BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Applications of AT&T Inc. and East Kentucky Network, LLC for Consent to Assign Licenses	)	WT Docket No 15-79
	)	
	)	

RESPONSE OF AT&T TO GENERAL INFORMATION REQUEST DATED MAY 21, 2015

June 4, 2015

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Introduction

AT&T Mobility Spectrum LLC ("Mobility Spectrum"), an indirect wholly-owned subsidiary of AT&T Inc. (collectively, "AT&T") hereby provides this response (the "Response") to the letter dated May 21, 2015 from Roger Sherman, Chief of the Wireless Telecommunications Bureau of the Federal Communications Commission ("FCC" or "Commission"), and the General Information Request for AT&T attached thereto (collectively, the "Request"). In three Requests, (individually referred to herein as "Request No. [#]"), the FCC asks AT&T (sometimes referred to in the request as the "Company," as defined therein) to provide by June 4, 2015 documents, data, and other information to compete the Commission's review of the application of Mobility Spectrum and East Kentucky Network, LLC ("EKN") for consent to the assignment of three Lower 700 MHz C Block licenses from EKN to Mobility Spectrum.

Consistent with AT&T's discussions with Commission staff on similar requests, AT&T's responses are based on a review of available documents that are likely to contain responsive information and inquiry of those individuals and available sources that are likely to have relevant information. Where the Request seeks documents, responsive documents are produced.

The Request calls for AT&T to submit certain information and documents that are sensitive from a commercial, competitive, and financial perspective, and that AT&T would not reveal in the ordinary course of business to the public or its competitors. AT&T is submitting information and documents on a Confidential and/or Highly Confidential basis pursuant to the Joint Protective Order for this proceeding that was issued on May 21, 2015. The inadvertent

inclusion of any material that is subject to an assertion of the attorney-client, attorney work-product, or other applicable privilege is not intended as a waiver of such privilege.

In the public version of the Response, AT&T has redacted Highly Confidential Information and marked the redactions with "**[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]** . . . **[END AT&T HIGHLY CONFIDENTIAL INFORMATION]**". The redacted Response is marked "**REDACTED – FOR PUBLIC INSPECTION**" and is being filed electronically in the Commission's Electronic Comment Filing System ("ECFS"). The Highly Confidential, unredacted Response is marked, "**HIGHLY CONFIDENTIAL INFORMATION – SUBJECT TO JOINT PROTECTIVE ORDER IN WT DOCKET NO. 15-79 BEFORE THE FEDERAL COMMUNICATIONS COMMISSION – ADDITIONAL COPYING RESTRICTED**" and is being delivered to the Secretary. Additional copies of the unredacted Response are being delivered as instructed in the Request.

In accordance with the Request and the Joint Protective Order, unredacted copies of Highly Confidential documents are marked "**HIGHLY CONFIDENTIAL INFORMATION – SUBJECT TO JOINT PROTECTIVE ORDER IN WT DOCKET NO. 15-79 BEFORE THE FEDERAL COMMUNICATIONS COMMISSION – ADDITIONAL COPYING RESTRICTED**." Pursuant to the Request, the Highly Confidential documents are being delivered to Scott Patrick of the Wireless Telecommunications Bureau.

Pursuant to discussions with the Commission staff, AT&T is submitting its Response consistent with the following qualifications:

- In the Request, AT&T interprets the term "relevant area" to mean each Cellular Market Area in the proposed transaction where AT&T is acquiring spectrum.
- AT&T has not verified that it has produced "all other documents referred to in the document or attachments," pursuant to Instruction 4.

