

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 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)	RM-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 the 37.0- 38.0 GHz and 40.0-40.5 GHz for Government Operations)	IB Docket No. 97-95

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INTRODUCTION AND SUMMARY

The United States leads the world in the deployment of 4G LTE. As the first company to invest tens of billions of dollars to bring a large scale, high-quality 4G LTE network to U.S. consumers, Verizon helped forge that leadership position. And though there is significant life left in 4G, Verizon has again set out an aggressive roadmap to be the leader in ushering in a fifth-generation, or 5G, world. That roadmap dovetails with the Commission's aggressive plans to allocate millimeter wave ("mmW") spectrum to fuel this next generation of wireless technology. While the rest of the world talks about 5G, the U.S. is taking action. And swift action in this proceeding is critical to whether the United States retains this global leadership in advanced wireless communications.

Wideband millimeter wave spectrum holds much promise for 5G applications requiring ultra-high data speeds and ultra-low latencies because it enables devices to operate across numerous ultra-wide channels and to use focused-beam smart antenna technologies for highly data-intensive applications. While Verizon and other technology companies are still working out the detailed specifications of 5G technology, it will bring consumers myriad game-changing new features and services and will be reliable and fast even in crowded locations. U.S. consumers will benefit from a vast array of 5G applications and new classes of wearables and sensors that will spur the emergence of a fully-connected society and a turbo-charged the Internet of Things.

Commission action allocating and auctioning new spectrum for new technologies has ushered in four previous generations of wireless networks and benefited U.S. consumers and the U.S. economy. The Commission, for example, successfully engineered the first "digital dividend" of 700 MHz spectrum nearly a decade before European regulators began to follow suit. As a result, the United States stands alone in the world with four nationwide facilities-based

4G LTE providers that have invested hundreds of billions of dollars and that serve 98 percent of the nation's population. Last year the Commission continued to support the growth of 4G with the allocation and auction of AWS-3 spectrum.

The Commission now has the opportunity to build on those past successes by moving rapidly to jumpstart a vibrant 5G ecosystem with the four mmW bands that the Notice¹ identifies as priorities. To accomplish this, the Commission must act quickly and embrace policies that assure operators that they will be able to recoup their major investments in next-generation technologies. Simplicity will be key. The Commission should embrace proven licensing models and resist calls to overcomplicate the proceeding with new, unproven ones.

Many of the Commission's principal proposals for the mmW bands will benefit U.S. consumers and enterprises and promote U.S. competitiveness. The Commission should promptly adopt its plan to allow existing 28 GHz and 39 GHz licensees to use their licenses for mobile services, and to auction the spectrum in those bands not currently licensed. Those simple steps, combined with authorizing flexible secondary market and leasing arrangements, will get spectrum quickly into the hands of companies poised to serve U.S. consumers. That combination of flexible-use spectrum licenses and flexible secondary market rules has been the foundation of the U.S. wireless industry's most extensive and robust wireless infrastructure in the world. Under that framework, Verizon alone has invested more than \$100 billion in wireless network infrastructure since 2000.

The Commission also correctly recognizes that reasonably long license terms and renewal expectancies will provide operators with certainty needed to make large investments;

¹ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, IB Docket No. 15-256, RM-11664, WT Docket No. 10-112, IB Docket No. 97-95, Notice of Proposed Rulemaking, FCC 15-138, 30 FCC Rcd 11878 (2015) ("Notice").

that flexible performance requirements will help ensure licensees put their spectrum to use to serve consumers; that operators' holdings of mmW spectrum should not at this time be applied towards the "spectrum screen" the Commission uses to evaluate spectrum aggregation; that Time Division Duplex ("TDD") likely will be the duplexing scheme deployed in these frequencies; and that the technical rules should be flexible enough to permit as yet unknown future use cases. To achieve its goal of technical flexibility, the Commission should modify the proposed power levels, and should not increase device costs by requiring operators to provide functionality that makes no sense, such as creating compatible air interfaces even for devices with no need to "talk" to one another.

The Commission should also build on its sound decisions by embracing additional policies proven to support investment and innovation. It should not establish any arbitrary band-specific aggregation limits for mmW spectrum, which would quash the development of nascent technologies that require operators to aggregate substantial amounts of spectrum. And to promote investment by operators that seek administrative and operational certainty, it should assign licenses with reasonably-sized service areas at least the size of existing 28 GHz and 39 GHz licenses.

Given the importance of getting it right at the outset with respect to the four priority bands under consideration at this stage, the Commission should not move forward at this point with the more untested proposals mentioned in the Notice. These proposals would create unnecessary complexities and delays that would hinder investment and innovation. For example, requiring 37 GHz licensees to share spectrum with a vaguely-defined class of real estate property owners would overcomplicate and delay deployments in these bands and would destroy licensees' certainty about their ability to use their spectrum when and where they need it. The

Commission instead should apply the same flexible-use principles to the 37 GHz band that it applies to the 39 GHz band. That will allow the Commission to seize the unique opportunity presented here to spur innovation and investment by creating a unified band plan between 37-39 GHz with 3,000 MHz of contiguous spectrum supporting multiple highly attractive licenses with bandwidths of 200 MHz or more.

