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
	)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	)	RM-11664
	)	
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 Rules and Policies for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in 37.0-38.0 and 40.0-40.5 GHz for Government Operations	)	IB Docket No. 97-95

COMMENTS OF
OPEN TECHNOLOGY INSTITUTE AT NEW AMERICA
AND PUBLIC KNOWLEDGE

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COMMENTS OF
OPEN TECHNOLOGY INSTITUTE AT NEW AMERICA
AND PUBLIC KNOWLEDGE

New America's Open Technology Institute and Public Knowledge ("OTI & PK") submit these Comments in response to the Commission's *Further Notice of Proposed Rulemaking*

("FNPRM") concerning the use and appropriate allocation of spectrum in the bands above 24 GHz.[1]

I. INTRODUCTION AND SUMMARY

As consumer advocates, our groups believe that the public interest goals of promoting innovation, market entry, competition, intensive spectrum re-use, and diverse uses and users are best served by ensuring that there is a more balanced mix of licensed, unlicensed and dynamic shared access to what will otherwise be grossly-underutilized mmW spectrum. Relying too heavily on a traditional licensing scheme, based on exclusive access to large geographic areas for inherently small cell deployments, is guaranteed to leave the spectrum unused for many years, and perhaps permanently, in low-density environments outside of central urban areas, shopping districts and well-trafficked venues. 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 both operators and end users* to open access (unlicensed) small cell spectrum. Accordingly, OTI & PK make the following recommendations:

First, OTI & PK generally support the framework proposed in the FNPRM, with access to the 37 – 37.6 GHz band authorized by rule and available to both Federal and non-Federal users on a coordinated, co-equal basis and subject to very short time-to-live authorizations (e.g., 7 days). Shared Access Licenses (SALs) should be as similar as feasible to General Authorized Access within the Part 96 framework adopted for the new Citizens Broadband Radio Service (CBRS). To the extent Shared Access licensees receive a degree of interference protection for "a particular bandwidth of spectrum at a particular location," the capabilities of a dynamic

[1] *In the Matter of Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, GN Docket 14-177 (adopted July 14, 2016) ("R&O" and "FNPRM").

Spectrum Access System (SAS) should be leveraged to maximize the availability of the band for all potential users, including channel sizes that vary based on need. We urge the Commission to adopt a standardized engineering metric to calculate the protection contour for a SAL, just as the Commission did to facilitate GAA to unused Priority Access spectrum in the 3.5 GHz band. OTI & PK also strongly support the Commission's proposal that registered non-Federal sites must be put into service within seven days and reassert their registration every seven days.

Second, the Commission should apply its three-tier framework under Part 96 to the 24 GHz bands under consideration. The public interest is best served by a two- or three-tier framework under Part 96 that divides the band between GAA and PALs with short time-to-live durations coordinated dynamically by a SAS or similar geolocation database.

Third, OTI & PK strongly support extending opportunistic access on a use-or-share basis across the entire 37 – 39 GHz band and, if and when feasible, to the 28 GHz and other bands allocated for exclusive licensing. There is no reason to believe that a SAS certified to manage shared access in the lower band segment below 37.6 GHz would not be equally capable of managing opportunistic access to unused spectrum above 37.6 GHz. The case for opportunistic access to unused spectrum is much stronger for mmW spectrum than it was for the 3.5 GHz band. Licensees maintain all of their rights to *use* the public resource – and lose only their ability to warehouse it.

Finally, with respect to the 71-76 GHz and 81-86 GHz bands, although OTI & PK strongly supported the three-tier sharing framework the Commission adopted for the new CBRS at 3.5 GHz, the Commission should refrain at this time from introducing a three-tier framework that includes making Priority Access Licenses available on an exclusive geographic area basis. The Commission instead authorize an unlicensed underlay, under Part 15, with secondary access for outdoor use subject to coordination by a geolocation database.

II. THE COMMISSION SHOULD EMPLOY DYNAMIC SPECTRUM ALLOCATION UNDER PART 96 FOR THE 37 – 37.6 AND 24 GHz BANDS

As consumer advocates, OTI & PK believe that extending the Commission's innovative Part 96 sharing framework and Spectrum Access System governance model to the mmW bands creates a flexible sharing framework that will best advance the public interest goals of promoting innovation, market entry, competition, intensive spectrum reuse, and diverse uses and users. In bands where unlicensed access under Part 15 is not feasible, dynamic spectrum sharing can protect band incumbents and priority access licensees, if any, while ensuring that the overall spectrum capacity of the band is used more efficiently than would any static or exclusive geographic-area licensing scheme.

