Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Use of Spectrum Bands Above 24 GHz for Mobile Radio Services	)	GN Docket No. 14-177
	)	
Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands	)	IB Docket No. 15-256
	)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, And 101 to Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	)	RM-11664

To: The Commission

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

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New America's Open Technology Institute ("OTI") and Public Knowledge ("PK") submit these Reply Comments in response to the Commission's *Notice of Proposed Rulemaking* concerning the use and appropriate allocation of spectrum in the bands above 24 GHz.[1]

[1] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177 *et al*., Notice of Proposed Rulemaking (rel. October 23, 2015) ("*NPRM*").

I. INTRODUCTION AND SUMMARY

As consumer advocates, OTI and PK believe that the public interest goals of promoting innovation, market entry, competition, intensive spectrum reuse, and diverse uses and users are best served by extending the three-tier spectrum access framework the Commission has adopted for the 3.5 GHz Citizens' Broadband Radio Service to ensure that there is an appropriate mix of licensed, unlicensed and dynamic shared access to what will otherwise be grossly-underutilized mmW spectrum. We are therefore pleased to see significant support among commenters for that approach and for a use-or-share obligation on licensees that facilitates opportunistic public access to unused mmW spectrum, as well as a strong consensus among commenters that the current unlicensed band at 57-64 GHz should be extended at least to 71 GHz.

First, the record in this proceeding reflects diverse and widespread agreement that the 64-71 GHz band should be allocated for unlicensed use under technical rules consistent with the existing unlicensed band at 57 to 64 GHz. OTI and PK agree with Microsoft's further recommendation that the Commission extend the upper boundary of the 60 GHz Band to 72.5 GHz, thereby facilitating the expected demand for high-capacity broadband channels where there are dense deployments of Wi-Gig networks. Extending the unlicensed band to 72.5 GHz (rather than 71 GHz) provides an additional non-overlapping channel for WiGig, thereby avoiding underutilization of a portion of the band and maximizing spectrum efficiency.

Second, OTI and PK strongly agree with commenters supporting the Commission's proposal for a "use-or-share" obligation on mmW licensees that authorizes opportunistic access to unused spectrum capacity in the 28, 37 and 39 GHz bands. The Commission should authorize opportunistic use wherever and whenever licensees are not operating, including in areas where licensees have not yet begun to deploy. Widespread opportunistic access can enhance efficient

reuse of mmW spectrum without any risk to licensee operations by relying on a geolocation database governance mechanism that is either an extension of, or similar to, the Spectrum Access System the Commission will soon certify to manage more intensive sharing of the 3.5 GHz band.

Unfortunately, mobile carriers and their suppliers repeat all the arguments against opportunistic access to unused spectrum capacity made during the 3.5 GHz proceeding. The Commission should once again reject these make-weight complaints, as it did in the context of the 3.5 GHz proceeding. Indeed, the case for opportunistic sharing is much stronger for mmW spectrum than it was for the 3.5 GHz band. As the *NPRM* points out, the propagation and atmospheric characteristics of mmW spectrum "provide greater opportunity for frequency reuse without interference." By certifying a SAS or other geolocation database mechanism the Commission will ensure there is absolutely no downside or risk for licensees, who would maintain all of their rights to *use* the public resource – and lose only their ability to warehouse it.

Third, the Commission can mitigate ISP concerns about the *NPRM*'s proposal to award *exclusive* indoor operating rights in the 37 GHz band to property holders on a license-by-rule basis – and make 37 GHz a far more intensively-used innovation band – by modifying its proposal so that indoor use is licensed by rule on a *non-exclusive* General Authorized Access (GAA) basis. Since a network operator (whether or not they have a wide area "exclusive" license) will need to secure the permission of any business, home or public building to deploy access points indoors, authorizing indoor use on a GAA basis creates no new obstacle or burden for wide-area licensees. If carriers have the venue's permission to operate, they can register as the user. On the other hand, a GAA (or unlicensed) allocation ensures that tens of millions of enterprises, households and public buildings can decide how best to use this particular band of

mmW spectrum inside their own building, thereby ensuring that it does not lie fallow in the tens of millions of structures where carriers will not be deploying.

