

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)	
)	
Unlicensed Use of the 6 GHz Band)	ET Docket No. 18-295
)	
Expanding Flexible Use in Mid-Band Spectrum)	GN Docket No. 17-183
Between 3.7 and 24 GHz)	

COMMENTS OF ERICSSON

Mark Racek
Kumar Balachandran
Jared Carlson

ERICSSON
1776 I Street, NW
Suite 240
Washington, DC 20006
Telephone: (202) 824-0110

February 15, 2019

TABLE OF CONTENTS

I.	INTRODUCTION AND SUMMARY	1
II.	THE COMMISSION SHOULD REASSESS THE 6 GHz BAND AND MAKE SPECTRUM AVAILABLE FOR UNLICENSED OPERATIONS AND LICENSED FLEXIBLE USE WIRELESS SERVICES.	5
	A. The Explosive Demand for Mobile Broadband and Other Factors Dictate that the Commission Repurpose Ample Mid-Band Spectrum for Licensed 5G Service.....	5
	B. Licensing Some of the 6 GHz Band Will Help to Balance the Amount of Mid-Band Spectrum Dedicated to Unlicensed Versus Licensed.	8
	C. The Benefits of the Licensed Model Will Resonate in the 5G IoT Market and in Offloading.	10
III.	THE COMMISSION SHOULD REPURPOSE THE 6.525-7.125 GHz BAND FOR FLEXIBLE USE LICENSED SERVICE AND WORK WITH NTIA TO EXPLORE NON-FEDERAL FIXED USE OF THE 7.125-8.5 GHz BAND.	13
IV.	THE COMMISSION SHOULD MAKE THE 6.425-6.525 GHz BAND AVAILABLE FOR INDOOR-ONLY LICENSED SERVICE.	16
V.	ERICSSON SUPPORTS UNLICENSED USE OF THE 5.925-6.425 GHz BAND PROVIDED THAT THE COMMISSION ADOPTS THE AUTOMATED FREQUENCY CONTROL REGIME AS MODIFIED HERE.	20
VI.	THE COMMISSION SHOULD PROMOTE TECHNOLOGICAL NEUTRALITY IN THE UNLICENSED PORTION OF THE 6 GHz BAND.	22
VII.	CONCLUSION.....	23

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)	
)	
Unlicensed Use of the 6 GHz Band)	ET Docket No. 18-295
)	
Expanding Flexible Use in Mid-Band Spectrum)	GN Docket No. 17-183
Between 3.7 and 24 GHz)	

COMMENTS OF ERICSSON

Ericsson submits these comments in response to the Notice of Proposed Rulemaking (“*NPRM*”) in the above-referenced proceeding,¹ in which the Commission proposes enabling more intensive spectrum usage in the 1,200 megahertz of spectrum from 5.925-7.125 GHz (“6 GHz band”).

I. INTRODUCTION AND SUMMARY.

Ericsson commends the Commission for its commitment to making mid-band spectrum available for new wireless services and for this rulemaking’s focus on the 6 GHz band. Mid-band spectrum is unique because it offers a balance of low-band capabilities (favorable signal range and indoor penetration) and higher-band benefits (increased capacity for faster speeds and lower latency). As it has before, Ericsson calls for the Commission to make a portion of the 6 GHz band available for licensed use.²

¹ *Unlicensed Use of the 6 GHz Band*, Notice of Proposed Rulemaking, FCC 18-147 (rel. Oct. 24, 2018) (“*NPRM*”).

² Comments of Ericsson, GN Docket No. 17-183, at 3 (Oct. 2, 2017) (“Ericsson Mid-Band NOI Comments”). *See also* Letter from Jared M. Carlson, Vice President, Government Affairs and

Ericsson is a firm supporter of both licensed and unlicensed use of spectrum – including in the 6 GHz band. Ericsson is currently manufacturing 5G radios in the U.S. and is boosting its U.S. investments in R&D.³ Ericsson produces many products like License Assisted Access (“LAA”) for use in unlicensed bands.⁴ And looking ahead, there is much promise for licensed and unlicensed in next-generation services. For example, 3GPP Release 16 will support both 5G New Radio (“NR”) and unlicensed (“NR-U”) technologies. Allowing both licensed and unlicensed use in the 6 GHz band will create tremendous opportunities for commercial and private uses of the mid-band across a wide variety of use cases. Accordingly, in this proceeding, Ericsson supports a fresh look at the 6 GHz band and a balanced approach that will enable these opportunities.

The mobile industry requires large blocks of *licensed* spectrum to support 5G – particularly in the mid-bands.⁵ Presently, there is *no* large swath of mid-band spectrum available for licensed macro 5G service in the U.S. The 3.5 GHz Citizens Broadband Radio Service (“CBRS”) three-tiered spectrum access regime will make 70 megahertz available for licensed use, with a single entity holding no more than 40 megahertz in a market. The 3.7-4.2 GHz band is the only pending opportunity, and only part of that spectrum may be available for repurposing.

Public Policy, Ericsson, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 14-177, at 2 (Oct. 9, 2018).

³ See Press Release, Ericsson, *Ericsson increasing US investments to support accelerated 5G deployments* (Aug. 10, 2018), <https://www.ericsson.com/en/press-releases/2018/8/ericsson-increasing-us-investments-to-support-accelerated-5g-deployments>.

⁴ See, e.g., Press Release, Ericsson, *T-Mobile, Ericsson exceed 1 Gbps with LAA demo* (Dec. 5, 2017), <https://www.ericsson.com/en/press-releases/2017/12/t-mobile-ericsson-exceed-1-gbps-with-laa-demo>.

⁵ See, e.g., Letter from Jared M. Carlson, Vice President, Government Affairs and Public Policy, Ericsson, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183, at 1-2 (Oct. 15, 2018).

Little if any mid-band spectrum is expected to be available from 7 to 24 GHz, at least in the foreseeable future. Ericsson respectfully submits that this scenario cannot be squared with the leadership role the United States intends to assume for 5G.⁶ The Commission can address this problem by identifying an appropriate balance between licensed and unlicensed use of mid-band spectrum,⁷ including the opportunity in this 1,200 megahertz of spectrum.

