

**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
	)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	)	RM-11664
	)	

**REPLY COMMENTS OF SAMSUNG ELECTRONICS AMERICA, INC., AND  
SAMSUNG RESEARCH AMERICA**

Farooq Khan, Ph.D.  
President

SAMSUNG RESEARCH AMERICA  
1301 E. Lookout Drive  
Richardson, TX 75082

John Godfrey  
Vice President, Public Policy

Robert Kubik, Ph.D  
Director, Public Policy  
Engineering & Technology

Steven E. Merlis  
Senior Counsel, Federal Affairs

SAMSUNG ELECTRONICS AMERICA  
1200 New Hampshire Avenue, NW  
Suite 650  
Washington, DC 20036

February 18, 2015

## TABLE OF CONTENTS

I.	INTRODUCTION AND SUMMARY .....	2
II.	THE COMMISSION SHOULD PRIORITIZE THE 28 AND 39 GHZ BANDS, AS WELL AS THE 64-71 GHZ BAND, FOR RULEMAKING PROCEEDINGS.....	4
A.	The 28 and 39 GHz Spectrum Bands Are Promising Bands for Near-Term Commission Action.....	4
B.	Current 28 and 39 GHz Licensees Have Expressed an Interest in Using Their Spectrum for 5G.....	8
C.	The 64-71 GHz Spectrum Band Is Also Appropriate for Near-Term Commission Action .....	10
D.	The Commission Should Not Delay in Initiating Rulemakings on 5G Millimeter Wave Services .....	12
III.	THE RECORD DEMONSTRATES THAT 5G TECHNOLOGIES ARE EMERGING RAPIDLY FOR FUTURE DEPLOYMENT IN SPECTRUM BANDS ABOVE 24 GHZ	14
A.	There Are Numerous Ongoing Efforts to Support the Development of 5G, and the Commission Should Make Development of a 5G Regulatory Framework a Top Priority.....	14
B.	Standards Groups Are Actively Working on Next-Generation Technologies .....	17
IV.	COMMENTERS SUPPORT A LICENSED REGIME FOR 5G .....	19
V.	THE COMMISSION SHOULD SUPPORT COLLABORATIVE EFFORTS TO ENABLE 5G .....	22
VI.	CONCLUSION .....	24

**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
	)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	)	RM-11664

**REPLY COMMENTS OF SAMSUNG ELECTRONICS AMERICA, INC., AND  
SAMSUNG RESEARCH AMERICA**

Samsung hereby submits these reply comments in response to the Commission’s *Notice of Inquiry* on the potential provision of Fifth-Generation (5G) mobile services in spectrum bands above 24 GHz.<sup>1</sup> The record developed in opening comments affirms Samsung’s own findings: 5G technologies will revolutionize mobile and their development is well under way. Given this rapid technological evolution, the Commission should act quickly to ensure that the United States remains a global leader in mobile broadband deployment. Participants in this proceeding, including existing licensees in the bands under consideration, have echoed Samsung’s support for a licensed 5G regime in the 28 and 39 GHz bands. As the wireless industry moves toward 5G standards and technologies, it is essential that the Commission keep pace with these world-wide efforts and that the diverse stakeholders involved engage in active technical discussions. Samsung recommends that the Commission initiate two rulemakings in the near term—one for the 28 and 39 GHz bands and the other for the 64-71 GHz band—to analyze how to implement 5G networks in these bands.

---

<sup>1</sup> *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Notice of Inquiry, FCC 14-154 (Oct. 17, 2014) (“*Notice of Inquiry*”). For purposes of these comments, “Samsung” refers to Samsung Electronics America, Inc. and Samsung Research America, collectively.

## I. INTRODUCTION AND SUMMARY

In its opening comments, Samsung detailed the tremendous industry efforts and investments that are taking place to develop 5G. Samsung also explained the key role that governments and standards bodies are beginning to take to effectuate the 5G transition. Ultimately, Samsung asked the Commission to focus on two key points, both critical to 5G's future success. First, Samsung urged the Commission to focus primarily on the provision of licensed mobile broadband systems in the 28 GHz and 39 GHz bands as well as 37/42 GHz bands for 5G, with a secondary eye toward other bands such as 60 GHz. Second, Samsung asked the Commission to take a leadership role in global efforts to promote international harmonization of 5G spectrum. The submissions of other commenters strongly support Samsung's positions. Samsung therefore asks the Commission to seriously consider the proposals advanced in its opening comments, and takes this opportunity to provide further detail on four key matters raised in opening comments.

First, the Commission should speed 5G deployment by focusing on the most promising candidate spectrum bands: the 28 and 39 GHz bands.<sup>2</sup> Existing licensees in these bands have already expressed an interest in using this spectrum to offer millimeter wave services. And Samsung urges the Commission to engage these licensees as it develops a mechanism to license spectrum for 5G. Commenters also strongly support consideration of the 64-71 GHz band for 5G technologies. However, commenters are unsettled on whether this spectrum should be licensed or unlicensed. This lack of consensus has created a need to address this spectrum on a separate track from the well-settled 28 and 39 GHz bands. The Commission should therefore

---

<sup>2</sup> For purposes of these comments, Samsung defines the 28 GHz band to include the LMDS spectrum spanning the 27.5-28.35 GHz, 29.1-29.25 GHz, and 31.075-31.225 GHz bands. Samsung defines the 39 GHz band to include not only the 39 GHz radio service spectrum at 38.6-40 GHz, but also the 37-38.6 GHz band.

promptly initiate distinct rulemaking proceedings that examine these candidate spectrum bands and potential licensing approaches.

Second, the record evidence makes clear that industry now needs the Commission to prioritize the development of a 5G framework. For years, the industry has invested heavily in 5G research and development. Now, the time has come for companies to think strategically about commercializing this innovation and marching through the complex task of standardization. For this to happen, however, industry needs greater clarity regarding the FCC's future regulatory framework. The United States has been a global leader in 4G LTE. For the U.S. to repeat this success with 5G technologies, all stakeholders will need to begin work now, and to focus continually on the development of 5G.

