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

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

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

New America's Open Technology Institute and Public Knowledge ("OTI & PK") submit these Reply 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. SUMMARY

As consumer advocates, OTI and PK believe that the public interest goals of promoting competition, market entry, intensive spectrum re-use, and spectrum access for diverse users and uses 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 and inside hundreds of thousands of venues where users should be able to choose to use mmW spectrum in a way that best suits their particular needs. 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, our groups were heartened to see strong support in the record for three important policy innovations:

First, there is widespread support for the Commission's proposal to authorize opportunistic access on a use-it-or-share-it basis across the entire 37-39 GHz band and, if and when feasible, to the 28 GHz and other millimeter wave bands allocated for exclusive licensing. Comments from the Dynamic Spectrum Alliance, a global coalition of high-tech companies, as well as comments filed by a diverse range of individual companies and associations, agree that a 'use-or-share' approach would accomplish a number of public interest objectives, including more

[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").

intensive use of fallow spectrum capacity, lowering barriers of entry to a diverse range of uses and users, and providing added incentives for licensees to construct and operate facilities. These commenters join OTI and PK in urging the Commission to leverage the capabilities of a Spectrum Access System (SAS) to make as much unused spectrum available as possible .

Predictably, comments from mobile carriers and their suppliers repeat all the same arguments against opportunistic access to unused spectrum capacity that they made during the 3.5 GHz proceeding – arguments the Commission rejected. Opponents ignore two crucial facts: If the Commission certifies a SAS or similar geolocation database mechanism, there is absolutely no downside or risk for licensees. Licensees maintain all of their rights to *use* the public resource and lose only their ability to warehouse it. In addition, far from being "experimental," the SAS and the use-or-share rule adopted for CBRS in the 3.5 GHz band will be operational and proven long before (probably years before) the 37 – 39 GHz band is auctioned and its licensees actually commence service, whether "5G" or otherwise. The Commission can make implementation of opportunistic access contingent on final certification of a SAS or other geolocation database needed to protect licensed operations, just as it did in the CBRS context.

Second, commenters representing many of the largest Internet and high-tech firms support extending the Commission's innovative Part 96 framework and SAS coordination mechanism to enable open and shared access to the 37 – 37.6 GHz band that the *Report & Order* has allocated for Shared Access licensing. OTI and PK agree that licensing by rule in a manner that is as similar as possible to General Authorized Access under the Part 96 rules will create a flexible sharing framework that will best advance the public interest goals of promoting innovation, market entry, competition, intensive spectrum reuse, and accommodate diverse uses and users.

Thanks to the Commission's operability requirement, the different access regimes for the lower and upper segments of the 37 GHz band become complementary, each enhancing the value of the other, exactly as the diversity of access offered by PAL and GAA spectrum at 3.5 GHz will do. Upper segment licensees can expand their operations at low cost by adding capacity using 37 – 37.6 GHz spectrum, even if it's on an as-needed or best-efforts basis. Because coverage areas will be very small, it's highly likely that a licensee with exclusive access to a channel or two above 37.6 GHz will discover that it can greatly enhance that capacity with opportunistic access to 37 – 37.6 GHz spectrum. For small operators, innovators and individual venues, the availability of 600 megahertz of open and shared GAA-like spectrum in the lower 37 GHz segment not only enables at least a modest deployment without a wide-area exclusive license, but it also encourages the opportunistic use of unused spectrum *above* 37.6 GHz.

Finally, the record demonstrates considerable agreement that the light-licensing framework for fixed wireless links in the 70/80 GHz bands is appropriate given the propagation characteristics and that the Commission should refrain from introducing a three-tier regulatory framework that includes exclusive licenses on an exclusive geographic-area basis. OTI, PK and other commenters believe that the public interest is best served by an underlay of "mobile" (really nomadic) use on an unlicensed basis, at a minimum for indoor-only use. Unlicensed, low-power use can be added without disrupting the current and very valuable use of the band for fixed links and backhaul. 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. OTI, PK and other commenters recommend that the Commission also authorize secondary access for low-power, outdoor use under Part 15 that is subject to coordination by a geolocation database.