Ericsson urges the Commission to revisit its approach to the 6 GHz band and reiterates key points it raised in comments on the Commission's Notice of Inquiry in GN Docket No. 17-183. In particular, the Commission should take the following actions:

- 1) Pursue unlicensed opportunities in the 5.925-6.425 GHz with an emphasis on rules that render the band neutral to choice of technology;
- 2) Explore the introduction of new licensed opportunities in the 6.425-7.125 GHz bands;
- 3) Ensure that incumbent operations are protected from harmful interference or accommodated; and
- 4) Examine whether to transition the 7.125-8.5 GHz band from an exclusive federal band to a shared one.⁸

Ericsson's support for unlicensed use at 5.925-6.425 GHz is premised on Commission adoption of an automated frequency control ("AFC") regime that adequately protects incumbent fixed service ("FS") licensees from harmful interference. The AFC should serve as a positive controller with regard to unlicensed operations in the band. Each FS incumbent licensee should

⁶ See Presidential Memorandum on Developing a Sustainable Spectrum Strategy for America's Future, Section 1 (Oct. 25, 2018) ("[I]t is imperative that America be first in fifth-generation (5G) wireless technologies ..."), <https://www.whitehouse.gov/presidential-actions/presidential-memorandum-developing-sustainable-spectrum-strategy-americas-future/>.

⁷ See *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, 8062 (2016) ("*Spectrum Frontiers R&O and FNPRM*") ("[I]t is optimal to include a balance of licensed rights and opportunities to operate on an unlicensed basis in order to meet the country's wireless broadband needs.").

⁸ Ericsson Mid-Band NOI Comments at 3.

be protected by an exclusion zone determined by the individual FS receive antenna pattern, path loss and the equivalent isotropically radiated power (“EIRP”) of the unlicensed device. In addition, it is critically important that unlicensed use of the 5.925-6.425 GHz band be technologically neutral. That is, the spectrum should not be a “Wi-Fi only” band but should be available for any air interface technology, including LAA, LTE and NR-U.

In Europe regulators have bifurcated the 6 GHz band, launching unlicensed operations in the 5.925-6.425 GHz band.⁹ The Commission should take a similar approach here – pursue an unlicensed spectrum sharing regime for the 5.925-6.425 GHz band – and it also should issue a notice of proposed rulemaking to consider repurposing the 6.425-7.125 GHz band for licensed flexible-use service and auctioning the band. Winning bidders would be responsible for making incumbents in the band whole, including through relocation as appropriate. The Commission and NTIA should explore converting the 7.125-8.5 GHz into a shared federal/non-federal band and transitioning 6.525-7.125 GHz fixed incumbents upwards in frequency to share the 7.125-8.5 GHz band with federal users. The Commission should work with NTIA to develop sharing studies that will ultimately lead to technical rules. Further, the Commission should study potential relocation options for incumbent Broadcast Auxiliary Service (“BAS”) and Cable Television Relay Service (“CARS”) operations, including relocation to other spectrum or use of different transmission technologies (*e.g.*, fiber, 5G).

⁹ In December 2017, the European Commission mandated that CEPT study the feasibility of and identify harmonized technical conditions for coexistence of wireless access systems or “WAS,” including radio local area networks (“RLANs”), in the 5.925-6.425 GHz band. Previously, at the 44th Plenary meeting (February 28 – March 3, 2017), the Electronic Communications Committee (ECC) of CEPT agreed to task Working Group Frequency Management (WG FM) to study the technical and regulatory feasibility of harmonized introduction of low power WAS/RLANs in the band 5.925-6.425 GHz. The related compatibility studies (with the Fixed Service and Fixed Satellite Service (uplink)) are to be conducted in System Working Group Spectrum Engineering 45 (SE 45).

Lastly, the Commission should set aside the 6.425-6.525 GHz band for indoor-only licensed mobile wireless service. Critical industries require communication platforms that are secure, protected from interference, reliable and with low latency. Ericsson recommends a licensed regulatory framework to make it possible for utilities and enterprises to invest in high performance systems.

II. THE COMMISSION SHOULD REASSESS THE 6 GHz BAND AND MAKE SPECTRUM AVAILABLE FOR UNLICENSED OPERATIONS AND LICENSED FLEXIBLE USE WIRELESS SERVICES.

A. The Explosive Demand for Mobile Broadband and Other Factors Dictate that the Commission Repurpose Ample Mid-Band Spectrum for Licensed 5G Service.

Demand projections confirm the importance of repurposing additional spectrum for 5G. The November 2018 *Ericsson Mobility Report* forecasts that over half (55 percent) of all mobile subscriptions in North America will be 5G by 2024.¹⁰ The *Ericsson Mobility Report* also found that North America continues to have the highest monthly data traffic per smartphone, reaching 8.6 gigabytes in 2018, and this figure is expected to rise to 50 gigabytes by the end of 2024.¹¹ In the same period, total mobile data traffic in North America is expected to rise to 19 exabytes per month (roughly six times the amount of traffic in 2018).¹² The global number of licensed cellular Internet of Things (“IoT”) connections is expected to reach 4.1 billion in 2024,¹³ and, as pointed out in the *NPRM*, one forecast predicts that more than 1 billion “smart home” devices

¹⁰ Ericsson, *Ericsson Mobility Report*, at 13 (Nov. 2018) (“*Ericsson Mobility Report*”), <https://www.ericsson.com/assets/local/mobility-report/documents/2018/ericsson-mobility-report-november-2018.pdf>.

¹¹ *Id.* at 16.

¹² *Id.* at 17.

¹³ *Id.* at 8.

will exist in the U.S. by 2023.¹⁴ Not surprisingly, U.S. wireless operators have concluded that “expectations for long-term mobile data traffic outweigh the capacity that can be provided with existing spectrum holdings.”¹⁵

It is equally clear that “the opportunity to round out and super charge 5G connectivity will rely upon opening up *mid-band* spectrum waves.”¹⁶ Mid-band spectrum, available in wide bandwidths, offers a hybrid of coverage and capacity unavailable in the lower bands (where coverage is the primary benefit) or the higher bands (where capacity is the primary benefit). Such mid-band spectrum is well-suited for robust, wide-area macro 5G offerings. And its coverage advantages will extend the availability of 5G beyond densely populated areas, complementing shorter range millimeter wave spectrum use in urban and suburban settings.¹⁷ Accordingly, investment in 5G buildout over mid-band spectrum will be significant. Analysis Group has estimated that wireless providers will invest in excess of \$154 billion on infrastructure to deliver 5G services over mid-band spectrum over a seven-year buildout period, resulting in

¹⁴ *NPRM* ¶ 7.