Third, the Commission should implement a licensed regime for 5G, which the record demonstrates has strong support over an unlicensed regime. Specifically, adopting a licensed regime will promote investment, efficient and intensive use of spectrum, certainty for 5G licensees, and competition in the provision of millimeter wave services.

Fourth, the Commission should seek additional information regarding incumbent satellite services above 24 GHz so that the wireless industry can more accurately model the current and future uses of candidate bands. As others have observed in this proceeding, it is feasible for 5G and incumbent satellite operations to share this spectrum, and the Commission should further promote efforts to accommodate both mobile and satellite services. This information exchange has already begun with the comments filed in this proceeding, and the Commission should spearhead further data collection from incumbent satellite systems.

## **II. THE COMMISSION SHOULD PRIORITIZE THE 28 AND 39 GHZ BANDS, AS WELL AS THE 64-71 GHZ BAND, FOR RULEMAKING PROCEEDINGS.**

As the Commission correctly observed in the *Notice of Inquiry*, there are several candidate bands that demonstrate promise as future homes for 5G millimeter services. Based on Samsung's own research efforts, as well as an examination of the record, Samsung believes that the Commission should make the 28 and 39 GHz bands its top priority. Commenters in this proceeding echo Samsung's findings that these bands are particularly well-suited for the provision of 5G services. Indeed, existing licensees of this spectrum have stated an interest in offering 5G millimeter wave services in their licensed spectrum. The Commission should also initiate a separate rulemaking to address 5G millimeter wave services in the 64-71 GHz band.

### **A. The 28 and 39 GHz Spectrum Bands Are Promising Bands for Near-Term Commission Action**

In their opening comments, several commenters echoed Samsung's findings regarding the numerous characteristics of the 28 and 39 GHz spectrum bands that make these bands ideal candidates for 5G millimeter wave services.<sup>3</sup> This spectrum has many positive characteristics that would allow for a relatively smooth transition to 5G: the 28 and 39 GHz bands allow for wide channel bandwidths, they are geographically licensed, they can support multiple licensees, and there are few to no obstacles to permitting mobile uses in this spectrum.

*The 28 and 39 GHz Bands Can Support Wide Channel Bandwidth.* In its opening comments, Samsung highlighted the fact that 5G systems will have extensive bandwidth

---

<sup>3</sup> See, e.g., Comments of Motorola Mobility LLC, GN Docket No. 14-177, RM-11664, at 7 (Jan. 15, 2015) ("Motorola Mobility Comments") ("Based on these considerations and an examination of the bands identified by the Commission, Motorola Mobility believes that the 27.5-28.35 portion of the LMDS band, the 39 GHz Band, and the 37/42 GHz band each warrants further attention from the Commission.")

requirements to provide the significant performance gains that are expected over 4G services.<sup>4</sup> As Qualcomm noted, bands such as these – which have 500 MHz or greater channel bandwidths available for licensing – “can be used to provide compelling mobile service throughputs.”<sup>5</sup> Indeed, increasing bandwidth in a wireless network greatly increases the number of users who can enjoy gigabit speeds. Several of the applications made possible by 5G will require at least 500 MHz of bandwidth, or even bandwidth up to 1 GHz, to deliver the capacity and data rates required by such applications. Samsung agrees with T-Mobile that prospective 5G licensees will be “incentivized to obtain licenses with a large amount of bandwidth (between 500 MHz and 1 GHz) . . . to address capacity issues.”<sup>6</sup> The 28 and 39 GHz bands are therefore ideal target bands for licensing for 5G services, and merit close and prompt examination by the Commission.

***The 28 and 39 GHz Bands Together Can Accommodate Multiple Licensees.*** The Commission has repeatedly cited the presence of multiple licensees in a market as key to promoting competition.<sup>7</sup> In developing a framework for 5G, the Commission will need to carefully balance the need to provide individual licensees with sufficient contiguous spectrum against the need to promote competition by offering multiple licenses in a market. The 28 and

---

<sup>4</sup> Comments of Samsung Electronics America, Inc. and Samsung Research America, GN Docket No. 14-177, RM-11664, at 8 (Jan. 15, 2015) (“Samsung Comments”).

<sup>5</sup> Comments of Qualcomm Incorporated, GN Docket No. 14-177, RM-11664, at 12 (Jan. 15, 2015) (“Qualcomm Comments”).

<sup>6</sup> Comments of T-Mobile USA, Inc., GN Docket No. 14-177, RM-11664, at 7 (Jan. 15, 2015) (“T-Mobile Comments”).

<sup>7</sup> *See, e.g., Policies Regarding Mobile Spectrum Holdings*, Report and Order, FCC 14-63, ¶ 17 (2014) (“This mandate was informed by the principle that consumers are best served by a marketplace with rules that enable and ensure competition, and that access to necessary inputs such as spectrum is a key element of such competition. As the Commission has found, in order for there to be robust competition, multiple competing service providers must have access to or hold sufficient spectrum to be able to enter a marketplace or expand output rapidly in response to any price increase or reduction in quality, or other change that would harm consumer welfare.”).

39 GHz bands therefore are ideal candidate bands, as each has sufficient bandwidth to support multiple licensees holding large, contiguous blocks of spectrum.

