers would be forced to bid on expansive geographical areas they do not intend to serve, for spectrum they do not intend to use, and outbid the large mobile carriers that are seeking to serve urban areas with greater capacity.[20] Such economic barriers to entry would make it practically impossible for rural service providers to acquire PALs.[21]

WISPA correctly observes that auctions for PEA-sized PALs would push out competitive providers. Among the nation's 416 PEAs, 377 have a population of more than 100,000, while the usual population for a census tract is about 4,000.[22] Our groups agree with WISPA that a bidder seeking to acquire the benefits of protected 3.5 GHz spectrum to serve a rural community – or an IIoT network, or an enterprise neutral host installation – would have to acquire, on average, a PEA containing 178 separate census tracts at a cost likely to be, on average, more than 100 times that for a census tract-sized PAL.[23]

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[18] DSA Comments at 13 ("Indeed, the record is exceedingly clear: large PEA-sized PALs would only be useful and valuable for national wireless carriers"); Cantor Telecom Comments at 8 ("Cantor Telecom agrees with commenters, including WISPs, who point out that larger geographic PAL units such as PEAs, in combination to other potential changes to the PAL licensing rules, would result in prohibitive license costs that only a handful of large companies would be able to feasibly afford.").
[19] General Electric Comments at iii ("By biasing the auction process and predetermining the entities and applications making use of the 3.5 GHz band, this policy would conflict with Chairman Ajit Pai's repeated warnings that the Commission has no business picking winners and losers in the marketplace.").
[20] DSA Comments at 16.
[21] *Id.*
[22] WISPA Comments at 25-26.
[23] *Id.*

The record shows that hundreds of small, rural ISPs will ramp up investment and deployment in unserved and underserved areas, but only if they have sufficient spectrum. All Points Broadband, a competitive fixed wireless internet service provider ("WISP"), showcases the burden that large license areas present to smaller providers. All Points Broadband notes there are "dozens" of census tracts within and adjacent to the company's current footprint where they would be an "aggressive" bidder for PALs.[24] The company attributes this to existing tower leases and infrastructure they own in the area and the knowledge that they could obtain additional customers if they had the additional capacity and coverage that CBRS PALs would provide them.[25] "If PAL sizes are increased from census tracts to counties or PEAs, all of our investment in CBRS activities will be stranded," All Points Broadband states in its comments.[26]

WISPs and other smaller ISPs across the country, and particularly in rural areas, have already made significant investments in the 3.5 GHz band due to the CBRS rules, and their investments would be completely disrupted and uprooted if the Commission were to change the sizes of PALs now.[27] WISPA's recent survey of its operator members found that 63 percent are currently deployed and providing service on the 3.5 GHz band. Several have already made considerable capital investments to procure and deploy equipment that is upgradeable to operate across the PAL portion of the 3.5 GHz band when it is available.[28]

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[24] All Points Broadband Comments at 2.
[25] *Id.*
[26] *Id.* "It is clear that All Points and other operators of similar size serving customers at fixed locations over several PEAs cannot possibly compete in an auction in which the minimum lot size is several times the size of our potential addressable market."
[27] WISPA Comments at 15. "Provided with the opportunity created and encouraged by the CBRS Order to continue to deploy fixed broadband service to consumers in the 3650-3700 MHz band, WISPs have done exactly that. Since April 18, 2015 – the day after the Commission froze the issuance of new licenses in the band – the Commission has registered more than 19,000 locations, none of which is even eligible for grandfathered interference protection."
[28] WISPA Comments at 16. One operator told WISPA that it has already invested $2 million, while other WISPs reported capital expenditures of several hundred thousand dollars.

As WISPA notes, most wireless internet service providers have 10 employees or fewer and serve small, rural communities suffering from a high-capacity broadband gap. These expenditures mark a high percentage of their total budgets.[29] Skywave Wireless, a provider that serves Northeast Nebraska, began investing in 3650 MHz spectrum in 2016, basing its strategy on the CBRS rules.[30] Skywave was "very excited" about CBRS, and continued investing in the band in 2017 with plans for a "big rollout" in 2018 that would leverage the acquisition of PALs to increase its service area 20 miles in all directions. The Commission's NPRM led Skywave to "quickly" halt its investment and plan to expand coverage to unserved areas by leveraging initial investments in 3650 MHz.[31] Ultimately it is unserved and poorly served rural consumers and businesses that will be harmed most as they remain on the wrong side of the digital divide.

Remarkably, the parties leading the effort to move to PEA-sized PALs previously supported census tracts. AT&T supported "census tract licensing" of PALs,[32] and Verizon did not oppose rules creating the same licenses sizes either.[33] As Google notes, the CBRS rules "garnered wide support across the entire wireless industry because they reflect the fact that the 3.5 GHz band is significantly different from other bands the Commission has designated in the past for commercial [mobile] use."[34]

The vast majority of parties do not support larger PAL areas and specifically oppose PEA-sized PALs. CTIA claims that "many stakeholders" support the use of PEAs as a marker for PALs, but it can cite to only a handful of comments filed by the largest national mobile carriers (AT&T, Verizon, and T-Mobile), their largest suppliers (Qualcomm and Ericsson), and

[29] *Id.*
[30] Skywave Wireless Comments at 1.
[31] *Id.*
[32] Reply Comments of AT&T at 17, GN Docket No. 12-354 (filed Aug. 15, 2014).
[33] Verizon Comments on Further Notice of Proposed Rulemaking at 13-14, GN Docket No. 12-354 (filed July 14, 2014).
[34] Google Comments at 2.

their trade associations (Telecommunications Industry Association and 5G Americas).[35] The reality is that the cellular industry is the only one that supports PEA-sized PALs because they are the only ones who stand to benefit from increasing the size of PALs to such extremes. All other industries and even smaller ISPs see the mobile carrier ploy for what it is: an attempt to gain exclusive and preclusive control of the 3.5 GHz band in perpetuity, an industrial policy guaranteed to both increase mobile carrier profits and to undermine innovation, competition and consumer welfare for virtually all other potential users.

CTIA and its members suggest that because the Commission chose PEAs for the TV Band Incentive Auction and for some bands in the *Spectrum Frontiers* proceeding, PEAs must be the appropriate choice for PALs as well.[36] The claim that PEAs are the new optimal licensing area for mobile bands ignores the glaring differences in propagation, power levels and purpose between the mid-band (and low-power) spectrum available through CBRS licensing and both the TV spectrum at 600 MHz and the millimeter wave spectrum at the 39 GHz band. The 600 MHz licenses auctioned last year were designed to promote an entirely different purpose. The propagation and power levels make that low-frequency band ideal for wide-area *coverage networks* and for propagation from towers into buildings. By contrast, PALs provide spectrum for *capacity* and network densification. Moreover, the 600 MHz spectrum was auctioned in paired blocks, with technical rules fashioned for a specific mobile carrier technology. This was an industrial policy intended to fit the architecture of incumbent mobile carriers, whereas PALs are not paired or wide area, since the more industry-neutral technical rules were intended to promote the localized capacity needs of a wide variety of use cases and enterprises.

[35] CTIA Comments at 8.
[36] *See, e.g.*, CTIA Comments at 9; T-Mobile Comments at 10-11.

The big mobile carriers also fail to put forward any credible cost-benefit analysis that could justify reversing course on the established rules for PAL licensing. Verizon is an example of the empty hand-waving that simply assumes all potential users – local and national, large and small – would find it both feasible and cost-effective to acquire PEA licenses at auction.[37] Verizon is wrong on two counts: first, there is already significant investment being made by fixed wireless providers in the 3.5 GHz band under the current CBRS rules, as detailed above through WISPA and All Points Broadband's accounts. And second, small entities are unlikely to acquire either PEA-sized licenses at auction *or* access to small area spectrum through secondary market transactions with mobile carriers (the latter scenario is addressed in a separate section below).