As OTI & PK, and other parties, observed in response to the *Notice of Inquiry* in this proceeding, high-frequency bands are especially suitable for unlicensed use and dynamic sharing – and not necessarily for traditional exclusive licensing on a geographic basis.[2] Unlike lower-frequency spectrum, the extremely attenuated propagation characteristics of millimeter wave (mmW) bands benefit wireless carriers and consumers alike not by increasing *coverage* for truly "mobile" use (on the go), but rather by enhancing the *density and capacity* of networks (self-provisioned as well as carrier-provisioned) that support the "nomadic" use of mobile devices, mostly indoors (in homes, offices, public places) and always very close to fixed, typically wireline, backhaul. As the Consumer Technology Association observed in its *NOI* comments, mmW frequencies can at best "serve a supplemental role for [mobile] service providers in urban

[2] *See, e.g.,* Reply Comments of Open Technology Institute and Public Knowledge, Notice of Inquiry, GN Docket No. 14-177 at 3-5 (Feb. 18, 2015); Comments of Google, Notice of Inquiry, GN Docket No. 14-177 at 7-9 (Jan. 15, 2015) ("Comments of Google"); Comments of National Cable & Telecommunications Assn., Notice of Inquiry, GN Docket No. 14-177 at 6, 9 (Jan. 15, 2015) ("Comments of NCTA"); Comments of Consumer Electronics Assn., Notice of Inquiry, GN Docket No. 14-177 at 13 (Jan. 15, 2015) ("Comments of CEA"); Comments of Wi-Fi Alliance, Notice of Inquiry, GN Docket No. 14-177 at 4 (Jan. 15, 2015) ("Comments of Wi-Fi Alliance").

areas" if deployments are sufficiently dense.[3] With the exception of certain point-to-point backhaul uses, the use of mmW spectrum for so-called "mobile" broadband data services is an inherently dense, small cell undertaking likely to be deployed only in high traffic and geographically limited areas where the extra capacity justifies the substantial added investment.

Exclusive licensing on a very large geographic area basis (e.g., PEAs, counties, or even census tracts) is therefore the access framework *least* conducive to serving the public interest in widespread and intensive spectrum re-use, lower market barriers to entry, promoting mobile market competition, and stimulating innovation. Relying too heavily on a traditional licensing scheme would not allow the largest possible number of businesses and individuals the ability to self-provision capacity for mobile data offload, the emerging Internet of Things, and other connectivity needs. That approach is also guaranteed to leave the spectrum unused for many years, and perhaps permanently, in low-density environments outside of central urban areas, shopping districts and well-trafficked venues. 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.

The opportunity loss and spectrum inefficiency inherent in geographic area licensing of these bands is particularly true for *indoor use*, where the connectivity needs of a wide variety of enterprise applications may not be well suited to commercial mobile network offerings, a reality the Commission acknowledged in the *NPRM*.[4] As OTI & PK explained at length in our *Reply Comments*, legitimate concern with the Commission's hybrid proposal could be remedied if the

[3] Comments of CEA at 13, citing FCC Technology Advisory Council, Summary of Meeting at 60-61, Spectrum Frontier Working Group Presentation at Slide 5-6 (Dec. 9, 2013), *available at* https://www.fcc.gov/encyclopedia/technological-advisory-council. *See also* Comments of NCTA at 6.

[4] 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." *NPRM* at ¶ 100.

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 access the spectrum on a 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 realize the benefits the Commission intended.

Most critically, Shared Access Licenses (SALs) should be as similar as feasible to GAA under Part 96 and assigned to permit open and intensive shared use. If SALs are defined on the basis of exclusive use over geographic areas, 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. What opponents of a separate GAA or unlicensed indoor authorization do not acknowledge is that they will need to contact and reach agreement with each individual venue or property holder regardless of the licensing scheme, as the NPRM acknowledged.[5] What carriers 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

[5] 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. *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Notice of Proposed Rulemaking, at ¶ 101 (rel. October 23, 2015) ("*NPRM*").

fits their business model and agrees to their terms. Otherwise the spectrum – most likely 95 percent or more nationwide – will remain fallow.