***The 28 and 39 GHz Bands Have a Built-In Licensing Framework.*** Both the 28 and 39 GHz bands have existing geographic area licensing mechanisms in place that would allow the bands to be adapted for 5G. The 28 GHz band is geographically licensed on the basis of Basic Trading Areas (“BTAs”) with two licensees per BTA.<sup>8</sup> The 39 GHz band is currently licensed by Economic Area and consists of fourteen paired blocks of 50 x 50 MHz channels. In both bands, many licenses have been cancelled and returned to the Commission, and the Commission could readily re-auction this spectrum for mobile services.<sup>9</sup> Numerous commenters support this proposal.<sup>10</sup> The existing licensing framework in these bands would make a transition of this spectrum to 5G mobile services a relatively smooth one. Because efforts are well under way to develop 5G technologies, the Commission should focus on bands that can be quickly established to support 5G operations. By leveraging the licensing regime already in place in the 28 and 39 GHz bands, the U.S. can be on the leading edge of 5G millimeter wave services.

***The 28 and 39 GHz Bands Can Readily Support Mobile Operations.*** Both the 28 and 39 GHz bands have co-primary allocations for fixed and mobile services, and the record supports Samsung’s view that these two bands represent some of the most promising homes for 5G

---

<sup>8</sup> FCC, “Local Multipoint Distribution Service,” at [http://wireless.fcc.gov/services/index.htm?job=service\\_home&id=lmds](http://wireless.fcc.gov/services/index.htm?job=service_home&id=lmds).

<sup>9</sup> See, e.g., Comments of Nokia (d/b/a Nokia Solutions and Networks US LLC), GN Docket No. 14-177, at 31 (Jan. 15, 2015) (“Nokia Comments”) (“Therefore, there is vacant spectrum available that could be licensed by auctioning exclusive rights to geographic service areas. The Commission rightfully discussed the upsides of such an approach...”).

<sup>10</sup> Qualcomm Comments at 17 (“For services such as LMDS and 39 GHz, which have not been as successful as the Commission had hoped and where many licenses were cancelled due to the licensees’ failure to meet the construction requirements, Qualcomm submits that the FCC should auction that spectrum for mobile use.”)

millimeter wave services in the near term. As Straight Path Communications observed, “[n]ow that technology has sufficiently advanced, it is time for the Commission to take the steps it said it would and adopt service rules that will permit mobile services in these bands.”<sup>11</sup> As discussed further below, current licensees in these bands have expressed an interest in using their authorizations to offer mobile services, and the spectrum that has been returned to the Commission can be re-auctioned. Because the beams generated in these bands are narrow and readily adjusted, a licensee can deploy both fixed and mobile services within its geographic license area.<sup>12</sup> Opening comments demonstrate that the 28 and 39 GHz bands are of great interest to the wireless industry, suggesting a strong incentive to innovate and make productive use of these bands.<sup>13</sup>

Samsung has carefully studied the potential of 5G services and their spectrum requirements, and has identified the 28 and 39 GHz as the most promising near-term homes for these services. By allocating these bands for mobile services and making reclaimed spectrum

---

<sup>11</sup> Comments of Straight Path Communications, Inc., GN Docket No. 14-177, RM-11664, at 17 (Jan. 15, 2015) (“Straight Path Comments”).

<sup>12</sup> *See, e.g.*, Qualcomm Comments at 9 (“The narrower beams that can be generated in bands above 24 GHz could help limit interference to incumbent users of the band.”).

<sup>13</sup> *See, e.g.*, Ericsson Comments at 7 (“Industry has an incentive to innovate and employ the 39 GHz band productively, especially if the rules for 37-38.6 GHz and 28.6-40 GHz were made uniform.”); *id.* at 37 (“The LMDS bands at 28 GHz will be of particular interest to the mobile industry for systems that may follow 4G into higher frequency bands.”); Comments of XO Communications, LLC, GN Docket No. 14-177, RM-11664, at 3 (Jan. 15, 2015) (“XO Communications Comments”) (“Among the upper microwave bands, XO believes that LMDS spectrum is well-suited for 5G commercial mobile operations. Licensees should be able to provide 5G services both in the LMDS A1 block, where the majority of LMDS point-to-point and point-to multipoint backhaul operations are concentrated, and in the LMDS A2, A3, and B blocks, which are comparatively less utilized. Similarly, the 39 GHz band should successfully support 5G mobile operations. The Commission should capitalize on the technical feasibility of these bands with specific actions that encourage successful 5G deployments.”).

available for exclusive licensing, the Commission will spur investment in these bands and will take an important step toward the deployment of 5G.

**B. Current 28 and 39 GHz Licensees Have Expressed an Interest in Using Their Spectrum for 5G**

In its opening comments, Samsung expressed support for licensed 5G services in the existing 28 and 39 GHz bands. So too did existing licensees in these bands. These licensees already understand the frequency environment in these bands, and are therefore well-positioned to efficiently use this spectrum for 5G. Ultimately, the 28 and 39 GHz licensees' stated interest in using this spectrum for mobile service should significantly factor into the Commission's calculus as it identifies 5G spectrum bands and licensing mechanisms.

*Straight Path Communications.* As it noted in its comments, Straight Path is one of the largest holders of spectrum in the 39 GHz band, holding licenses covering the entire United States with an average of 833 megahertz of bandwidth in the top 30 U.S. markets.<sup>14</sup> Straight Path also holds licenses in the LMDS bands.<sup>15</sup> Straight Path “has been actively engaged in evaluating how it can maximize the full potential of its spectrum holdings for next generation mobile solutions such as 5G.”<sup>16</sup> In fact, Straight Path is an industrial affiliate of NYU WIRELESS, the United States' leading 5G think tank.<sup>17</sup> Straight Path indicated that “we expect to work collaboratively to highlight our assets for utilization for mmW mobility, it “is also working cooperatively with these companies toward miniaturization and product development, which are key components of commercializing 5G mmW technologies,” and, finally, it “expects

---

<sup>14</sup> Straight Path Comments at 2.

