

**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	)	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 the 37.0- 38.0 GHz and 40.0-40.5 GHz for Government Operations	)	IB Docket No. 97-95

**COMMENTS OF AT&T**

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**COMMENTS OF AT&T**

**I. INTRODUCTION & SUMMARY**

AT&T Services Inc. (“AT&T”), on behalf of the subsidiaries and affiliates of AT&T Inc. (collectively, “AT&T”), hereby submits the following comments in response to the Federal Communications Commission’s (“Commission”) Notice of Proposed Rulemaking (“*NPRM*”) in

the above captioned proceeding.<sup>1</sup> The *NPRM* proposes a number of service rules that would authorize mobile operations in certain spectrum bands above 24 GHz, sometimes referred to as millimeter wave (“mmW”) bands. Building upon a *Notice of Inquiry* (“*NOI*”) released in 2014, the *NPRM*’s proposed regulatory framework arises in the context of the Commission’s efforts to facilitate fifth generation (“5G”) wireless services.<sup>2</sup> AT&T commends the Commission for releasing the *NPRM* and taking an important step toward fostering a thriving ecosystem for the next generation of wireless services.

5G networks and services will revolutionize the mobile experience as consumers know it today. With high-capacity, low-latency, ultra-reliable networks, 5G will provide a more consistent user experience capable of supporting a wide-range of innovative services and technologies. 5G will enable the Internet of Things (“IoT”) to flourish, introducing an unprecedented level of connectivity into everyday life. Smart cities, telemedicine, connected cars, smart grids, and beyond will all be possible. Yet the transformation from 4G to 5G wireless services is about more than just lightning-speed data rates and groundbreaking applications; it is about cementing the United States as the unquestioned leader of mobile technology and propelling the country toward a new era of technological advancement.

To achieve this vision, mobile service providers will need more spectrum – and lots of it. 5G will consist of a network of networks that will include spectrum that has been or will be allocated for mobile broadband use. As 5G systems develop over time, it should be emphasized that low frequency spectrum (below 6GHz), in general, is essential to allow the smooth

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<sup>1</sup> *In the Matter of Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Notice of Proposed Rulemaking, FCC 15-138 (Oct. 23, 2015) (“*NPRM*”).

<sup>2</sup> *In the Matter of Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.*, Notice of Inquiry, FCC 14-154 (Oct. 14, 2014) (“*NOI*”).

migration from LTE to 5G. Therefore, a key priority must be to make more spectrum in those low bands available. As a result, the mobile broadband industry can evolve 4G systems and phase into 5G technologies and new LTE features can be implemented in mobile bands below 6 GHz in a timely manner. While the mmW bands offer an important opportunity to help complement 5G services by increasing capacity, additional spectrum below 6 GHz will also be critical. AT&T applauds the Commission for taking the preliminary step of unleashing some of the mmW bands for mobile uses, but the Commission should not lose sight of the paramount need to free additional spectrum below 6 GHz to support 5G.

AT&T and other innovators have already begun working toward making the promise of 5G a reality. Although standards-setting processes are still in an early stage, several core principles have emerged that are driving next generation development forward and shaping expectations about what 5G will look like and how it will operate. Specifically, the 5G environment will need to support integrated network design; promote innovative technologies; facilitate new services; contemplate a variety of use cases covering a wide-range of geography; provide large channel bandwidth; and, prioritize international harmonization. A carefully crafted regulatory framework that does these things will foster investment in next generation technologies and services, ensuring a successful 5G ecosystem in the near future.

To this end, AT&T believes that the Commission should be guided by the following 5G principles as it develops service rules for the 28 GHz, 39 GHz, 37 GHz, and 64-71 GHz bands. In the 28 GHz band, the Commission should authorize mobile operations and address fixed satellite service (“FSS”) concerns by granting FSS licensees throughout the band co-primary status. Likewise, AT&T agrees that mobile operations should be authorized in the 39 GHz band. While coordination issues may arise with federal incumbents in this band, such issues should be

resolved via coordination zones rather than novel spectrum sharing techniques. The 37 GHz band should also be leveraged to support 5G services. To put this spectrum to its highest and best use, however, the Commission should license it under the same licensing framework as the 39 GHz band. Combining the 37 GHz and 39 GHz bands will be the most useful for 5G systems, which will require large contiguous blocks of spectrum. Finally, consistent with global allocations in the 66-76 GHz band, the Commission should grant exclusive-use licenses in at least a portion of the 64-71 GHz band segment. Such an approach will help ensure that the spectrum can be put to its most efficient use supporting 5G systems.