The Commission proposes an innovative, straightforward way to promote successful coexistence with satellite operations: giving earth station operators the option of purchasing terrestrial licenses to eliminate the risk of interference with terrestrial operators. Although satellite operators are secondary users of this spectrum, the Commission reasonably concludes that each one should be able to increase its quality of service assurances if doing so makes sense for its operations. The Commission should not, however, permit satellite operators to obtain free terrestrial licenses via a “closed window” administrative process. Nor should it invite new satellite operations, such as satellite terminals, into the bands it is repurposing for terrestrial use. Those proposals, like the hybrid proposal for the 37 GHz band, would create unnecessary complications for terrestrial licensees and delay the emergence of 5G operations.

The Commission is right to be open-minded about new regulatory structures for mmW and other bands, but some of those proposals are not right for this proceeding’s four priority bands. For example, Verizon supports the Commission’s decisions to experiment with new regulatory models, such as using a new Spectrum Access System (“SAS”) in the 3.5 GHz proceeding to facilitate efficient spectrum sharing among multiple tiers of users. Experiments with small service territories and short license terms in that docket also may facilitate use of 3.5 GHz spectrum. But these complex models take time to develop, and attempting to impose such brand-new sharing experiments in the priority mmW bands for 5G would inevitably create

delays and uncertainties. The Commission should thus keep an open mind about similar approaches for mmW bands, but only for the additional mmW bands that it plans to repurpose around the corner—not for the priority bands it identifies for immediate and simple repurposing.

I. THE COMMISSION SHOULD USE PROVEN POLICIES TO MINIMIZE DELAYS AND CREATE CERTAINTY FOR COMPANIES INVESTING IN NEW TECHNOLOGIES.

To trigger robust investment and innovation in the mmW bands in the near term, the Commission’s licensing approach in this proceeding should primarily mirror the approach that propelled the United States to global leadership in 4G technology: assigning flexible-use licenses conveying strong quality of service assurances throughout reasonably-sized service areas. Promptly moving forward with that framework will help usher in 5G services for U.S. consumers.

A. The Commission Should Promptly Adopt its Proposals To Repurpose the 28 GHz and 39 GHz Bands Under a Flexible-Use Licensing Framework.

The Commission's proposal to grant flexible-use rights to existing licensees in the 28 GHz and 39 GHz bands² will benefit U.S. consumers and the U.S. economy. It will unleash mmW spectrum via secondary market transfers and leasing arrangements or partnerships with operators who can deploy it productively. Granting existing licensees flexible use rights promotes the Commission’s goal of repurposing mmW spectrum to support new technologies in an efficient and simple way.

The Commission also correctly proposes using auction procedures to allocate all unassigned spectrum in the 28 GHz and 39 GHz bands. The Commission can and should hold that auction promptly. And it need not reinvent the wheel: it can use traditional, proven bidding

² Notice, ¶¶ 92-95.

procedures and auction rules to avoid delay and unanticipated complications. It should also, as discussed in Section I-C below, auction licenses with recognizable terms, renewal expectancies, and service territories.

The Commission should not “overlay” mobile rights onto existing licenses, and then assign those overlay rights as separate licenses.³ That would overcomplicate deployment by creating uncertainty for holders of the overlay licenses about their interference rights and obligations vis-à-vis point-to-point and point-to-multipoint operations undertaken under the original licenses. It would also undercut the expectations of the existing licensees,⁴ and would constitute a time-consuming and administratively complex project for the Commission to design, monitor, and enforce.

B. The Commission Should Unify the 37 and 39 GHz Bands into a Single Band Subject to the Same Rules.

The Notice proposes to auction licenses that give licensees rights only to deploy *outdoor* operations for 37 GHz spectrum, while assigning a separate bundle of *indoor* operating rights (on the same channels and in the same service territory) to a to-be-defined class of real estate owners or building tenants.⁵ That “hybrid” proposal for 37 GHz spectrum would impair its value. The Commission should instead unify the 37 GHz and 39 GHz bands to create a 3 GHz band of attractive contiguous spectrum subject to a more traditional licensing framework.

³ Notice, ¶ 97.

⁴ When establishing the LMDS bands, the Commission made clear it anticipated authorizing mobile operations in them if presented with a record supporting such an authorization. *See* Notice, ¶ 26. That expectation extended to all LMDS bands, so in addition to granting flexible use for the A1 sub-band, the Commission should consider also including the B Block and the rest of the A Block when granting flexible-use rights.

⁵ Notice, ¶¶ 99-104.

1. A Single, Contiguous 37-39 GHz Band Plan Would Create Attractive Wideband Licenses.

The Commission can create a unified block of 3,000 MHz of spectrum under a single band definition by combining the 37 GHz band (37-38.6 GHz) and 39 GHz band (38.6-40 GHz). It should grab this unique opportunity to spark consumer benefits. Equipment manufacturers could achieve economies of scale producing equipment that operates on standardized channels across the entire band. And the band could host a large pool of very wide-bandwidth channels that would facilitate major efficiencies for operators and would be ideal for future high-bandwidth applications such as video distribution. Achieving those benefits requires the Commission to apply the same rules to both 37 GHz and the 39 GHz bands, and establish a single channelization scheme for the new band.