<sup>15</sup> *Id.*

<sup>16</sup> *Id.*

<sup>17</sup> *Id.*

to participate in standards setting bodies for 5G in order to address, among other things, seamless mobility and interoperability among different radio access technologies including 4G, 5G, and Wi-Fi.”<sup>18</sup> In noting its interest in 5G, Straight Path also submitted that “[e]quity dictates that the Commission should allow [incumbent millimeter wave licensees] to realize the full value of the spectrum for which they paid and the benefits associated with FCC rule changes that would allow them to offer mobile services.”<sup>19</sup>

**XO Communications.** XO Communications currently holds 91 LMDS licenses and nine 39 GHz licenses.<sup>20</sup> XO stated that “[t]he best regulatory approach for realizing a rapid, efficient 5G deployment above 24 GHz is to permit XO and other microwave band licensees to operate 5G commercial mobile facilities under the existing, exclusive geographic area licensing regime in each frequency band.”<sup>21</sup> XO added that “[a]s an existing licensee, XO has extensive experience and expertise in the upper microwave bands and will be able to deploy 5G facilities in a manner that enables those systems to co-exist with incumbent backhaul and other existing deployments.”<sup>22</sup>

**T-Mobile.** T-Mobile currently holds 20 LMDS licenses and four 39 GHz licenses. In its comments, T-Mobile noted that “[i]ncumbents are also poised to make beneficial use of the spectrum in a quick time period. Incumbents are best positioned to determine how to achieve mobility by coordinating fixed and mobile uses of the spectrum in their license areas. The

---

<sup>18</sup> *Id.* at 3.

<sup>19</sup> Straight Path Comments at 23.

<sup>20</sup> XO Communications Comments at 2.

<sup>21</sup> *Id.* at 3-4.

<sup>22</sup> *Id.* at 4.

Commission should create a regulatory environment where these incumbent licensees can seamlessly and easily begin mobile uses.”<sup>23</sup>

**FiberTower.** FiberTower currently holds seven 39 GHz licenses. Like T-Mobile, FiberTower supports permitting incumbent licensees in the 39 GHz and LMDS bands to offer mobile services pursuant to their existing authorizations. FiberTower stated that “[t]o the extent mobile deployments in the 24 and 39 GHz bands are not currently permitted under Commission rules, the Commission should permit incumbent licensees to provide mobile services pursuant to their existing geographic licenses using as guidance the same border interference and coordination standards that are currently in place.”<sup>24</sup>

In light of the fact that incumbent licensees in the 28 and 39 GHz bands support the provision of flexibility to incumbent licensees, and the fact that some have been actively pursuing research and development efforts of their own, the Commission should make these two bands a top priority. Near term action by the Commission should focus on the characteristics of these bands and what steps will promote the rapid adoption of rules that will promote these bands as initial homes for 5G services.

**C. The 64-71 GHz Spectrum Band Is Also Appropriate for Near-Term Commission Action**

In addition to pursuing the 28 and 39 GHz spectrum for 5G, the Commission should initiate a separate proceeding focused on the 64-71 GHz band. The record before the Commission demonstrates that this spectrum might hold potential to meet the requirements for 5G services. However, since there is a lack of current license holders for this spectrum (as well as service rules), Samsung believes that this spectrum should have its own rulemaking to

---

<sup>23</sup> T-Mobile Comments at 7.

<sup>24</sup> FiberTower Comments at 16-17.

evaluate both the potential for use of this spectrum for 5G services in the future and the technical and service rules that would need to be adopted to accommodate 5G..

Samsung agrees with the many commenters who highlight that the 64-71 GHz band might be suitable for 5G services. Qualcomm, for example, urges the Commission to “... promptly issue an NPRM proposing to expand the current 60 GHz unlicensed band (i.e., the 57 to 64 GHz band) to include the 64 to 71 GHz band identified in the NOI.”<sup>25</sup> The Wi-Fi Alliance is “... particularly interested in the expansion of the current 57-64 GHz authorizations for mobile and fixed unlicensed operations pursuant to Part 15 to the 64-71 GHz band, which would create a 14-gigahertz wide spectrum band operating under a common set of rules.”<sup>26</sup> Huawei indicates that equipment will be available for operations above 60 GHz in the short-term.<sup>27</sup> Nokia has argued that the 64-71 GHz spectrum should be made available for licensed, exclusive use services.<sup>28</sup> Ericsson believes that the 64-71 GHz spectrum could be utilized for both licensed and unlicensed 5G services.<sup>29</sup>

But Samsung also finds that there are significant differences about whether to allow licensed or unlicensed services in this band. Given this lack of consensus, especially as

---

<sup>25</sup> Qualcomm Comments at 17.

<sup>26</sup> Comments of Wi-Fi Alliance, GN Docket No. 14-177, RM-11664, at 3 (Jan. 15, 2015) (“Wi-Fi Alliance Comments”).

<sup>27</sup> Comments of Huawei Technologies, Inc. (USA) and Huawei Technologies, Ltd., GN Docket No. 14-177, RM-11664, at 6-7 (Jan. 15, 2015) (“Huawei Comments”) (“While antenna technology and design will continue, some mobile equipment operating in the 60 GHz bands is becoming available and will likely form the basis for future mmW systems in the short term and beyond.”)

<sup>28</sup> Nokia Comments at 34 (“We believe that 64-71GHz will benefit from a licensing regime that makes spectrum available by auctioning exclusive rights to geographic service areas...”).

<sup>29</sup> Ericsson Comments at 39 (“The band offers a unique opportunity to accommodate both licensed and unlicensed operation using similar technology.”).

compared to the widespread support for licensed operations in the 28 and 39 GHz bands, the Commission should adopt a distinct proceeding for the 64-71 GHz band. This approach meshes with TIA’s proposal to approach each potential spectrum band on a case-by-case basis.<sup>30</sup> This will also permit the Commission to focus on the unique technical characteristics and needs of this spectrum, and to establish band-specific rules that will promote the proliferation of 5G technologies. Under this approach, the Commission can seek comment on a licensed (which is Samsung’s preference) or unlicensed service rule regime to govern use of the 64-71 GHz band.