More broadly, the foundational 5G principles militate in favor of a few general licensing and performance concepts. First, a county-based geographic licensing approach may raise troublesome coordination challenges for several 5G use cases. Second, with much work left to be done to bring 5G to fruition, long license terms coupled with clear renewal terms are appropriate. Providing licensees with concrete license terms and renewals will be critical to incentivizing investment in 5G deployments. Third, the Commission should not adopt a “use-it-or-share-it” obligation at this time. Deploying 5G systems will be difficult; adding an additional layer of complexity with untested sharing mechanisms may make the endeavor even more time-consuming and costly. Finally, 5G will bring about a seismic shift in how we think about wireless deployments and services. To keep pace with this transformation, the Commission may need to take a fresh look at performance requirement models and develop a new framework for evaluating licensee performance in these mmW bands.

With 5G will come an exciting array of new services and technologies that may change the way people (and machines) connect around the globe. The possibilities are endless. The United States led the global 4G revolution and is poised to lead the 5G journey into new

frontiers. Developing a successful regulatory regime, however, is an important first step to securing our leadership role. AT&T looks forward to collaborating with the Commission and interested stakeholders to develop a regulatory framework that ensures 5G networks and services reach their full potential. By following such principles as it develops service rules for the mmW bands, the Commission will help facilitate the rapid deployment of next generation services for consumers.

## **II. SEVERAL FOUNDATIONAL PRINCIPLES ARE GUIDING THE MOVEMENT TOWARD 5G SYSTEMS**

As the Commission has recognized, 5G networks and services will revolutionize the mobile experience.<sup>3</sup> 5G will be a new communications ecosystem from end-to-end, offering exceptional data rates and unprecedented levels of mobility.<sup>4</sup> A thriving 5G environment will support groundbreaking applications, a fully-realized Internet of Things (“IoT”), and enhanced mobile broadband.<sup>5</sup> To achieve these advancements, 5G systems will be utterly unlike their predecessors, harnessing both revolutionary and evolutionary technologies to transform existing notions of connectivity. Ultra-high data rates and reliability coupled with ultra-low latency and

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<sup>3</sup> See *NPRM* ¶ 8.

<sup>4</sup> In particular, the new 5G ecosystem will encompass air interfaces, devices, transport, antennas, packet core, and more. See Comments of 4G Americas, GN Docket No. 14-177, at 7 (Jan. 15, 2015) (“4G Americas Comments”).

<sup>5</sup> See, e.g., Comments of Nokia (d/b/a Nokia Solutions and Networks US LLC), GN Docket No. 14-177, at 2 (Feb. 17, 2015) (“Nokia Comments”) (“5G will support applications and industries of the future such as innovative health care services that provide real time monitoring capabilities, self-driving cars, and deliver the next generation of industry automation.”); Comments of Qualcomm Inc., GN Docket No. 14-177, at 1 (Jan. 15, 2015) (“Qualcomm Comments”) (envisioning that 5G will “deliver unparalleled forms of connectivity, not just in terms of capacity, data rates, and latency, but also in terms of the mode of connectivity (*i.e.*, device to device, mesh, etc.), and the support of new device types, including drones, robots, and other industrial machines”).

power will characterize 5G systems, integrating mobile services into nearly every aspect of daily life.

As industry moves forward with developing 5G systems, several key principles have emerged that will help ensure the success of next generation networks and services.

Understanding these principles will be essential for setting effective 5G spectrum policies.

Informed by the technical requirements needed to support 5G systems, these core tenets are designed to elevate the mobile experience to new heights of connectivity. Adopting a 5G regulatory framework consistent with the principles outlined below will ensure that 5G quickly reaches its full potential, transforming everyday wireless capabilities.

*First*, 5G spectrum policies will need to support integrated network design. The wireless networks used to support 5G services will be fundamentally different from the models used to provide mobile broadband today. 5G will embody wholly new network designs to create an unprecedented ecosystem for mobile communications.<sup>6</sup>

Unlike its predecessors, 5G will not consist of a single Radio Access Technology (RAT). Rather, a combination of existing RATs and new RATs optimized for specific deployments and use cases will work together to support 5G services.<sup>7</sup> The next generation of networks will use higher frequencies, more bandwidth, and higher density cell deployments.<sup>8</sup> As AT&T has advised the Commission, radically new system architecture and innovative concepts such as

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<sup>6</sup> See Comments of Samsung Electronics America, Inc. and Samsung Research America, GN Docket No. 14-177, at 34 (Jan. 15, 2015) (“Samsung Comments”) (“5G networks must evolve toward a more distributed and flat architecture with elements of both the service-provider and end-user models.”).

<sup>7</sup> Nokia Comments, Attachment at 4.

<sup>8</sup> See Qualcomm Comments at 13 (forecasting that most mobile deployments in the bands above 24 GHz will be comprised of densified collections of small cells).

separation of control and data planes will be deployed to achieve the ultra-dense network 5G will need to thrive.<sup>9</sup> Simultaneous connections to multiple technologies and additional infrastructure will be required.<sup>10</sup> A mixture of high-band, mid-band, and low-band spectrum may be used in concert to seamlessly support 5G services.<sup>11</sup> To bring these different network elements and designs together, spectrum policies will need to permit efficient and manageable coordination between network deployments.