To support high bandwidth next generation applications, the Commission should promptly create a band between 37.0 GHz and 40.0 GHz comprised of multiple channels that are each at least 200 MHz wide. Those channels should be un-paired, so that they are suitable for Time Division Duplexing, the likely predominant technology to be deployed in this context.⁶ The Commission possesses all the licensing tools and auction expertise to move forward promptly to create this highly attractive new band.⁷

2. The “Hybrid” Proposal To Assign Spectrum Based on Real Property Holdings Would Impair and Devalue 37 GHz Spectrum.

The 37 GHz band itself would be more attractive and valuable, and more likely to be quickly put to use for 5G, under a traditional framework than under the proposed hybrid one.

⁶ See *infra*, Section III-A-2.

⁷ The Commission will need to repack existing 39 GHz licenses to clear a contiguous swath of spectrum to be repurposed into this new uniform band. In that process, incumbent 39 GHz licensees, whose licenses currently are paired 50x50 MHz blocks, should have the option to convert their licenses into contiguous non-paired licenses. That would increase their attractiveness for future mobile terrestrial uses because they would be consistent with the new uniform band plan.

With no terrestrial licensees, this band offers an excellent opportunity for a variety of next generation technologies. Holders of flexible-use licenses in the 37 GHz band would thus have a clean slate on which to rapidly deploy next generation technologies in a band harmonized globally for mobile operations.

By contrast, the hybrid proposal would limit the utility of the 37 GHz band. The NPRM assumes that operators will predominantly be interested in outdoor deployments, but that is not so. The mmW spectrum will likely be used heavily in more populated, urban environments where indoor coverage is critical. As the Commission has pointed out, the vast majority of current wireless use is indoors.⁸ Operators may not be able to make a business case for developing the 37 GHz band without the opportunity for indoor deployments. And licensees whose business plans involve providing both outdoor and indoor coverage would need to negotiate a patchwork of agreements with various building owners and tenants within their service territories. Just the first step of that process—identifying whom to contact for every indoor location—would be costly and time consuming.

Even for a licensee that chooses to exclusively provide outdoor coverage (which the Notice speculates might be typical), the interference coordination issues between the two co-primary users (indoor and outdoor) would create substantial uncertainty that would impede investment. The Commission would need to create well defined rules—for every type of structure in every part of the country—about precisely where the license boundaries are. And there would be substantial uncertainty on how the coexistence regime would work in practice.

⁸ Notice, ¶ 11.

3. Traditional Licensed and Unlicensed Regimes Will Facilitate Efficient Indoor Uses of mmW Spectrum.

If the NPRM's unsupported assumption that some 37 GHz licensees will choose to focus on outdoor deployments in some areas is true, licensing that spectrum under a traditional paradigm with flexible-use principles will support indoor deployments far better than the hybrid proposal. Holders of exclusive-use licenses who have outdoor-only business plans could efficiently use secondary market tools to share their spectrum with operators seeking to deploy indoor-only networks. Such private, secondary-market leasing or partitioning arrangements would do a much better job of delineating the physical boundaries and technical interference rules necessary for successful sharing than attempting to do so by regulatory fiat.

And to the extent some facilities owners or tenants want to create private networks (and the NPRM does not identify any specific need for such deployments), many existing spectrum bands are already available for such applications. For example, operators could deploy indoor networks in the unlicensed spectrum the Commission has already set aside in the 92 GHz – 95 GHz band for indoor use. They also could use the unlicensed spectrum available at 57 GHz – 64 GHz, or the additional unlicensed spectrum the Commission appropriately intends to make available in this proceeding.

These licensed and unlicensed models should not be replaced with a hybrid proposal that would grant operating rights to premises owners or tenants who may have no expertise or even the desire to use the spectrum. At best, the hybrid proposal would allow facilities owners or tenants lacking expertise or interest in using the 37 GHz spectrum to lease or sell their spectrum rights, thereby granting a windfall to those entities at the expense of the U.S. Treasury and the American taxpayer. That could repeat the experience from the 1980s and early 1990s of assigning cellular licenses; those failed experiments prompted the Commission to instead start

auctioning spectrum. At worst, the unwanted spectrum would lay fallow, frustrating the efforts in this proceeding to propel the United States to the forefront of the race to 5G.

C. License Terms, Renewal Expectancies, and Service Areas Should Mirror Known, Proven Ones.

The technology and infrastructure deployments in the mmW frequencies will require large investments. Companies will invest capital only if the Commission gives operators substantial regulatory certainty about their ability to recoup their investments. That means assigning licenses with attributes proven to encourage investment and innovation. The Commission should assign licenses that have reasonably long terms and renewal expectancies. That will encourage investment and innovation by improving the expectations of returns on capital expenditures to build out the spectrum and maintain current accounting and tax rules that come with renewal expectancy. Initial license terms should be at least the 10 years proposed in the Notice and potentially longer given the need for certainty and the costs of network densification.