More generally, OTI and PK strongly concur with commenters suggesting that the Commission should extend its Part 96 framework for intensive, three-tiered sharing to at least the 37 GHz band. Extending the three-tier 3.5 GHz sharing framework and the Spectrum Access System governance model to the mmW bands creates a flexible sharing framework that protects band incumbents, facilitates efficient spectrum re-use, and promotes lower barriers to entry and innovation. A dynamic spectrum access framework on at least a substantial portion of the mmW bands in this proceeding will ensure that limited spectrum resources do not go underutilized and that there is a truly flexible and hybrid spectrum access option for current and future technologies.

II. THE RECORD REFLECTS DIVERSE AND SUBSTANTIAL SUPPORT FOR EXPANDING THE 60 GHZ UNLICENSED BAND

The record in this proceeding reflects diverse and widespread agreement that the 64-71 GHz band should be allocated for unlicensed use.[2] The Consumer Technology Association, for example, observes that unlicensed spectrum "is a hotbed for innovation and [is] integral in addressing the spectrum crunch."[3] CTA supports the FCC's proposal since it "will add important capacity to the existing 57-64 GHz band, which is already allocated for unlicensed operations."[4]

[2] *See, e.g.*, Comments of CTA at 8; Comments of NCTA, GN Docket No. 14-477 *et al.* (filed Jan. 28, 2016) ("Comments of NCTA"), at 3; Comments of Huawei, GN Docket No. 14-477 *et al.* (filed Jan. 28, 2016), at 20; Comments of Qualcomm, GN Docket No. 14-477 *et al.* (filed Jan. 27, 2016) ("Comments of Qualcomm"), at 14; Comments of Microsoft, GN Docket No. 14-477 *et al.* (filed Jan. 27, 2016) ("Comments of Microsoft"), at 5; Comments of Google, GN Docket No. 14-477 *et al.* (filed Jan. 27, 2016) ("Comments of Google"), at 6.
[3] Comments of the Consumer Technology Association, GN Docket No. 14-477 *et al.* (filed Jan. 27, 2016) ("Comments of CTA"), at 8.
[4] Comments of CTA at 8.

Intel points out that "[t]he 64-71 GHz band is ideally situated to extend the growing demand for high capacity wireless LAN operations."[5]

Importantly, Intel also notes that allocating the entire 64-71 GHz band for unlicensed use is necessary to accommodate the high data rates contemplated by expansion of the WiGig standard. PK and OTI concur with Intel's assessment that "[a] lesser amount of spectrum would diminish the growth potential and limit the usage cases and the simultaneous users of high bandwidth services."[6] Qualcomm also expressed support, noting "the current 60 GHz band is useful for ultra-high-speed unlicensed uses, such as streaming Ultra HD audiovisual content across a large room."[7]

Support for unlicensed access to the 64-71 GHz band is not limited to chip and hardware manufacturers. Google and Facebook support for the Commission's proposal.[8] Google notes that "harmonized rules for the frequencies between 57 and 71 GHz will allow economies of scale and other efficiencies, thereby facilitating rapid and widespread deployment of unlicensed devices."[9]

Microsoft goes further, recommending that the Commission extend the upper boundary of the 60 GHz Band to 72.5 GHz," citing "the expected high demand for large capacity broadband channels where there are dense deployments of Wi-Gig networks."[10] Extending the unlicensed band to 72.5 GHz (rather than 71 GHz) provides an additional non-overlapping channel for WiGig, thereby avoiding underutilization of a portion of the band and maximizing spectrum efficiency.[11] PK and OTI agree with this assessment, and with Microsoft's proposal