Verizon's argument that PEA-sized licenses would spur more investment – and by a diversity of providers – is highly unlikely, as the record shows. PALs as large as counties or PEAs *might* increase investment by one or more national mobile carrier – and perhaps even from big cable companies relying on carriers as MVNOs – but it would deter investment from the vast majority of small providers and other potential users.

Moreover, while investment by non-carrier and localized users that require interference protection hinge on small area PALs, big carriers using multiple bands of licensed spectrum are able to aggregate census tracts with little risk. As General Electric argues, licensing by census tract (which in 2015 served as the compromise between site-specific licenses and larger, traditional license areas) is "appropriate in a band where most operations are likely to be small-

[37] Verizon Comments at 9. "PEAs in the 3.5 GHz band would similarly enable access by both large and small providers and incent larger providers to invest in the band, innovate with new 3.5 GHz technologies, and deploy 3.5 GHz networks more rapidly and to more areas, including rural areas," Verizon argues.

cell, localized wireless network deployments."[38] GE and WISPs, hospitals, commercial real estate interests, hotels, resorts, government agencies, and educational institutions are able to competitively bid for licenses in 3.5 GHz for a wide range of case uses.[39]

General Electric explains that the company and its customers would be "highly unlikely to win PEA licenses at auction, since it would not be economically rational for them to outbid established wireless carriers for PEA licenses covering territory extending far beyond their geographically targeted deployments."[40] As discussed above, PEA-sized license areas would drastically increase the price for PALs, essentially converting the 3.5 GHz band into a traditional cellular band designed to encourage wide-area coverage networks by national or regional mobile ISPs.

There are more than 100 comments in the record from WISPs that describe how enlarging the size of PALs to PEAs would harm competition and preclude small providers and non-providers alike from competing with the four major nationwide carriers for spectrum in the 3.5 GHz band. Intelligent Computing Solutions, a small fixed wireless service provider in Illinois, states that larger geographic areas for PALs will only benefit the four wireless providers with deep pockets and nationwide presences.[41] BDA Wireless, a small provider from Alabama, similarly notes: "The adoption of PEA sized PAL license areas would be far too expensive since our existing network in located in 3 PEAs (#300, #344, #377), and it would also doom any future

[38] GE Comments at 3-4.
[39] *Id.*
[40] *Id.*
[41] Intelligent Computing Solutions Comments at 1-2 ("To cover the same areas I cover today with PEAs, I'm required to bid on licenses covering 9,818,357 people likely costing tens of millions of dollars just for the spectrum. To expand my coverage to include currently unserved or underserved areas near me with the new equipment available for this band, I must also bid on a license that covers the Sears Tower, the most populous city in the state, and the highest per-capita income areas of the state. Expanding the scope of eligible participants brings higher costs and thus more revenue to the Treasury, but more importantly, better use by the American people.").

expansion."[42] Skywave Wireless argues, "Creating these very large areas will essentially drive out competition as well as not allowing other industries like power, security, and education to use this spectrum at all."[43]

Moreover, as Ruckus Wireless argues, the Commission noted in the *Spectrum Frontiers* NPRM that tailoring the size of license areas to the likely deployment scenarios (as the Commission did with census tracts for PALs) reduces the potential for spectrum warehousing.[44] Later, in the Commission's *Spectrum Frontiers* Report and Order, the Commission adopted smaller, county-sized license areas in the 28 GHz band, and in doing so rebutted some of the same arguments for PEA-sized PALs made in this proceeding.[45] In the 3.5 GHz band, the SAS coordinates the PAL-to-PAL border protections based on deployments, meaning licensees have essentially no administrative burdens.[46] This is one reason that for CBRS, the Commission concluded that the benefits of smaller license areas for the 3.5 GHz band outweigh any potential administrative burden on licensees and the Commission.[47] While OTI and PK argued during the *Spectrum Frontiers* proceeding that both counties and PEAs are far too large for capacity

[42] BDA Wireless Comments at 2-4. "These 3 PEAs would consist of 10,596 square miles, and our network only covers 1.8% of that area. As for the Census Tracts, we would have a chance at bidding and winning a total of 5 tracts (6870, 404, 405, 9871, 9731). These tracts make up 906.8 square miles and our current network covers 21.4% of the area. This photo depicts the large size of the PEA for our current coverage area. We will not be able to economically bid on an area with this much land mass. We should not have to obtain a license for an area that is 95% larger than the area we intending on ever using."
[43] Skywave Wireless Comments at 1.
[44] Ruckus Wireless Comments at 10-11; *Spectrum Frontiers* NPRM ¶ 111.
[45] See Report and Order and Further Notice of Proposed Rulemaking, *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, 31 FCC Rcd. 8014 ¶ 35 (July 2016) ("Spectrum Frontiers Order"); Ruckus Wireless Comments at 11. The Commission stated, for example, that although county-sized licenses would result in more license border protection requirements than PEA-sized licenses, the adoption of a power flux density limit at the license borders would promote coordination between licensees.
[46] CBRS 2nd Report and Order ¶ 138; Ruckus Wireless Comments at 11.
[47] CBRS 2nd Report and Order ¶ 138; Ruckus Wireless Comments at 11 ("Ruckus believes that the Commission's determination was correct in the 28 GHz band, and the guiding principles regarding propagation, intended coverage range, targeted deployments, discouragement of spectrum warehousing, license border coordination, and the overall cost- benefit of smaller licenses relative to administrative burdens, apply with equal or greater force in the 3.5 GHz CBRS band.").

spectrum with limited propagation, the diversity of license area sizes even among millimeter wave bands belies CTIA's suggestion that suddenly PEAs have become the only and best choice.

2. Most Parties Agree that Census Tract PALs Promote More Efficient Use of the Band and Better Advance 5G as a Diverse, Innovative Ecosystem

Most parties in the record agree that census tract-sized PALs promote more intensive and efficient use of the 3.5 GHz band and also facilitates the development of a more diverse and innovative 5G wireless ecosystem. MIT economist William Lehr details how in this band smaller license areas promote more efficient spectrum use and preclude fewer use cases because census tracts "allow better matching between potential user needs and the assets that are licensed for their use, and enhances efficiency in multiple ways." Lehr explains:

> First, users do not need to purchase or be allocated access to spectrum in areas other than where they actually need it. . . . Second, if excess spectrum is acquired via PALs, then other potentially efficient uses of the spectrum by other users is excluded . . . . Third, . . . [a]llowing potential bidders for PALs to better match spectrum to their actual needs helps ensure the widest participation by potential bidders. In this way, the willingness to pay for protected PAL spectrum is better matched to the available spectrum resources, making it more likely that there will be an efficient allocation if there are multiple users contending for access. Moreover, . . . all users of CBRS will be better able to balance the use of PAL and GAA spectrum."[48]

Lehr explains that while CBRS may be the only practical source of interference-protected spectrum for smaller and localized users and use cases, the national mobile carriers are not dependent on having contiguous geographic coverage in the 3.5 GHz band or any other band.[49] "Indeed, having such coverage would likely result in the spectrum being underutilized in many less-densely populated areas where the national cellular operators do not confront capacity constraints," Lehr argues.[50]