¹⁵ GSMA, *The 5G era in the US*, at 34 (2018) (“GSMA 5G Report”), <https://www.gsma-intelligence.com/research/?file=4cbbdb475f24b3c5f5a93a2796a4aa28&download>.

¹⁶ Roslyn Layton, *The U.S. Must Move Quickly On Mid-Band Spectrum If It Wants To Lead In 5G*, *Forbes* (May 23, 2018) (emphasis added), <https://www.forbes.com/sites/roslynlayton/2018/05/23/the-us-must-move-quickly-on-mid-band-spectrum-if-it-wants-to-lead-in-5g/#40ee41e7462a>.

¹⁷ David W. Sosa & Greg Rafert, *The Economic Impacts of Reallocating Mid-Band Spectrum to 5G in the United States*, at 2, Analysis Group (Feb. 2019), <https://api.ctia.org/wp-content/uploads/2019/02/The-Economic-Impacts-of-Reallocating-Mid-Band-Spectrum-to-5G-1.pdf> (“Unlike prior generations of wireless networks such as 3G and 4G, the benefits of 5G are achieved through complementary relationships between low-, mid-, and high-band spectrum. In particular, the United States’ large landmass and range of population densities will necessitate a more complex solution, leveraging the complementarity of the different bands, to deliver a 5G experience. Constrained supply of spectrum in any of the three spectrum ranges could jeopardize the full potential of U.S. 5G leadership.”).

\$274 billion in additional GDP and 1.3 million new jobs, accounting for both direct and spillover effects.¹⁸

To lead on 5G, the United States needs to identify more mid-band spectrum – and soon – as other countries are moving forward quickly to seize the 5G mantle. As GSMA recently noted, “[c]ompared to 4G, more markets are set to be involved in early 5G deployments around the world.”¹⁹ And those early deployments will rely increasingly on mid-band spectrum. This is reflected in a recent report prepared for CTIA by Analysys Mason.²⁰ The report analyzed thirteen “benchmark” countries²¹ and found that an average of nearly 300 megahertz of mid-band spectrum per country will be assigned to mobile service by the end of 2020 – more than the amount of mid-band spectrum expected to be assigned to mobile service in the United States over the same period of time.²² Japan and China, for example, are projected to assign 700

¹⁸ *Id.* at 1.

¹⁹ *GSMA 5G Report* at 32.

²⁰ David Abecassis, Janette Stewart, Michael Kende & Chris Nickerson, *Mid-band spectrum global update* (Nov. 2018), Analysys Mason (“Analysys Mason Report”), submitted as an attachment to Reply Comments of CTIA, GN Docket No. 18-122 (filed Dec. 11, 2018).

²¹ The countries were the United States, Australia, Canada, China, France, Germany, Japan, Russia, Singapore, Spain, South Korea, Sweden and the United Kingdom.

²² Analysys Mason Report at 1, 3-4. *See also* Monica Allevén, *South Korea wraps 5G auction for 3.5, 28 GHz*, FierceWireless (June 20, 2018), <https://www.fiercewireless.com/wireless/south-korea-wraps-5g-auction-for-3-5-28-ghz>; CTIA, *The Global Race to 5G*, at 8 (Apr. 2018), <https://api.ctia.org/wp-content/uploads/2018/-04/Race-to-5G-Report.pdf>; Dylan Bushell-Embling, *China edges ahead in 5G race*, telecomasia.net (Apr. 17, 2018), <https://www.telecomasia.net/content/china-edges-ahead-5g-race>. *See also* Asha Keddy, *US must respond to increasing 5G global competition*, The Hill (Sept. 6, 2018), <https://thehill.com/opinion/technology/404405-us-must-respond-to-increasing-5g-global-competition> (“A recent study by Deloitte states that ‘China and other countries may be creating a 5G tsunami, making it near impossible to catch up.’ Most critically, these nations are taking steps to open up bigger slices of the ‘mid-band’ spectrum to 5G. Doing so enables both the speed and range needed for networks based on this fast-emerging, next-generation technology.”).

megahertz and 500 megahertz, respectively, of mid-band spectrum to mobile service by the end of 2020.²³ In other words, as Chairman Pai observed, “[o]ther countries, especially China, are eager to seize these opportunities for themselves, confident that the first mover will claim the bulk of the benefits (as happened when the United States led on 4G).”²⁴

B. Licensing Some of the 6 GHz Band Will Help to Balance the Amount of Mid-Band Spectrum Dedicated to Unlicensed Versus Licensed.

At this point, spectrum in the 3.7-4.2 GHz band is the only mid-band spectrum option under consideration that could be suitable for an exclusive-use, flexible-rights, licensed service, with a sufficient amount of spectrum for macro 5G operations. Even there, however, the opportunity may be limited as satellite incumbents have offered to make only 180 megahertz of the 3.7-4.2 GHz spectrum (200 MHz less a 20 MHz guardband) available for repurposing.²⁵ This amounts to just *15 percent* of the 1,200 megahertz of spectrum the Commission is now proposing to make available for unlicensed operations in the 6 GHz band. Moreover, any repurposing of the 3.7-4.2 GHz band will likely be subject to a transition period for incumbents that will delay access to the spectrum for 5G.

Reliance on other mid-band spectrum will not solve the problem. While Ericsson supports the Commission’s 3.5 GHz CBRS – and applauded the recent Report and Order modifying the Priority Access Licenses (“PALs”) to enhance investment and innovation in the

²³ Analysys Mason Report at 3-4.

²⁴ Ajit Pai, *5G is in reach. But only if we set the right policies.*, Wash. Post (Sept. 26, 2018), https://www.washingtonpost.com/opinions/5g-is-in-reach-but-only-if-we-set-the-right-policies/2018/09/26/9d5c322e-c1c7-11e8-8f06-009b39c3f6dd_story.html?utm_term=.93c577a5f57b.