[5] Comments of Intel, GN Docket No. 14-477 *et al.* (filed Jan. 27, 2016) ("Comments of Intel"), at 17.
[6] Comments of Intel at 18.
[7] Comments of Qualcomm at 14.
[8] Comments of Facebook at 5; Comments of Google at 7.
[9] Comments of Google at 7.
[10] Comments of Microsoft at 5-6.
[11] *Id.* at 6-7.

that the 50 MHz control channel at 57 GHz "be eliminated as technological advancement has supplanted its need."[12]

Unfortunately, despite this broad-based consensus, mobile carriers and their equipment suppliers continue their efforts to limit the availability of unlicensed technologies. CTIA argues that only 2 GHz of the 64-71 GHz band should be allocated for unlicensed, while the remainder should be licensed on an exclusive basis.[13] In support of this assertion, CTIA cites potentially forthcoming international allocations for mobile services – and the assumption these will be limited to exclusively licensed use.[14] The benefits of international harmonization in the 66-71 GHz band are entirely speculative. There is no certainty that undeveloped future technologies or standards will generate greater public interest benefits than unlicensed use, or even that carriers will actually need and intensively deploy intensively in 60 GHz in addition to all the other licensed mmW allocations they seek in the 28, 37 and 39 GHz band. Moreover, the U.S. should continue to be the leader – not the follower – on forward-thinking spectrum policy, just as the FCC was in adopting the unique 3-tier framework for dynamic sharing in the 3.5 GHz band.

CTIA opines that the Commission's current proposal would be unfair to licensed providers, as "only 3.85 GHz of [mmW] spectrum would be made available for licensed services while 14 gigahertz" would be available for unlicensed uses.[15] The suggestion that some form of gigahertz parity is appropriate not only ignores the fact that the preponderance of low-frequency bands with the most highly desirable characteristics are the exclusive domain of licensed carriers, but also glosses over the benefits unlicensed bands yield for both consumers and carriers. Among those, Cisco's *Virtual Networking Index* estimates that 66 percent of U.S. mobile data traffic will

[12] *Id.* at 5.
[13] Comments of CTIA at 17-19
[14] Comments of CTIA at 18.
[15] Comments of CTIA at 19.

be transported via Wi-Fi, rather than licensed networks, by 2019.[16] Mobidia, which measures the actual usage of tens of thousands of consumers, reports that Wi-Fi is already carrying an average of 80 percent of total mobile device data traffic.[17]

Wideband unlicensed technologies like WiGig therefore benefit not only consumers, but also carriers by reducing network load and improving performance. The appeal of unlicensed spectrum for this purpose is so strong, in fact, that the carriers are attempting to push LTE-U into existing unlicensed allocations to supplement their network's limited capacities. It is unfortunate, and puzzling, to see the established carriers, such as Verizon[18] and AT&T,[19] continue to stand in the way of unlicensed technologies that to date have directly complemented their offerings.

A. Allocating the full 57-72.5 GHz Band to Unlicensed will speed deployment of next-generation wireless technologies

PK and OTI agree with numerous commenters who argue that the Commission's proposal to expand unlicensed spectrum in the 60GHz band will facilitate faster and more widespread deployment of next-generation wireless technologies. As Microsoft notes, products using WiGig are already available and "deliver multi-gigabit speeds, low latency, and security-protected connectivity between nearby devices."[20] WiGig standards, and successors that would utilize the full 57-71 GHz band, are already under development by commenters such as Intel.[21] PK and OTI concur with Wi-Fi Alliance's view that "[t]he ubiquity and economic impact of Wi-

[16] Robert Pepper, *Cisco Visual Networking Index* (VNI) *Mobile Data Traffic Update, 2014-2019*, presentation at Mobile World Congress, GSMA Seminar (Mar. 3, 2015), *available at* http://www.gsma.com/spectrum/wp-content/uploads/2015/03/MWC15-Spectrum-Seminar.-Dr-Roberto-Pepper.-Cisco-presentation.pdf. Globally Cisco projects that by 2018 more than 60 percent of *all* Internet traffic (fixed and mobile) will connect to the end user over a Wi-Fi connection, including both mobile device offload and home/enterprise routers.
[17] *See* Mobidia, "Network Usage Insights: Average Data Usage for LTE, 3G and Wi-Fi of Wireless Subscribers in the USA, Q3 2014" (Nov. 2014).
[18] Comments of Verizon at 13.
[19] Comments of AT&T at 17.
[20] Comments of MIcrosoft at 4-5.
[21] Comments of Intel at 18.