Another opportunity loss of exclusive licenses based on geographic areas 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.'"[6] 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. 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.

A. THE COMMISSION SHOULD AUTHORIZE SHARED ACCESS LICENSES IN 37 – 37.6 GHz THAT ARE SIMILAR TO GENERAL AUTHORIZED ACCESS UNDER CBRS, WITH ASSIGNMENTS COORDINATED BY A SPECTRUM ACCESS SYSTEM (SAS)

OTI & PK generally support the framework proposed in the FNPRM, with access to the 37 – 37.6 GHz band authorized by rule and available to both Federal and non-Federal users on a coordinated, co-equal basis and subject to very short time-to-live authorizations (e.g., 7 days). Our groups agree with the Commission that "[a]llowing part of the band to be made available on

[6] Comments of Google at 3.

a non-exclusive, shared basis will promote access to spectrum by a wide variety of entities, support innovative uses of the band, and help ensure that spectrum is widely utilized."[7] To realize this goal, the Commission should define Shared Access Licenses (SALs) to be as similar as feasible to General Authorized Access within the Part 96 framework adopted for the new Citizens Broadband Radio Service (CBRS).

OTI & PK remain unconvinced that interference protection is necessary for SAL authorizations to use 37 – 37.6 GHz in what is inherently an extremely small cell band. Most deployments and use are likely to be indoors, where walls provide shielding and the property holder will necessarily need to authorize access points. This modest amount of spectrum (600 megahertz) could be GAA indoors and outdoors, on a best efforts basis, allowing an access option to the public that is truly open, uncomplicated and low cost**.** Wide area 5G network deployments, premised on exclusive control and quality of service, would still have enormous amounts of spectrum capacity licensed over relatively large geographic areas (3,250 megahertz in the 28 and 37.6 – 39 GHz bands alone), as the Commission determined in the *R&O*. In our Comments and Reply Comments, OTI & PK recommended that the Commission divide the 37 GHz band 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 licensed on a geographic area basis.

[7] *R&O* at ¶ 112.

OTI & PK recommend that to the extent Shared Access licensees receive a degree of interference protection for "a particular bandwidth of spectrum at a particular location,"[8] the capabilities of a dynamic Spectrum Access System (SAS) should be leveraged to maximize the availability of the band for all potential users. An automated SAS, certified by the Commission and operated by one or more third parties, would have the capability to coordinate the greatest degree of spectrum sharing by a wide variety of users with varying needs for interference protection. Due to the propagation characteristics of the band, the coverage area of a registered device will be very small. Manual coordination through a portal will not scale to handle the sheer quantity of authorizations. Nor could it handle the potential for multiple and overlapping SALs in an area, combinations that could change frequently given the short-term nature of the SAL authorizations. A SAS is also the most reliable mechanism to protect incumbent Federal sites, while also enforcing any prioritization for Federal operations that the Commission adopts now or in the future.

Regardless of the precise nature of the geolocation database used to manage assignments on the 37 – 37.6 GHz band, we urge the Commission to adopt a standardized engineering metric to calculate the protection contour for a SAL, just as the Commission did to facilitate GAA to unused Priority Access spectrum in the CBRS *Second Report and Order*.[9] It would be most objective and efficient for the SAS to calculate the protection contour based on the location, power, height and other information the device would report upon registration. To the extent SAL licensees are permitted to report their coverage area, the protection contour should be subject to an objective maximum enforced by the SAS.[10]

[8] *FNPRM* at ¶ 449.
[9] *Order on Reconsideration and Second Report and Order*, GN Docket No. 12-354 (rel. May 2, 2016).
[10] *Id.* at ¶ 174.