RESPONSES

1. REQUEST:

On page 3 of the Public Interest Statement, the Applicants assert that "[t]he additional spectrum will be used to deploy AT&T's 4G network using LTE technology, and will increase network capacity to the benefit of all AT&T subscribers." In addition, on page 3, the Applicants maintain that "the acquisition of this spectrum will also give AT&T 24 contiguous megahertz of paired 700 MHz spectrum, enough to support a 10×10 MHz LTE deployment," and further contend that this "more robust LTE network . . . will improve spectral efficiency, increase network capacity, and enable AT&T to offer faster, higher quality services to its customers in the affected markets." For each of CMA 110 (Huntington-Ashland, WV/KY/OH) and CMA 116 (Lexington-Fayette, KY), provide:

a. A detailed discussion of the Company's plans to provide high-quality, high-speed wireless broadband services prior to the Proposed Transaction, including a detailed description of the Company's current and planned deployment of HSPA+ and LTE, which identifies the spectrum bands and the total amount of spectrum used for HSPA+ and LTE deployment.

AT&T has worked tirelessly to deploy 4G LTE wireless broadband services throughout its nationwide footprint. As of September 2014, AT&T's 4G LTE network reached more than 300 million Americans,[1] including approximately **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION] [END AT&T HIGHLY CONFIDENTIAL INFORMATION]** people in CMAs 110 and 116. AT&T currently uses Lower 700 MHz B Block, Lower 700 MHz C Block, and AWS-1 spectrum to provide LTE services. AT&T has also launched LTE service on cellular and PCS spectrum in select areas.[2] As more customers upgrade to LTE service, and compatible handsets and equipment become available, AT&T

[1] Press Release, AT&T, "AT&T 4G LTE Network Reaches More than 300 Million People" (Sept. 4, 2014), *available at* http://about.att.com/story/att_4g_lte_network_expands_reach_to_more_than_300_million_americans.html.

[2] AT&T's ability to repurpose cellular and PCS spectrum for LTE services will depend on the need to continue to use that spectrum to support customers on the existing technologies for which the spectrum is being used.

expects to deploy LTE service using additional spectrum bands, including WCS and the Lower 700 MHz D and E Blocks.

AT&T generally uses the following spectrum deployment strategy for its LTE services.

[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]

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In the Huntington-Ashland, WV/KY/OH CMA, AT&T currently operates an LTE network **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]**

[END AT&T HIGHLY CONFIDENTIAL INFORMATION]

In the Lexington-Fayette, KY CMA, AT&T currently operates an LTE network **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]**

[END AT&T HIGHLY CONFIDENTIAL INFORMATION]

As explained in Response Nos. 1(b)-(d), AT&T will use the 700 MHz spectrum to be acquired in this transaction to improve the quality of service for subscribers in these markets and to respond to subscribers' considerable demand for LTE services.

b. A detailed description of how the Company would use the spectrum that it would acquire under the Proposed Transaction to provide a 10×10 MHz LTE network, on a standalone basis and/or in conjunction with any other of the Company's spectrum holdings.

In the two affected CMAs, AT&T currently has spectrum sufficient to deploy a 5 x 5 MHz LTE carrier in 700 MHz spectrum. Acquisition of the EKY 700 MHz licenses in these markets will enable AT&T to create a 10 x 10 MHz LTE deployment in the Lower 700 MHz spectrum. As explained further below, the benefits of such a deployment are considerable, and represent a major improvement in speed and efficiency over a 5 x 5 MHz LTE carrier. Further, for those subscribers whose devices can take advantage of carrier aggregation technologies, they will be able to access a 20 x 20 MHz carrier-aggregated LTE configuration, as compared to the current 15 x 15 MHz configuration. This is achieved by using carrier aggregation technology to combine the 700 MHz spectrum with Broadband PCS or AWS-1 spectrum.