Fi will be extended as WiGig technologies continue to be implemented in the millimeter wave bands."[22] As Qualcomm noted, "[s]upport for this band is integrated into the latest suite of handsets that include Qualcomm's latest Snapdragon chipset."[23] With standards established and hardware already developed and available, the opportunity for deployment and growth in the 60 GHz band is indisputable. Unlike 5G technologies that would depend on licensed spectrum, technologies like WiGig that utilize unlicensed spectrum are already developed and coming to market.

B. PK and OTI Support Commenters' Proposal that Transmissions in the 57-71 GHz Band be permitted on aircraft

Several commenters proposed that transmissions in the expanded 57-71 GHz band be permitted aboard aircraft, to facilitate greater connectivity over WiFi for consumers.[24] Microsoft, for example, notes that "[i]nside the controlled environment of a transport aircraft, the risk of harmful interference . . . can be managed and minimized."[25] PK and OTI concur, noting that at the ranges and power levels that govern the band, harmful interference with satellite services or ground stations is extremely unlikely inasmuch as signals emitted from unlicensed devices aboard an aircraft would be unable to penetrate the aircraft's skin or windows to any meaningful extent, if at all. As NCTA puts it, "provided that radio astronomy operations can be protected from harmful interference, the Commission should remove the prohibition throughout the 57-71 GHz range."[26]

[22] Comments of Wi-Fi Alliance at 4.
[23] Comments of Qualcomm at 14.
[24] *See, e.g.*, Comments of Intel at 19; Comments of Microsoft at 11; Comments of IEEE at 5; Comments of NCTA at 7-8.
[25] Comments of Microsoft at 11.
[26] Comments of NCTA at 8.

III. A USE-OR-SHARE OBLIGATION ON LICENSEES IS NOT BURDENSOME AND WILL FACILITATE MORE EFFICIENT SPECTRUM RE-USE

The record reflects continuing disagreement about the impact of the "use-or-share obligation" that the Commission proposes in the *NPRM*.[27] OTI and PK strongly agree with NCTA that the Commission should "authorize unlicensed users to operate wherever and whenever licensees are not operating, including in areas where licensees have not yet begun to deploy," throughout the 28, 37, and 39 GHz bands."[28] Moreover, as NCTA and Federated Wireless explain, widespread opportunistic access can enhance efficient reuse of mmW spectrum without any risk to licensee operations by relying on a geolocation database governance mechanism that is either an extension of, or similar to, the Spectrum Access System the Commission will soon certify to manage more intensive sharing of the 3.5 GHz band.[29]

Predictably, mobile carriers and their suppliers repeat all the arguments against opportunistic access to unused spectrum capacity that they made during the 3.5 GHz proceeding – and which the Commission rejected – including concerns that reporting information to a SAS would be unduly burdensome, that it would create uncertainty about interference, that "unused spectrum" is impossible to define, and that the geolocation database concept for managing spectrum sharing is a "regulatory experiment" that should be restricted to the 3.5 GHz band for some indefinite period.[30]

The Commission should discard these arguments, as it did in the context of the 3.5 GHz proceeding. In fact, the case for opportunistic sharing is much stronger for mmW spectrum than it was for the 3.5 GHz band. As the *NPRM* points out, the "propagation and atmospheric

[27] *NPRM* at ¶¶ 215-216.
[28] Comments of NCTA at 11.
[29] Comments of NCTA at 11-13; Comments of Federated Wireless at 10. *See also* Comments of Facebook at 6-7; Comments of O3b at 28.
[30] *See, e.g.*, Comments of CTIA at 3, 26; Comments of Verizon at 20-25; Comments of AT&T at 20-21; Comments of Nokia at 20; Comments of Qualcomm at 14.