II. THERE IS WIDESPREAD SUPPORT FOR THE COMMISSION'S PROPOSAL TO AUTHORIZE OPPORTUNISTIC ACCESS ON A USE-IT-OR-SHARE-IT BASIS ACROSS AT LEAST THE 37 - 39 GHZ BAND AND OTHER LICENSED BANDS IF FEASIBLE

The record strongly supports the proposal to authorize opportunistic access on a use-it-or-share-it basis across the entire 37-39 GHz band and, if and when feasible, to the 28 GHz and other millimeter wave bands allocated for exclusive licensing.[2] OTI and PK concur with the Dynamic Spectrum Alliance, which represents a global coalition of large high-tech firms, that a "'use-or-share' approach would accomplish a number of objectives, including more intensive use of fallow spectrum capacity, lowering barriers of entry to a diverse range of uses and users, and providing added incentives for licensees to construct and operate facilities."[3] Facebook similarly suggests that a "broader use-or-share performance requirement in the millimeter wave bands . . . can maximize the use of spectrum, ensure that licensed spectrum does not lie fallow, and provide unlicensed access to spectrum for new and innovative uses."[4] Microsoft also "supports a Part 96 type framework to enable use-or-share across the 28 GHz, 37 GHz, and 39 GHz bands . . . either in lieu of, or to support relaxation of, network build out requirements."[5]

To maximize these efficiencies, several commenters join OTI and PK in urging the Commission to leverage the capabilities of a SAS to make as much unused spectrum available as possible to potential users. For example, Federated Wireless states that, "just as the Part 96 framework in the 3.5 GHz band leverages the SAS's spectrum allocation capabilities … to

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[2] *See, e.g.*, Comments of Dynamic Spectrum Alliance, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016), at 6 ("Comments of Dynamic Spectrum Alliance"); Comments of Facebook, GN Docket No. 14-177 *et al*. (filed Sep. 30, 2016), at 3 ("Comments of Facebook"); Comments of Microsoft, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016), at 13 ("Comments of Microsoft"); Comments of Starry, Inc. (filed Sep. 27, 2016), at 5 ("Comments of Starry"); Comments of Federated Wireless GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016) ("Comments of Federated Wireless"), at 10; Comments of NCTA, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016), at 17 ("Comments of NCTA").

[3] Comments of Dynamic Spectrum Alliance at 6.

[4] Comments of Facebook at 3, 7.

[5] Comments of Microsoft at 13.

enable opportunistic use and dynamic adjustments… so too could a SAS administer a 'use-or-share' regime in the 37 GHz band."[6] The Dynamic Spectrum Alliance likewise agrees that "a SAS can effectively review requests for access to bandwidth above 37.6 GHz and deny, grant or renew requests based on up-to-date information about active operations provided by licensees, as the Commission proposes."[7]

Predictably, mobile carriers and their suppliers repeat all the same arguments against opportunistic access to unused spectrum capacity that they made during the 3.5 GHz proceeding – arguments the Commission rejected. The cellular industry's makeweight claims include assertions that reporting information they necessarily have on hand to a SAS would be unduly burdensome, that opportunistic users 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.[8]

The Commission should once again reject these tired arguments, as it did in the context of both the 3.5 GHz and 600 MHz proceedings. In fact, the case for opportunistic sharing is much stronger for mmW spectrum than it was for the 3.5 GHz band. As Federated Wireless states, given the attenuated propagation of millimeter wave transmissions, a SAS "will enable even denser, more efficient use of valuable high-band spectrum while continuing to provide highly reliable interference protection to incumbent and high priority systems."[9] Most

[6] Comments of Federated Wireless at 10.
[7] Comments of Dynamic Spectrum Alliance at 6.
[8] *see, e.g.*, Comments of Intel, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016), at 16 ("Comments of Intel"); Comments of CTIA, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016), at 19 ("Comments of CTIA"); Comments of AT&T, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016), at 12 ("Comments of AT&T"); Comments of T-Mobile, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016), at 24 ("Comments of T-Mobile").
[9] Comments of Federated Wireless at 4.

opportunistic use is likely to be indoors, where the structure would prevent the signal from creating harmful interference to nearby licensed operations. And even outdoors, transmissions at 37 – 39 GHz are inherently limited to a very localized area that the SAS or similar geolocation database mechanism can ensure is a safe distance from licensed operations.

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, when the licensee commences operation in that location, the licensees' operations are not impacted. The only thing licensees will lose is their ability to warehouse spectrum. As Microsoft states, a use-or-share framework, "will discourage licensees from warehousing spectrum in each of the three UMFUS bands."[10]

Finally, OTI and PK agree with commenters, including NCTA, Facebook, and Dynamic Spectrum Alliance, that there is no reason to deny the public opportunistic access to unused mmW spectrum capacity for a period of 5 years.[11] The only relevant consideration is 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. An arbitrary five-year waiting period would needlessly undermine the Commission's goal to deter 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.