OTI & PK strongly support the Commission's proposal "that registered non-Federal sites must be put into service within seven days of coordination and that registered and coordinated sites must reassert their registration every seven days."[11] While it is not clear that enforcing mutual exclusivity to a particular bandwidth at a particular location is truly necessary given the propagation characteristics and the ability of a SAS to dynamically coordinate potentially conflicting requests for bandwidth, a seven day authorization would at least minimize the number of other potential users and uses excluded from spectrum that is not actually put to use. It is also critical that SAL renewability is contingent on demonstrating actual use of the spectrum. We agree with the Commission's proposal in the *FNPRM* that to renew a SAL, the operator "must reassert their registration every seven days"[12] in a manner that verifies actual use. Seven days is a reasonable balance between the needs of operators and the public interest in ensuring capacity on this band does not lie fallow if there is demand by others who are ready to put it to immediate use.

OTI & PK do not support static channel sizes in what should be a flexible and dynamically shared band. We recommend that the Commission "refrain from setting a minimum channel size and instead require the coordination mechanism to attempt to maximize the number of users in a given area."[13] A full SAS implementation is capable of granting SAL assignments based on the actual bandwidth the user requires, which increases the availability of bandwidth for other users. Accordingly, device registrations and/or operator requests for a SAL should specify the bandwidth needed both initially and each time the user reasserts their registration at the end of the short time-to-live period.

[11] *FNPRM* at ¶ 456.
[12] *Ibid.*
[13] *FNPRM* at ¶ 455.

The Commission should ensure that SAS coordination accommodates as many users as possible. If the band is fully occupied in a particular location, then a first-in approach would be most fair and predictable. At the same time, OTI & PK believe that first-in rights should not operate to limit access in a particular location to a single user where there are competing requests. The FNPRM proposes that a single user could occupy "up to the maximum of 600 megahertz where available."[14] In the absence of contention, OTI & PK agree this will optimize the use of the band, particularly because the most prevalent use case is likely to be indoors where only a single operator is likely to be active. However, if a contending authorization request would be denied because a single operator has SALs that in the aggregate exceed 400 megahertz, then the SAS should reduce the first-in-time authorization to a maximum of 400 megahertz, if necessary, to accommodate a conflicting request.

OTI & PK also recommend that the Commission consider the feasibility of separately authorizing indoor-only use of the 37 to 37.6 GHz band on a General Authorized Access (GAA) basis. The Commission declined to adopt the NPRM's proposal to authorize unlicensed indoor-only operations across the entire 37 GHz band because "signal leakage through windows" could adversely impact the operations of UMFUS licensees, many of which require exclusive rights to ensure quality of service. However, if a GAA assignment for indoor-only use is limited to the lower 37 – 37.6 GHz band segment, the trade-off is very different. Although the Commission has proposed a measure of interference protection to SALs – relying on protection contours managed by a SAS or other frequency coordinator – this may not be necessary with respect to indoor devices separated by at least one wall from neighboring deployments. At the same time, the guaranteed availability of General Authorized Access inside every building for indoor-only use

[14] *Id*. at ¶ 454.

would ensure that every venue (including every Federal building) has access to and control over 600 megahertz of mmW bandwidth that can enable a diverse variety of needs and new innovations.

If needed, the Commission can adopt additional protections to minimize the risk that "signal leakage" from indoor-only use of the 37 – 37.6 GHz band will disrupt neighboring deployments. First, the Commission can adjust the technical rules for GAA operations to preclude the power levels and/or directional antennas that make signal leakage significant enough to create risks of disruption to neighboring SAL operations. Second, as the FNPRM observes, the Commission can "require that these devices be AC-powered in order to ensure that they only operate indoors."[15] Third, if GAA users are required – like SAL users – to register and recheck the SAS for continued permission to operate, if a SAL operator experiences harmful interference, it can be more readily identified and resolved, including by denying permission for any continued GAA operation within the protection contour associated with the impacted SAL.

Finally, OTI & PK recommend that no portion of the 37 – 37.6 GHz band should be reserved in advance for "priority access" by Federal users or any other users. If the Commission determines, now or in the future, that there are compelling Federal uses that require priority access to this particular spectrum, the SAS can make that "priority" assignment in the local areas where it is needed and only for as long as needed. One of the advantages of a full SAS implementation in the 37-39 GHz band is that bandwidth can be dynamically assigned and reassigned as needed. Further, as recommended above, this dynamic assignment can best meet the needs of the greatest number of users, including Federal users, if authorizations are based on the bandwidth needed for the deployment rather than on static 100 megahertz channel sizes.