characteristics" of mmW spectrum "provide greater opportunity for frequency reuse without interference."[31] Federated Wireless correctly notes that "the propagation and spectral reuse characteristics of the bands above 24 GHz make them especially well-suited to more active spectrum management which can be administered by a SAS."[32] By certifying a geolocation database mechanism similar to the SAS, or to the TV Bands Database, there is absolutely no downside or risk for licensees, who would maintain all of their rights to *use* the public resource – and lose only their ability to warehouse it.

The utility and value of the spectrum for mmW band licensees would not be diminished in the slightest. CTIA and other opponents of the provision do not explain why there would be any "substantial uncertainty" about clearing a channel, since a core purpose of a SAS is to record actual use and enforce permissions that protect the rights of licensees. So long as a geolocation database is established, with rules requiring opportunistic users to vacate the channel (as in the 3.5 GHz band), or to reduce their power, once the licensee commences operation in that area, the licensees' operations are not impacted.

In short, licensees lose no rights whatsoever and bear a *de minimus* burden to simply inform the SAS (or other geolocation database administrator) prior to commencing service in a particular local area, so that all unlicensed devices can be immediately denied permission to operate on that frequency band. The obligation to notify the SAS of the commencement of operations does not involve collecting any data that operators do not have readily at hand for their own purposes (since certainly the carriers know the location and timing of their own buildout and customer service rollout some period in advance). Moreover, to the extent there is a cost, there is a far greater benefit to the public interest, and licensees can factor this into the bids

[31] *NPRM* at ¶ 215.
[32] Comments of Federated Wireless at 10.

they make when they purchase the spectrum. The transaction costs of the SAS itself can be passed along to opportunistic and GAA users.

Finally, OTI and PK strongly agree with NCTA and Federated Wireless that there is no reason to deny the public opportunistic access to unused mmW spectrum capacity for a period of 5 years. Federated Wireless correctly notes "a dynamic spectrum management system such as a SAS could be deployed at the outset, detecting where there is unused spectrum at any time and permitting opportunistic use, on a non-interfering basis, immediately upon launch of the service."[33] Further, waiting 5 years would needlessly undermine the Commission's stated goal of avoiding the warehousing of fallow spectrum capacity, particularly in exurban, small town and rural areas where licensees may not have a financial incentive to deploy for many years. There is no justification for denying WISPs, individual firms, schools, libraries and other parties opportunistic use of unused spectrum capacity. In addition, as NCTA correctly observes, a five-year delay would stifle unlicensed innovation and product development: "Under the Commission's approach, the unlicensed industry would have little incentive to develop equipment for the bands until at least five years after most of the band is licensed."[34]

IV. A 3-TIER FRAMEWORK FOR THE 37 GHZ BAND THAT ALLOCATES HALF THE BAND FOR GENERAL AUTHORIZED ACCESS WILL BEST SERVE THE PUBLIC INTEREST, INCLUDING FOR INDOOR ENTERPRISE SPECTRUM

The Commission's proposal to award *exclusive* indoor operating rights in the 37 GHz band to property holders on a license-by-rule basis under Section 307(e) garnered some support,[35] but a far greater degree of opposition, particularly from current and aspiring mobile

[33] Comments of Federated Wireless at 20.
[34] Comments of NCTA at 11.
[35] *See, e.g.*, Comments of Federated Wireless at 16-18; Comments of Huawei at 19; Comments of OTI and PK at __ (proposing that the separate authorization of indoor rights not be exclusive to property holders, but be unlicensed and/or licensed-by-rule as General Authorized Access).