*Second*, a successful 5G framework must promote new and innovative technologies. Achieving the revolutionary network architecture 5G demands will require technological advancements. As the Commission has observed, the emergence of advanced technologies is needed to pave the way for a “new and radically more capable generation of wireless mobile service that can capitalize on the use of [millimeter wave spectrum].”<sup>12</sup> To this end, innovative high-order multiple input, multiple output (“MIMO”), multi-band carrier aggregation, and direct beam forming technologies will all play a role in future 5G networks.<sup>13</sup> Massive MIMO antenna schemes and beam-forming in particular may help overcome “some of the challenging propagation characteristics of mmW bands,” and leverage the spectrum bands above 24 GHz for

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<sup>9</sup> Letter from Stacey Black, Assistant Vice President, Federal Regulatory, AT&T Services, Inc., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, Attachment at 3 (Jan. 6, 2016) (“*AT&T Ex Parte*”) (discussing network densification requirements).

<sup>10</sup> *Id.*, Attachment at 2.

<sup>11</sup> Qualcomm Comments at 3.

<sup>12</sup> *NOI* ¶ 13.

<sup>13</sup> *See, e.g.*, 4G Americas, *Recommendations On 5G Requirements And Solutions* (Oct. 2014), at 5.1, available at [http://www.4gamericas.org/files/2714/1471/2645/4G\\_Americas\\_Recommendations\\_on\\_5G\\_Requirements\\_and\\_Solutions\\_10\\_14\\_2014-FINALx.pdf](http://www.4gamericas.org/files/2714/1471/2645/4G_Americas_Recommendations_on_5G_Requirements_and_Solutions_10_14_2014-FINALx.pdf) (“4G Americas White Paper”).

mobile uses.<sup>14</sup> Likewise, new self-backhauling and self-discoverable technologies are potentially game-changing coverage and capacity innovations that may be used to balance the cost and performance of connectivity in ultra-dense deployments.<sup>15</sup> Device-to-Device (“D2D”) communications may also play a role in the evolving 5G network architecture. D2D technology enables devices to communicate directly without routing data paths through network infrastructure and could thus be used to extend coverage beyond the reach of conventional networks.<sup>16</sup> Aside from these promising emergent technologies, the 5G ecosystem will likely include a number of technologies that have not yet been imagined. During 5G’s nascent stage, a regulatory framework that encourages innovative technological developments will be critical.

*Third*, the 5G environment must support a range of new services. 5G contemplates much more than faster data speeds; it will create new services across a wide range of use cases. Innovative services such as enhanced mobile broadband, massive machine, and ultra reliable communications are expected to overhaul users’ mobile experiences. With enhanced mobile broadband, for example, users will see the benefits of higher download speeds, extreme density, and improved network capacity. Meanwhile, machine to machine communications will contemplate energy optimization, reduced signaling, and massive connectivity. With these advancements, the IoT will become a reality.<sup>17</sup> 5G systems will be capable of supporting a range of machine-to-machine services, from connected cars to smart cities to telemedicine and beyond.

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<sup>14</sup> *NOI* ¶ 18.

<sup>15</sup> Self-backhaul may be used to simplify short-range cell infrastructure. With self-backhaul, no transport is needed to provide backhaul; access links and backhaul/relay links are time-frequency-antenna multiplexed through the scheduler. *See AT&T Ex Parte*, Attachment at 2, 4.

<sup>16</sup> *See 4G Americas White Paper* at 5.8.

<sup>17</sup> *See Samsung Comments* at 7-8.

To support these remarkable services and meet consumer expectations, 5G services will need to always be available, secure, and reliable.

*Fourth*, 5G will need to accommodate a variety of different use cases covering diverse geographies. As commenters have made clear, 5G deployments will initially be driven by small cell network builds.<sup>18</sup> Small cell deployments are often used to provide wireless connectivity in areas that present coverage and capacity challenges to traditional networks. With small cell technologies more likely to be deployed initially in dense urban areas, urban and rural 5G use cases may differ significantly. As a result, flexibility for a wide range of use cases is a “key design principle[]” for next generation systems.<sup>19</sup> Indeed, the Commission has recognized the importance of this principle, noting that one of its goals is to enable services “among a wide variety of users and platforms.”<sup>20</sup> As such, sound spectrum policy should account for geographic variances and establish an approach that is consistent with expected 5G use cases and services.