**D. The Commission Should Not Delay in Initiating Rulemakings on 5G Millimeter Wave Services**

As noted above, Samsung appreciates that the Commission is juggling numerous spectrum priorities. But the Commission should not lose focus on taking the important next steps toward deploying 5G. As FiberTower observed, “global leadership in 5G has yet to be fully determined, and much is at stake for the regions seeking to win the 5G mantle.”<sup>31</sup> For 5G services to go live by 2020, stakeholders – including the Commission – must begin work now and continuously focus on the development of 5G technologies, services, standards, and regulations.

The Commission should strive for the U.S. lead deployment of 5G, just as it did with 4G LTE. Creating robust, high-speed 5G networks will promote substantial innovation and yield great dividends for both consumers and the U.S. economy. In particular, innovation and investment in 5G technologies could help address mobile broadband availability in rural areas

---

<sup>30</sup> Comments of the Telecommunications Industry Association, GN Docket No. 14-177, RM-11664, at 3 (Jan. 15, 2015) (“TIA Comments”) (“...it is essential that each band receive case-by-case attention, rather than having the agency attempt to formulate overly general policies for millimeter-wave spectrum as a whole.”).

<sup>31</sup> FiberTower Comments at 1.

and generally address the needs of unserved and/or underserved communities.<sup>32</sup> Samsung urges the Commission to maintain its focus on the next generation of wireless and to help sustain the United States' leading role in wireless innovation.

As a next step, the Commission should issue a Notice of Proposed Rulemaking (NPRM) that dives deeper into using the 28 and 39 GHz spectrum bands for 5G services. Separately, the Commission should issue a NPRM exploring use of the 64-71 GHz band. Samsung agrees with TIA that “the Commission should avoid a one-size-fits-all approach” because “[g]ood spectrum policy decisions need to be made on a band-by-band basis.”<sup>33</sup>

The Commission's band-specific rulemakings should, where applicable, focus on necessary technical coordination among the diverse services operating in the frequency bands under consideration. The Commission's NPRM on the 28 and 39 GHz bands should also discuss a possible licensing and service rule regime for 5G spectrum. The prompt issuance of an NPRM has the support of several commenters in this proceeding,<sup>34</sup> and prompt action will help ensure that the Commission does not serve as a source of delay in the deployment of 5G services and technologies.<sup>35</sup> Samsung looks forward to continuing as an active participant in these important discussions at the Commission and elsewhere.

---

<sup>32</sup> Nokia Comments at 3 (“Significant early investment in 5G would help close the gap in ultrafast mobile broadband between the U.S. and other countries. Sustained investment in 5G research would begin to address limitations in mobile broadband availability in rural areas.”).

<sup>33</sup> TIA Comments at 2.

<sup>34</sup> *See, e.g.*, Straight Path Comments at 1-2 (“Straight Path urges the Commission to proceed quickly to issue one or more notices of proposed rulemaking in order to adopt regulations that will enable the mmW bands to be used for flexible use, including mobile applications.”).

<sup>35</sup> CEA Comments at 11 (stating that “the FCC must continue to play an active role as facilitator in the further development of the technologies utilizing the mmW bands. The FCC should work at a pace commensurate with industry developments. Waiting to issue Notices of

### **III. THE RECORD DEMONSTRATES THAT 5G TECHNOLOGIES ARE EMERGING RAPIDLY FOR FUTURE DEPLOYMENT IN SPECTRUM BANDS ABOVE 24 GHZ**

#### **A. There Are Numerous Ongoing Efforts to Support the Development of 5G, and the Commission Should Make Development of a 5G Regulatory Framework a Top Priority**

This proceeding makes clear that “industry is moving in earnest towards 5G.”<sup>36</sup> Several parties have been working to develop 5G-enabled technologies, and the industry is on pace to make these services available commercially by 2020. The United States has been a leader with respect to 4G innovation and deployment, and it has the opportunity to play the same role in the 5G ecosystem as well. Commenters in this proceeding have demonstrated their significant investment and progress in developing 5G technologies, and agree that 5G networks and services hold great potential. The progress made by the industry demonstrates the importance of continued action by the United States generally and the Commission in particular.

Commenters in this proceeding have devoted considerable resources to developing 5G technologies, and they echo Samsung’s optimism regarding the great potential of 5G networks and services.<sup>37</sup> As T-Mobile observed, “5G mobile services offer enormous potential for consumers, with the prospect of being considerably faster and substantially exceeding the

---

Proposed Rulemaking until industry is ready to deploy mmW technologies risks foreclosing opportunities. Consumer demand is growing too fast to have such a reactive approach and its associated delay”).

<sup>36</sup> Comments of the Consumer Electronics Association, GN Docket No. 14-177, RM-11664, at 5 (Jan. 15, 2015) (“CEA Comments”).

<sup>37</sup> See, e.g., Comments of Alcatel-Lucent, GN Docket No. 14-177, RM-11664, at 3 (Jan. 15, 2015) (“Alcatel-Lucent Comments”); Comments of FiberTower Spectrum Holdings, LLC, GN Docket No. 14-177, RM-11664, at 13 (Jan. 15, 2015) (“FiberTower Comments”); Comments of Huawei at 3-4 ; Nokia Comments at 5; TIA Comments at 4-5.

capacity of existing mobile technologies.”<sup>38</sup> These emerging technologies “will allow provision of services with higher and more consistent bitrates, lower end-to-end latency, higher connection densities to support both personal and machine-type communications devices, improved battery life and higher reliability.”<sup>39</sup> Numerous others share Samsung’s vision of 5G: a potentially revolutionary technological development that will promote higher data rates, lower latency, greater spectral and energy efficiency, and unprecedented mobility and connectivity.<sup>40</sup>

Notably, commenters agree that spectrum bands above 24 GHz are well-suited to support 5G millimeter wave technologies, and have demonstrated a commitment to examining the capabilities of these bands for mobile services. As Motorola Mobility noted, “the propagation characteristics of these higher frequency bands are well-suited for indoor and small cell deployments, making the spectrum especially appealing as a source of extra capacity in highly-congested areas.”<sup>41</sup> Further, these bands can accommodate the large channel bandwidths

---

<sup>38</sup> Comments of T-Mobile USA, Inc., GN Docket No. 14-177, RM-11664, at 3 (Jan. 15, 2015) (“T-Mobile Comments”).