[48] Comments of Dr. William Lehr at 11.
[49] *Id*. at 8.
[50] *Id.*

Census tracts are a particularly good fit for the CBRS framework due to the characteristics of the 3.5 GHz band and how the PALs will be used in both urban and rural areas. The Commission noted in creating the CBRS rules that the "3.5 GHz Band has physical characteristics that make it particularly well-suited for mobile broadband employing small cell technology."[51] The Commission further argued this small cell technology "can provide broadband coverage and capacity in targeted geographic areas."[52] In urban areas, the 3.5 GHz spectrum will likely be used to expand network capacity.[53] In rural and less densely-populated areas, where small cell densification of wide-area carrier networks is either not needed or not profitable, 3.5 GHz PAL spectrum will play a significant role in providing broadband access to Americans who currently have no connectivity using highly directional, point-to-point or point-to-multipoint connections.[54]

Google explains this critical distinction between spectrum for capacity and spectrum for coverage, as our groups did at length in our comments:

> Because it is suited to shorter-distance transmission, there is no realistic possibility that CBRS spectrum will be used to reach additional users under a traditional carrier model that relies on wide-area macrocell coverage. In urban as well as rural areas, therefore, 3.5 GHz spectrum would be an impractical tool to increase coverage over large areas following the network architectures large carriers employ in other bands. CBRS deployments will not involve network build-outs blanketing large geographic territories.[55]

Google illustrates the impracticality of using PEAs through field tests assessing the likely service area of a single CBSD. Google's tests showed that even a rural Category B CBSD would

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[51] *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, FCC 15-47, 30 FCC Rcd. 3959, 3961 ¶ 1 (2015).
[52] *Id.* ¶ 98.
[53] Google Comments at 5.
[54] *Id.* at 6.
[55] Google Comments at 6. WISPA similarly asserts that "[u]nder the current rules, bidders representing a wide variety of technologies and use cases can compete on a level playing field, and successful bidders can aggregate census tracts to create an appropriate spectrum footprint whether for *capacity* in densely populated areas or for *coverage* in rural areas." WISPA Comments at v.

cover only 0.2% of even the smallest PEA, and only 0.039%, of the average PEA in the continental United States.[56] To cover even half of the total geographic area of the average PEA, a carrier would need to deploy more than 1,271 Category B CBSDs – and that estimate conservatively assumes no overlap between coverage areas.[57]

The financial impracticality of a carrier relying on PAL spectrum to deploy small cells for either fixed wireless or to densify an existing network over very large and contiguous areas (as 4G coverage networks do) is clear based on Verizon's plan for a massive decade-long capital investment in high-capacity fixed wireless network to support future 5G mobile capacity. A very recent and indepth financial analysis of Verizon's fixed wireless plans by New Street, a Wall Street analyst firm that specializes in telecom, found that Verizon will need to deploy 360,000 small cell nodes at a cost of $35 billion to reach the company's goal of reaching 30 million urban and suburban homes in the top 100 metropolitan statistical areas (MSAs).[58] The project would take 7 to 15 years, according to the report.[59]

Most critically, the New Street report concludes that even if Verizon spends $35 billion to achieve its stated goal of addressing 30 million homes and businesses, this represents just one-third of U.S. homes and businesses (and only 50 percent of the homes in each of the nation's top 100 MSAs). New Street concludes that even for Verizon – and even assuming a roughly 30 percent take rate on its fixed service *and* its use to densify capacity for its 5G mobile offerings after 2022 – that there is no business case for Verizon to deploy beyond a certain density to locations that include half the homes in the top 100 MSAs. And outside of those largest metro markets, presumably Verizon will not be deploying small cells using CBRS at all.

[56] Google Comments at 6.
[57] *Id.*
[58] New Street Report
[59] *Id.*

Google correctly anticipated the financial reality of CBRS deployments in its comments, stating: "Absent additional regulations forcing broader build-outs, even major carriers are likely to cover only a small fraction of a typical PEA with CBRS equipment."[60] Increasing PALs to the size of PEAs would have that same effect on startup providers and other CBRS users as well.

The American Petroleum Institute and the Energy Telecommunications and Electrical Association explains how census tract PALs promote a more efficient use of spectrum for potential users of CBRS outside of the typical wireless provider ecosystem:

> The Houston area demonstrates the importance of this distinction. The difference between the Houston PEA and any of the individual census tracts that comprise [it] demonstrates that many, if not all, CII entities would be foreclosed from competing with commercial providers for CBRS spectrum in an entire PEA. An oil and gas company would not be able to compete for CBRS spectrum to cover an individual refinery, for example, if the licensed area offered by the Commission is an entire PEA.[61]

Opening PALs to a wider variety of potential licensees among energy producers and utilities, to name just one category of critical infrastructure with growing needs for customized IIoT and real-time data analysis, promotes higher overall intensity of use, supports increased economic activity, and avoids the "hazards that follow when government auction rules artificially limit access to spectrum that otherwise would support many business models," as Google argues.[62] OTI and PK agree with the assessment of Professor Paul Milgrom that generally, "the twin goals of promoting economic efficiency and increasing auction revenues both favor allowing local and wide area uses to coexist and compete for incremental spectrum access in congested areas. In particular, local users with high value uses should be able to bid to

[60] Google Comments at 4.
[61] American Petroleum Institute and the Energy Telecommunications and Electrical Association Comments at 3.
[62] Google Comments at 3.

supply their own needs, without being forced to bargain with a third party that controls their access."[63]

The argument that the Commission should harmonize 3.5 GHz rules with the international community ignores the unique circumstances in the U.S.[64] The continued presence of federal and existing commercial incumbents in the CBRS band was precisely the reason the Commission opted for the necessary power level restrictions and the three-tiered sharing framework—the rules were tailored for the country's particular situation.[65] As Ruckus Wireless notes:

> Other countries have either already made small license areas available in this band (e.g., the Company Specific licensing regime in 3410-3800 MHz in the Netherlands) or have sought industry input on enabling localized vertical industry or micro-operator access to these frequencies (e.g., Australia, Italy, Switzerland). Both the United States' unique realities in this band and the still evolving international outlook for the 3.4-3.8 GHz frequency range directly refute global harmonization as a basis for PEA-sized licenses in the 3.5 GHz CBRS band.[66]

U.S. leadership in 5G also hinges on the Commission retaining census tracts for PALs, as the innovative and unique spectrum-sharing framework of CBRS is primed to enable a growing variety of next-generation wireless services that could support the development of 5G networks.[67] Policymakers and regulators in other countries have shown interest in the CBRS framework as they also attempt to make spectrum available for commercial services such as 5G,

[63] Letter from Paul Milgrom, Auctionomics, to Marlene H. Dortch, Secretary, FCC, ¶ 15, GN Docket No. 12-354 (Aug. 7, 2017).
[64] GE Comments at 34.
[65] Ruckus Wireless Comments at 12.
[66] *Id.*
[67] GE Comments at 34.

and any reversal on this framework in the U.S could harm the country's standing in the race to 5G.[68]

Verizon itself acknowledges that 5G applications will "involve technologies, network designs, and deployment scenarios beyond our current expectations and experiences."[69] The Commission should not give away the innovative 3.5 GHz band to the biggest wireless providers to promote a new technology, 5G, of which even the major providers do not yet know the details.