*Fifth*, 5G networks will require wide channel bandwidth. To support 5G’s expected performance, networks will require large contiguous channel allocations. The need for large channel bandwidth is driven by 5G’s technical requirements and the anticipated explosion in mobile traffic. ITU Recommendations indicate that there will be a greater than 10x increase in peak data rate, reaching greater than 10 Gbps.<sup>21</sup> At the same time, the ITU expects a 10x

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<sup>18</sup> See, e.g., Samsung Comments at 25-26.

<sup>19</sup> Nokia Solutions and Networks, 5G Use Cases and Requirements, at 4 (2014), available at [http://networks.nokia.com/sites/default/files/document/5g\\_requirements\\_white\\_paper.pdf](http://networks.nokia.com/sites/default/files/document/5g_requirements_white_paper.pdf)

<sup>20</sup> NPRM ¶ 2.

<sup>21</sup> ITU, *Recommendation ITU-R M.2083-0, IMT Vision – Framework and Overall Objectives of the Future Development of IMT for 2020 and Beyond*, at 14 (Sept. 2014), available at [https://www.itu.int/dms\\_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf)

increase in the average experienced user throughput, reaching 100 Mbps.<sup>22</sup> Further, demand for data applications and connected devices is expected to multiply.<sup>23</sup> Estimates project that the demand for mobile data will grow by unprecedented factors as 5G is unveiled.<sup>24</sup> Network densification gains and advances in spectral efficiency alone will not be sufficient to deliver ultra-high throughputs and accommodate projected demand increases; ultra-wide channel bandwidths of at least 200 MHz are needed.<sup>25</sup>

Large channel bandwidths are also necessary to optimize traffic management techniques and improve system performance. A single wide carrier permits centralized spectrum management, promoting system agility and optimization. Relying on carrier aggregation techniques to meet demand, by contrast, would be costly in terms of power consumption, equipment complexity, and system performance.<sup>26</sup> Devices, for example, are much more energy efficient when working with a single wideband carrier as opposed to multiple narrow bands. With these important benefits, AT&T believes that providing large contiguous channel bandwidths will be essential to 5G's advancement.

*Finally*, international harmonization will be a key component of 5G's ultimate success. The transition to 5G systems will be a global revolution, requiring international efforts to ensure

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<sup>22</sup> *Id.*

<sup>23</sup> *Id.* at 4.

<sup>24</sup> *See id.*

<sup>25</sup> *See also* Qualcomm Comments at 12 (noting that the wide bandwidths available above 24 GHz offer compelling mobile opportunities).

<sup>26</sup> *Id.* at 4 (aggregating “small chunks of disparate spectrum” may increase RF transceiver complexity).

that 5G systems flourish.<sup>27</sup> Retaining global harmonization where possible will be critical to incentivizing investment in the spectrum bands above 24 GHz and promoting 5G development.<sup>28</sup> International harmonization reduces equipment cost, promotes greater economies of scale, and makes the use of services outside of the United States more accessible. Indeed, with these benefits, the Commission has acknowledged the importance of maintaining internationally harmonized spectrum allocations and licensing frameworks where possible.<sup>29</sup> Accordingly, sound spectrum policy should reflect global allocations and licensing approaches in the spectrum bands above 24 GHz.

### **III. THE COMMISSION’S REGULATORY FRAMEWORK SHOULD BE TAILORED TO PROMOTE KEY 5G PRINCIPLES IN EACH MMW BAND**

The *NPRM* identifies several mmW spectrum bands that may be suitable for mobile operations and proposes service rules for each. As the Commission considers what regulatory treatment to accord each band, it should be guided by the principles driving 5G development forward. By anchoring its regulatory approach to the mmW bands in the 5G guideposts that AT&T has outlined, the Commission will help ensure that 5G systems rise to their full potential.

#### **A. 28 GHz Spectrum**

The 28 GHz band includes a co-primary fixed satellite service (“FSS”) Earth-to-space allocation.<sup>30</sup> However, under the Commission’s rules, this FSS allocation is currently secondary

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<sup>27</sup> See 4G Americas Comments at 6-7 (urging the Commission to consider international allocations to foster global harmonization); Nokia Comments at 2-3 (“Lack of coordination and cooperation will promote fragmentation and delay in vital standards work”).

<sup>28</sup> See Samsung Comments at 17 (“5G will require international harmonization at a level that has not been achieved with other mobile broadband spectrum bands.”).

<sup>29</sup> See *NPRM* ¶¶ 17, 21.

<sup>30</sup> *Id.* ¶ 26.

to Local Multipoint Distribution Service (“LMDS”) in the band.<sup>31</sup> Twenty stations are currently licensed for Earth-to-space transmissions on a secondary basis in this band and the Commission reports that nineteen applications to authorize operations are pending.<sup>32</sup>

AT&T agrees that the Commission should authorize mobile operations in this band.<sup>33</sup> Permitting mobile operations alongside FSS would be consistent with the Commission’s goal of enabling “sharing among a wide range of users and platforms.”<sup>34</sup> As the *NPRM* acknowledges, the 28 GHz band—the LMDS A block—offers 850 MHz of contiguous spectrum, making it particularly attractive for 5G innovation and investment.<sup>35</sup> Further, the band is already licensed on a geographic basis and could easily be divided into the wide channels needed to support 5G, *e.g.*, 200 MHz.