Rather than assign licenses on a county level,⁹ however, the Commission should issue licenses for 28 GHz and 39 GHz that are no smaller than those bands' existing license sizes—Basic Trading Areas (“BTAs”) and Economic Areas (“EAs”), respectively.¹⁰ Licenses with such reasonably-sized, long-standing geographic service areas offer a proven vehicle to spark investment and create administrative and operational efficiencies. County-level licenses, by contrast, would impose substantial burdens on licensees, and if combined with performance

⁹ Notice, ¶ 111.

¹⁰ As discussed above, the Commission should apply the same licensing rules to 37 GHz spectrum that it applies to 39 GHz.

requirements could deter operators from acquiring licenses, and deploying operations, in less densely populated counties.¹¹

County-sized licenses increase administrative costs both for the Commission, which would need to change the licenses it has already issued for 28 GHz and 39 GHz, and for operators. Small market sizes could also stifle secondary markets by complicating transactions that would otherwise increase efficiency and support the public good, and for some use cases they could complicate and delay deployment by creating border RF issues that are difficult to manage. It would not be efficient for operators with serious business plans to deploy infrastructure on a large-scale—i.e., the operators who are likely to drive the initial ecosystem for mmW technology—to aggregate sufficient spectrum from more than 3,000 counties nationwide. The likely result would be a Swiss cheese of service areas.

The Notice suggests that county-level licenses might support investment by providing licensees with flexibility to target their deployments in counties where they are capable of meeting build-out requirements.¹² But while build-out rules work at an EA and BTA level, if used for county-level licenses, they could deter operators from acquiring licenses for less densely populated counties, and from deploying in them. Consider a relatively rural county that is part of an EA or BTA that on an *overall* basis is attractive to licensees—such as Pike County, Pennsylvania, which is part of the New York EA. Meeting a reasonable build-out requirement may be viable on an EA-basis, but not on a county basis. The build-out requirement would thus deter an operator from purchasing the *county*-level license, but not a larger license that includes

¹¹ If the Commission nevertheless determines that smaller license sizes further a public policy goal, it could assign licenses of several different sizes—some small and some traditional-sized. In the past the Commission has frequently pursued multiple policy goals by assigning licenses with different sizes. It could similarly assign licenses with different bandwidths to the extent the record indicates that different use cases are likely to require different bandwidths.

¹² Notice, ¶ 111.

the county. If the operator purchases a license for an EA that includes the rural county, it will likely invest in the county, including in the more densely populated areas and along interstate highways (such as I-80 and I-84 in Pike County, which are part of the commuter circuitry for New York City). Reasonably-sized license areas would thus facilitate investment in such rural counties, whereas county-level licensing could create investment disincentives.

The Notice also suggests that the county-level licensing proposal may represent a reasonable middle ground because the nation's 3,143 counties are much smaller than traditional service areas but much larger than the census tracts planned for the 3.5 GHz proceeding (which number more than 74,000 nationwide).¹³ But the 3.5 GHz licensing framework is not a tested and proven comparison point; it is an experiment in the planning stage necessitated in part because of the need to coordinate with government radars. The Commission has not even begun to address the administrative complexities associated with auctioning, and then keeping track of, such a large number of licenses.¹⁴

If the Commission goes forward with assigning county-level licenses, it would be critical to permit package bidding, so operators can efficiently assemble nationwide or region-wide footprints. In addition to the administrative inefficiencies created by small license sizes, small licenses increase the "exposure problem," i.e., the risk that an operator may fail to acquire all licenses in a business plan. That can inhibit participation in the auction because, for some bidders, they must acquire all desired licenses to support the amount of a bid for multiple licenses. The Commission has acknowledged that package bidding can reduce the exposure

¹³ Notice, ¶ 110.

¹⁴ What the Commission *has* done in the 3.5 GHz context, however, is abandon its traditional performance requirements framework. *See Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Report & Order and Second Further Notice of Rulemaking, FCC 15-47, 30 FCC Rcd 3959, ¶ 113 (2015). As discussed above, establishing county-level licenses here would similarly call into question the viability of the performance requirements framework.

problem by facilitating the entry of applicants whose business plans involve achieving economies of scale over large contiguous geographic areas.¹⁵

D. Dedicating a Substantial Amount of mmW Spectrum to Unlicensed Uses Will Support Innovation.

Verizon supports dedicating a substantial portion of the spectrum repurposed in this proceeding to unlicensed use under Part 15 of the Commission’s rules, which constitutes a known regulatory regime proven to support innovation. The Commission proposes to make all of the 14 GHz of spectrum between 57 GHz and 71 GHz unlicensed but it should consider dedicating a portion of that massive swath of spectrum to other paradigms. The amount of licensed spectrum in these upper frequencies is low, whereas there are substantial blocks (e.g., 56-64 GHz, 92-95 GHz) of upper-frequency spectrum already dedicated to unlicensed use. Assigning some of the 64-71 GHz to licensed uses may help achieve a better balance. And if the Commission perceives, despite the evidence to the contrary,¹⁶ that there is a need to assign spectrum to property owners on a license-by-rule basis, doing so with spectrum from the upper portion of the 64-71 GHz band would cause less harm than the proposal to create a “hybrid” licensing framework at 37 GHz.