3. The Record Shows that Census Tract Areas for PALs Would Not be Overly Complex or Burdensome

There is strong support in the record that retaining census tracts for PALs, adopted as a compromise back in 2015, would not be overly complex or burdensome. An auction of census tract PALs would be "entirely feasible and reasonable," GE argues, noting there is no compelling evidence to back up the false assertion that a PAL auction would be overly complicated and burdensome.[70] According to Stanford economist and FCC auction consultant Paul Milgrom, the "characteristics of the 3.5 GHz spectrum and the FCC's priority licensing scheme obviate the need for the relatively complex auction designs that have been used to sell licenses for other frequencies."[71] Microsoft correctly states that:

> The auction and operation, via the SAS, of up to seven PALs in 74,000 census tracts will not create undue uncertainty. Small applicants will be focused on one or a handful of census tracts. . . . Modern databases can easily keep track of tens of thousands of licenses, so neither the Commission nor the SAS administrators should be overwhelmed by the auction of census tract licenses."[72]

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[68] *Id.*
[69] Verizon Comments at 7.
[70] GE Comments at 35.
[71] Letter from Paul Milgrom, Auctionomics, to Marlene H. Dortch, FCC Secretary, GN Docket No. 12-354, at 7 (Aug. 8, 2017).
[72] Microsoft Comments at 6.

G.E. correctly observes that although ten parties applied to be SAS operators under the current rules, "[n]o SAS administrator candidate indicated that census-tract licensing is a concern or will prevent a smooth SAS implementation at 3.5 GHz."[73]

Further, national or regional mobile carriers that wish to use multiple PALs across multiple census tracts should have no trouble doing so. The carriers that are large enough to offer service over large numbers of census tracts have the systems in place to manage their expansive spectrum holdings, and could put those systems to use for CBRS spectrum.[74]

With regard to interference being caused by too many borders with smaller areas, this too is no cause for concern. While smaller license areas will indeed result in more borders, it will not actually impose an undue burden for licensees.[75] Census tracts do not create interference protection problems because the SAS does not protect census tract *boundaries*, but instead protects the actual CBSD *deployments*.[76] As G.E. explains: "Because SAS manages interference on a highly granular, device-by-device basis, the size of the PAL license area has virtually no effect on the complexity of SAS activity or licensee protections."[77]

The size of the PAL has virtually no impact on the complexity of the boundary protection or the auctions. As Google, a SAS operator, explains: "PAL areas receive protection from harmful interference based upon actual deployments of one or more PAL CBSDs. In other words, the claimed actual service area . . . is the area the SAS protects. The formal boundaries of the license area do not define the area to be protected, except to the extent that service outside of

[73] GE Comments at 37.
[74] Comments of Google Inc. and Alphabet Access, filed July 24, 2017, in response to Petitions for Rulemaking Regarding the Citizens Broadband Radio Service, GN Docket No. 12-354, RM-11788 and RM11789 ("Google Comments") at 24.
[75] Microsoft Comments at 6.
[76] *Id.;* Comments of Google Inc. and Alphabet Access, filed July 24, 2017, in response to Petitions for Rulemaking Regarding the Citizens Broadband Radio Service, GN Docket No. 12-354, RM-11788 and RM11789 ("Google Comments") at 25.
[77] GE Comments at 37.

license areas is not protected. Therefore, the size of the PAL license area has essentially no effect on the complexity of PAL protections."[78]

B. Shorter License Terms and Competitive Renewals Align Best with CBRS as Primarily a Small Cell Capacity Band

The Commission should retain the relatively short three-year license terms and competitive renewal rules for PALs, as this best reflects the characteristics of CBRS as a small cell spectrum band that will be used to add interference-protected *capacity* (not wide-area coverage) on a targeted basis and for a diversity of use cases. By proposing an industrial policy that steers PALs to a specific small group of favored companies, the Commission is regressing to a command-and-control approach that tries to second guess both market forces and unforeseeable innovations in network architecture. As MIT economist William Lehr stated in his analysis:

> The inability to repurpose spectrum resources that were originally allocated with long, effectively perpetual, licenses has been one of the major reasons that spectrum has been under-utilized and used inefficiently in so many bands for so long.[79]

And just as conventional wisdom a decade ago failed to foresee that Wi-Fi would carry the vast majority of mobile device data, the Commission's attempt to force the marketplace to conform to its ideological predisposition is likely to be similarly inapt in a mobile future dominated by convergent fixed and wireless networks.

The current PAL framework for CBRS is also distinct from other bands licensed for wireless services with longer license terms due to the smaller cells adopted as part of the need to protect military and commercial incumbents from harmful interference.[80] Small cells can be

[78] Comments of Google Inc. and Alphabet Access, filed July 24, 2017, in response to Petitions for Rulemaking Regarding the Citizens Broadband Radio Service, GN Docket No. 12-354, RM-11788 and RM11789 ("Google Comments") at 6.
[79] Lehr Comments at 13.
[80] Ruckus Wireless Comments at 4.

deployed and amortized over a shorter time, meaning shorter lengths for license terms better fit the needs of operators using this band of spectrum.[81] As Ruckus observed in its comments:

> The return on investment horizons for the metro area small cell deployments envisioned by operators for this band are shorter than those for macro cellular deployments. Many operators possess metro area assets (e.g. fiber, hybrid-fibercoax, and siting) that will enable them to deploy these small cells more quickly than "greenfield" buildouts of macro cellular systems.[82]

The adamant consensus among rural WISPs and other smaller ISPs in favor of the current PAL rules reflects the reality that three years (and particularly the option to take six years initially) are sufficiently long for licensees to recoup their investments in areas of the U.S where deployment costs are generally the highest.[83] This is particularly true considering that WISPs typically aim to cover sparsely populated rural areas with tight construction budgets.[84] Vivint Wireless described why the CBRS band is particularly helpful for shorter license terms: "The 3.5 GHz band serves as an ideal home for small cell operations, where a buildout can occur quite expeditiously and equipment can be amortized within a three (3) year window."[85]

WISPA member survey, referenced above, found that over 63 percent already have invested and deployed service in reliance on the current PAL rules finalized in 2016.[86] The survey also found that 60 percent of respondents have already decreased their investment or downsized deployment due to the threat of the potential changes to the PAL licensing rules by

[81] DSA Comments at 10 ("DSA has always been consistent that license terms should be tied to the length of time required to ensure return on initial capital investment. Given the characteristics of relatively inexpensive small cell deployments, shorter PAL terms are the most appropriate for the CBRS band. If the Commission is serious about innovation, nothing can justify ten-year terms with an expectation of renewability, amounting to de facto perpetual licenses.").
[82] *Id.*
[83] Google Comments at 15.
[84] *Id.*
[85] Reply Comments of Vivint Wireless, Inc. at 6, GN Docket No 12-354, RM-11788, RM11789 (filed Aug. 8, 2017).
[86] WISPA Comments at 2.

the Commission.[87] "That translates to millions of dollars sidelined and thousands of consumers without fixed broadband access because many WISPA members are deeply concerned that they cannot effectuate business plans without PAL spectrum," WISPA stated.[88]

Lengthening PAL license terms to 10 or even to 7 years would disproportionately hurt rural areas. As Cantor Telecom Services argues:

> "In addition to reducing fungibility and liquidity necessary for a robust secondary market, an extended license term, in particular coupled with larger geographic license areas, could negatively impact rural deployments by precluding market entry for smaller service providers with niche rural markets that require lower costs of entry and would encourage larger providers with greater resources to stockpile and warehouse spectrum, as many commenters have noted."[89]

If the Commission were to extend the license term for PALs, it would make it much more expensive for companies to obtain PALs and could also drive up the cost of PALs to the point where many of the potential users of the CBRS band, including smaller commercial entities and private network operators, could not afford them.[90] SouthernLinc explains that while a ten-year license term would drastically increase the cost of PALs, this would be "exacerbated by making these licenses renewable, which would effectively make the grant of a PAL permanent, thus driving the upfront acquisition cost of a PAL even higher and foreclosing access to PALs for new technologies and services and new market entrants."[91]