[10] Comments of Microsoft at 14.

[11] Comments of Federated Wireless, *Notice of Proposed Rulemaking*, GN Docket No. 14-177 *et al.* (filed Jan 26, 2016), at 6 ("NPRM Comments of Federated Wireless"); Comments of NCTA, *Notice of Proposed Rulemaking*, GN Docket No. 14-177 *et al.* (filed Jan 26, 2016) ("NPRM Comments of NCTA"), at 11; Facebook Comments at 7.

A. OPPORTUNISTIC ACCESS TO UNUSED MMW SPECTRUM PROMOTES THE PUBLIC INTEREST IN SPECTRUM ACCESS AND EFFICIENCY WITH NO DOWNSIDE TO LICENSEES IN PLACES THEY ARE NOT OPERATING

Many commenters[12] 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 constant and productive use."[13] As the NPRM observes, the "propagation and atmospheric characteristics" of mmW spectrum "provide greater opportunity for frequency reuse without interference."[14] Opportunistic access across the entire 37 – 39 GHz bands, combined with the device operability requirement, further encourage innovative deployments by both private sector and Federal users in the lower 37 GHz band segment by opening up additional bandwidth where spectrum *above* 37.6 GHz lies fallow.

As Federated Wireless correctly states: "Given the operability requirement for equipment across the 37 and 39 GHz bands, a SAS could permit lower 37 GHz SAL or Federal users, as well as other licensees holding authorizations in the upper 37 GHz band, to opportunistically expand their operations into unused upper 37 GHz band spectrum."[15] In fact, mmW licensees will benefit as well, since they will be able to opportunistically enhance their own capacity with unused spectrum licensed to *other licensees* who deploy more slowly, or not at all, in a particular location. And because the coverage area of each individual access point will be so small, there's a far higher chance that additional spectrum will be available, both above and below 37.6 GHz.

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[12] *see, e.g.*, Comments of Facebook; Comments of Google; Comments of NCTA; Comments of Dynamic Spectrum Alliance; Comments of Federated Wireless.

[13] *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Report and Order and Second Further Notice of Proposed Rulemaking, GN Docket No. 12-354, 30 FCC Rcd 3959 (rel. Apr. 21, 2015) ("*3.5 GHz Report & Order*"), at ¶ 72.

[14] *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*"), at ¶ 215.

[15] Comments of Federated Wireless at 10.

To promote spectrum access and efficient reuse, while minimizing interference, the Commission should adopt a fully automated SAS, just as it did in the 3.5 GHz band. Our groups concur with NCTA that 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.[16] As the Dynamic Spectrum Alliance (DSA) states, "the use of a SAS would [allow] more intensive use of fallow spectrum capacity, lowering barriers of entry to diverse uses and users, and providing added incentives for licensees to construct and operate facilities."[17] In addition, we agree with DSA that because "a SAS is 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,"[18] the Commission can ensure that the public interest benefits twice over by harnessing the SAS to both safeguard Federal users and facilitate more open and efficient opportunistic access across at least the entire 37 – 39 GHz band.

B. Mobile Carrier Interests Repeat the Same Makeweight Objections that the Commission Rejected in the 3.5 GHz CBRS Proceeding

Opponents of opportunistic access trot out the same insubstantial objections the Commission rejected in the 3.5 GHz CBRS proceeding.[19] Mobile carriers, their trade associations and equipment manufacturers have all stated that a use-or-share framework would create "uncertainty" in the market.[20] CTIA hyperventilates that "a 'use it or share it' mandate would *wreak havoc* on the millimeter wave bands."[21] AT&T opines that "opportunistic sharing

[16] Comments of NCTA at 18.
[17] Comments of Dynamic Spectrum Alliance at 6.
[18] *Id.* at 4.
[19] *see, e.g.,* Comments of CTIA; Comments of AT&T; Comments of T-Mobile; Comments of Qualcomm.
[20] Comments of CTIA at 19; Comments of Qualcomm at 15; Comments of T-Mobile at 24-25; Comments of AT&T at 12; Comments of Ericsson at 19-20.
[21] Comments of CTIA at 19 (*emphasis added*).