II. THE RULES SHOULD PROVIDE FLEXIBILITY FOR COMPANIES TO TRANSFER, SHARE, AND ACQUIRE SPECTRUM.

The Commission should implement its proposals to permit licensees in the Upper Microwave Flexible Use Service to transfer their licenses on the secondary market, and to permit partitioning and disaggregation.¹⁷ A dynamic, efficient secondary market for mmW licenses will

¹⁵ See *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, et al., Second Report and Order, FCC 07-132, 22 FCC Rcd 15289, ¶ 290 (2007).

¹⁶ See Section II-B, *infra*.

¹⁷ Notice, ¶ 232-33.

spur innovation and investment by ensuring that operators can obtain licenses when needed, and that they can divest them if not needed. Companies would be more likely to acquire licenses and to experiment with new innovative ways to use spectrum if the Commission eliminates uncertainty about their ability to later divest their spectrum (or a portion of it) if their business plans change. That is particularly so for these nascent mmW bands since it is difficult to predict what will emerge in them. The same is true about the Commission's proposal to apply its wireless spectrum leasing rules to mmW spectrum: it is good public policy because it promotes efficient spectrum sharing.

On the flip side, operators need flexibility to efficiently assemble substantial amounts of contiguous mmW spectrum. A strong theme runs through virtually all current visions for the next generation of wireless technology: operators will seek to create high data rates and low latencies. That technology will likely need much larger bandwidths than are typical in the context of the "traditional" wireless bands. So to a large extent the attractiveness of the mmW bands stems from the substantial amounts of spectrum that will be available at these frequencies.

The Commission is thus right to be skeptical about including mmW spectrum in the spectrum screen it applies when reviewing secondary market transactions.¹⁸ While this spectrum holds much promise, the Commission is correct that there is no basis today to conclude that it is suitable for providing mobile service "in the same manner as other spectrum bands that currently are included in the Commission's spectrum screen."¹⁹ Many technologies and deployment paradigms for mmW are likely to be substantially different from the traditional mobile telephony, so including mmW spectrum along with "traditional" mobile spectrum could create a screen comprised of apples and oranges. So the Commission should wait until mmW

¹⁸ Notice, ¶ 192.

¹⁹ *Id.*

technologies and services develop before deciding whether and how to include mmW spectrum in the screen.

And the Commission should not artificially limit bandwidth, performance, and innovation through arbitrary pre-deployment aggregation limits.²⁰ It is far too early in the innovation cycle to know how much bandwidth an operator will require to provide the type of services envisioned in a 5G environment. The objective of this proceeding is to promote future innovative uses of spectrum, and it is impossible to predict *a priori* how much spectrum different technologies will require. Not only would a band-specific spectrum aggregation cap not address any valid public policy objective, but it would risk causing substantial consumer harm by precluding wideband operations that may be necessary for maximizing the utility of this spectrum.

If any competition issues arise in the future, the Commission and the antitrust authorities can address them as the industry develops; doing so now would be premature. Any theoretical risk that an operator might acquire market power by aggregating “too much” mmW spectrum, however, is remote given both the incipency of 5G technology and the sheer volume of mmW spectrum that can be made available for mobile and other terrestrial uses. The four bands identified as priorities constitute an important initial swath of mmW spectrum, but the Commission has made clear it intends to work diligently to identify and repurpose additional mmW bands.

²⁰ *Id.*, ¶ 191

III. THE TECHNICAL AND SERVICE RULES SHOULD SUPPORT ROBUST FLEXIBLE DEPLOYMENTS.

A. The Technical Rules Must Accommodate mmW Technologies.

1. Power Limits Should Be Increased and Should Support a Diversity of Potential Use Cases.

To achieve its goal of not prescribing particular use cases for future mmW technologies,²¹ the Commission should not simply import technical rules from other bands. For example, applying the same maximum transmission power limit used for base stations in PCS and AWS spectrum to mmW bands would restrict power levels too much because power would likely be spread over much wider bandwidths, resulting in much lower EIRP-per-MHz levels and correspondingly lower ranges. And the Notice considers neither the increased propagation losses nor beamsteering and antenna gain effects for future mmW technologies in proposing the power limit. These high frequencies and very short RF wavelengths mean that companies can utilize high gain antennas and planar antenna arrays in proportionally smaller volumes. “Conventional” base station antenna gains for other mobile uses typically have gains in the 9 – 25 dBi range because they are limited by practical antenna size. In mmW bands, however, gains from 20 – 45 dBi can be achieved depending upon beamwidths desired. A base station power limit of between 68 and 75 dBm EIRP is thus more appropriate for these higher frequency bands than the 62 dBm EIRP maximum proposed based on the properties of other spectrum.