The *NPRM* notes that several satellite operators have opposed authorizing mobile use in the 28 GHz band, arguing that mobile operations would interfere with satellite systems’ existing uses of the band.<sup>36</sup> To address these concerns, the Commission can and should protect incumbent FSS licensees by according them co-primary status throughout the band. Mobile service providers can coordinate with FSS to eliminate interference issues where fixed earth stations are located. The number of FSS stations is finite; indeed, only a “small number of

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<sup>31</sup> *Id.*

<sup>32</sup> *Id.* ¶ 27.

<sup>33</sup> *Id.* ¶ 30.

<sup>34</sup> *Id.* ¶ 2.

<sup>35</sup> *Id.* ¶ 30.

<sup>36</sup> *Id.* ¶ 28.

gateway stations . . . are required to operate . . . a FSS system.”<sup>37</sup> Once such a gateway station is installed and is in operation, licensees providing 5G services will be able to coordinate with the FSS operator to ensure that neither operator suffers interference. Furthermore, the interference is most likely to be into mobile, not into FSS. Finally, these gateways also do not need to be located in dense urban areas—the areas where the initial 5G use cases have been developed.

At the same time, the Commission should not grant mobile satellite services (“MSS”) co-primary status in the spectrum bands above 24 GHz. While the FSS already enjoys co-primary status in many of the bands above 24 GHz, the MSS has not been afforded similar status. The Commission should maintain this status quo. Coordinating operations with the MSS, or with mobile services in the FSS, is considerably more complex and burdensome than coordinating with fixed FSS because mobile operations can span wide geographic areas.<sup>38</sup>

## **B. 39 GHz Spectrum**

The 39 GHz band includes a co-primary allocation for fixed and mobile services.<sup>39</sup> This spectrum band is licensed by Economic Area (“EA”), consisting of 14 paired blocks of 50 x 50 MHz channels.<sup>40</sup> At this time, out of 2,464 possible EA licenses, only 859 are licensed.<sup>41</sup> Unlike

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<sup>37</sup> Comments of Echostar Satellite Operating Corp., Hughes Network Systems, LLC, and Alta Wireless, Inc., GN Docket No. 14-177, at 24 (Jan. 15, 2015) (“Echostar Comments”).

<sup>38</sup> See *Wireless Telecommunications Bureau Seeks Comment On the State of Mobile Wireless Competition*, Public Notice, 28 FCC Rcd 7305, 7307-08 (2013).

<sup>39</sup> *NPRM* ¶ 36.

<sup>40</sup> *Id.* ¶ 35.

<sup>41</sup> *Id.*

the 28 GHz band, there are no current commercial satellite operations in the 39 GHz band, “but there are federal operations.”<sup>42</sup>

AT&T agrees with the Commission that the 39 GHz band is “suitable for mobile use” and should be leveraged to support 5G development and deployment.<sup>43</sup> To maximize this spectrum’s suitability for 5G purposes, the Commission should reconfigure this band to allow for wider bandwidth channels. As AT&T has explained, 200 MHz channels in particular will help optimize traffic management and system performance.<sup>44</sup>

The *NPRM* invites comment on whether “any limitations or special rules” for mobile use might be necessary to protect federal incumbents in the 39 GHz band.<sup>45</sup> AT&T believes that the Commission should not attempt to resolve federal coordination issues through untested sharing systems. 5G deployment will be challenging enough without the added difficulties inherent in implementing a novel sharing mechanism. This additional layer of complexity may stymie innovation as resources are diverted to deploy sharing systems. Worse, these burdensome efforts may be futile because sharing systems have not yet been shown to efficiently eliminate interference problems.<sup>46</sup>

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<sup>42</sup> *Id.* ¶ 44.

<sup>43</sup> *Id.* ¶ 42.

<sup>44</sup> *See* Part II, *supra*.

<sup>45</sup> *Id.* ¶ 46.

<sup>46</sup> *See, e.g.*, Comments of CTIA – The Wireless Association, GN Docket No. 12-354, at 13 (Jul. 14, 2015) (“CTIA 3.5 GHz Comments”) (explaining that the Spectrum Access System, a proposed spectrum sharing mechanism, presents “tremendous near-term uncertainty,” reflecting “new architectural concepts, protocols, interfaces, stringent security, and policy-enforcement methods”).

Rather than deploying a complex spectrum sharing system in areas with federal incumbents, the Commission should adopt coordination zones for the protection of incumbent users. Within a coordination zone, licensees would be permitted to provide service to the extent they have successfully coordinated their operations with a federal incumbent. Importantly, coordination zones can balance the twin goals of ensuring that spectrum is used efficiently and preventing harmful interference to incumbents.