AT&T will use the EKY 700 MHz licenses to deploy LTE in the 700 MHz band with a 10 x 10 MHz configuration, where it was previously limited to a 5 x 5 MHz configuration. As explained in more detail below, a 10 x 10 MHz deployment of contiguous Lower 700 MHz B and C Block spectrum is more spectrally efficient than a deployment of two non-contiguous 5 x 5 MHz blocks. This will also improve the capacity of AT&T's LTE network. The relative gain in capacity from a 5 x 5 MHz to a 10 x 10 MHz deployment is nonlinear, meaning that the capacity of a 10 x 10 MHz block is greater than the total capacity of two separate 5 x 5 MHz blocks. For example, AT&T estimates that the average downlink capacity of a 10 x 10 MHz block, optimized for average user performance, is more than double — 2.2 times — the capacity of a 5 x 5 MHz block. Thus, the 10 MHz block would have approximately 10 percent more capacity than two 5 MHz blocks.[3] The wider bandwidth also results in noticeably better performance for users than a deployment using two 5 x 5 MHz blocks. For example, under multi-user bursty traffic conditions and assuming a 50 percent load (where load is defined as the resource block utilization level), a 10 x 10 MHz deployment is expected to support a median user throughput of about **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]**

[END AT&T HIGHLY CONFIDENTIAL INFORMATION] compared to **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION] [END AT&T HIGHLY CONFIDENTIAL INFORMATION]** for a 5 x 5 MHz deployment, for a relative gain of about **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION] [END AT&T**

[3] *See* ATT- EKY 000049-ATT- EKY000050 (setting forth assumptions underlying capacity gain estimates).

HIGHLY CONFIDENTIAL INFORMATION].[4] Finally, it is well known that the peak data rate for a 10 x 10 MHz block is twice that of a 5 x 5 MHz block.[5]

In addition, AT&T currently uses carrier aggregation to bond its 700 MHz LTE deployment with its LTE carriers in the AWS-1 or Broadband PCS band. The result is that customers whose devices support carrier aggregation can currently access a 15 x 15 MHz carrier-aggregated LTE deployment. Post-closing, these customers will be able to access a 20 x 20 MHz carrier-aggregated LTE network. Obviously, for the approximately 70% of subscribers whose handsets do not support carrier aggregation, the transaction will be even more important as it will permit AT&T to utilize a 10 x 10 MHz carrier for 700 MHz LTE services. As documented above, customers using 700 MHz LTE services will see a substantial benefit in terms of speed and throughput.

c. A detailed description of how deployment of a 10×10 MHz LTE network would improve spectral efficiency, and the Company's timeline for such a deployment.

There are numerous spectral efficiency benefits associated with the deployment of a 10 x 10 MHz LTE network, as opposed to a 5 x 5 MHz LTE network. First, the 10 x 10 MHz deployment's wider bandwidth provides greater trunking efficiencies. Additionally, a 10 x 10 MHz contiguous block also benefits from signaling efficiency as many of the control overhead/messages (such as Physical Broadcast Control Channel, Shared Channel, *etc*) need to be transmitted only once instead of twice, as would be the case for two non-contiguous 5 x 5

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[4] *See* ATT-EKY000007 (setting forth assumptions underlying calculations).

[5] *See, e.g.*, Eiko Seidel, Junaid Afzal, Günther Liebl, Nomor Research GmbH, *White Paper — Dual Cell HSDPA and its Future Evolution* at 2 (January 2009) (stating that doubling bandwidth will double data rates), *available at* http://www.nomor-research.com/uploads/1h/pA/1hpAccByjinAOWBDzTNt4w/WhitePaper_DC-HSDPA_2009-01.pdf.

MHz blocks. These efficiency improvements result in higher system capacity and spectral efficiency and a better user throughput experience than would be possible over two separate 5 x 5 MHz blocks.

The wider bandwidth of a contiguous 10 x 10 MHz block provides trunking efficiency gains due to the pooling of the resources across a single scheduler, thus enabling AT&T to carry more traffic (more calls and more megabytes of data traffic per busy hour) than AT&T would be able to carry over two separate 5 x 5 MHz blocks. In other words, the increased efficiency results from the fact that potential users can be scheduled over a larger number of resources (sub-channels) in the 10 x 10 MHz deployment than they can if they were split between two separate 5 x 5 blocks.[6] In addition, when the channel bandwidth is significantly greater than the coherence bandwidth[7] (the coherence bandwidth is generally somewhat less than 5 MHz in these systems), it ensures that the entire signal does not undergo a deep fade, and by using proper frequency-selective resource allocation, this should result in increased efficiency.