While the proposed mobile base station power limits of 43 dBm EIRP are reasonable for mobile base station use, the Commission must ensure that the rule does not preclude other use cases that fall in between the classic mobile use case and the high-power point-to-point and point-to-multipoint use cases established for Part 101 operations. The rule should contemplate

²¹ Notice, ¶ 266.

other fixed mmW applications using fixed-beam or adaptive-use narrow-beam technology on a customer premises basis or for other narrow beam transmissions between localized devices. The Commission should thus consider adding a use case for stationary Customer Premises Equipment applications requiring higher power than the 43 dBm EIRP authorized for traditional mobile applications, but lower than the 75 dBi EIRP available for Part 101 point-to-point applications. For such operations, the Commission should not prescribe different power levels for uplink and downlink because the use case would not involve traditional base stations and mobile devices.

2. Licenses Should Be Unpaired To Support Time Division Duplexing.

The Commission correctly concludes that the Time Division Duplex (“TDD”) system offers flexibility that will help facilitate deploying technologies in mmW spectrum.²² TDD enables smart-antenna adaptive-beam technologies for highly directive antenna gain and provides users with the greatest amount of flexibility in terms of managing the balance of uplink and downlink traffic ratios. While the Commission should not require TDD, it should support it by establishing unpaired license blocks in the repurposed spectrum. TDD is much more useful at higher frequencies where adaptive beam antennas are deployed because the device’s received signal’s phase weightings can be used to properly steer the beam.

3. An Interoperability Mandate on Devices Using mmW Spectrum Would Harm Consumers by Chilling Innovation and Increasing Costs.

The Commission should not implement an interoperability requirement across “all air interfaces” used by equipment in each mmW band.²³ That would chill innovation and unnecessarily increase device costs. The Commission should instead return to its successful historical policy of relying on industry-driven processes to achieve interoperability.

²² Notice, ¶ 268.

²³ Notice, ¶ 296.

No public policy justification exists to require operators and manufacturers using mmW spectrum for one purpose (e.g., driverless cars) to modify their devices so that they can “interoperate” with devices using very different technologies for very different use cases (e.g., data-intensive video). To the contrary, an interoperability mandate would deny consumers the potential benefits of technologies that become too costly to deploy or cause them to pay more for devices.

The Commission can instead rely on industry-driven processes to efficiently achieve interoperability as new technologies emerge and become widely deployed. Prior to the emergence of interoperability challenges in the 700 MHz band, the Commission recognized that the right policy is to permit industry participants to pursue interoperability through collaborative processes that enable, rather than displace, innovation and investment. For example, in the PCS auction, the Commission rejected calls for an interoperability mandate and instead chose to “allow PCS to develop in the most rapid, economically feasible and diverse manner.”²⁴ That historical policy went hand-in-hand with the Commission’s flexible use policy and promoted the evolution of a strong, vibrant wireless ecosystem. It should be replicated here.

B. Reasonable Performance Requirements To Renew Licenses Ensure that Spectrum Is Put To Use.

As it has done in most spectrum bands, the Commission should require licensees to demonstrate that they are providing “substantial service” to qualify for license renewals. That longstanding requirement has proven to be an important tool to discourage speculation and spectrum warehousing, and to ensure that licensees use their spectrum productively.

²⁴ *Amendment of the Commission's Rules to Establish New Personal Communications Services*, GEN Docket No. 90-314, Memorandum Opinion and Order, FCC 94-144, 9 FCC Rcd 4957, ¶ 162 (1994).

The Commission should apply the “substantial service” requirement flexibly, given that future technologies and deployment paradigms may be different than past ones. That is particularly important in the context of mmW technologies because no one can know what use cases will emerge, let alone how to measure the scope of operators’ deployments of new technologies in these bands. In the context of promoting new services in new bands, the Commission has correctly explained that factors to be taken in account when applying the “substantial service” standard include “whether the licensee is offering a specialized or technologically sophisticated service that does not require a high level of coverage to be of benefit to customers, and whether the licensee's operations serve niche markets or focus on serving populations outside of areas served by other licensees.”²⁵

The Commission should keep using “safe harbors” that constitute non-exhaustive examples of what will be deemed substantial service. The unique characteristics of mmW spectrum, of course, will require new approaches to safe harbors measuring the scope of operators’ deployments. For example, analyzing whether a licensee has met a traditional benchmark based on a service area’s population would have to account for use of mmW spectrum at places such as stadiums or industrial parks where people do not live. So a safe harbor should permit licensees to count deployments where customers transit (such as along a highway for smart vehicle application) or where they visit (such as in shopping malls, stadiums, or dense business districts). Other potential safe harbors to address the unique uses of mmW spectrum could include usage-based benchmarks (e.g., the amount of throughput that a network is capable of handling), or a showing by an operator that it has invested a sum of money (perhaps

²⁵ See *Rulemaking To Amend Parts 1, 2, 21, and 25 Of the Commission’s Rules to Redesignate The 27.5-29.5 GHz Frequency Band, To Reallocate the 29.5-30.0 GHz Frequency Band, To Establish Rules and Policies for Local Multipoint Distribution Service And For Fixed Satellite Services*, CC Docket No. 92-297, Second Report and Order, Order on Reconsideration, and Fifth Notice of Proposed Rulemaking, 12 FCC Rcd 12545, ¶ 270 (1997).

a specific percentage of the value of the license) to develop or deploy technologies specific to the frequencies covered by the license.