CTIA argues that the current policy of competitive renewal "creates uncertainty as to future costs to retain a license and poses the risk that a licensee that invests in network buildout

[87] *Id.*
[88] WISPA Comments at 23.
[89] Cantor Comments at 7.
[90] SouthernLinc Comments at 11.
[91] *Id.*

will not 're-win' its license at auction."[92] However, if shorter terms and competitive renewal works for small, rural internet service providers – such as the more than 130 WISPs and other small ISPs that filed in support the current CBRS rules – then surely the largest nationwide providers will be able to "re-win" licenses at auctions under these terms as well.[93]

The big mobile carriers have both an inherent cost advantage and a safeguard that other wireless providers do not: big mobile carriers have access to other licensed bands and will most commonly use 3.5 GHz spectrum for added capacity, *not* for primary coverage. If the national or regional carriers lose a PAL, they have other licensed spectrum, as well as the option to use both GAA and unlicensed via LAA.

In addition, our groups concur with Google and other parties observing that incumbent operators have the advantage in bidding for an extended term on a license due to the fact that they already have the equipment and infrastructure in place to provide service in that area.[94] If the incumbent happens to be outbid, it would serve the same purpose as the initial auction in ensuring that the spectrum is assigned (or in this case, reassigned) to its highest and best use.

II. Most Parties Agree Secondary Markets Will be More Liquid and Efficient Under Current PAL Rules with Census Tracts and Limited Term Licenses

There is substantial agreement in the record that the current PAL rules based on census tracts and limited-term licenses will facilitate a more liquid and efficient secondary markets. A wide variety of non-national carriers investing in the CBRS band agree that it is highly unlikely that either partitioning or leasing of spectrum would significantly address the preclusive impact

[92] CTIA Comments at 6.
[93] Google Comments at 15.
[94] Google Comments at 16 ("Initial licensees in fact would have an inherent advantage in subsequent PAL auctions; they generally would have lower costs for the successive license term due to their use of the spectrum in the initial term.").

of large PALs the size of either PEAs or counties in a fashion that meets the needs of industrial, enterprise or rural providers.

Our groups agree with Cantor Telecom Services that shorter and non-permanent license terms will empower more robust secondary markets for the CBRS spectrum.[95] Three-year license terms and competitive renewals also serve the public interest by fostering innovation and investments in the 3.5 GHz band through a wide variety of companies and use cases.[96] As Cantor argues, "Many entities who would otherwise participate in the PAL auction – and who have likely invested resources already in anticipation of obtaining 3.5 GHz spectrum – would be foreclosed from participation as a result of the higher cost of licensing fees associated with longer terms."[97]

If PAL license terms are extended with a renewal expectancy, however, the large nationwide mobile carriers will have little to no incentive to participate in a secondary market at all. National and regional mobile carriers would have only *disincentives* concerning a voluntary partitioning or leasing of large and perpetual licenses. Some of these disincentives are the administrative burden to the license holder, the loss of potential future use of the affected portion of the license (optionality), and the natural incentive of the incumbent to stifle competition or, relatedly, to deprive industrial and enterprise owners the possibility to self-provision, customize and control IIoT, neutral host and other networks that do not generate business for the mobile carriers.[98]

[95] Cantor Telecom Services Comments at 5 ("Longer license terms would make the market less fluid and dynamic and potentially result in large swaths of spectrum lying fallow for extended periods of time during which another user could make productive use of the license.").
[96] Cantor Comments at 6.
[97] *Id.*
[98] Ruckus Wireless Comments at 16.

While the large carriers argue that partitioning and disaggregation will solve the problem of the secondary market, these methods are a woefully inefficient way of aligning license areas with small-cell service areas in the CBRS band. Microsoft accurately states that this approach has previously failed to promote competition or provide right-sized spectrum access to smaller providers, and that there is even less reason to believe national carriers will partition or lease areas that fit the needs of industrial, enterprise, institutional or rural providers. "The bottom line is that partitioning and disaggregation will not actually make spectrum available in less densely populated areas, and these areas will remain unserved by interference-protected PAL licenses."[99]

The disincentives of large carriers to resell spectrum have manifested themselves in other bands as well. WISPA recently conducted a survey among its ISP members that confirmed that large carriers typically do not lease spectrum to smaller competitors. The survey found that while roughly 25 percent of survey respondents reported that they had attempted to obtain licensed spectrum from AT&T, Verizon, Sprint or T-Mobile, fewer than ten percent of those who had made those attempts were successful.[100]

WISPA's survey is no outlier—Commission data also shows that the major mobile carriers are unwilling to foster an active secondary market with smaller, competitive players. The Commission's licensing records show that the large mobile carriers that generally acquire large-area licenses at auction (such as Economic Areas or PEAs with 10-year licenses and non-competitive renewal) rarely engage in secondary market transactions with smaller entities, and the major mobile carriers are much less likely to engage with parties that are not established

[99] Microsoft Comments at 7 ("It is no surprise then that partitioning and disaggregation have largely failed in the real world, because the transaction costs to acquire access to spectrum in small geographic areas in less densely populated areas are higher than the value of the spectrum to be leased or sold.").
[100] WISPA Comments at 43-44.

telecommunications companies.[101] Mobile Future studied the Commission's Universal Licensing System database, and found that 89% of secondary market transactions have involved transferring spectrum resources to major wireless providers or between non-nationwide providers.[102] Secondary market transactions that transfer spectrum *away* from smaller operators far outnumber those going *toward* those licensees, according to Mobile Future.[103]

We agree with NTCA and other parties noting that to date the reality is that today, spectrum secondary markets work primarily through acquisitions – or through license transfer transactions among national and regional mobile carriers. Secondary markets have completely failed when it comes to leasing or partitioning spectrum to smaller competitive or rural carriers, let alone industrial, enterprise or institutional users.[104] As NTCA bluntly stated: "In reality, the secondary market has proven to be an effective tool for large operators to *consolidate* spectrum."[105]

Our groups agree with MIT economist William Lehr's conclusion that secondary markets would likely be more liquid and efficient if the license areas were smaller and better aligned with the small cell character of deployments.[106] Although the efficiency of spectrum secondary markets in relation to partitioning or leasing a *portion* of a large license area is

[101] Google Comments at 19.
[102] Mobile Future, *FCC Spectrum Auctions and Secondary Market Policies: An Assessment of the Distribution of Spectrum Resources Under the Spectrum Screen* (Nov. 2013), at 19, *available at* http://mobilefuture.org/wp-content/uploads/2013/11/Paper-Distribution-ofSpectrum-Resources.pdf. *See also* Google Comments at 20.
[103] *Ibid*.
[104] NTCA Comments at 6 ("Secondary markets are neither a reliable source of spectrum nor a solution to the lack of coverage in rural areas. Relying on small and rural carrier access to spectrum via the secondary market assumes without justification or evidence that such a market will develop and a leap of faith that license holders are willing to part with spectrum at reasonable prices.").
[105] NTCA Comments at 6 (emphasis in original).
[106] Lehr Comments at 12.

questionable, smaller license areas are likely to foster a healthier secondary market. As Lehr states:

> Favoring large territories by auctioning only PEA-sized PALs would impose asymmetric transaction costs on the small users . . . Those with excess spectrum may prefer not to partition their spectrum either to foreclose the competition or to avoid incurring the transaction costs. Moreover, if those with excess spectrum are small users, then they have to incur spectrum leasing costs that are likely to be higher for them than for a large national operator who is likely already to have an in-house team to manage spectrum transactions."[107]