Internet Service Providers and their suppliers.[36] Although mobile carriers will always oppose any hybrid or opportunistic access framework that awards them anything less than total control over every megahertz of spectrum in the mmW spectrum in the 28, 37 and 39 GHz bands, the Commission can address their legitimate concerns – and make 37 GHz a far more intensively-used innovation band – by modifying its proposal so that indoor use is licensed by rule on a *non-exclusive* General Authorized Access (GAA) basis. Since a network operator (whether or not they have a wide area "exclusive" license) will need to secure the permission of any business, home or public building to deploy access points indoors, authorizing indoor use on a GAA basis creates no new obstacle or burden for wide-area licensees. If carriers have the venue's permission to operate, they can register as the user. On the other hand, a GAA allocation ensures that tens of millions of enterprises, households and public buildings can decide how best to use this particular band of mmW spectrum inside their own building, thereby ensuring that it does not lie fallow in the tens of millions of structures where carriers will not be deploying.

More generally, OTI and PK strongly concur with the recommendation of Google and other commenters that "the Commission should extend to these bands its Part 96 framework for intensive, three-tiered sharing."[37] As Federated Wireless observed in its comments, there are spectrum incumbents and disparate uses in the mmW bands – including federal incumbents in the 37 GHz band – that will need protection as the bands are opened to new public uses.[38] Extending the three-tier 3.5 GHz sharing framework and the Spectrum Access System governance model to the mmW bands creates a flexible sharing framework that protects band incumbents, facilitates efficient spectrum re-use, and promotes lower barriers to entry and

[36] *See, e.g.*, Comments of CTIA at 15-17; Comments of NCTA at 14-16; Comments of Intel at 13-15; Comments of Verizon at 7-8; Comments of Qualcomm at 9-10.
[37] Comments of Google at 4. *See also* Comments of Federated Wireless at 8-14; Comments of NCTA at 12; Comments of O3b at 28.
[38] Comments of Federated Wireless at 9-10.

innovation. "[D]ynamic spectrum access systems will ensure that limited spectrum resources do not go underutilized at a time when bandwidth demands are growing exponentially."[39]

The Commission, in its *NPRM*, emphasized two fairly unique and critical characteristics of the 37 GHz band to justify a separate authorization of indoor use by rule. First, in this band signals are so "heavily attenuated by exterior walls and windows" that indoor use is unlikely to cause harmful interference to outdoor (wide area) users and vice-versa.[40] Therefore the propagation characteristics of mmW spectrum create an opportunity for nearly universal access to the band for an entirely separate and very diverse set of uses and users. Second, the *NPRM* correctly observed that deployments will require the permission of the property owner for siting, installation, backhaul and power *whether or not* property holders are assigned spectrum rights by rule.[41] In addition, the Commission stated it would be "highly efficient" if each individual enterprise or other venue could decide for itself whether it would prefer to use this mmW spectrum, in whole or in part, to support applications "not suited to unlicensed spectrum or public network services."[42]

Despite much hand waving, the mobile industry's comments in opposition to the Commission's three common sense justifications for a separate indoor allocation really do not rebut them at all. Concerning the propagation characteristics of the 37 GHz band, despite widespread concern about "uncertainty," it should be a simple enough matter for the Commission (and other parties) to test whether – at a low-but-still-useful power level – indoor transmissions are likely to cause harmful interference to unaffiliated outdoor deployments. If in

[39] *Id.* at 8.
[40] *NPRM* at ¶ 101.
[41] *Id.*
[42] *Id.* at ¶ 100. With respect to business enterprises, Cisco observed that after recent FCC decisions clarifying that hotels and other venues cannot ensure quality of service on unlicensed spectrum by blocking or degrading other unlicensed users, there is an unmet need for unmediated access to local area connectivity "where the use case requires active management of spectrum." Comments of Cisco at 7.

fact low-power transmissions on this band readily pass through windows or certain building materials, the Commission might reasonably decide, based on the physics and facts, that it cannot authorize two separate allocations on the same mmW spectrum. On the other hand, such a finding would be a reason to restrict indoor use on a GAA basis to the portion of the 37 GHz band that is available on a GAA basis for both indoor and outdoor use. (OTI and PK proposed in our comments that half the 37 GHz band be allocated for GAA).