²⁵ See C-Band Alliance, *C-Band Alliance Proposal Fact Sheet: October 22 Update*, at 1 (Oct. 2018), <https://c-bandalliance.com/wp-content/uploads/2018/10/20181022-200-MHz-FactSheet-Clean-and-Final.pdf>.

band – the rules continue to limit the 3.5 GHz band’s utility for macro 5G deployments. Among them, as the Report and Order observed, the transmit power levels are “significantly lower” than in other flexible use bands due to coexistence concerns.²⁶ Further, a maximum of 70 megahertz will be available for the licensed PALs service, and a single entity is limited to holding no more than 40 megahertz of PALs spectrum in a market, further limiting the opportunities for capacity. With its sharing arrangement, lower transmit power, and narrower channelization, the CBRS spectrum offers different capabilities and opportunities compared with the 3.7-4.2 GHz band. And, as NTIA leads a review to consider repurposing the 3.45-3.55 GHz band, it must address similar circumstances as in the 3.5 GHz band.²⁷

Against this backdrop, it is incongruous for the Commission to devote so much mid-band spectrum to unlicensed operations while the mid-band opportunity for licensed service remains limited. Today, 580 megahertz of additional unlicensed mid-band spectrum is already available in the 5 GHz U-NII bands,²⁸ and the Commission is still considering the possibility of making the 5.850-5.925 GHz band available for unlicensed use as well. And, looking more broadly, three years ago the Commission made seven gigahertz of unlicensed spectrum available in the 64-71 GHz band, on top of the seven gigahertz of unlicensed spectrum already available at 57-64 GHz.²⁹ Of note, even as wireless carriers have started to launch 5G licensed service in new

²⁶ *Promoting Investment in the 3550-3700 MHz Band*, Report and Order, FCC 18-149 ¶ 65 (rel. Oct. 24, 2018).

²⁷ David J. Redl, *NTIA Identifies 3450-3550 MHz for Study as Potential Band for Wireless Broadband Use*, NTIA (Feb. 26, 2018), <https://www.ntia.doc.gov/blog/2018/ntia-identifies-3450-3550-mhz-study-potential-band-wireless-broadband-use>.

²⁸ See 47 C.F.R. § 15.407.

²⁹ *Spectrum Frontiers R&O and FNPRM*, 31 FCC Rcd at 8018.

millimeter wave bands, Commission records indicate that only three devices have obtained equipment authorization to operate in the unlicensed 64-71 GHz band.³⁰

In sum, rebalancing the amount of 6 GHz spectrum the Commission proposes to reserve for unlicensed use is the most effective near-term option for creating more licensed mid-band spectrum for 5G.

C. The Benefits of the Licensed Model Will Resonate in the 5G IoT Market and in Offloading.

In proposing to open the full 1,200 megahertz of spectrum to unlicensed use, the *NPRM* references as two relevant rationales the growth of the Internet of Things (“IoT”) and further reliance on Wi-Fi offloading.³¹ Ericsson believes that both deserve a second look, as does the exclusive focus on unlicensed in the 6 GHz band.

First, many types of IoT deployments will choose licensed networks. GSMA highlights why licensed spectrum is critical to IoT, and why regulators should take notice:

Licensed spectrum is uniquely able to provide high quality of service guarantees over wide areas, as operators are not at risk of interference and can control usage levels. As a result licensed cellular IoT may be the only choice for services which require concrete assurance levels such as for security and medical applications amongst others. ... *As a result regulators should ensure the IoT market can be allowed to benefit from the unique benefits licensed spectrum brings.*³²

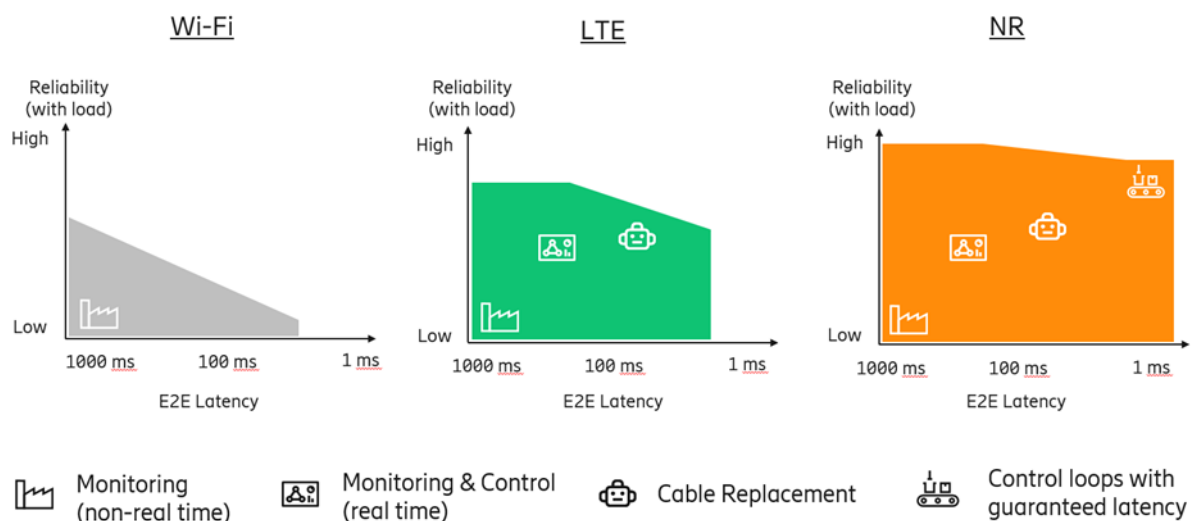
³⁰ Review of the Commission’s Equipment Authorization database on February 15, 2019 indicates that since the *Spectrum Frontiers R&O and FNPRM*, the only authorizations for original equipment are for devices with the following FCC IDs: HEDML60PRS4601, TV7SXTSQ60AD, and NZ4IP20V.

³¹ *NPRM* ¶ 7.