[15] *FNPRM* at ¶ 440.

B. THE PART 96 CBRS FRAMEWORK, LEVERAGING A SAS, IS WELL SUITED FOR OPEN AND EFFICIENT SHARING OF THE 24 GHz BAND

OTI & PK recommend that the Commission apply its three-tier framework under Part 96 to the 24 GHz bands under consideration. The 24 GHz band currently is allocated for FSS uplinks (Earth-to-space, limited to Broadcast Satellite Service feeder links) and digital Fixed Service.[16] Only five of the band's 890 licenses are active, occupying a very limited portion of the bands under consideration for services that could coexist well with PALs and GAA users subject to coordination by an automated SAS. Like the 3.5 GHz band, fixed satellite links can be protected by a geolocation database in the same manner the Commission adopted to protect fixed satellite earth station receive sites adjacent to the 3.5 GHz CBRS under Part 96. Registered fixed links can be protected similarly. The SAS certified to manage this coordination could be an extension of either one or more of the SASs certified for CBRS (which is being designed to protect FSS sites), or as an integral part of the millimeter band SAS certified to coordinate dynamic sharing in the more similar 37 – 37.6 GHz band, as recommended in the section above.

As Commissioner Rosenworcel has repeatedly pointed out, a balanced and healthy spectrum ecosystem should have a mix of exclusively licensed and unlicensed, or at least open access spectrum, with a variety of propagation characteristics, in low-band, mid-band *and* high-band frequencies. For example, the unlicensed bands at 2.4 and 5 GHz have proven to be a productive complement to licensed carrier bands below 5 GHz. Although the Commission has made an additional seven gigahertz of unlicensed spectrum available at very high frequencies with very limited propagation (64 – 71 GHz), no millimeter wave spectrum is proposed for unlicensed or General Authorized Access below 60 GHz. More critically, no open access spectrum is proposed in the bands below 30 GHz, which is generally considered the breakpoint for radio signal penetration through an outer wall, foliage and/or precipitation.[17] At a time when small cell, open access and mostly self-provisioned Wi-Fi networks operating on unlicensed

[16] *FNPRM* at ¶¶ 379-380.
[17] *See Technical feasibility of IMT in bands above 6 GHz,* Report ITU-R M.2376-0 (July 2015).

spectrum is carrying roughly 80 percent of all mobile device data traffic in the U.S. and Western Europe, OTI & PK believe the public interest is best served by a two- or three-tier framework under Part 96 that divides the band between GAA and PALs with short time-to-live durations coordinated dynamically by a SAS or similar geolocation database.

III. THE COMMISSION SHOULD AUTHORIZE OPPORTUNISTIC ACCESS, ON A USE-OR-SHARE BASIS, TO UNUSED SPECTRUM ACROSS THE 28 AND 37 – 39 GHz BANDS, OR ANY OTHER BANDS ASSIGNED USING EXCLUSIVE GEOGRAPHIC AREA LICENSES

OTI & PK strongly agree with the Commission's proposal "to permit shared access of the unused portions of the five channels in the upper band segment" of the 37 GHz band (37.6-38.6 GHz).[18] As the Commission has recognized in other recent proceedings, a robust "use-or-share" obligation on licensees would accomplish a number of objectives, including more intensive use of fallow spectrum capacity, lowering barriers of entry to a diverse uses and users, and providing added incentives for licensees to construct and operate facilities. OTI & PK urge the Commission to conclude, as it did last year in its *3.5 GHz Report & Order*, that permitting opportunistic access to unused channels "would maximize the flexibility and utility of the [ ] band for the widest range of potential users" and "ensure that the band will be in consistent and productive use."[19]

The case for opportunistic access to unused spectrum is much stronger for mmW spectrum than it was for the 3.5 GHz band. As the *NPRM* pointed out, the propagation and atmospheric characteristics of mmW spectrum "provide greater opportunity for frequency reuse without interference."[20] As the FNPRM acknowledges, there is likely to be "significant unused spectrum in the upper band segment at any given time" due to the "flexible build out requirements" adopted in the *Report*

[18] *FNPRM* at ¶ 460.
[19] *3.5 GHz Report & Order* at ¶ 72.
[20] *NPRM* at ¶ 215.