Concerning the Commission's observation that licensees will need to solicit the permission of property holders whether or not they have license-by-rule access to the airwaves within their own buildings, several mobile carrier comments falsely suggest the contrary. Verizon, for example, suggests that it "may not be able to make a business case" because to provide both indoor and outdoor service it "would need to negotiate a patchwork of agreements with various building owners and tenants," and that simply identifying who to contact at these locations "would be costly and time consuming."[43] What Verizon, CTIA and other opponents of a separate indoor authorization do not acknowledge is that they will need to contact and reach agreement with each of these individual venues regardless. What they also do not acknowledge is that they are effectively asking the government to give them the leverage to foreclose even *non-interfering* uses of the band indoors by tens of millions of businesses, homes and community anchor institutions unless that location fits their business model and agrees to their terms. Otherwise the spectrum – most likely 95 percent or more nationwide – will remain fallow.

NCTA, by comparison, was honest enough to acknowledge that the mobile ISP's self-interest in avoiding a separate indoor authorization boils down to bargaining power and transaction costs over the rights to use the spectrum inside buildings owned by others. NCTA acknowledges that "network operators already must contract with property owners for electrical

[43] Comments of Verizon at 8.

power, siting permission, and other non-spectrum inputs necessary to provide service."[44] However, NCTA complains, "adding spectrum rights to the bundle of permissions that network operators must obtain from property owners would unnecessarily complicate network deployments and increase costs for network operators."[45]

NCTA raises a very valid point: If broadband ISPs and future IoT network operators must affirmatively seek some sort of "contractual" agreement to use 37 GHz spectrum because the license-by-rule allocation is *exclusive* to property owners, this could "impose an unnecessary set of transaction costs on both the proposed spectrum rights holder and 37 GHz network operators."[46] This could be particularly counterproductive in situations where the property holder (e.g., a homeowner or small business) is already a customer of the ISP (e.g., Comcast's XFINITY, or Verizon's FiOS), and the ISP (or IoT provider) simply wants to integrate this band into the service as an upgrade to premises equipment. It would appear that the ISP would have no legal right to deploy – even with the customer's tacit permission – unless the *property holder* (however that is determined) affirmatively registers for his or her "exclusive" indoor licensing rights and gives the network operator written consent.

This legitimate concern with the Commission's hybrid proposal could be remedied if the Commission instead authorized indoor use across the band on a *non-exclusive* unlicensed or GAA basis. Since *any* indoor access point will ultimately require the permission of the property holder, it is most efficient to authorize ISPs and other providers to operate on the same GAA or unlicensed basis, obviating the need for special negotiations or payments to property owners (e.g., apartment buildings or condo associations). Ultimately, whoever controls the venue can control the access points or other equipment operating inside its walls, and so enterprises can still

[44] Comments of NCTA at 15.
[45] *Id.*
[46] *Id.*

realize the benefits the Commission intends. This approach also resolves the often-cited concerns of opponents that it will be overly complicated and confusing to determine who exactly holds exclusive rights to indoor use in MDUs or other properties owned by a group of residents or investors.

The Commission's third rationale for its hybrid proposal – to support a wide variety of enterprise applications "not suited to unlicensed spectrum or public network services" – provides just one example of the huge and multifaceted opportunity losses to society if the Commission bends to the incumbent wireless industry's insistence that every megahertz of the 28, 37 and 39 GHz mmW bands should be auctioned for nothing but "exclusive" licenses.