³² GSMA, *Spectrum for the Internet of Things – GSMA Public Policy Position*, at 5 (Aug. 2016) (emphasis added), <https://www.gsma.com/spectrum/wp-content/uploads/2017/05/Spectrum-IOT-Position-Paper.pdf>. See also James Blackman, *AT&T sets 2019 schedule for rollout of NB-IoT networks in the US and Mexico*, Enterprise IoT Insights (June 20, 2018), <https://enterprise-iotinsights.com/20180620-/channels/news/att-sets-nb-iot-schedule-tag40> (“AT&T said NB-IoT and LTE-M have advantages over technologies that operate in unlicensed spectrum, such as

And, market trends reflect that licensed spectrum may be on its way to becoming the preferred medium. “The rate of growth of licensed low-power, wide-area (LPWA) network connections will outpace their unlicensed equivalents as the LPWA market swells by 53 per cent per year over the next five years.”³³

The following graphs further illustrate why licensed spectrum is preferred to Wi-Fi for IoT networks that require higher reliability and latency:



Licensed IoT networks are starting to move forward, in the form of Narrowband Internet of Things (“NB-IoT”) and LTE-M IoT networks that use licensed spectrum. DISH, for example, recently selected Ericsson to deliver a radio access and core network for DISH’s NB-IoT

LoRa and Sigfox, including greater protections from interference, broader coverage availability and carrier-grade security.”).

³³ James Blackman, *NB-IoT and LTE-M to usurp unlicensed LPWA as the go-to choice for IoT by 2023*, Enterprise IoT Insights (June 11, 2018), <https://enterpriseiotinsights.com/20180611-/channels/news/nb-iot-and-ltem-to-usurp-unlicensed-lpwa-tag40>.

network slated for completion in March 2020.³⁴ In sum, while unlicensed spectrum is a component of the IoT landscape, IoT services and applications that demand high reliability will increasingly rely on networks operating on licensed spectrum.³⁵

Although the *NPRM* also references Wi-Fi offloading of mobile network traffic as a basis for advancing unlicensed across all of the 6 GHz band, there are multiple reasons why U.S. consumers may rely less on offloading over time. First, Wi-Fi offloading is not the optimal solution for all wireless use cases – in certain high density environments, licensed broadband service – and the higher reliability and quality that it provides – is preferred.³⁶ As but one example, while Super Bowl in-stadium traffic on DAS and Wi-Fi networks have both increased, the percentage of traffic offloaded to Wi-Fi has been dropping.³⁷

In addition, with the increasing prevalence of unlimited data plans, consumers rely more extensively on their mobile broadband service, rather than Wi-Fi. Perceiving no boundaries,

³⁴ Press Release, Ericsson, *DISH selects Ericsson for NB-IoT radio access and core network, including radio frequency design* (Nov. 6, 2018), <https://www.ericsson.com/en/press-releases/6/2018/dish-selects-ericsson-for-nb-iot-radio-access-and-core-network>.

³⁵ See, e.g., Press Release, Ericsson, *Ericsson lays out vision for cellular IoT with new segments and solutions* (Jan. 31, 2019), <https://www.ericsson.com/en/press-releases/2019/1/ericsson-lays-out-vision-for-cellular-iot-with-new-segments-and-solutions> (“In line with its cellular IoT vision, Ericsson is launching enhanced functionalities for Massive IoT and new solutions for Broadband IoT. One example of Massive IoT enhancement is the NB-IoT Extended Cell Range 100km, which stretches the standards-based limit from around 40km to 100km through software updates without changes to existing NB-IoT devices. This opens huge opportunities in IoT connectivity in rural and remote areas, particularly for logistics, agriculture and environment monitoring. Ericsson has deployed NB-IoT data connections up to 100km with Telstra and DISH.”).

³⁶ See Kyung Mun, *Mun: Wi-Fi offloading isn't as popular as it used to be in stadiums*, FierceWireless (May 9, 2016), <https://www.fiercewireless.com/wireless/mun-wi-fi-offloading-isn-t-as-popular-as-it-used-to-be-stadiums>.

³⁷ For instance, five years ago at Super Bowl 48 at MetLife Stadium, about 53 percent of total wireless traffic was offloaded to the Wi-Fi network, whereas two years later, at Super Bowl 50 at the Levi's Stadium, total wireless traffic offloaded to Wi-Fi had come down to less than 39 percent. *Id.*

unlimited plan users both consume more data in total, and allow a higher share of their traffic through mobile networks rather than Wi-Fi offload.³⁸ Further, reliance on mobile broadband allows for sustained service with handoffs and roaming between base stations, which Wi-Fi cannot provide. In addition, deployment of small cell networks gives operators another opportunity to maintain QoS traffic to the network with less impact on wide-area network capacity and less need to rely on unlicensed spectrum for offloading. Finally, licensed spectrum is going to be capable of using 5G technology to provide greater network performance from the numerous end user devices back to base stations, and from base stations back to the network operators. Each successive connection in the network chain will aggregate more and more data from the previous station, and if enough spectrum is made available, the 5G network will scale to accommodate the increased data traffic.

III. THE COMMISSION SHOULD REPURPOSE THE 6.525-7.125 GHz BAND FOR FLEXIBLE USE LICENSED SERVICE AND WORK WITH NTIA TO EXPLORE NON-FEDERAL FIXED USE OF THE 7.125-8.5 GHz BAND.

For the reasons set forth above, repurposing the 6.525-7.125 GHz band for flexible use licensed service would address the licensed spectrum gap in the mid-band and substantially advance the U.S. effort to lead on 5G. It would facilitate the wide bandwidths necessary for carriers to achieve gigabit-level service in 5G and serve as a strong complement to millimeter wave band networks, extending 5G beyond urban core and more densely populated areas. The Commission should launch a new notice of proposed rulemaking to consider repurposing the 6.525-7.125 GHz band for licensed service.

³⁸ See Ericsson, *Shifting Mobile Data Plans, Extract from the Ericsson Mobility Report*, at 4 (Nov. 2017), <https://www.ericsson.com/en/mobility-report/reports/november-2017/shifting-mobile-data-consumption-and-data-plans>.

The Commission should propose rules for the 6.525-7.125 GHz band drawn from the Upper Microwave Flexible Use Service (“UMFUS”) regulations. With the right policy approaches, the 6 GHz band can provide a coverage layer that augments the capabilities of UMFUS without compromising on quality of experience for enhanced mobile broadband users. The 6.525-7.125 GHz band rules should therefore allow the use of high-power transmissions from base stations and must allow the use of advanced/active antenna system (“AAS”) techniques on the base stations and user equipment. AAS enables state-of-the-art beamforming and multiple input and multiple output (“MIMO”) techniques that are powerful tools for improving end-user experience, capacity and coverage. As a result, AAS significantly enhances network performance in both uplink and downlink directions. Higher power and AAS techniques will overcome higher propagation losses as compared to broadband use at lower frequencies.