& Order and because of the economics of deploying very dense small cell networks outside of heavily-trafficked urban areas and venues.

Licensees would maintain all of their rights to *use* the public resource – and lose only their ability to warehouse it. OTI & PK agree that UMFUS licensees above 37.6 GHz should "retain the primary right to construct and provide service anywhere within its license area at any time" and that any opportunistic use is inherently temporary and "subject to displacement by the primary licensee" once that licensee is ready to commence operations.[21] If temporary permission to use vacant bandwidth is managed by the SAS or similar geolocation database mechanism that will be needed to manage efficient shared access to 37 – 37.6 GHz, there is absolutely no downside or risk for 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. A SAS can effectively review requests for access to bandwidth and deny, grant or renew requests based on up-to-date information about active operations provided by licensees, as the Commission proposes.[22] OTI & PK recommend that these authorizations for opportunistic access be subject to the same technical rules and short time-to-live duration as a Shared Access License for the 37 – 37.6 GHz band segment (that is, no longer than seven days).

Because the public interest benefits and the Commission's stated rationale applies equally to the adjacent 39 GHz band, OTI & PK strongly support extending opportunistic access on a use-or-share basis across the entire 37 – 39 GHz band and, if and when feasible, to the 28 GHz and other bands allocated for exclusive licensing. There is no reason to believe that a SAS

[21] *FNPRM* at ¶ 462.
[22] *FNPRM* at ¶ 462.

certified to manage shared access in the lower band segment below 37.6 GHz would not be equally capable of managing opportunistic access to unused spectrum above 37.6 GHz. The logic and feasibility of a uniform use-or-share obligation across at least the entire 37 – 39 GHz Band is reinforced by the technical and service rules adopted in the *Report & Order*, which "provide 2400 megahertz of contiguous spectrum under the same licensing and technical rules,"[23] including a requirement that devices must be capable of operating across the entire 37-40 GHz band.

In addition, OTI & PK recommend that the Commission leverage the capabilities of a SAS to make as much unused spectrum as possible available to potential users. As we recommended above with respect to the assignment of SALs, we urge the Commission to adopt a standardized engineering metric to calculate the protection contour for deployments by UMFUS licensees. The process for a SAS grant of opportunistic access should be the same as the Commission has adopted to facilitate General Authorized Access to unused PAL spectrum in its *Order on Reconsideration and Second Report and Order* for the CBRS at 3.5 GHz.[24] The most objective and efficient option is for the SAS to calculate the protection contour based on the location, power, height and other information the device would report upon registration. To the extent that UMFUS licensees are permitted to report their coverage area, it should be subject to an objective maximum enforced by the SAS.[25]

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

[23] *Id*. at ¶ 460.
[24] *Order on Reconsideration and Second Report and Order*, *supra* note 9.
[25] *Id.* at ¶ 174.

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 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 believe there is no reason to deny the public opportunistic access to unused mmW spectrum capacity for a period of five years or for any arbitrary period of time. The only relevant consideration should be whether a qualified SAS is certified, tested and ready to accurately ensure that a use-or-share authorization will be revoked and the spectrum is fully available for the licensee on the date it plans to commence commercial operations. Opportunistic access to a band should be authorized even prior to an auction for licenses if a SAS is certified and the temporary users will not cause harmful interference to incumbent band licensees. A five-year delay 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.

IV. THE COMMISSION SHOULD AUTHORIZE UNLICENSED ACCESS ON AN OPPORTUNISTIC BASIS TO THE 70/80 GHz BANDS, USING A GEOLOCATION DATABASE TO PROTECT LICENSEES, AND MAINTAIN THE CURRENT REGISTRATION-BASED LIGHT-LICENSING APPROACH

The 71-76 GHz, 81-86 GHz and 92-95 GHz bands are currently allocated on a non-exclusive nationwide basis to non-Federal and Federal users on a co-primary basis. Since 2003

the bands have been available on a shared basis using a "light licensing" registration system and third-party database manager that simultaneously facilitates open access, protects fixed point-to-point links from interference, and coordinates with NTIA to ensure no interference with Federal users. OTI & PK believe that this non-exclusive, light-licensing framework for fixed wireless links is very appropriate to the propagation characteristics of the band. At the same time, the band could also support an underlay of "mobile" (really nomadic) use, particularly for indoor use, without disrupting the current and very valuable use of the band for fixed links and backhaul.