### C. 37 GHz Spectrum

Although there is a co-primary allocation for terrestrial mobile service in the 37 GHz band, the Commission has not yet adopted rules authorizing service.<sup>47</sup> As the Commission notes, there are currently no commercial satellite operations in this band, nor are there “concrete announced plans to use this band for satellite use.”<sup>48</sup> Like the 39 GHz band, the 37 GHz band is home to several federal incumbents.<sup>49</sup>

AT&T supports authorizing mobile operations in this band and agrees that, as with other mmW bands, the 37 GHz band “could potentially support high data-rate transmissions.”<sup>50</sup> Rather than implementing a unique licensing framework solely in the 37 GHz band, however, AT&T believes that the Commission should combine the 37 GHz and 39 GHz bands. Because the 37 GHz band is adjacent to the 39 GHz band, a large block of contiguous spectrum could be created by combining the bands under a single licensing framework. As AT&T has explained,

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<sup>47</sup> *NPRM* ¶ 47.

<sup>48</sup> *Id.* ¶ 52.

<sup>49</sup> *Id.* ¶ 48. For the same reasons articulated in Part III.B, *supra*, the Commission should resolve interference issues with federal incumbents by employing coordination zones rather than untested sharing mechanisms.

<sup>50</sup> *Id.* ¶ 51.

5G networks and services will rely in part on large contiguous blocks of spectrum characterized by wide channel bandwidth.<sup>51</sup> By adopting the same licensing regime for both the 37 GHz and 39 GHz bands, the Commission will ensure that 5G systems have access to the contiguous spectrum they need to thrive.

Licensing the 37 GHz and 39 GHz bands together will also avoid the complexities inherent in the *NPRM's* proposed hybrid licensing model. The *NPRM's* “hybrid licensing scheme” would grant property owners indoor operating rights by rule while establishing county-based geographic area licenses for outdoor use throughout the 37 GHz band.<sup>52</sup> As an initial matter, carving out specific indoor operating rights for property owners is unnecessary. To the extent that there are 5G use cases appropriate for deployment by a property owner inside their own property, the Commission’s existing secondary market and leasing policies permit private actors to negotiate an appropriate transfer of rights that protects all parties. With these flexible rules, at most, the Commission could dedicate one 200 MHz channel nationwide for property owner indoor use cases.

Moreover, AT&T is concerned that the hybrid approach would be burdensome to administer and could interfere with 5G deployments. Operating local area and wide area networks over the same frequencies poses a considerable risk of harmful interference. As such, the proposed hybrid licensing framework may undermine the development of 5G integrated network designs. It may also hinder providers’ ability to implement new technologies and services with the reliability that consumers expect.

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<sup>51</sup> See Part II, *supra*.

<sup>52</sup> *NPRM* ¶ 4.

#### **D. 64-71 GHz Spectrum**

At present, there are no authorized non-Federal operations in the 64-71 GHz band segment.<sup>53</sup> In the adjacent 57-64 GHz band segment, the Commission permits unlicensed operations pursuant to Part 15 of its rules.<sup>54</sup> The *NPRM* proposes extending unlicensed operations to include the 64-71 GHz spectrum.

AT&T is concerned that expanding unlicensed uses in the entire block of spectrum would be contrary to the important principle of promoting international harmonization. Licensing a portion of this band would be consistent with global allocations, promoting economies of scale and globally accessible services. As commenters have indicated, the 64-71 GHz band “holds promise as a home for licensed 5G services.”<sup>55</sup> Consistent with international efforts in the 66-76 GHz band, the Commission should license this spectrum for exclusive use.

#### **IV. THE COMMISSION SHOULD ADOPT A 5G LICENSING REGIME THAT IS CONSISTENT WITH 5G SYSTEM REQUIREMENTS**

##### **A. Small Geographic Licensing Units May Raise Coordination Issues For Some Key 5G Use Cases**

The *NPRM* proposes using counties as the base geographic area unit for licenses in the 28 GHz, 39 GHz, and 37 GHz bands.<sup>56</sup> As the Commission notes, counties are “significantly smaller than traditional license areas” like basic trading areas (“BTAs”). While there are currently over 3,000 counties, there are only 493 BTAs.<sup>57</sup>

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<sup>53</sup> *Id.* ¶ 54.

<sup>54</sup> *Id.*

<sup>55</sup> Samsung Comments at 45.

<sup>56</sup> *NPRM* ¶ 110.