Our groups concur with Dr. Lehr's assessment, as well as with General Electric's determination that "[u]nder a PEA-based framework, the large wireless operators holding these CBRS licenses would be unlikely to make meaningful amounts of 3.5 GHz spectrum available to GE, its IIoT customers, and other non-traditional spectrum users. PAL licensees would have no legal obligation to lease or partition spectrum, and there would be no process compelling them to make their frequencies available to third parties. In many cases, large carriers choose to warehouse their frequencies rather than convey spectrum to entities that might use that resource to develop competitive offerings."[108] Additionally, secondary markets under a PEA-sized PAL framework would at best impose large and asymmetric transaction costs on smaller operators and involve extensive and highly complicated negotiations.[109]

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[107] *Id.*

[108] General Electric Comments at 23-24. G.E.'s Comments state: "Historical evidence from other wireless bands indicates that these carriers would largely hold onto their CBRS spectrum, even frequencies lying fallow or underused in rural and remote areas. A 2013 report revealed that only 11.01% of the MHz/POPs transferred or assigned from 2003 to 2013 were conveyed from nationwide operators to non-nationwide operators, while only 8.58% of the MHz/POPs leased between 2003 and 2013 were leased by nationwide operators to non-nationwide operators. In comparison, nationwide carriers received 67.58% of all MHz/POPs transferred or assigned during that period (from nationwide and non-nationwide operators), while nationwide operators leased 75.71% of all MHz/POPs leased during that timeframe (again, from both nationwide and non-nationwide operators)."

[109] *Id.*

OTI and PK agree with Ruckus that a better approach would be modifications and enhancements to the existing light-touch leasing framework to promote spectrum access to enterprises and smaller vertical industry entities through the secondary market.[110] Ruckus Wireless elaborates:

> Specifically, the Commission will need to encourage the formation of spectrum exchanges in order to overcome the administrative burden that leasing would entail absent such exchanges. Further, strong and appropriate incentives should be defined to promote the availability of PAL usage rights to the secondary markets.[111]

OTI and PK further agree with Ruckus and other commenters who argue that light touch leasing should be retained and strengthened – and that the market will be operate most efficiently if the Commission retains the compromise of small PAL areas. The combination will form the most flexible and robust framework for secondary market transactions. As Cantor Telecom Services argues, "A vibrant secondary market requires maximum flexibility and should permit PAL users to gain access to additional spectrum as future needs arise between auction windows."[112]

III. The Record Shows Strict and Geographic Performance Requirements are Necessary if PALs are Largeer, Long Term and Non-Competitive for Renewal

If the Commission does choose to enlarge the geographic areas and lengthen the terms for PALs, while also making them non-competitive for renewal, the agency must impose strict and geographic performance requirements for license holders. Increasing the size of PALs to PEAs would require the Commission to implement strict build-out requirements, an unnecessary

[110] Ruckus Wireless Comments at 5.
[111] *Id.* at 6.
[112] Cantor Telecom Services Comments at 11.

regulatory intervention since PAL holders under the current rules are already able to aggregate up from census tracts.[113]

Charter, for example, argues that a traditional performance requirements would need to be implemented if the Commission changes the license terms to longer than three years and changes the expectations for renewability.[114] "By adopting performance requirements for the 3.5 GHz Band, the Commission will ensure the public interest is served by the promotion of spectrum availability, efficiency, and usability," Charter notes.[115]

In addition, as Ruckus Networks explains, the constant monitoring of deployments on CBRS spectrum by SAS operators – which are the Commission's designated band coordinators — permits the agency to continually monitor performance toward buildout benchmarks using metrics that are most relevant to the efficient and intensive use of the entire geographic area of the PAL.

> We believe that the SAS coordination and management of the overall CBRS spectrum environment provides a new level of detail, and a resulting increased range of metrics, upon which such performance requirements could be based. For example, traditional coverage metrics, both population and geographic, could be reported as the cumulative average over a specified period of time by the SAS. When tied to either service obligations or renewal standards, such "rolling metrics" would incent PAL license holders to make the most intensive use of their spectrum rights as early as possible in the term of the license and also maintain that intensive use throughout the reporting period."[116]

OTI and PK agree with DSA that by asking whether performance requirements are necessary, the Commission concedes the economic inefficiency of the proposal to extend the PAL licenses to ten years with no competitive renewal.[117] If the Commission extends the length

[113] *See, e.g.,* Google Comments at 4; Ruckus Wireless Comments at 8.
[114] Charter Comments at 4-5.
[115] *Id.*
[116] Ruckus Wireless Comments at 8.
[117] DSA Comments at 11.

of PALs and removes the presumption of renewal, it would also need to enforce an associated build-out requirement, which would add regulatory costs as well as an oversight and enforcement burden.

By comparison, the market-driven approach of shorter license terms, more auctions, and broader access to the spectrum band is far superior to the type of regulatory oversight of build-out that would be necessary if the Commission moves CBRS to 10-year PALs.[118] As Google correctly points out: "Although complicated build-out requirements and secondary market rules will become necessary if the Commission expands and extends PALs, these regulatory measures are no substitute for right-sized PALs."[119]

CTIA argues that the "use or share" model provides a sufficient alternative and that "opportunistic GAA use effectively eliminates any theoretical foreclosure risks and counters the need for the Commission to adopt and enforce any construction and performance requirements."[120] Although opportunistic GAA use definitely promotes more intensive use of the spectrum band, the need for build-out requirements relates to *interference protection* and the certainty of investment in services that promise quality of service will not be disrupted.

T-Mobile proposes a population-based performance requirement, similar to one adopted in the *Spectrum Frontiers* proceeding for millimeter wave spectrum, based on 40 percent of the population of the license area by the end of the ten-year term.[121] However appropriate this might be for millimeter wave spectrum, this proposal would set an embarrassingly low bar in a small cell band located in highly-valued mid-band spectrum. T-Mobile's position is a clear signal that the national carriers want an advantage in securing exclusive access to PALs over multi-county

[118] *Id.*
[119] Google Comments at 18.
[120] CTIA Comments at 7.
[121] T-Mobile Comments at 7.

areas, but with an understanding they will use the spectrum only in cities and other high-demand areas. Even Verizon, which has announced it plans to spend tens of billions in capex deploying hundreds of thousands of small cell access points, a buildout limited to the densest half of the top 100 MSAs would provide ubiquitous network densification only in urban and other high-traffic and high ARPU areas, as the New Street analysis, discussed above, concludes.