First, and most obviously, the Commission would be requiring by law that the mmW spectrum capacity inside most buildings in most places will remain fallow, even if it can be used on a non-interfering basis, unless a licensee decides to deploy in that location and can reach an agreement with the building owner. Because 5G access points in this band must be very densely deployed, there is little doubt that carriers and other operators will focus on a relatively small number of high-traffic locations with sufficient return on investment. Moreover, as Federated Wireless observed, carrier "[e]fforts to deploy licensed solutions indoors [] have not met with success." Federated opines that "the net result of the conflict between spectrum and real estate rights" is that only 2 percent of indoor locations nationwide have internal access to licensed broadband today." In contrast, the only proven model to achieve high rates of spectrum reuse – and both fast and affordable wireless connectivity indoors – is open and opportunistic access *by end users* to open access (unlicensed) small cell spectrum.

Another opportunity loss stems from the mismatch between what a very limited number of 37 GHz licensees will choose to deploy (based on a common denominator business model)

and the specialized needs and priorities of a diverse range of users and uses, from industrial automation to health systems management to university campuses. As Google commented, "extending the wide-area exclusive licensing approach employed in the lower frequencies would establish a high barrier to entry and fail to 'facilitate sharing among a wide variety of users and platforms.'"[47] Direct access to a substantial amount of mmW capacity would likely spur a flowering of third-party providers to design local area networks customized to meet the particular needs of each different industry vertical, as well as households and community anchor institutions. Indeed, simply having the option to deploy a very high-capacity network indoors without the need to rely on a small number of licensed spectrum intermediaries is likely to spur more competition and innovation that extends far beyond the operators that initially gobble up the newly available wide area licenses.

The availability of a substantial amount of GAA capacity will also allow enterprises and other end users to make different and more efficient arrangements for broadband capacity than what the three or four licensees in the band may be willing to offer. For example, at the recently concluded Mobile World Congress, Qualcomm and Ruckus demonstrated "Neutral Host Network" (NHN) access points that are aimed at hotels and other venues that want to self-provision – and control – a means of providing robust indoor phone and broadband coverage for any participating carrier. The companies announced they are adding access to the 3.5 GHz band to NHN gear by the end of this year, so that these venues can give their customers, visitors, and others at least 80 megahertz of GAA capacity at most times and places, augmenting their Wi-Fi network with potentially more reliable connectivity.

As our groups stated in our Comments, there is no reason to believe that allocating the entire 37 GHz band for exclusive, wide area licenses will result in more intensive, diverse or

[47] Comments of Google at 3.

innovative uses than would the truly hybrid licensing model adopted last year in the 3.5 GHz proceeding. OTI and PK recommend that the Commission divide the band's 1,600 megahertz into contiguous blocks of 800 megahertz for shared GAA and 800 megahertz for Priority Access Licenses. The far more limited propagation characteristics of 37 GHz spectrum makes it likely that property owners and other end users (both public and private) will take advantage of a GAA allocation not only for indoor use, but to extend their LANs across outdoor spaces – a beneficial outcome that would be completely foreclosed if all outdoor mmW spectrum capacity in the band (as well as in the 28 and 39 GHz bands) is exclusively licensed on a wide area basis.

V. CONCLUSION

Open, shared and opportunistic access to small cell spectrum is a proven success in the Part 15 bands where Wi-Fi offload and other wireless innovation is booming. The Commission should extend the balanced approach exemplified in the agency's proposed 3.5 GHz band Citizens' Broadband Radio Service to the mmW bands to the greatest extent possible. The 37 GHz band, which is currently not licensed to non-federal users for terrestrial use, is a prime candidate to create another flexible and intensively used "innovation band" that also promotes the widest possible range of uses and users. The Commission should also leverage the ability to separate indoor ("local area") and outdoor ("wide area") operating rights to make all, or at least most, indoor use of mmW spectrum available to the public on an unlicensed or General Authorized Access basis. In addition, the 57-64 GHz unlicensed band should be extended to include 64-72.5 GHz under harmonized Part 15 rules. This balanced approach, avoiding the waste and warehousing inherent in relying primarily on exclusive geographic area licensing in mmW spectrum, best serves the public interest by promoting a wide variety of uses and users,

intensive and efficient spectrum re-use, innovation, market entry and the prospect of greater competition.

Respectfully Submitted,

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