<sup>57</sup> *Id.*

AT&T is concerned that selecting such a small geographic licensing unit may undermine some of the new services that 5G promises to offer. Many of the planned 5G use cases would benefit from large licensing tracts covering densely populated areas.<sup>58</sup> Smart grids, telemedicine, smart cities, connected cars, and the IoT will not be confined by small and arbitrary county boundaries. Rather, 5G's innovative services will permeate large geographic areas and consumers will expect a seamless and reliable user experience. The Commission's approach to geographic licensing areas should be consistent with the broad territorial reach of 5G services and use cases. If consumer demand or other market forces cannot support services throughout a larger geographic area, the Commission's existing rules would permit licensees to partition, disaggregate or lease unused spectrum.

Further, a county-based licensing approach would require extensive and burdensome interference coordination efforts as licensees would be forced to coordinate across numerous neighboring counties. Larger geographic licensing units, by contrast, would reduce interference coordination burdens by allowing operators to focus such efforts along the perimeters of larger service areas. Moreover, small geographic license areas would create synchronization complexities during time division duplexing ("TDD") implementation that spans neighboring counties. Ultimately, handling these added coordination challenges would only divert resources from investment in new services and technologies.

Aside from coordination obstacles, a county-based licensing regime comes with significant administrative burdens.<sup>59</sup> Verifying buildout, for example, is a challenging and time-

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<sup>58</sup> See Ericsson, 5G Use Cases, available at <http://www.ericsson.com/res/docs/2015/5g-use-cases.pdf> ("Ericsson 5G White Paper") (delineating a number of 5G use cases that may span large geographic areas).

<sup>59</sup> *NPRM* ¶ 110.

consuming endeavor when over 3,000 counties are under review.<sup>60</sup> The Commission can and should avoid these burdens by selecting a larger geographic licensing unit. Doing so will encourage investment in the spectrum bands above 24 GHz and advance the fundamental principle of promoting new services and diverse use cases in the 5G ecosystem. In any event, the 28 and 39 GHz bands are already licensed in larger geographic tracts and there is no reason to depart from that approach here.<sup>61</sup>

**B. The Commission Should Adopt License Terms Commensurate With 5G Standards Development**

As the Commission acknowledges, license terms should depend “upon the type of service authorized and the purpose for which the service was created.”<sup>62</sup> Here, potential 5G use cases and services are still being studied and developed. Indeed, 5G standards activity is just beginning in earnest with the Third Generation Partnership Project’s (“3GPP”) publication of Release 14 expected sometime early this year.<sup>63</sup> At some point between 2017 and 2019, 3GPP will likely publish Release 15, which will propose LTE enhancements to continue the evolution toward meeting 5G requirements. The ITU standardization process is moving along a similar timeline, with IMT-2020 specifications projected for release sometime in 2019 or 2020. Accordingly, standardized 5G commercial launches are predicted to begin sometime in 2020.

The Commission should adopt license terms that allow these standards processes to unfold before licensees must begin full deployments. In particular, license terms should afford

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<sup>60</sup> *See id.*

<sup>61</sup> *See id.* ¶¶ 25, 35 (noting that the 28 GHz is licensed by basic trading areas (“BTAs”), while the 39 GHz band is licensed by EA).

<sup>62</sup> *NPRM* ¶ 119.

<sup>63</sup> *See Reply Comments of AT&T, GN Docket No. 14-177, at 4 (Feb. 8, 2015) (“AT&T Reply Comments”).*

licensees the flexibility to employ “innovative technologies which may not be available immediately upon licensing.”<sup>64</sup> Depending on how the 5G standards process progresses, it may be appropriate to consider extending the initial license term beyond ten years. If, for example, the standards process is delayed, longer initial license terms may be necessary to allow licensees sufficient time to develop the spectrum and realize a return on investment.

AT&T agrees that ten year license renewal terms are appropriate and supports providing renewal expectancies if licensees “continue to provide at least the level of service required at the end of their license terms through the end of any subsequent license terms.”<sup>65</sup> Consistent with the important principle of maximizing new technologies and services throughout 5G systems, ten year renewal terms and license expectancies will promote capital investments in the mmW bands. Concrete renewal terms are important for bolstering confidence that the investment needed to deploy complex 5G technology and infrastructure will not be stranded.<sup>66</sup> Put simply, a ten year license term coupled with a renewal expectancy will provide sufficient assurance that operators will have enough time to deploy new infrastructure and realize a return on investment.

### **C. The Commission Should Not Adopt A “Use-It-Or-Share-It” Approach**

The *NPRM* proposes that portions of a license that are “unused” five years after a license grant be made available for shared use by others.<sup>67</sup> The Commission should not adopt such a rigid sharing mandate at this time. First, imposing a “use-it-or-share-it” obligation on licensees

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<sup>64</sup> *NPRM* ¶ 119.

<sup>65</sup> *Id.* ¶ 122.

<sup>66</sup> See Petition for Reconsideration of CTIA – The Wireless Association®, GN Docket No. 12-354, at 3 (Jul. 23, 2015) (describing the amount of time needed to deploy a new network and make a return on the investment).