As OTI and PK have previously argued, if the Commission incorporates any of the proposed changes to the PAL license terms, the agency should also propose strict geographic build-out requirements based on areas no smaller than census tracts. The major carriers claim that large PAL areas are necessary to avoid the risk of a "coverage gap" with respect to a wide-area deployments. The Commission should therefore require PAL holders to deploy in every census tract and return any census tract not served after the initial license term.[122]

IV. Record Strongly Supports the View that the Current Rules Best Promotes Economic Productivity and Growth for a Wide Range of Industries and Localities

The current CBRS rules reflect the right balance to best promote economic productivity for a wide variety of industries in rural, urban, low-population dense, and high-population dense areas. The CBRS framework is tailored to address the fact that the modern-day wireless marketplace now includes a far more diverse set of companies than in the past, and these companies, as well as schools, cities and other institutions, need access to licensed and unlicensed spectrum to support a far more diverse set of business operations.[123]

Dr. Lehr's filing details how the CBRS rules impact this new and diverse set of companies seeking direct access to interference-protected spectrum for their own localized

[122] OTI Comments on Petition for Rulemaking
[123] Lehr Comments at 6.

needs: “These businesses need licensing rules that permit economically feasible license acquisition by this larger set of potential bidders, rather than rules designed solely to accommodate the interests of large national carriers. The FCC's current CBRS rules were designed to accommodate the need for spectrum resources for all of these diverse users, while also providing additional spectrum access opportunities for the national cellular providers.”[124] Professor Paul Milgrom similarly argues, “The twin goals of promoting economic efficiency and increasing auction revenues both favor allowing local and wide area uses to coexist and compete for incremental spectrum access in congested areas. In particular, local users with high value uses should be able to bid to supply their own needs, without being forced to bargain with a third party that controls their access.”[125]

The framework for the size, terms and renewability of PALs was a key aspect of the Commission’s CBRS rules. The small, targeted area sizes for PALs were precisely the compromise needed to enable competition between new entrants to the wireless market and the major incumbents who already have a nationwide footprint. As Google states: “Unlike the current rules, a Commission decision to use only PEAs would pick a small and closed subset of operators that can economically bid on PEA-sized PALs over a large and open class of potential bidders who cannot. It would reduce the overall utility of the spectrum by effectively barring rural broadband providers, industrial IoT operators, venue owners, and other non-traditional licensees from the PAL market, and concentrate the remaining benefits in a small group of large carriers.”[126]

[124] *Id.*
[125] Letter from Paul Milgrom, Auctionomics, to Marlene H. Dortch, Secretary, FCC, ¶ 15, GN Docket No. 12-354 (Aug. 7, 2017).
[126] Google Comments at 12.

Census tract PALs also promote significant public interest goals, as General Electric details: "There is an inherent value in having an alternatively licensed 'innovation band' that gives critical-infrastructure entities and other non-traditional users a rare chance to access commercial spectrum. The Commission should preserve the opportunities afforded by this unique regulatory structure."[127] Additionally, the current CBRS rules enhance the "resiliency, reliability, safety, and efficiency of the nation's critical-infrastructure facilities," a necessity given the functions of these facilities such providing safe transportation, clean water, electricity, oil and gas power, nuclear energy, and other important societal needs.[128]

With regards to the length of license terms, the current rules also strike the right balance to promote efficient and competitive use of the 3.5 GHz band. The current rules, which set up contestable renewal auctions of PALs, promote economic efficiency and make sure that as technologies, consumer preferences and business models evolve over time, the spectrum is used by the entity that values it the most highly.[129] Ensuring that entity is able to use the spectrum results in the likelihood that the spectrum generates the highest value possible.[130] "The inability to repurpose spectrum resources that were originally allocated with long, effectively perpetual, licenses has been one of the major reasons that spectrum has been under-utilized and used inefficiently in so many bands for so long," Dr. Lehr explains.[131]

[127] General Electric Comments at 30-31.
[128] General Electric Comments at 31 ("...Their internal communications systems are built and maintained to exceptionally high standards. These private wireless networks must be more reliable and resilient than commercial mobile systems, since they must sustain critical-infrastructure communications during natural disasters and other emergencies and support connectivity in remote areas beyond commercial coverage.").
[129] Google Comments at 17.
[130] *Id.*
[131] Lehr Comments at 13 ("As examples, consider the television broadcast spectrum in the 600 and 700 MHz bands, where it has taken decades to repurpose or open this spectrum to shared use; or the Federal spectrum in many other bands (including the 3.5 GHz band).").

The current CBRS rules provide a strong base for 5G innovation and have already spurred important investments that would be disrupted by any changes to the thoughtful framework developed by the Commission in 2015. As General Electric envisions, 5G could likely involve a "broad-based, heterogeneous ecosystem" that incorporates a diversity of operators, technology vendors, and spectrum users.[132] "Such a vibrant ecosystem – including IIoT developers and users – should support the development of networks that deliver exponential improvements in latency, throughput, connectivity, and other wireless parameters. While CBRS alone cannot deliver the full benefits of 5G, the Commission's unique framework at 3.5 GHz can serve as a significant driver toward this goal," General Electric argues.[133]

One indication is the number and variety of fixed broadband service providers that have been deploying steadily since 2015 in anticipation of the expanded band and more accessible PAL framework. According to WISPA, since April 18, 2015 – the day after the Commission froze the issuance of new licenses in the band – "the Commission has registered more than 19,000 locations [on the 3650-3700 MHz portion of the band], none of which is even eligible for grandfathered interference protection."[134] Rural WISPs, enterprise broadband providers, energy companies, municipalities and government agencies, telecommunications cooperatives, private networks and resorts make up those licensees, reflecting the diversity of economic empowerment the CBRS rules promoted.[135] When the Commission passed its CBRS rules, it enabled a wide variety of business models to flourish, and 3.5 GHz development has "involved collaboration and coalitions between established and traditional and non-traditional wireless stakeholders,"

[132] General Electric Comments at 18.
[133] *Id.*
[134] WISPA Comments at 15.
[135] WISPA Comments at 16.

General Electric notes, detailing the several significant partnerships that have begun premised on the existence of the CBRS rules.[136]

For rural providers, the CBRS rules have already predicated significant investment and deployment. that it has demonstrated "great success" with its experimental 3.5 GHz license which is currently providing service of up to 100 Mbps speeds to homes and businesses.[137] Rise reports thanks to its favorable propagation characteristics, ability to deliver high capacity and high speed service, its software-upgradable platform which mitigates capex exposure when increasing speeds to endusers, and, as it describes, The rules themselves served as a catalyst and basis for small providers to invest in the 3.5 GHz band to support new services for their customers. Rise Broadband reports that because, "most importantly," the PAL rules afford a level of protection to our broadband services at a reasonable cost," it has invested almost $10 million and currently serves over 12,000 customers in the 3650-3700 MHz band. [138] As BDA Wireless attests, the company invested in the 3650 MHz band with the "good faith" that the

[136] General Electric Comments at 18-20 ("In addition to GE's collaborative arrangements described supra at 15, other agreements and partnerships are advancing the CBRS ecosystem at 3.5 GHz. For instance, Ruckus Wireless and Qualcomm have developed technologies for the 3.5 GHz band that involve the deployment of neutral host-capable small cells supporting cost-effective in-building coverage. Earlier this year, Nokia, Alphabet Access, and Qualcomm partnered with stock car race operators on the use of 3.5 GHz band technologies to create "a 360-degree virtual reality zone inside a stock car to provide a streaming, real-time virtual user experience at speeds over 180 mph." Multiple companies have also applied for certification as SAS administrators, with seven receiving the Commission's conditional approval in December 2016.32 Federated Wireless has been involved in forty trials of its SAS technology, ranging from technology demonstrations to operational pilots, and it expects to receive final Commission certification for its 3.5 GHz CBRS product during 2018. Google's Alphabet Access, meanwhile, has also engaged in extensive SAS testing and performed the "first end-to-end demonstrations of CBRS mobile devices." Numerous other companies have obtained experimental authorizations from the Commission to test equipment, explore network architectures, evaluate market demand, and assess a mix of innovative uses. Clearly, the opportunities created by the existing CBRS framework have sparked intense industry interest in the 3.5 GHz band.").
[137] Rise Broadband Comments at 1.
[138] *Id.*

Commission would continue with its original 2015 CBRS rules to add additional spectrum and to license by census tract.[139]

If the Commission were to enlarge license areas to PEAs,[140] or extend PAL terms to ten years with renewal expectancy,[141] it would not be in keeping with the clear purpose ofSection 309(j) of the Communications Act. The statute directs the Commission to promote "the development and rapid deployment of new technologies, products, and services for the benefit of the public" while "disseminating licenses among a wide variety of applicants" and "avoiding excessive concentration of licenses."[142] The statute requires the Commission's auction process to also advance the "efficient and intensive use of the electromagnetic spectrum."[143] Retaining the current CBRS rules, auction process, PAL size and license terms all achieve the goal of serving a wide variety of applicants, avoiding a concentration of licenses, and promoting the efficient use of 3.5 GHz spectrum.