. . . has not been successfully deployed on any large scale basis . . . ."[22] And Intel, oddly, dismisses opportunistic use of vacant spectrum as "an inferior form of unlicensed access with inherent limitations and conditions on its use and availability" that will also (inexplicably) "impede sustained U.S. investment in mmW 5G."[23]

These cellular industry arguments ignore two crucial facts: First, if the Commission certifies a SAS or similar geolocation database mechanism, there is absolutely no downside or risk for licensees. Licensees maintain all of their rights to *use* the public resource – which is, after all, the public interest rationale for their license – 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 fail to explain why there would be any "uncertainty" about clearing a channel, since the core functionality of a SAS is to record actual use and enforce permissions that protect the rights of licensees. So long as a geolocation database is certified, 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.

Second, the Spectrum Access System (SAS) and the use-or-share rule adopted for CBRS in the 3.5 GHz band will be operational and proven long before (probably years before) the 37 – 39 GHz band is auctioned and its licensees actually commence service, whether "5G" or otherwise. The Commission can also make its authorization of opportunistic access to mmW bands contingent on final certification of a SAS or other geolocation database needed to protect licensed operations, just as it did in the CBRS context for both the SAS and Environmental Sensing Capability (ESC). Moreover, another fail-safe mechanism for opportunistic access

[22] Comments of AT&T at 12.
[23] Comments of Intel at 16, 19.

governed by a geolocation database is that unlike traditional Part 15 device authorizations, devices cannot continue to operate without continually re-checking the database and renewing the permission to operate at a particular location and power. The Commission can direct the SAS to deny access, or change the rules governing access, at any time – thereby doubly ensuring that primary licensees will be safe from harmful interference.

In short, licensees lose no rights whatsoever and bear a *de minimus* burden to simply inform a SAS (or other certified 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 they make when they purchase the spectrum. The transaction costs of the SAS itself can be passed along to opportunistic and GAA users.

T-Mobile and Qualcomm, for their part, recycle the same previously rejected canard that a "use-or-share" framework will undermine investment and stifle innovation.[24] It seems that every pro-consumer or pro-competition proposal by the Commission – from the Open Internet Order to consumer privacy to spectrum sharing – faces this generic, unfounded claim from ISPs and their suppliers. The claim that innovation and investment will suffer ignores the self-evident fact that whereas licensees are not impacted whatsoever by opportunistic access, providing spectrum access to a wide range of firms and users who cannot acquire a wide-area license is

[24] Comments of T-Mobile at 20; Comments of Qualcomm, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016) ("Comments of Qualcomm"), at 15.

likely to result in increased innovation and investment in otherwise fallow or warehoused spectrum, just as it has in unlicensed bands.

Commenters also attempt to argue that a use-or-share framework will somehow limit licensees' access to the bands. CTIA argues that "licensees will need unfettered access to their licensed spectrum to test new technologies, experiment with novel deployments, and transform today's ambitious vision of 5G into reality . . . ."[25] However, Federated Wireless and other commenters correctly observe that under a use-or-share obligation, geographic area licensees retain primary rights to their spectrum and, as such, face no possibility of loss of rights, as their commencement of operations necessarily precludes opportunistic users."[26] In the CBRS Order the Commission addressed and remedied the legitimate need to test deployments prior to commencing operations for paying customers – and it will no doubt do the same here.

CTIA argues that implementation of use-or-share in the mmW bands faces practical obstacles because the Commission "would need to define when spectrum is considered 'in use' such that the sharing requirement would be triggered."[27] CTIA, yet again, ignores the thoroughly debated outcome of the 3.5 GHz and 600 MHz proceedings, where the Commission resolved these issues. As Microsoft argues, the definitions of terms such as "use" and "commence operations" should, "for consistency… be the same as that used in the rules for the 3.5 GHz band."[28]

A final argument put forth by opponents of opportunistic access to fallow spectrum, such as Mobile Future, is that "sufficient spectrum is already available on an unlicensed basis in the

[25] Comments of CTIA at 20.
[26] Comments of Federated Wireless at 11.
[27] Comments of CTIA at 20.
[28] Comments of Microsoft at 14.

mmW bands," suggesting that there is no need for opportunistic access.[29] But as the Consumer Technology Association observes, unlicensed spectrum "is a hotbed for innovation and [is] integral in addressing the spectrum crunch."[30] The Commission itself has stated that, with the roll-out of 5G, there will be an "increasing demand for data from consumers using an ever wider variety of devices."[31] Since a "use-or-share" framework, coordinated by a SAS, would make certain that licensees' use would not encounter interference, why not maximize the amount of spectrum available for opportunistic use, especially in the wake of 5G rollout? And since the relative demand for different types of spectrum in different locations is unknowable by the agency at this time, the public interest is better served by making unused spectrum available to its owners – the public – rather than adopting a rule that the resource should lie fallow.