Although OTI & PK strongly supported the three-tier sharing framework the Commission adopted for the new CBRS at 3.5 GHz, we do not believe it is the best approach in these bands. The Commission should refrain at this time from introducing a three-tier regulatory framework that includes making Priority Access Licenses available on an exclusive geographic area basis. OTI & PK recommend that the Commission instead authorize an unlicensed underlay under Part 15, with secondary access for outdoor use subject to coordination by a geolocation database.

At a minimum, we urge the Commission to authorize unlicensed, indoor-only operations across the entirety of both the 71-76 GHz, 81-86 GHz bands, subject to the AC power and other technical rules that already apply to indoor-only operation under Part 15 in the 92 – 95 GHz band.[26] In addition, unlicensed outdoor use should be authorized on an opportunistic basis subject to checking and receiving permission from a Spectrum Access System, as the Commission proposes for a three-tier framework.[27] Authorizing unlicensed secondary access outdoors and indoors would be particularly beneficial in the 71-76 GHz band that is contiguous

[26] *FNPRM* at ¶ 440.
[27] *Id.*

to the existing unlicensed band at 57 – 71 GHz already in use for wide-channel WiGig connectivity.

In our Comments and Reply Comments, OTI, PK and other parties proposed extending the 64-71 GHz unlicensed band to 72.5 GHz to enable an additional IEEE 802.11ad channel for WiGig and other consumer connectivity. The Commission decided that permitting unlicensed operations as a general underlay in the band is not warranted at this time "due to the presence of the numerous existing fixed links in the 71-76/81-86 GHz bands."[28] Nevertheless, the Commission noted that WiGig devices operate over unlicensed spectrum in the 60 GHz band and are designed to deliver multi-gigabit speeds, low latency, and security-protected connectivity between nearby devices.[29] These products are already being marketed and "are standardized pursuant to an internationally harmonized channelization scheme, which should promote their growth and usage."[30] Since most high-capacity broadband use is indoors, the availability of greater capacity on an open and unlicensed basis inside every building would serve the public interest.

Whether or not the Commission ultimately decides to authorize Priority Access Licenses on all or a portion of the 70/80 GHz bands, OTI & PK agree that "authorizing unlicensed, indoor-only operations" under Part 15 would be feasible and not interfere with licensed outdoor operations. As the Commission acknowledged in the FNPRM, "the comparative amount of signal leakage through windows could be much lower in the 71-76 GHz and 81-86 GHz bands, and consequently less likely to interfere with outdoor operations."[31] The means to limit an unlicensed underlay to indoor use in these mmW frequencies is already established in Part 15 for

[28] *Report & Order* at ¶ 131.
[29] *Report & Order* at ¶ 130.
[30] *Id.*
[31] *Report & Order* at ¶ 131.

the 92-95 GHz band, "requir[ing] that these devices be AC-powered in order to ensure that they only operate indoors."[32] Similarly, in the 70/80 GHz bands, unlicensed devices certified for indoor-only use would have no impact on outdoor operations and could be available for consumers off-the-shelf without the complication or burden of database registration. Indeed, an AC power requirement to ensure indoor-only use would be more protective of outdoor operations than the conditions on level probing radars (LPRs) that the Commission authorized under Part 15 in 2014 to share access to the 75-85 GHz band.[33]

[32] *Id.*; *see also* 47 CFR § 15.257.
[33] *Report & Order* at ¶ 131.

V. CONCLUSION

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 – 37.6 GHz and 24 GHz bands are prime candidate to create another flexible and intensively used "innovation band" that also promotes the widest possible range of uses and users. Each should be opened for dynamic spectrum sharing using Part 96 and coordination by a SAS. 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 public interest benefits of an unlicensed underlay should be extended to the 71 – 76 GHz and 81-86 GHz bands, with outdoor opportunistic access coordinated by a geolocation database to protect fixed incumbent licensees from harmful interference. Finally, opportunistic access to unused millimeter wave spectrum, based on a use-or-share obligation, should apply to all bands allocated for geographic area licensing in this proceeding, particularly the 37 – 39 GHz bands.

Respectfully Submitted,

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