Our groups concur with Ruckus Wireless, which argues that "[i]f the Commission were to increase the PAL size to PEAs absent this type of specificity from those seeking such large license areas, and without consideration for the other use cases at the PAL tier… The Commission will not have fulfilled the objectives of Section 309(j) of the Act to encourage efficient and intensive use, to provide an equitable distribution of licenses and services among geographic areas, and to allow economic opportunity for a wide variety of applications."[144]

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[139] BDA Wireless Comments at 2.
[140] Ruckus Wireless Comments at 5.
[141] Microsoft Comments at 3.
[142] 47 U.S.C. §§ 309(j)(3)(A)-(B).
[143] 47 U.S.C. § 309(j)(3)(D).
[144] Ruckus Wireless Comments at 13 (Ruckus also points out that the Commission cited a lack of specificity regarding service plans in rejecting proposals to increase the 28 GHz band license size from counties to PEAs, a lack of specificity that exists with calls to expand PALs to PEAs as well).

The current framework for the 3.5 GHz band best promotes the directives given to the Commission through Section 309(j) by promoting access to spectrum for as many entities and business models as possible.[145]As General Electric details, census-tract licensing for CBRS PALs furthers all of the statutory objectives as put forward under Section 309(j). Census-tract licensing will "lower barriers to entry at 3.5 GHz and result in a wider variety of licensees than found in other commercial wireless bands," and there will likely be no "excessive concentration" of census-tract PALs in the 3.5 GHz band under the CBRS rules.[146] "In addition, by matching applicants' deployment plans to geographically tailored authorizations, census-tract licensing will minimize warehousing and foster intensive, efficient, localized use of 3.5 GHz spectrum," General Electric added.[147]

Finally, OTI and PK agree with WISPA that if the Commission were to adopt all of the potential changes to its licensing approach as outlined by the agency in the NPRM, "the fundamental conflicts with these, as well as other requirements of Section 309(j) unmentioned by the Commission, would be so stark as to constitute a violation of the statute."[148]

V. The Record Supports Public Disclosure of Anonymized CBSD Registration Data as Necessary to Optimize Productive Use of the Band

The record supports public disclosure of anonymized CBSD registration data as necessary to optimize productive use of the CBRS band. The Commission's existing rules, which protect confidentiality while requiring the licensing database administrator (SAS operators) to make information about the radio environment available to stakeholders, strikes the "right

[145] Google Comments at 3.
[146] General Electric Comments at 33-34.
[147] *Id.*
[148] WISPA Comments at 45.

balance" between licensees' desire for confidentiality as well as the GAA users' and the public's needs to understand how the airwaves are being used.[149]

CTIA brazenly claims that "there is no countervailing benefit to publicly disclosing CBSD registration information to outweigh the potential harms."[150] However, the record clearly describes several important public interest benefits related to the disclosure of this information. The benefits of transparency are much stronger than any claimed harms to security and competition that have been asserted in the record, and the rule requiring public disclosure of CBSD registration information serves a significant purpose. As WISPA argues, "With access to certain basic information, CBRS users will be better able to plan their operations and design their networks in the first instance, and will not have to go to the SAS on a trial-and-error basis to keep asking 'How's this?' Moreover, users will have more data points to determine the 'best' available channel rather than having the SAS decide the channel it wants to assign to the user."[151]

As DSA argues, "Public disclosure of the basic CBSD registration information used by SAS operators to calculate protection areas between PALs and access to vacant PAL spectrum on a GAA basis is critical to the integrity and efficient functioning of the CBRS framework."[152] The public, and in particular potential network operators, must have access to information about the spectral environment and channel availability of deployment in the GAA and PAL tiers.[153] We also agree with Google that the Commission's existing rules "protect confidentiality while permitting SASs to make information about the radio environment available to stakeholders."[154]

[149] Google Comments at 22.
[150] CTIA Comments at 12.
[151] WISPA Comments at 52.
[152] DSA Comments at 24.
[153] *Id.*
[154] Google Comments at 22.

Under current procedures, GAA operators can use *anonymized* CBRS deployment data to determine which channels are available, in order to plan their networks. The current CBRS rules already protect sensitive information, and the successful operation of the 3.5 GHz framework hinges on the public availability of some information.[155] And some commenters show no willingness to accept a reasonable framework for sharing important data. T-Mobile, for example, is opposed to disclosing *any* carrier information, even if that data is anonymized and is not a threat to security.[156]

Further, the purported harms of retaining transparency in the record would not be solved by restricting disclosure of CBSD registration data. For example, the actual locations of most base stations, including small cells, are difficult to obscure, as they will generally be visible. Most small cells will utilize the same LTE-based air interface technology, making it relatively easy to identify the carrier from the transmitted signal.[157]

As DSA notes: "DSA is unaware of any legitimate reason why anonymized CBSD information for this particular band should be shrouded in secrecy while very specific (and carrier identified) information about other licensed wireless deployments are disclosed in ULS and other Commission licensing databases."[158] There is no reason to believe that the information on actual spectrum use in the 3.5 GHz band is any more sensitive than other bands. At the same time, this information serves important uses by both promoting more intensive GAA use of the band and holding SAS administrators accountable by providing at least a degree of transparency about whether registrations are accurate and up to date.

[155] Google Comments at 22.
[156] T-Mobile Comments at 13.
[157] WISPA Comments at 52.
[158] DSA Comments at 23.

Other commenters, such as Federated Wireless, argue the Commission should amend the rules to restrict SASs from disclosing CBSD registration data that may compromise security or be considered completely sensitive, despite previously pushing for the current set of rules.[159] "SAS administrators should nevertheless be permitted to depict information needed by current or prospective CBRS users to plan and operate their installations. Such information could include visualizations based on certain anonymized or obfuscated registration information," Federated Wireless argued in its comments to CTIA's petition to change the CBRS rules.[160] Federated got it right the first time around: The rules already protect sensitive information, and the disclosure of this important information should not be further prohibited.

[159] Federated Wireless Comments at 10-11.

[160] Comments of Federated Wireless, filed July 24, 2017, in response to Petitions for Rulemaking Regarding the Citizens Broadband Radio Service, GN Docket No. 12-354, RM-11788 and RM11789.

VI. CONCLUSION

Our groups urge the Commission to retain the current PAL rules, particularly with respect to census tract license areas and competitive license renewal, and to focus instead on an expedited implementation of the rules as adopted in 2015 and 2016. The uncertainty and delay inherent in re-opening the rules for the exclusive benefit of one particular group of companies would not serve the broader public interest in our view. The CBRS is designed to promote innovation, competition, rural broadband access and consumer choice. The cellular industry's cynical effort to revise the finalized rules to tailor licensing rules to better fit the carriers' wide-area business model will needlessly foreclose localized and potentially competing new users and uses. We urge the Commission to reject any effort to backtrack on this unique achievement in forward-thinking spectrum policy.

Respectfully submitted,

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