<sup>67</sup> *NPRM* ¶ 216.

would inject unnecessary complexity into the already arduous task of deploying 5G networks. Indeed, even defining “unused spectrum” would be challenging. In some instances, managing a very high quality of service requirement may cause spectrum “use” to appear very low in certain intervals when capacity is actually being held in reserve for peak demand periods.<sup>68</sup> Crafting a definition of “unused” that accounts for all of these nuanced scenarios will be difficult, if not impossible.

Second, it would be premature to redistribute “unused” spectrum for shared uses a mere five years into a license term. As the record in this proceeding already highlights, it will still require additional research and development to leverage mmW bands to support 5G systems in the first place.<sup>69</sup> At the same time, 5G use cases and services are still being developed.<sup>70</sup> The Commission’s regulatory approach should reflect these practical realities and grant prospective licensees sufficient time to deploy complex 5G networks and services before redistributing the spectrum.

Finally, a “use-it-or-share-it” approach may jeopardize the commercial viability of the spectrum. The *NPRM* does not propose how a sharing system would be implemented or managed. Spectrum sharing concepts are still new and untested.<sup>71</sup> If such a system is not managed properly, it could cause harmful interference and undermine integrated network design deployments. Simply put, for licensees to invest in both the licenses and infrastructure needed to

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<sup>68</sup> See Comments of Verizon, GN Docket No. 12-354, at 10-11 (Jul. 14, 2014) (“Verizon 3.5 GHz Comments”) (explaining complexity of determining whether spectrum is “in use”).

<sup>69</sup> See, e.g., Qualcomm Comments at ii.

<sup>70</sup> See Nokia Solutions and Networks, 5G Use Cases And Requirements at 8 (2014), available at 6 [http://networks.nokia.com/sites/default/files/document/5g\\_requirements\\_white\\_paper.pdf](http://networks.nokia.com/sites/default/files/document/5g_requirements_white_paper.pdf)

<sup>71</sup> See CTIA 3.5 GHz Comments at 13.

bring 5G to bear, they must have certainty that they will be able to freely and fully access their licensed spectrum without interference.

## **V. 5G MAY REQUIRE A NEW APPROACH TO PERFORMANCE REQUIREMENTS**

With studies and development still under way, 5G use cases may be significantly different from the traditional use cases that gave rise to the Commission’s existing performance requirements. As AT&T has explained, 5G systems will be fundamentally different from their 4G and 3G predecessors.<sup>72</sup> Wireless innovators are pushing the boundaries of technological development and network architecture to bring about a revolution in the mobile experience. Likewise, the Commission will need to reevaluate its existing notions of performance requirements to ensure that its regulatory approach is practical and effective.

5G’s groundbreaking services and technologies coupled with the unique characteristics of mmW band spectrum may require a totally new kind of performance requirement—one that accounts for small cell deployments and self-backhaul schemes, point to point links, larger area coverage, fixed wireless access, etc. Indeed, the Commission may need to think creatively, beyond traditional metrics, to design performance requirements suitable for 5G deployments. Such an approach would be consistent with the Commission’s typical practice of tailoring its performance requirements to the “unique characteristics of individual frequency bands and the types of services expected.”<sup>73</sup>

At this early stage in the development of 5G, if the Commission believes it must adopt performance requirements, AT&T suggests that the flexibility inherent in a “substantial service” approach may be appropriate—especially coupled with safe harbors recognizing the state of

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<sup>72</sup> See Part I, *supra*.

<sup>73</sup> *NPRM* ¶ 194.

overall 5G progress. Indeed, at the beginning, the Commission could simply require licensees to submit a report setting forth a detailed description of what early deployments will look like. As time progresses and with a clearer understanding of how 5G networks and systems will operate, the Commission's evaluation of substantial service showings can evolve accordingly.

## **VI. CONCLUSION**

AT&T appreciates the opportunity to provide input on the Commission's proposed service rules for mobile use of certain mmW spectrum bands. There are great expectations for 5G services and AT&T looks forward to working with the Commission to ensure that these expectations become reality. While mmW spectrum alone will not enable next generation services, it is an important piece of the puzzle. Low-band spectrum will still be critical to providing 5G coverage, but harnessing the mmW bands to support 5G deployments will provide an important complement—speed and capacity.

Understanding the key principles pushing 5G development forward is the first step in crafting an effective regulatory framework for each mmW band. Even at this early stage, some 5G hallmarks have emerged, including supporting integrated network designs, promoting new technologies, supporting new services, facilitating many use cases across the country, maintaining wide channel bandwidth, and promoting international harmonization. By tailoring its regulatory approach in each mmW band to these principles, the Commission will help facilitate a smooth and successful transition to the next generation of revolutionary wireless services.

Respectfully submitted,

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