1. These Bands Are Too Important To Experiment with a “Use it or Share it” Obligation.

The Notice also seeks comment on whether an additional mechanism to promote productive use of spectrum should be to require licensees to share the “unused” portions of the service territories with opportunistic users after five years.²⁶ That approach should be explored in the right contexts but the stakes are too high here for such an experiment—especially given that the Commission is already proposing to employ a traditional performance requirement to achieve the goal of ensuring that operators use spectrum productively.

As Verizon explained in its initial comments, the Commission should explore “use it or lose it” rules as a potential substitute for traditional build-out requirements,²⁷ but not as a cumulative penalty in addition to build-out rules. In *this* context, where the Commission is establishing buildout requirements to ensure licensees put their spectrum to use, also applying a “use-it-or-share it” standard would create two penalties—one for not meeting the performance requirement objective after the initial term and another for having left “unused” (an undefined and vague term) spectrum after 5 years. First-deployers of brand new technologies in brand new bands will need operational flexibility, not the overhanging risk that their investments may become impaired by third parties using the spectrum.

The Commission is experimenting with the “use-it-or-share-it” framework in the 600 MHz band and 3.5 GHz bands, but today it constitutes a regulatory experiment that, until tested and proven to work, would introduce risk that licensees may not be able to use their spectrum

²⁶ Notice, ¶¶ 215-16.

²⁷ Verizon Initial Comments (filed Jan. 15, 2015) at 4.

when and where they need it. For example, once opportunistic operations are invited into a license's service territory, the licensee faces the risk that it may not be able to clear those opportunistic users when it expands its service (or when it brings online new channels to increase capacity). The licensee also faces the risk that the Commission may authorize opportunistic uses of its spectrum that undermine its ability to meet quality of service requirements. These risks not only reduce the value of the license, but can deter investment by creating uncertainties.

2. The Commission Should Not Experiment with an “Option” Framework To Deter Squatting in These Bands.

The Notice states that a potential alternative to traditional performance requirements might be an option framework under which licensees would be required to make annual payments in order to retain their spectrum.²⁸ The idea would be that a licensee's willingness to make those payments may be a proxy for its seriousness about putting its spectrum to productive use. That hypothesis may be worth testing in other contexts, but not for mmW bands critical to deploying 5G.

There is no evidence that the proposal could ensure spectrum is used as productively as under the traditional, proven performance requirements approach, coupled with standard auction procedures under which companies are required to pay upfront for their spectrum in exchange for reasonably long license terms with renewal expectancies. Operators interested in investing in spectrum have built sophisticated models that project economic returns from an up-front investment, and changing the alignment of these models to care for a periodic liability into perpetuity might reduce a company's desire to invest in new, risky spectrum assets. These

²⁸ Notice, ¶ 255.

operators and their investors are also familiar and comfortable with the accounting and tax rules associated with the existing licensing model, which the option framework would upend.

And while the proposal may deter *communications providers* from acquiring these licenses at auction, it might encourage *other* types of bidders to engage in harmful speculation. By imposing an annual fee on license holders, the proposal would suppress the price of the original license, which speculation-oriented investors may view as an opportunity to acquire licenses even if they do not have business plans to actually put the spectrum to use. Such investors may be willing to bet that they can re-sell the spectrum before they incur the need to pay substantial royalties on it. Those speculators may even view the proposal as a form of installment financing—which, as the Commission has seen from past experience, can promote harmful speculation by firms without the business plans to both pay for their spectrum and pay to deploy it. For example, the Commission permitted participants in the PCS auction to pay only a portion of the price of the license at auction and a portion through installment financing. As a consequence, numerous parties overbid to win licenses, and some subsequently went bankrupt. The Commission should not repeat that ill-fated experiment here.

IV. SUCCESSFUL COEXISTENCE WITH SATELLITE OPERATIONS IN THE mmW BANDS REQUIRES AVOIDING UNNECESSARY COMPLICATIONS.

A. The Simple, Innovative Proposal To Allow Earth Station Operators To Upgrade Their Interference Protections Has Merit.

Consistent with the well-tested flexible-use principle that has guided Commission spectrum policy for decades, the Commission appropriately concludes that earth station operators should be permitted to bid on or buy terrestrial licenses to remove the risk that interference to or

from mobile licensees could impair their secondary satellite operations.²⁹ That proposed market-based approach would be an efficient, innovative way to authorize earth station operators to achieve heightened quality of service assurances, if and where they need them and to the extent that the economic value of their operations necessitates such assurances.

As a practical matter, an earth station operator who purchases a terrestrial license to avoid interference problems with terrestrial operators would likely only need to use a small portion of the license's service area. The earth station owner would thus be incented to partition its license and transfer unneeded portions to, or to enter into a leasing arrangement with, a terrestrial operator. Or a satellite operator could enter into an arrangement with a terrestrial operator to bid jointly at auction on the relevant license under an agreement specifying the appropriate post-auction leasing or partitioning arrangement. Either way, permitting satellite operators to acquire terrestrial licenses under flexible leasing and secondary market rules would constitute an efficient vehicle to promote 5G deployment and successful coexistence between satellite and terrestrial operations.