<sup>39</sup> Alcatel-Lucent Comments at 3.

<sup>40</sup> *See, e.g.*, Alcatel-Lucent Comments at 4 (“With this approach to 5G evolution, mobile operators will be able to construct unique service offerings for mobile broadband, ultra dense machine-type communication, mission-critical support for national roaming of public safety officers and many other use cases, customize to optimal investment in radio access and network infrastructure.”); CEA Comments at 5 (“Several organizations are sketching out a framework with the following requirements: (1) high availability and reliability; (2) faster downloads and connectivity; (3) simultaneously connected devices with always-on access to the Internet; (4) lower battery consumption; (5) better coverage; and (6) lower latencies, all at an affordable cost.”); Huawei Comments at 11 (“5G systems are being designed to achieve maximum data throughputs up to 10 Gbit/s and at least 100 Mbit/s performance at the cell edge with a maximum latency of no more than one millisecond. Achieving these performance goals, Huawei believes, will require contiguous channel bandwidths in excess of 1-2 GHz available within each access network.”).

<sup>41</sup> Motorola Mobility Comments at 3.

required by 5G services.<sup>42</sup> The allocation and licensing of spectrum for mobile services is a complicated process, and Samsung urges the Commission to maintain its focus on the bands it identified in the *Notice of Inquiry*, with a near-term emphasis on bands that can be more rapidly deployed – in this case, the 28 and 39 GHz bands.

As several commenters observed, there are many steps that need to be taken before the provision of 5G services in millimeter wave spectrum can be a reality. However, companies are already developing products and applications that require the high performance enabled by 5G. As FiberTower asserted, “[t]he path to accelerating innovation and deployments in these millimeter wave bands is ready to be taken.”<sup>43</sup> The record in this proceeding demonstrates that from a product and technology standpoint, the process to deploy millimeter wave technologies by 2020 is well under way. For example, Samsung has highlighted its Gear VR and Project Beyond camera, both of which will use millimeter wave technologies to immerse users in various exciting experiences.<sup>44</sup> Ericsson is developing phased-array antenna solutions that would put one hundred or more antennas and radios on a single chip for use in high-capacity 5G small

---

<sup>42</sup> Motorola Mobility Comments at 6 (“More contiguous spectrum will be required in any new band to maximize the utility of next generation technologies, and 100 MHz per operator should be the minimum threshold for higher frequency band systems. To accommodate the very large channel bandwidths and to support carrier aggregation of spectrum bands, Motorola Mobility agrees with the suggestion in the Notice that new bands ideally should be 1 to 2 GHz wide.”); TIA Comments at 3 (“As the Commission explores various millimeter-wave bands for mobile broadband applications, it should pay particular attention to the need for larger bandwidths. In particular, the agency should prioritize any opportunities for providing large blocks of contiguous spectrum. Carrier aggregation under LTE is always becoming more difficult, and aggregation of spectrum from several hundred MHz to even 1 GHz may be essential to promote next-generation wireless networks.”).

<sup>43</sup> FiberTower Comments at 3.

<sup>44</sup> Samsung Comments at 5.

cells.<sup>45</sup> Meanwhile, Qualcomm has recently developed a chipset for multi-gigabit Wi-Fi, or “WiGig.”<sup>46</sup> Given the progress made by the industry thus far, it is essential that U.S. regulators keep pace with the development of technology. Near-term action by the Commission will be necessary to prevent technological stagnation.

Evolving to the next generation of wireless will take several years, and the Commission should begin work today so that 5G services can be deployed by 2020. This is particularly important because the evolution from 4G to 5G likely will occur more quickly than the evolution from 3G to 4G.<sup>47</sup> Samsung agrees with the Telecommunications Industry Association that “[f]or reasons of maintaining global competitiveness and to encourage further innovation, the U.S. ICT industry would benefit from near-term policy development – and the increased regulatory certainty that will hopefully result – regarding various millimeter-wave spectrum bands.”<sup>48</sup> Samsung therefore takes the opportunity in this proceeding to outline certain near-term steps that the Commission should take to ensure that the United States remains on track to lead in 5G.

#### **B. Standards Groups Are Actively Working on Next-Generation Technologies**

Continued effort and investigation by the Commission is essential, as it will enable the Commission to keep pace with the standards development process. As 4G Americas highlighted in its comments, the Third Generation Partnership Project (“3GPP”), ITU, and other standards bodies are already undertaking efforts to research and develop 5G services. There are several

---

<sup>45</sup> Ericsson Comments at 9-10.

<sup>46</sup> TIA Comments at 5.

<sup>47</sup> FiberTower Comments at 3 (“There also are signals that there are historic time compressions in the 5G development cycle. In other words, the standard time periods for developing and moving networks from 2G to 3G, and from 3G to 4G, are predicted by some to be shorter for 4G to 5G.”).

<sup>48</sup> TIA Comments at 7.

benchmarks that must be achieved to develop a new generation of wireless service, and for this reason Samsung asks the Commission to not lose the momentum generated in this proceeding.