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[6] A useful analogy is to the ticket agent line at an airport. One line that is served by four ticket agents will provide more prompt and efficient service for customers than two separate lines, where each line is served by two ticket agents and customers cannot change lines. When one line is served by four ticket agents, whenever an agent is available, the next customer in line will be served. With two separate lines, if one line is empty and the other is full, the ticket agents serving the empty line are not utilized because customers cannot change lines. Combining the two lines results in better service to the customers as a whole, uses the ticket agents more efficiently, and provides the capacity to serve more customers in a given amount of time.

[7] "Coherence bandwidth is a statistical measure of the range of frequencies over which the channel can be considered 'flat' (*i.e.*, a channel which passes all spectral components with approximately equal gain and linear phase). In other words, coherence bandwidth is the range of frequencies over which two frequency components have a strong potential for amplitude correlation." Theodore S. Rappaport, Wireless Communications: Principles and Practice (2007).

In addition to deploying a 10 x 10 MHz LTE carrier in the Lower 700 MHz spectrum, AT&T uses carrier aggregation technology to combine its 700 MHz and Broadband PCS or AWS-1 spectrum holdings into a carrier-aggregated 20 x 20 MHz LTE deployment. Studies have shown that the use of carrier aggregation **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION] [END AT&T HIGHLY CONFIDENTIAL INFORMATION].**[8]

The spectral efficiency benefits of a 10 x 10 MHz LTE deployment are a matter of Commission record. In approving another transaction in which AT&T acquired Lower 700 MHz B Block spectrum to complement its C Block holdings, the Commission agreed that "the proposed transaction has the potential to enable AT&T to achieve greater spectral efficiency and greater throughput in the license areas at issue, which would enable AT&T to expand its LTE deployment using contiguous spectrum. Indeed, AT&T's description of its plans for these markets generally suggests that AT&T would take advantage of these potential benefits to provide better service to customers."[9]

In the Huntington-Ashland, WV/KY/OH CMA, AT&T's LTE network currently covers approximately **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION] [END AT&T HIGHLY CONFIDENTIAL INFORMATION]** people.[10] In the Lexington-

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8 *See* ATT-EKY000002.

9 *Applications of AT&T Inc., Cellco Partnership d/b/a Verizon Wireless, Grain Spectrum, LLC, and Grain Spectrum II, LLC*, Memorandum Opinion and Order, 28 FCC Rcd 12878, ¶ 59 (2013).

10 **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION] [END AT&T HIGHLY CONFIDENTIAL INFORMATION]** The current coverage data may include "spillover" coverage from adjacent

Fayette, KY CMA, AT&T's LTE network currently covers approximately **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION] [END AT&T HIGHLY CONFIDENTIAL INFORMATION]** people.[11] Where AT&T has already deployed LTE on its 700 MHz B Block spectrum in these markets, AT&T expects to deploy the C Block spectrum within 60-90 days after closing.

d. A detailed explanation of why the Company needs more than approximately one-third of the suitable and available spectrum below 1 GHz for the provision of mobile wireless services.

By acquiring the Lower 700 MHz C Block licenses in these CMAs, AT&T will be able to enhance and extend AT&T's LTE services. These benefits cannot be replicated through the acquisition of any spectrum in these markets other than the EKY licenses. For the reasons explained below, this spectrum is of particular interest to AT&T – the fact that it happens to be below 1 GHz is secondary to the role this license plays in complementing and enhancing AT&T's existing spectrum holdings and network deployments.