A key aspect of broadband networks that use these antenna systems is that their emissions tend to be spatially spread across the available spectrum. Accordingly, the Commission should expeditiously develop a framework for measurement of emissions based on average Total Radiated Power rather than instantaneous EIRP based on the antenna boresight.

Any repurposing of the 6.525-7.125 GHz band must accommodate the incumbent licensees in the band – fixed service point-to-point, BAS and CARS, and FSS uses. With macro 5G operations to be deployed in the band, this largely means relocating incumbents out of the band. The Commission should apply its long standing *Emerging Technologies* policies, requiring winning bidders that acquire the new licenses at auction to relocate incumbents to comparable facilities, be it in different frequencies or transmission media.

For FS incumbents, there are a number of options for comparable facilities available including other FS bands and fiber. Ericsson also reiterates its call for the Commission and NTIA to jointly examine transitioning the 7.125-8.5 GHz band from an exclusive federal band to a shared one, allowing relocation of non-federal FS incumbents to adjacent frequencies with identical propagation characteristics.³⁹ There will soon be a need for more spectrum to support backhaul requirements with multi-gigabit capacity needs, but current FCC rules limit bandwidth channelization in the upper 6 GHz band. The wide channels available at 7.125-8.5 GHz would accommodate the truly high-capacity long haul point-to-point links of the future. And equipment that supports gigabit backhaul is already available for the 7.125-8.5 GHz band in other markets. Access to the 7.125-8.5 GHz band thus would yield profound benefits for backhaul, especially in more remote areas where wireless is the only realistic option for long-haul links. The Commission should work with NTIA to develop sharing studies for non-federal FS links that will ultimately lead to technical rules.

As to timing, Ericsson proposes swift relocation of urban and suburban FS links. New FS channels and sites should be avoided to simplify the transition process and to ensure that protection can be supported. Because the density of receivers is less in rural areas, the Commission should allow rural links to be protected by utilizing an off-line database either on a permanent or temporary basis, so as to permit licensed mobile services to co-exist with rural incumbents and thus serve underserved rural areas on a more expedited basis.

³⁹ Ericsson Mid-Band NOI Comments at 10-11. Conversion of the 7.125-8.5 GHz band to shared use was originally proposed by the Fixed Wireless Communications Coalition (“FWCC”) in 2010. Petition of the Fixed Wireless Communications Coalition, Inc. for Rulemaking, RM-11605 (Mar. 16, 2010).

The Commission also would need to determine how to ensure that BAS and CARS electronic news gathering incumbents in the 6.875-7.125 GHz band are made whole. The *Emerging Technologies* approach would apply here as well, with new licensees responsible for relocation to comparable facilities. Stakeholders should consider all options, including a reexamination of whether BAS and CARS facilities are using their spectrum as efficiently as possible. For example, in some circumstances it may be most efficient to move BAS and/or CARS facilities to a different transmission medium, *e.g.*, fiber or 5G.⁴⁰

Finally, Ericsson does not believe that FSS earth stations operating in the earth-to-space direction in the 6.875-7.125 GHz band need protection. The effect of aggregate interference from 5G devices to satellites is expected to be of no concern in this respect.⁴¹ As for the limited space-to-earth stations, the Commission should explore whether coordination zones would provide protection.

IV. THE COMMISSION SHOULD MAKE THE 6.425-6.525 GHz BAND AVAILABLE FOR INDOOR-ONLY LICENSED SERVICE.

The 6.425-6.525 GHz band presents a unique challenge but also an opportunity for the Commission as it deliberates how to allocate spectrum in the 6 GHz band. Currently, this band is used extensively by broadcast stations, programming networks, and video production companies for electronic news gathering and wireless video links. This band also has an FSS (Earth-to-space) allocation, but no fixed service allocation.

⁴⁰ For an example of broadcaster use of millimeter wave 5G cellular technology to stream 4K video for nationwide broadcasts (in this case, the U.S. Open golf tournament), *see* Ben Munson, *Fox Sports details 5G livestreaming trial with AT&T, Ericsson at U.S. Open*, FierceVideo (Dec. 10, 2018), <https://tinyurl.com/yac3yyrb>.

⁴¹ *See, e.g., Spectrum Frontiers R&O and FNPRM*, 31 FCC Rcd at 8117 (“We do not believe that aggregate interference from UMFUS transmitters will ever reach a level that harms the operations of the 28 GHz satellite systems.”).