C. A Five-Year Waiting Period for Public Access and Spectrum Efficiency is Arbitrary and Unnecessary Once a SAS is Certified and Licensees Can be Protected from Harmful Interference

OTI and PK strongly agree with NCTA, Federated Wireless and Facebook that there is no reason to deny the public opportunistic access to unused mmW spectrum capacity for a period of 5 years or any other arbitrary period.[32] 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] The only relevant consideration should be whether a qualified SAS is certified, tested and ready to accurately ensure that a use-or-share authorization

[29] Comments of Mobile Future at 6.
[30] Comments of the Consumer Technology Association, GN Docket No. 14-177 et al. (filed Jan. 27, 2016) ("Comments of CTA"), at 8.
[31] NPRM at ¶ 7.
[32] NPRM Comments of Federated Wireless at 6; NPRM Comments of NCTA at 11; Facebook Comments at 7.
[33] NPRM Comments of Federated Wireless at 6.

will be revoked and that 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. 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] 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.

III. THE RECORD SUPPORTS THE COMMISSION'S PROPOSAL FOR GENERAL AUTHORIZED ACCESS TO THE 37 – 37.6 GHZ BAND USING A PART 96 FRAMEWORK

OTI, PK, and commenters representing many of the largest Internet and high-tech firms support extending the Commission's innovative Part 96 framework and Spectrum Access System governance model to enable open and shared access to the 37 – 37.6 GHz band that the *Report & Order* has allocated for Shared Access licensing.[35] OTI and PK agree that licensing by rule in a manner that is as similar as possible to General Authorized Access under the Part 96 rules will create a flexible sharing framework that will best advance the public interest goals of promoting

[34] NPRM Comments of NCTA at 11.
[35] *See, e.g.*, Comments of Dynamic Spectrum Alliance at 4; Comments of Facebook at 7. *See also* Comments of Microsoft at 16 (proposing unlicensed secondary access to the lower 37 GHz band segment, if there is not opportunistic access on a use-or-share basis to the bands above 37.6 GHz); Comments of Wi-Fi Alliance, GN Docket No. 14-177 *et al.* (filed Sep. 30, 2016) ("Comments of Wi-Fi Alliance"), at 8 (37 – 37.6 GHz "should be completely unlicensed").

innovation, market entry, competition, intensive spectrum reuse, and accommodate diverse users and uses.

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 and/or dynamic sharing – and not necessarily for traditional exclusive licensing on a geographic basis.[36] Exclusive licensing on a very large geographic area basis (e.g., PEAs, counties, or even census tracts) is 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, stimulating innovation, and enabling the customization of solutions for the very diverse needs of both commercial firms and public venues. Relying on exclusive licensing over relatively large geographic areas across the entire 37 – 39 GHz band would not allow the largest possible number of businesses and individuals the ability to self-provision capacity for mobile data off load, 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.

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 and several other commenters agree with the Commission that "[a]llowing

[36] 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 National Cable & Telecommunications Assn., *Notice of Inquiry*, GN Docket No. 14-177, at 6, 9 (Jan. 15, 2015); Comments of Consumer Electronics Assn., *Notice of Inquiry*, GN Docket No. 14-177, at 13 (Jan. 15, 2015); Comments of Wi-Fi Alliance, *Notice of Inquiry*, GN Docket No. 14-177, at 4 (Jan. 15, 2015).

part of the band to be made available on 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."

OTI and PK strongly concur with the Dynamic Spectrum Alliance (DSA) that to achieve the Commission's stated goal to "promote access to spectrum by a wide variety of entities, support innovative uses of the band, and help ensure that spectrum is widely utilized,"[37] the Commission "should define Shared Access Licenses (SALs) to be as similar as feasible to General Authorized Access within the CBRS/Part 96 framework."[38] Federated Wireless similarly states that "a flexible sharing framework, which . . . employs a SAS to manage disparate uses and technologies, provides regulatory and technological flexibility that allows use cases to develop over time."[39] OTI and PK further agree with DSA that the Commission should "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."[40]

Opponents of the SAL sharing concept outlined in the FNPRM, employing a license-by-rule framework and very short (7-day) assignments, offer nothing more substantive than a rehashed argument for exclusive geographic-area licensing across the entire 37 – 39 GHz band, a one-size-fits-all outcome the Commission rejected in the *Report & Order*. Commenters such as CTIA and AT&T, apparently rehearsing their arguments for a more procedurally relevant petition for reconsideration, once again argue that the "Commission has already allocated ample