But the Commission should not award free terrestrial licenses to earth station operators through a "closed window" administrative process prior to auction.³⁰ History shows that subjective administrative judgments about who should be awarded free spectrum inevitably fail to assign the spectrum to its highest and best use because that process is inherently less efficient than objective market-based determinations about which potential users value it most and are most likely to deploy it productively. Assuming the Commission is correct that a particular earth station is unlikely to negatively impact future terrestrial uses because terrestrial operators are

²⁹ Notice, ¶ 129. While the Notice characterizes this market proposal as permitting satellite operators to "acquire co-primary status" (*id.*), the more apt characterization may be that the satellite operator should be permitted to remove the risks associated with its secondary status by using a terrestrial license to exclude terrestrial operations.

³⁰ *See, e.g.*, Notice, ¶ 140-41, 145.

unlikely to deploy near it,³¹ the market-based approach would efficiently provide the same protection for the earth station owner because it can construct its station knowing that the terrestrial license's price at auction will be low.

B. Satellite Terminals, or Other New or Expanded Satellite Services, Should Not Operate in the Repurposed Bands.

The Commission asks if it should start authorizing a variety of new satellite operations, including fixed satellite terminals, movable satellite operations, and FSS user receivers, to operate opportunistically in the 28 GHz and 37.5-40 GHz bands.³² It should not. Addressing coexistence issues for the FSS earth stations already authorized to operate in these bands is challenging enough; the Commission should not magnify that challenge by authorizing satellite providers to start deploying new types of services. Doing so would require mobile licensees to share their spectrum with opportunistic users, reducing the attractiveness of their licenses for next generation use cases and their value at auction.

None of the sharing mechanisms discussed in the Notice could be implemented in the near term and in a way that ensures mobile licensees that they can deploy their spectrum promptly and with acceptable quality of service assurances. First, citing the planned use of a SAS to manage interference among various tiers of users in the 3.5 GHz band, the Notice asks whether a similar SAS might be an option for managing sharing between 28 GHz licensees and opportunistic users.³³ Attempting to develop a SAS in this proceeding would create substantial technical, regulatory, and administrative changes that would delay repurposing this attractive spectrum for mobile uses. It also would reduce the attractiveness of the spectrum for licensees

³¹ Notice, ¶145.

³² Notice, ¶¶ 147-65.

³³ Notice, ¶¶ 150-52.

by creating extensive uncertainty about their ability to use their spectrum when and where they need it. The SAS concept is the subject of extensive collaborative work efforts among various stakeholders in the context of the 3.5 GHz proceeding, but it is not a proven regulatory tool that can be readily imported into mmW bands. Three years after the 3.5 GHz proceeding was initiated, not only is there no commercial SAS in operations, but there are ongoing discussions among stakeholders about how the SAS will work, what information will be inputted into it, and what security protocols will be in place to ensure that lower-tier users adhere to the SAS's instructions with sufficient dispatch.

The Commission is developing a complex SAS in the 3.5 GHz proceeding to accomplish the proceeding's overarching purpose of facilitating sharing between government incumbents and private operators. In that context—where a SAS needs to be developed to repurpose the spectrum in the first place—it makes sense to also use the SAS to manage opportunistic users' access to licensees' spectrum. But developing a SAS for the sole purpose of granting opportunistic access to licensed spectrum would overcomplicate licensees' use of that spectrum and delay getting this attractive spectrum into the hands of companies that will deploy it.

The Commission also should not experiment in this proceeding with requiring terrestrial operators to transmit “beacons” so future secondary satellite operators can avoid causing interference to their operations³⁴ or imposing antenna-pointing obligations or other constraints on their operations.³⁵ There is no basis to assume the Commission could develop and impose workable coexistence rules, in a reasonable time frame, that could work well for the full range of

³⁴ Notice, ¶¶ 154-55.

³⁵ Notice, ¶ 156. Another technique mentioned is active signal cancelling. *Id.*, ¶¶ 157-58. But interference cancellation only applies to self-induced interference from duplexing one's own transmitter with a highly sensitive receiver at the same location. Active cancellation (as opposed to beam nulling) cannot be accomplished at a location remote from the interfering transmitter because the exact copy of the signal with the appropriate phase is not known at the receiver location, and cannot be easily obtained nor feasibly conveyed to the remote receiver location.

possible use cases and that avoids precluding future use cases. If satellite operators identify a need to deploy future operations, and if they develop reliable sharing tools that provide sufficient certainty for licensees about their ability to use their spectrum when and where they need it, they can implement such sharing arrangements contractually with terms tailored to all parties' particular needs for the spectrum.

CONCLUSION

As discussed above, the Commission should seize the opportunity presented in this proceeding to usher in a 5G era by promptly repurposing the four priority bands using licensed and unlicensed paradigms that are proven to support innovation and investment.

Respectfully submitted,

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