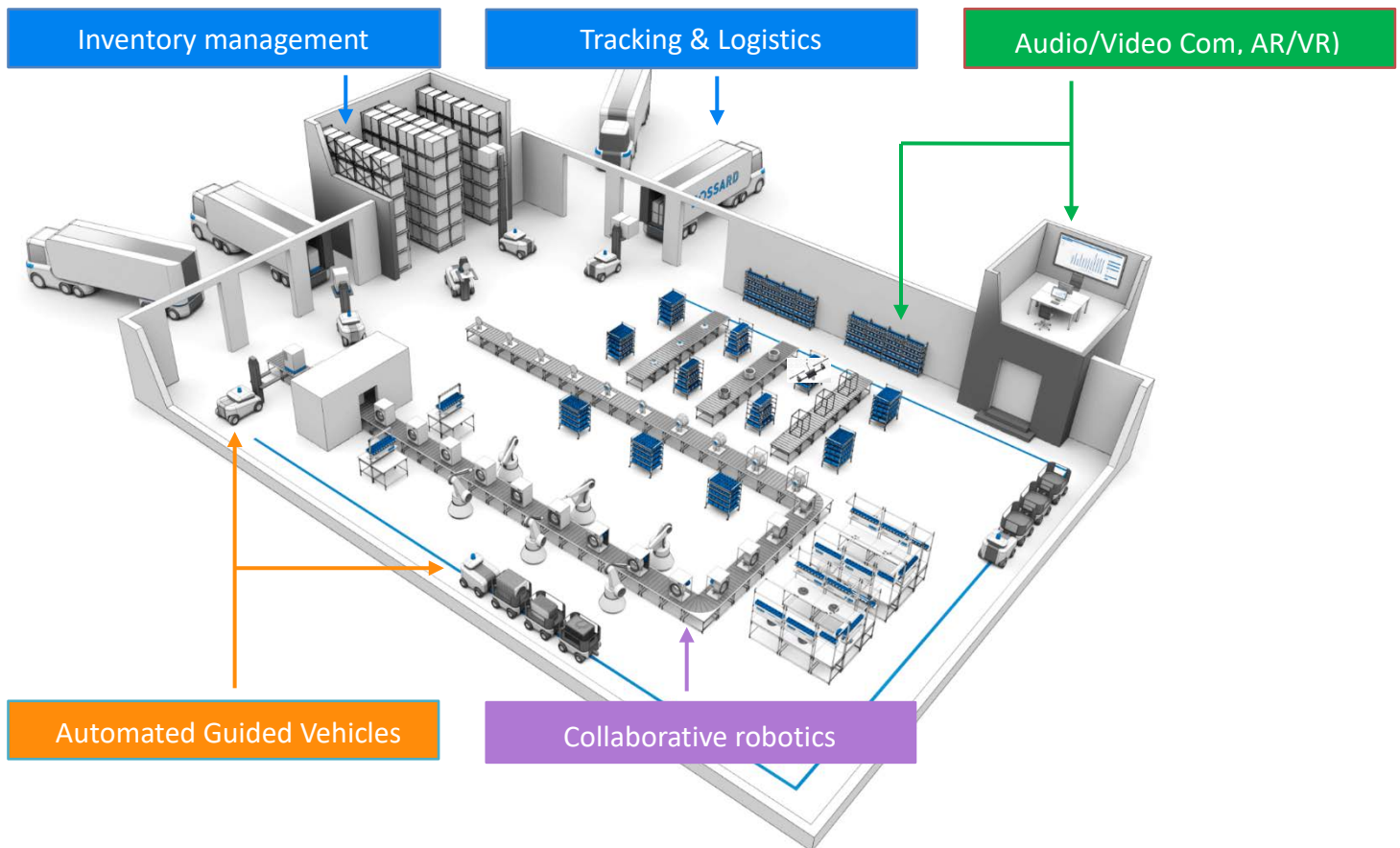
Ericsson proposes that this 100 megahertz of spectrum be used on an indoor-only, licensed basis. We propose 36 dBm EIRP and maximum conducted power of 30 dBm (as in the U-NII-3 band). We believe that such a power limitation, combined with indoor-only, licensed use, can protect incumbents in the band while also potentially attracting a new use for this spectrum. Licensed use of the spectrum will not only provide incumbents with assurance that licensees will not interfere with their use of the band but can also enable Industrial IoT use cases described more fully below. One analysis shows that there are distinct benefits to capacity and QoS through the use of a local licensing approach instead of an unlicensed framework.⁴²

Cellular IoT technology supported in existing 4G LTE networks and the 5G networks of tomorrow will enable a very broad range of use cases across many industries. For example, 5G seeks to address the automation of industrial manufacturing and process control within local private networks enabling Industrial IoT. These use cases may be served by very local licenses, typically linked to a specific structure, with interference managed, potentially, as a maximum signal strength at the border of the structure. This regulatory framework gives industry flexibility in management and control of a network, while offering the high degree of availability, reliability, and resilience with respect to security, end-to-end mission objectives, and communication performance that characterizes indoor, factory and warehouse applications. The Industrial IoT scenario is characterized by the need for very high data rates, low latency, and robustness. Ericsson believes the 6.425-6.525 GHz band may be ideally suited to provide this degree of connectivity.

⁴² See Gregorious Kristian Purwidi, *Quantitative Analysis on the Feasibility and Benefits of Local Licensing*, at 33, KTH Royal Institute of Technology School of Information and Communication Technology (2017), <http://www.diva-portal.org/smash/get/diva2:1164177-/FULLTEXT01.pdf>.

Ericsson has launched new solutions to support Cellular IoT that will enable service providers to address a larger part of these requirements with diverse use cases across industries including automotive, manufacturing, and utilities.⁴³

In the following example, we see how various IoT uses can be addressed in a Smart Manufacturing scenario. We have Massive IoT in blue used for the simpler use cases such as tracking and logistics in/out of the factory and sensors to monitor stock for inventory management. We see in green, the Broadband IoT segment, used for Augmented Reality in the factory, perhaps to show interactive schematics or for video communications. For the Critical IoT segment, shown here in orange, there are use cases that require lower latency and higher



reliability demands, such as automated guided vehicles. And finally, the time sensitive

⁴³ Ericsson Press Release, *supra* note 35

networking and industrial protocols perhaps combined with very precise positioning can be used to support use cases involving collaborative or co-operative robotics.

As noted above, to realize the full potential of the industrial IoT, however, as GE noted, “[I]ndustrial and critical-infrastructure customers require a spectrum platform that provides secure, reliable, and cost-effective connectivity on a localized basis.”⁴⁴ Unlicensed spectrum may not provide certain users with the interference protection or a guaranteed quality of service demanded by Industrial IoT use cases

Therefore, rather than adopting a framework supporting indoor *unlicensed* systems and devices in the 6.425-6.525 GHz band, Ericsson recommends a regulatory framework to make it possible for utilities and enterprises to invest in high performance systems for use on their private property to support their Industrial IoT needs.

New business models, enabled by the capabilities 5G brings to the table, are just now starting to emerge. “From owning and operating their own networks, critical industries are now procuring private networks and services that leverage service providers’ existing network assets and operations – without compromising required local control.”⁴⁵ Using 6.425-6.525 GHz as an indoor-only, licensed band⁴⁶ can offer industrial users the coverage and capacity, security, and QoS needs that they require.

⁴⁴ Comments of General Electric Company, GN Docket No. 17-258, at ii (Dec. 28, 2017).

⁴⁵ See Press Release, Ericsson, *Ericsson launches critical communications broadband networks offering* (Feb. 7, 2019), <https://www.ericsson.com/en/press-releases/2019/2/ericsson-launches-critical-communications-broadband-networks-offering>.

⁴⁶ Guaranteed access to the spectrum is required for critical IoT applications and therefore a framework, possibly using AFC, to monitor whether a signal strength threshold has been exceeded from the network outside the building could be considered.

V. ERICSSON SUPPORTS UNLICENSED USE OF THE 5.925-6.425 GHz BAND PROVIDED THAT THE COMMISSION ADOPTS THE AUTOMATED FREQUENCY CONTROL REGIME AS MODIFIED HERE.