[37] *Report & Order* at ¶ 112.
[38] Comments of Dynamic Spectrum Alliance at 4.
[39] Comments of Federated Wireless at 5.
[40] *Id*. at 5.

millimeter wave spectrum for sharing and unlicensed experimentation," making "exclusive-use licensing policies … all the more important."[41]

The cellular industry's argument that unlicensed allocations above 60 GHz is a complete substitute for the benefits of dynamic, license-by-rule sharing of the lower 37 GHz band segment (37-37.6 GHz) falls short in several respects:

First, the propagation characteristics and channel sizes of the bands are entirely different. The unlicensed WiGig technologies that are making use of the combination of the wide channels but extremely attenuated propagation above 60 GHz are not what should be expected at 37 – 37.6 GHz. Because of the operability requirement across the 37 – 39 GHz band, we expect that thousands of small operators and tens of thousands of individual venues (from school and industrial campuses to factories, hotels and convention centers) will deploy "5G" gear driven by the overall 37 – 39 GHz market, but in innovative, customized and/or carrier-neutral configurations that would not be possible if those users had to go to a one-time auction and purchase an expensive wide-geographic-area exclusive license. In other words, the diversity of spectrum access the Commission is creating for the lower 37 GHz band segment will spur innovations in uses that are both entirely different from unlicensed technologies above 60 GHz and complementary to 5G technologies deployed above 37.6 GHz.

Second, as Federated Wireless noted in its comments, like the GAA spectrum in the upper segment of the 3.5 GHz band, the SAL spectrum in the lower segment of the 37 – 39 GHz band will encourage innovation, investment and deployment by both upper segment licensees and opportunistic users across the entire band. Upper segment licensees can expand their operations at low cost by adding capacity using 37 – 37.6 GHz spectrum, even if it's on an as-needed or best-efforts basis. Because coverage areas will be very small, it's highly likely that a

[41] Comments of CTIA at 10; Comments of AT&T at 11.

licensee with exclusive access to a channel or two above 37.6 GHz will discover that it can greatly enhance that capacity with opportunistic access to 37 – 37.6 GHz spectrum.

For small operators, innovators and individual venues, the availability of 600 megahertz of open and shared GAA-like spectrum in the lower 37 GHz segment not only enables at least a modest deployment without a wide-area exclusive license, but it also encourages the opportunistic use of unused spectrum *above* 37.6 GHz. Without the availability of the 37 – 37.6 GHz band segment on a GAA-like basis, potential innovators, operators and market entrants would be far less likely to invest in equipment that relies on temporary, opportunistic access to licensed spectrum that could be foreclosed at a later date, stranding their investment. Under the Commission's proposal – and thanks to the Commission's operability requirement – the different access regimes for the lower and upper segments of the 37 GHz band instead become complementary, each enhancing the value of the other, exactly as the operability requirement and diversity of access offered by PAL and GAA spectrum at 3.5 GHz is likely to do.

Because the lower band segment will be appealing to both upper segment licensees and opportunistic users, OTI & PK recommend that to the extent SALs receive a degree of interference protection for "a particular bandwidth of spectrum at a particular location," the capabilities of a dynamic Spectrum Access System (SAS) should be leveraged to maximize the availability of the band for all potential users. As Dynamic Spectrum Alliance correctly notes, "An automated mmW SAS . . . would best be able to coordinate the greatest degree of spectrum sharing by a variety of users with varying needs for interference protection."[42] Federated Wireless similarly states that "a SAS will allow both ("SALs") and Federal users in the lower 37 GHz band to access needed spectrum—up to the entire 600 MHz, if available—nearly

[42] Comments of Dynamic Spectrum Alliance at 4.

immediately, thus allowing licensees to scale on short notice to support short-term operations requiring greater bandwidth."[43]

Opponents of the SAS claim is to too new and untested to implement in the mmW bands.[44] For example, CCA insists that, "the Commission must first assess the SAS framework once it has been implemented in the 3.5 GHz band."[45] This argument quickly becomes moot because by the time the Commission certifies a SAS to implement sharing in the 37 - 37.6 GHz band, its effectiveness (or not) in the 3.5 GHz band will be well established. There is no reason that the Commission cannot make dynamic sharing, in reliance on a full SAS implementation, contingent on future testing and certification. That is exactly what the Commission is doing with respect to both the SAS and an Environmental Sensing Capability (ESC) at 3.5 GHz to ensure protection of Federal incumbent operations.