Acquisition of the EKY licenses will allow AT&T to expand its Lower 700 MHz LTE deployment in these markets from 5 x 5 MHz to 10 x 10 MHz. It is not a requirement that contiguous LTE spectrum be below 1 GHz – many of AT&T's competitors are successfully deploying LTE in large, contiguous blocks in other bands.[12] AT&T, too, has deployed LTE in

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areas, potentially resulting in the Subject CMA having population coverage although no LTE sites have been deployed within the CMA boundaries.

[11] *Id.*

[12] *See, e.g.*, Kevin Fitchard, "Verizon Quietly Unleashes its LTE Monster, Tripling 4G Capacity in Major Cities," Gigaom (Dec. 5, 2013), *available at* https://gigaom.com/2013/12/05/verizon-quietly-unleashes-its-lte-monster-tripling-4g-capacity-in-major-cities/ ("Verizon is tapping the Advanced Wireless Services airwaves it acquired from the cable operators back in 2012, and these are no paltry frequencies. In every major city east of the Mississippi and in several western markets, Palmer said, Verizon has fielded LTE systems

spectrum above 1 GHz, and this spectrum has played a valuable role in serving AT&T's subscribers. However, for AT&T the acquisition of these particular licenses is a logical complement to its B Block holdings. The acquisition of additional 700 MHz spectrum for LTE also makes particular sense for AT&T because as a general matter, AT&T's LTE deployment has centered around the Lower 700 MHz band.

In addition, the acquisition of this particular spectrum will facilitate a more efficient and productive network deployment in West Virginia. One of the licenses AT&T seeks to acquire in this transaction covers Huntington, West Virginia. In adjacent Charleston, West Virginia, AT&T holds both the Lower 700 MHz B and C Block licenses and **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]**

[END AT&T HIGHLY CONFIDENTIAL INFORMATION] and acquisition of the EKY license will enable AT&T to provide seamless coverage to subscribers

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utilizing a full 40 MHz of spectrum, twice as big as the 20 MHz network it's spent the last three years rolling out nationwide. In some cities it couldn't piece together a 40 MHz block, but it has been able to get close: In San Francisco and Los Angeles, for instance, the new networks are hosted on 30 MHz of AWS spectrum."); News Release, T-Mobile, "Customer Data Proves T-Mobile Network Now Fasted 4G LTE in the U.S." (Jan. 8, 2014), *available at* http://newsroom.t-mobile.com/news/customer-data-proves-t-mobile-network-now-fastest-4g-lte-in-the-us.htm ("The company also revealed the continued rapid expansion of its nationwide LTE network to reach 209 million people, with 43 of the top 50 markets now served by 10+10 MHz LTE. . . . With the launch of T-Mobile Wideband LTE in North Dallas last November, T-Mobile beat another company milestone, delivering 20+20 MHz LTE ahead of 2014, which is capable of peak download speeds of 150 Mbps. T-Mobile has measured download speeds of 147 Mbps and uplink speeds of up to 40 Mbps in North Dallas, meaning customers could download a 90-minute HD movie in under three minutes or a whole music album in 7 seconds."); Chuong Nguyen, "Sprint Chooses Radically Different Approach for LTE Network, And It May Pay Off," GottaBeMobile (Apr. 18, 2013), *available at* http://www.gottabemobile.com/2013/04/18/twitter-music-app-for-iphone-and-web-browsers-launches/ ("In essence, this will give Sprint roughly about a 20 X 20 channel for LTE when maximized, which is double the 10 X 10 channel that Verizon has for its LTE deployment and far more than the 5 X 5 channel that AT&T is limited to in select markets. . . .[Sprint Director of Solutions Engineering Kim Wade] says that essentially, this large chunk of bandwidth from Sprint and as part of its agreement with Clearwire will allow Sprint to deliver speeds up to 100 Mbps in the future.").

using this service and moving throughout the area. This will also promote greater spectral efficiency, as AT&T currently must limit the signal strength of its 700 MHz C Block deployment in Charleston, West Virginia. The consummation of this transaction will therefore improve AT&T's service in adjacent markets by allowing AT&T to increase its signal strength at the market border.