Samsung continues to support the ongoing efforts of the ITU's WRC working groups with respect to high-frequency spectrum. Indeed, the ITU process and the achievement of international harmonization will be an important component of the success of 5G. In its opening comments, Samsung expressed support for a new agenda item at WRC-19 that would seek global and harmonized spectrum bands for 5G between all regions. Numerous commenters echoed Samsung's support for international harmonization. As Nokia stressed, "WRC 2019 will be a unique opportunity to identify spectrum for mobile broadband (5G) above and also below 6 GHz, and it is therefore important that the WRC 2015 will decide on the respective agenda item for the WRC 2019."<sup>49</sup> Commenters also noted that global harmonization will promote compatibility with incumbent services, enhance roaming ability, simplify the development of equipment, and lower the cost of user equipment.<sup>50</sup> Put simply, "International harmonization is crucial to enabling the most efficient deployment of next generation technology."<sup>51</sup>

---

<sup>49</sup> Nokia Comments at 26.

<sup>50</sup> See, e.g., Comments of ARRL, the National Association for Amateur Radio, GN Docket No. 14-177, RM-11664, at 8 (Jan. 15, 2015) ("ARRL Comments") ("[I]nternational harmonization of mobile allocations in the mmW bands and utilization of the ample current mobile allocations above 24 GHz will contribute to avoiding incompatibility between incumbent services and new 5G mobile services."); Ericsson Comments at 35 ("Global harmonization will limit the number of models of equipment required to be developed, making each cheaper and more affordable for operators to deploy."); Motorola Mobility Comments at 4 ("The uniform identification of spectrum bands for mobile reallocation in all three ITU regions of the world would promote consistent utility of new spectrum bands globally and would drive down equipment costs, which would benefit consumers in the United States and abroad."); Qualcomm Comments at 16 ("The Commission should favor global harmonization in the millimeter wave bands used for mobile operations where possible because it lowers equipment costs, particularly antenna and RF transceiver complexity, and also offers end users a more predictable QoE when traveling outside the U.S."); TIA Comments at 4 ("Global harmonization remains critically important to enable efficiencies of scale in product development and manufacturing, while also promoting roaming ability."); XO Communications Comments at 6-7 ("Equipment and device

In addition, the 3GPP has initiated active discussion regarding the development of 5G standards. Samsung has requested that this study item be considered as part of 3GPP Release 13 – the current release – of the anticipated time and effort involved. Each 3GPP Release lasts for approximately 18 months, and is divided into three stages: service description and requirements, architecture and functional description, and detailed protocol description. By commencing consideration of 5G issues with the current release, 3GPP will help to promote a productive evolution toward 5G.

The efforts under way at the ITU and 3GPP demonstrate the importance of continued focus by the Commission. The Commission should encourage active involvement by the United States in these efforts, lest the U.S. be left behind in the 5G standards development process. Samsung looks forward to continuing its active role in these efforts, and encourages the Commission and other key stakeholders in the United States to do the same.

#### **IV. COMMENTERS SUPPORT A LICENSED REGIME FOR 5G**

Commenters widely agree that the Commission can most effectively encourage competition and investment in the 5G ecosystem by focusing on the development of licensed services.<sup>52</sup> As Nokia observed, “[t]he commercial mobile market has blossomed under a framework of access to exclusively licensed spectrum. This paradigm is driving the deployment

---

manufacturers for these complementary new services would benefit greatly from global economies of scale as they undertake the formation of a new 5G ecosystem, and, as a result, XO urges the Commission to promote global harmonization of the upper microwave bands for 5G purposes.”).

<sup>51</sup> CEA Comments at 11.

<sup>52</sup> See, e.g., Motorola Mobility Comments at 8-9 (“As mobile industry commenters have explained previously, exclusive licensing on a geographic service area basis is the preferred mechanism for commercial mobile broadband access systems.”); T-Mobile Comments at 7 (“Finally, as T-Mobile has noted before, clear, exclusive use spectrum is the most effective way for carriers to deploy services to consumers.”).

of robust 4G broadband networks across the country and can continue to be the case for 5G. Therefore, identifying additional spectrum for exclusive licensing must remain the top objective for government spectrum decision makers, even for 5G.”<sup>53</sup> Commenters agree with Samsung that exclusive-use licenses promote investment in new infrastructure, research and development, a robust secondary market, clear and enforceable interference protections, and competition in the provision of mobile services.

It is well-established that the certainty promoted by exclusive-use licensing enables licensees to confidently invest in new infrastructure, as well as in research and development. As CTIA observed, “[c]reating an environment with certainty, predictability, and transparency through exclusive use licensing will be key to promoting investment and fostering efficiency throughout the higher frequency bands.”<sup>54</sup> While certainty regarding one’s spectrum assets is desirable as a general matter, it is particularly important where, as here, a considerable amount of new technology development is required. As T-Mobile observed, “[e]xclusive use licenses would provide the certainty that carriers need to invest in devices and infrastructure to support use of this spectrum. Major differences exist between the spectrum allocated to 5G technologies and the lower band spectrums. Operators may need to invest in new infrastructure to use the 5G spectrum, and exclusive use licenses would promote this investment.”<sup>55</sup>

Exclusive-use licensing also promotes a robust secondary market that will ensure that spectrum goes to those who most value it, and will not lie fallow. In the *Notice of Inquiry*, the Commission expressed concern that millimeter wave spectrum would lie fallow outside of urban

---

<sup>53</sup> Nokia Comments at 30.

<sup>54</sup> Comments of CTIA – The Wireless Association, GN Docket No. 14-177, RM-11664, at 8-9 (Jan. 15, 2015) (“CTIA Comments”).