Moreover, as noted above, the highly-attenuated propagation characteristics of the mmW bands make it an especially good candidate for both SAS use and dynamic sharing. A SAS is so perfectly tailored for coordination in these bands that Intel, despite opining that a "SAS is neither necessary nor recommended" if it enables license-by-rule SALs at 37 – 37.6 GHz,[46] later touts the benefits of a "coordination database" and recommends that it play "a frequency coordination role."[47] The "coordination database" described by Intel sounds functionally indistinguishable from a SAS.

Equipment manufacturers, like Ericcson, make additional predictable arguments against SAS implementation such as, "the Commission should pursue a straight-forward manual-

[43] Comments of Federated Wireless at 8.
[44] Comments of AT&T at 11; Comments of CCA at 5; Comments of CTIA at 23-24; Comments of T-Mobile at 8; Comments of Ericsson at 16.
[45] Comments of CCA at 5.
[46] Comments of Intel at 4.
[47] *Id.* at 5.

frequency coordination [framework],"[48] suggesting that the use of a SAS is overly complex. But as Dynamic Spectrum Alliance points out, "Manual coordination through a portal will not scale to handle the sheer quantity of authorizations, or the potential for multiple and overlapping SALs in an area…"[49] Ultimately, if the Commission wants a flexible framework that can truly maximize the potential of the lower 37 band, the authorization of an automated and dynamic SAS is not only recommended, but necessary.

IV. THERE IS STRONG SUPPORT FOR RETAINING THE 'LIGHT-LICENSING' FRAMEWORK FOR THE 70/80 GHZ BANDS AND ADDING AN UNLICENSED UNDERLAY

The record demonstrates considerable agreement that the non-exclusive, light-licensing framework for fixed wireless links in the 71-76 GHz and 81-86 GHz bands is appropriate given the propagation characteristics of the band and that the Commission should refrain from introducing a three-tier regulatory framework that includes making even short-term licenses available on an exclusive geographic area basis.[50] Our groups concur with DSA's observation that the non-exclusive, light licensing framework is "well suited to the point-to-point links" in these bands.[51] Google explains that at 70/80 GHz, the "comparatively poor propagation and atmospheric absorption characteristics mean that operations typically require high power and directional gain in order to achieve significant range."[52] As a result, the 70/80 GHz bands "are well suited to high-speed, point-to-point or short-range applications, but less suited to traditional wide-area operations."[53]

[48] Comments of Ericsson at 16.
[49] Comments of Dynamic Spectrum Alliance at 4.
[50] *See, e.g.*, Comments of Dynamic Spectrum Alliance Comments at 8; Comments of Microsoft at 6; Comments of Google at 2; Comments of Wi-Fi Alliance at 6; Comments of NCTA at 7.
[51] Comments of Dynamic Spectrum Alliance at 8.
[52] Comments of Google at 3.
[53] *Id.*

While there is strong support in the record for continued use of the current open access, light-licensing framework – and for expanded use of the band for both point-to-point and point-to-multipoint links[54] – there is a strong consensus that the band is so underutilized that it can accommodate shared use by local area mobile operations. OTI & PK believe that the band is best suited for an underlay of "mobile" (really nomadic) use on an unlicensed basis, particularly for indoor use, which can be done without disrupting the current and very valuable use of the band for fixed links and backhaul. 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. OTI and PK join other commenters in urging the Commission to initially authorize unlicensed, indoor-only operations across the entirety of both the 71-76 GHz and 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.[55]

OTI and PK agree with the Dynamic Spectrum Alliance that "[i]n 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."[56] NCTA supports this view, stating that unlike outdoor operations, indoor uses "are unlikely to cause harmful interference to incumbents, given the limited propagation of millimeter wave spectrum."[57] 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. Microsoft also notes that authorizing unlicensed indoor use of the 80 GHz band may also

[54] *See, e.g.*, Comments of Google at 5; Comments of Ericsson at 13-14.
[55] *See, e.g.*, Comments of Microsoft at 10.
[56] Dynamic Spectrum Alliance comments at 9.
[57] NCTA comments at 9.

serve to unlock wider commercial use of the unlicensed 90 GHz band (92-95 GHz) spectrum, which can only support unlicensed use indoors."[58]

With respect to outdoor use, there is widespread agreement by commenters that the need to protect both fixed wireless incumbents and Federal uses will require coordination by a geolocation database.[59] The primary disagreement is whether the geolocation database should be coordinating unlicensed access or, instead, exclusively-licensed geographic area licensing. Under either scenario, the record suggests that the function of the geolocation database would be exactly the same: to establish exclusion zones that protect fixed wireless links and licensees from mobile operations.