Provide all documents relied on in preparing the responses to 1(a)-1(d).

Relevant documents are attached at Bates Ranges ATT-EKY000001-ATT-EKY000186.

2. REQUEST:

Provide polygons in an ESRI shapefile format representing geographic coverage for AT&T in each Relevant Area, including each mobile broadband network technology (e.g., CDMA, EV-DO, EV-DO Rev. A, GSM, EDGE, UMTS, HSPA, HSPA+, LTE) deployed in each frequency band (e.g., Lower 700 MHz, Cellular, AWS-1, PCS). Provide all assumptions, methodology (e.g., propagation, projection, field measurements), calculations (including link budgets), tools (e.g., predictive and field measurements) and data (e.g., terrain, morphology, buildings) used in the production of the polygons, and identify the propagation tool used, the propagation model used within that tool, including but not limited to, the coefficients used in the model and any additions, corrections or modifications made to the model.

RESPONSE:

Exhibit 2 provides polygons in ESRI shapefile format representing geographic coverage for AT&T.

The polygons were generated by Forsk's Atoll propagation tool, which AT&T uses in the ordinary course of its business to create signal level files, which are collected and compiled to create coverage maps. Inputs to the propagation tool include cell site location, antenna height, antenna down tilt, antenna azimuth (direction in which the antenna points), antenna pattern (shape of antenna signal), signal power, topography/terrain, and clutter (physical land use and vegetation obstructions to the propagation of radio waves other than topography).

AT&T customizes the Atoll propagation tool primarily through the use of area-specific propagation models, which leverage up-to-date geographic terrain and clutter information provided by **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]**

[END AT&T HIGHLY CONFIDENTIAL INFORMATION], a geodata provider.

AT&T contracts with a third-party vendor, **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]** **[END AT&T HIGHLY CONFIDENTIAL INFORMATION]**, to tune and deliver pre-calibrated propagation models to AT&T. The calibrated propagation models are based on **[BEGIN AT&T HIGHLY CONFIDENTIAL INFORMATION]**

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3. REQUEST:

On page 4-5 of the Public Interest Statement, the Applicants assert that "the proposed transaction will enhance competition by enabling AT&T to be a more effective competitor, while preserving meaningful competition in the affected markets" and that "the transaction will not result in public interest harm in mobile telephony/mobile broadband markets because of the affected market's 'characteristics that would allow rival service providers to provide an effective competitive constraint.'" For each of CMA 110 (Huntington-Ashland, WV/KY/OH) and CMA 116 (Lexington-Fayette, KY), provide a detailed discussion of how the Proposed Transaction promotes and preserves meaningful competition, would still allow rival service providers and potential new entrants to provide an effective competitive 2 constraint, and how it would allow the Company to become a more effective competitor. Provide all documents relied on in preparing the response.

RESPONSE:

The proposed transaction will preserve competition and allow rival service providers to provide an effective competitive constraint for several reasons. First, the transaction will not affect any subscribers in the Subject CMAs. As such, this transaction will not lead to an increase in market concentration or decrease the number of entities providing service to customers in these markets. Meanwhile, Verizon Wireless, Sprint, T-Mobile, and DISH all have substantial spectrum holdings in these markets and will continue to provide a competitive constraint post-transaction.

The proposed transaction will allow AT&T to become a more effective competitor because it will allow AT&T to deploy a higher quality 4G LTE network in these markets than it would be able to deploy in the absence of this transaction (see above). Wireless carriers compete vigorously on the speed and quality of their networks, and the higher speeds and technical

efficiencies made possible by this acquisition of spectrum will allow AT&T to be a more effective competitor in the Relevant Areas.