<sup>55</sup> T-Mobile Comments at 7.

areas where demand is not as high.<sup>56</sup> This concern can be obviated through the use of an exclusive licensing mechanism that allows flexibility for licensees to sell or lease their spectrum on the secondary market. As Verizon Wireless correctly observed, “[s]pectrum is unlikely to remain fallow under a truly flexible licensing regime. The Commission should take care to ensure that its rules allow secondary market transactions to take place efficiently and permit parties to enter into leasing and partitioning arrangements without cumbersome regulatory approvals.”<sup>57</sup> Indeed, parties should be encouraged by the Commission to turn to the secondary market as a means of ensuring usage of their spectrum in areas where the licensee does not feel it can make full use of its license.<sup>58</sup> Conversely, in a more lightly licensed regime, the licensee may not be as compelled to make use of the secondary market as a means of promoting spectral efficiency.

Exclusive-use licensing is also desirable because it brings with it clear and enforceable protections against interference. As an initial matter, and as discussed above, current licensees of 28 and 39 GHz spectrum have expressed an interest in offering mobile services pursuant to their existing authorizations. If mobile and fixed services were managed by the same operator, management of interference between fixed and mobile services would be a much simpler task.<sup>59</sup> However, even where mobile rights are not offered to an incumbent, exclusive use licensing “will allow the licensee to provide a reliable QoS and high QoE for end users and enable quick

---

<sup>56</sup> *Notice of Inquiry* ¶ 93.

<sup>57</sup> Comments of Verizon, GN Docket No. 14-177, RM-11664, at 4 (Jan. 15, 2015) (“Verizon Comments”).

<sup>58</sup> FiberTower Comments at 18 (“The Commission should encourage licensees who may experience low-use regions within their license areas to make their spectrum available for lease, partitioning, or disaggregation through the secondary spectrum market proceeding process.”).

<sup>59</sup> Straight Path Comments at 23.

remediation in the unlikely event that licensed mobile use causes interference to other users of the band.”<sup>60</sup> In particular, by employing geographic area licensing such as licensing on the basis of BTAs or EAs, the Commission would provide licensees with the flexibility to deploy services within their market area while helping “to ensure that licensees could prevent harmful interference to other providers since interference would need to be managed only along the perimeters of large service areas.”<sup>61</sup>

Finally, by developing a licensing regime that allows for multiple licensees to operate in a market, the Commission will promote competition. Competition in the provision of mobile services has long been one of the Commission’s top priorities. Through exclusive-use licensing, the Commission will give licensees the incentive to invest heavily in their networks and, if multiple entities hold exclusive licenses in a market, they will have strong incentives to compete on the quality of their service offerings, ultimately benefiting consumers.

## **V. THE COMMISSION SHOULD SUPPORT COLLABORATIVE EFFORTS TO ENABLE 5G**

It is clear that no matter what rules the Commission adopts in this proceeding, it will be necessary for the satellite and wireless industries to coordinate and ensure that the deployment of 5G millimeter wave services does not result in harmful interference to either satellite or wireless operations. Samsung submits that it would be extremely helpful to have additional information about the technical parameters of potentially affected satellite systems, so that the wireless industry can evaluate the potential coordination issues implicated by 5G.

In its comments, O3b Limited provided extremely helpful information regarding its satellite operations and the technical capabilities and limitations of its services. It also submitted

---

<sup>60</sup> Qualcomm Comments at 16-17.

<sup>61</sup> FiberTower Comments at 17.

several technical questions regarding 5G systems that would inform its analysis of the radiofrequency environment.<sup>62</sup> Samsung notes that the same data flagged by O3b – equipment power levels, power density, modulation, antenna size, and antenna parameters – is also needed for satellite operations. Indeed, O3b’s submission is an extremely positive example of the information sharing that needs to take place.

While 5G is in the very early stages of development, key technical information regarding incumbent satellite operations is already known by the satellite operators. Access to this information would be extremely helpful to stakeholder companies seeking to model compatibility between the two types of services. Specifically, the Commission should encourage the provision of general technical parameters for incumbent satellite services. These include information such as transmitter power, antenna patterns, antenna gain, noise figures, noise temperatures, allowable signal-to-noise ratio and/or minimum receive sensitivity level, spectrum emission masks, the power control process, channel bandwidth, and duplexing direction. Similarly, it would be very helpful to learn more about satellite systems’ deployment configurations, including the space station orbit, space station coverage, earth station location(s), density of earth stations within the coverage area of a space station, and the practical deployment configuration.

The Commission should also encourage information sharing regarding fixed services. Like satellite systems, the parameters of these services should already be known by fixed service operators, and receipt of this information will enable the wireless industry to examine the coexistence of 5G with incumbent services. With more information regarding the coverage by a center station in a fixed service network, the density of sub-stations, and deployment

---

<sup>62</sup> Comments of O3b Limited, GN Docket No. 14-177, RM-11664, at 13 (Jan. 15, 2015) (“O3b Comments”).

configurations, 5G stakeholders can better model the interaction of incoming and incumbent services.

## VI. CONCLUSION

The record makes clear that a successful evolution to 5G depends on rapid action by the Commission. In the near term, the Commission should initiate a rulemaking that focuses on a licensed 5G ecosystem in the 28 and 39 GHz spectrum bands. The Commission should also initiate a separate rulemaking for the 64-71 GHz band to fully explore the potential for 5G network developments in this spectrum. It is clear that these services hold great potential, and Samsung looks forward to continuing its role as a 5G leader. Samsung asks the Commission to do the same, and to act quickly to help make the promise of 5G a reality.

Respectfully Submitted,

/s/ Farooq Khan, Ph.D.

/s/ John Godfrey

Farooq Khan, Ph.D.  
President

John Godfrey  
Vice President, Public Policy

SAMSUNG RESEARCH AMERICA  
1301 E. Lookout Drive  
Richardson, TX 75082

Robert Kubik, Ph.D.  
Director, Public Policy  
Engineering & Technology

Steven E. Merlis  
Senior Counsel, Federal Affairs

SAMSUNG ELECTRONICS AMERICA  
1200 New Hampshire Avenue, NW  
Suite 650  
Washington, DC 20036

February 18, 2015