OTI & PK recommend that the Commission authorize secondary access for low-power, outdoor use under Part 15 that is subject to coordination by a geolocation database. One key reason is that given the propagation characteristics of the band, geographic area licenses would preclude diverse and intensive use, and leave too much of the spectrum fallow. As Google explained, "the kind of area-based licensing and incumbent protection zones that are specified in the 3.5 GHz CBRS rules would impair more spectrum than necessary, significantly reducing efficiency."[60] Instead, as Microsoft correctly argues, "a geolocation database would be used to create exclusion zones around the incumbents' installation sites based on the protection requirements."[61]

An enhanced version of the current geolocation database used to coordinate access to the 70/80 GHz bands can protect fixed wireless incumbents operating outdoors from interference

[58] Microsoft comments at 10.
[59] *See, e.g.*, Comments of CTIA at 14-15 (proposing to "preserv[e] and strengthen[] the existing 70/80 GHz management database" to accommodate the "most efficient 5G use"); Comments of Microsoft at 9 ("a geolocation database would be used to create exclusion zones around incumbents' installation sites").
[60] Comments of Google at 3; Comments of Microsoft at 8.
[61] Comments of Microsoft at 9.

and do so without imposing any additional burden on those licensees. Although the 70 GHz WiGig channels will be used almost entirely indoors, at least initially, there will be some outdoor use and untold innovation on the band. A geolocation database and requirement for mobile devices to check their location at regular intervals, or after moving a certain distance, can ensure that both commercial and Federal incumbents are protected. Additionally, Microsoft correctly states that "given the projections for the number of WiGig devices, providing access to the 70 GHz channels may result in an additional source of revenue for these database providers."[62]

The record similarly exhibits little support for a three-tier, Part 96 framework for the 70/80 GHz band among mobile carriers and their suppliers. Ericsson "recommends assigning the lowest priority to the 71–76 GHz/81–86 GHz band due to its importance as an existing and growing spectrum location for the fixed service ("FS")—*i.e.*, for backhaul."[63] Ericsson goes on to note that point-to-point links are "a key component in many mobile networks" and that a study it published concludes "the 70/80 GHz band is expected to experience major growth and represent up to 20% of new backhaul deployments annually as soon as 2020."[64]

Although T-Mobile proposes "exclusive geographic licensing" and would require any future fixed wireless (point-to-point) licensee to compete at auction for wide-area spectrum, other major carriers appear to have limited interest in the 70/80 GHz bands for "mobile" operations. AT&T and Verizon do not specifically address the bands. CTIA "believes the Commission should largely retain its existing 70/80 GHz licensing framework" and instead

[62] Comments of Microsoft at 9.
[63] Comments of Ericsson at 13-14.
[64] *Id*. at 14. *See* Ericsson, *Microwave Towards 2020*, at 8 (Sept. 2015), https://www.ericsson.com/res/docs/2015/microwave-2020-report.pdf.

"consider enhancing the existing sharing database that manages the 70/80 GHz bands to accommodate new mobile services."[65]

OTI and PK agree with CTIA that the existing 70/80 GHz "database could be modified to account for new, mobile uses in the 70/80 GHz bands while still fully protecting incumbent fixed microwave links."[66] However, rather than exclusive geographic area licenses, the most appropriate secondary use for the 70 and 80 GHz bands is unlicensed access. As noted above, Google, DSA, Microsoft, NCTA and other commenters are correct that the propagation characteristics of these bands can support open access and far more widespread use for very diverse local area deployments. 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 far more than exclusive geographic licenses that effectively prohibit use in most venues and leave the spectrum vacant in the vast majority of places. And even outdoor use on a "mobile" basis would be inherently small cell, supporting coverage over considerably less area than even the millimeter wave bands below 40 GHz. As Google stated, "the kind of area-based licensing and incumbent protection zones that are specified in the 3.5 GHz CBRS rules would impair more spectrum than necessary, significantly reducing efficiency."[67]

V. CONCLUSION

OTI and PK urge the Commission to extend the balanced approach to spectrum access exemplified by the agency's 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

[65] Comments of CTIA at 14-15.
[66] *Id*. at 16.
[67] Comments of Google at 3.

candidates 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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