Ericsson supports the introduction of a spectrum sharing regime and unlicensed operations into the 5.925-6.425 GHz band so long as the Commission preserves and protects the “important base of incumbent users” in the band.⁴⁷ As the Commission recognizes, given the existing FS uses in the band today, including public safety and utility links and long-distance backhaul, it is imperative that fixed services not be compromised. While Ericsson supports the introduction of unlicensed services on a technology neutral basis in the 5.925-6.425 GHz band, the Commission must ensure that those services do not cause harmful interference to FS incumbents and that FS can continue to deploy additional links in the band. To that end, Ericsson appreciates the ongoing cooperation between FWCC and some RLAN proponents as they work toward a system of automatic frequency control that would protect FS receivers.⁴⁸

The Commission’s proposed AFC regime can be an effective means of preventing interference to FS incumbents provided that certain conditions are satisfied. First, any AFC system should maintain positive control of frequency usage, such that every co-channel unlicensed access point obtains a list only of available frequencies and permitted transmit power from the AFC, informed by the given access point’s location and the locations of the incumbent licensed receivers and their technical parameters. This positive control aspect of an AFC must be applied to both outdoor and indoor access points, because uncontrolled indoor devices pose a

⁴⁷ *NPRM* ¶ 2.

⁴⁸ Letter from Cheng-yi Liu & Mitchell Lazarus, Counsel for the Fixed Wireless Communications Commission, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 17-183, at 1 (Oct. 2, 2018).

serious interference threat to the interference-free operation of FS stations.⁴⁹ Further, the AFC should be focused on one objective: protecting FS incumbents, *not* managing co-existence among unlicensed devices.

Second, the AFC should protect each fixed station based on an “exclusion zone” determined by parameters such as the incumbent’s receive antenna pattern, path loss and the EIRP of the unlicensed device.⁵⁰

Third, the Commission should ensure that AFC algorithms are based on appropriate protection criteria for fixed services, and should include use of terrain-specific models such as the Irregular Terrain Model (“ITM”) or the ITU-R P.452 model. The P.452 model belongs to the same class of models as the ITM and is used in ITU-R sharing studies with regularity. Such models should account for extraneous effects such as the presence of clutter, especially from man-made structures. Additionally, propagation models could account for the beneficial effect of indoor to outdoor attenuation when the AFC is able to determine that the unlicensed devices are deployed indoors. The AFC must be able to account for a broad range of device usage scenarios in order to provide sufficiently robust characteristics for unlicensed operations while still providing adequate protection to the incumbent services. However, it is essential that the AFC have knowledge of the location of every unlicensed access point in the 6 GHz band.

Fourth, the AFC must have the capability to direct unlicensed devices to change frequencies immediately in the event of interference. This type of corrective action is necessary to ensure the primacy of the fixed service link in the band, while recognizing that the

⁴⁹ *Id.* at 6.

⁵⁰ *See NPRM* ¶ 37.

interference impact on existing microwave services is an aggregate effect from many radiating interferers.

Lastly, the Commission should consider facilitating a multistakeholder process to develop AFC standards, including registration information, operating procedures, and testing requirements for the 6 GHz band. AFC administrators should be required to attend workshops and meetings convened by the Commission or OET, just as has been required for SAS Administrators in the CBRN band.

VI. THE COMMISSION SHOULD PROMOTE TECHNOLOGICAL NEUTRALITY IN THE UNLICENSED PORTION OF THE 6 GHz BAND.

To realize the full potential of unlicensed use of the 6 GHz band, it is essential that unlicensed providers be given the latitude to select the technologies they believe will be most responsive to market demand. The Commission should not mandate, nor prohibit, particular technologies or standards. Or, put another way, the unlicensed portion of the 6 GHz band should not be a “Wi-Fi only” band. Ericsson embraces a technology neutral approach permitting 802.11/Wi-Fi, Bluetooth, LAA/NR-U, and other future technologies in unlicensed bands. The Commission should confirm that its rules for the unlicensed portion of the 6 GHz band will be technologically neutral.

Such action is fully consistent with the Commission’s repeated invocation of technological neutrality. A technologically neutral approach here would encourage innovation, technological development, and investment. It would avoid “locking in” a given technology, allowing today’s technologies to evolve over time as well as facilitating the development and introduction of innovative new technologies, provided they are capable of providing the needed

degree of interference protection.⁵¹ The value of unlicensed spectrum is not spectrum efficiency alone, but the improvement of spectrum utility for RLAN applications and SRDs.

To that end, the Commission should avoid any proposals that would favor one unlicensed technology over another and should allow any technology so long as it conforms to neutral FCC rules. For example, Ericsson would not support rules that simply cut and paste IEEE 802.11 standards for etiquette based on “listen before talk” (“LBT”) into the regulatory framework for the unlicensed portion of the 6 GHz band. Instead, the Commission should take actions that promote technical rules that are inclusive, rather than exclusive. This will drive innovation and empower equipment manufacturers and service providers to make significant investments in developing the 6 GHz band. These developments can encourage regulators in other parts of the world to take the same inclusive approach that will not favor a single technology choice, for example, a technology-specific preamble detection procedure. Were industry to agree on an LBT protocol (independent of regulatory fiat), the Commission’s rules should permit devices that use a single energy threshold for use with LBT but not include specific LBT algorithms. Finally, there should be no requirement that would place a particular standards body, in the position of gatekeeper for all innovation and development in the unlicensed bands.

VII. CONCLUSION.

Ericsson urges the Commission to act promptly in this proceeding and make spectrum available in the 6 GHz band for both licensed and unlicensed opportunities while protecting incumbent services, in accordance with the comments set forth above.

⁵¹ Ericsson has advocated in favor of technological neutrality in other Commission proceedings involving unlicensed spectrum. *See, e.g.*, Reply Comments of Ericsson, ET Docket No. 15-105, at 7 (June 26, 2015).

ERICSSON

/s/ Mark Racek

MARK RACEK

KUMAR BALACHANDRAN

JARED CARLSON

ERICSSON

1776 I Street, NW

Suite 240

Washington, DC 20006

Telephone: (202) 824-0110

Facsimile: (202) 783-2206

February 15, 2019