

**Before the
U.S. DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
Washington, D.C. 20230**

In the Matter of)	
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)	
The National Strategy to Secure 5G)	Docket No. 200521-0144
Implementation Plan)	
)	

COMMENTS OF LIGADO NETWORKS LLC

The race to move our country to fifth generation wireless technologies, or 5G, has begun, and this is a race America cannot afford to lose. Advancement to 5G promises to transform the way we communicate, learn, and conduct business, and the speed with which the United States transitions to 5G has far-reaching implications for global leadership in data security and privacy. A successful transition to 5G is vitally important, and the good news is that the policy requirements to achieve that goal are obvious and agreed to by all: 5G requires more spectrum, and to unleash the true potential of 5G in a rapid manner, carriers will need more spectrum in a variety of bands, including low, mid-band, and high-band or mmWave. The United States, to its credit, moved early to make mmWave spectrum available, and more recently has turned to the next vital task: making mid-band spectrum, particularly lower mid-band spectrum, available on a nationwide basis.

The Federal Communications Commission (“FCC”) this year already has taken important steps in that direction. First, it adopted the C-band Order, which over the next few years will make available nearly 300 MHz of mid-band spectrum.¹ Then, in April, the FCC adopted on a

¹ *Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Report and Order and Order of Proposed Modification, 35 FCC Rcd 2343, GN Docket No. 18-122 (rel. Mar. 3, 2020).

unanimous, bipartisan basis an Order enabling Ligado Networks LLC to begin the process of putting 35 MHz of greenfield spectrum in the critical lower mid-band frequencies to work in advancing deployment of 5G.² We submit these comments to highlight the importance of mid-band spectrum to 5G deployment, and lower mid-band spectrum in particular. Global leaders in 5G infrastructure such as Nokia and Ericsson, as well as the FCC itself,³ have recognized the opportunity that lower mid-band spectrum presents, both in terms of supporting innovation and accelerating the transition to 5G. Accordingly, we urge the NTIA to include this critical lower mid-band spectrum in its Implementation Plan for the National 5G Strategy.

I. LOWER MID-BAND SPECTRUM IS ESSENTIAL TO 5G.

The advancement to 5G promises to be transformative, but it will also require an extraordinary amount of spectrum, both in terms of total MHz and in terms of variety of bands. Spectrum best suited for wireless network deployments generally falls into four categories: (1) low-band (below 1 GHz); (2) lower mid-band (1-2 GHz); (3) higher mid-band (2-6 GHz); and (4) high-band spectrum (above 6 GHz and mmWave). 5G networks will need the right mix of spectrum from all four of these categories to succeed, and mid-band spectrum is a critical element that needs attention now.

Mid-band frequencies offer both favorable propagation characteristics and wide channel bandwidth, capabilities considered foundational for next-generation networks.⁴ Of the two mid-

² See *Ligado Amendment to License Modification Applications*, Order and Authorization, 35 FCC Rcd 3772, IB Docket No. 11-109 *et al.* (rel. Apr. 22, 2020) (“*Order*”).

³ See *id.* at 3784 ¶ 19 (citing Ligado’s intention to partner with carriers to “support more broad-based 5G deployment” as a public interest benefit).

⁴ See *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd 6373, 6375 (2017) (“The combination of favorable propagation

band sub-categories, lower mid-band spectrum is of particular value. Long regarded as the “workhorse” spectrum in the wireless industry, lower mid-band spectrum is prized for its flexibility in providing nationwide coverage and capacity solutions. Higher mid-band spectrum is also attractive because it offers wide channels capable of facilitating higher data speeds and substantial bandwidth for 5G deployments, but its utility is ultimately limited by its less-favorable propagation capabilities. Whereas the lower frequency and larger wavelength of lower mid-band spectrum enables better propagation through both “free space” (unobstructed sight paths) and the environment (e.g., rain, trees, cars, buildings, etc.), higher-frequency mid-band spectrum faces greater risk of path loss and signal deterioration, particularly in urban environments.

Because of these limitations, early 5G testing and trials confirm that higher-band spectrum alone is insufficient to support broad 5G coverage. For example, commercial testing by Finnish telecom operator Elisa has demonstrated that 5G networks relying solely on higher-band spectrum deliver increased mobile data capacity and download speeds but suffer from poor indoor coverage and inconsistent network service.⁵ Many carrier tests of mmWave spectrum have encountered similar issues, as early users have reported difficulty finding a signal in some

characteristics of the mid-band frequencies (as compared to bands above 24 GHz) and the opportunity for additional channel bandwidth (as compared to bands below 3.7 GHz), could make many of these mid-band frequencies well-suited for next-generation wireless services.”).

⁵ See *First Impressions from the World’s First Commercial 5G Network*, Rewheel (Aug. 7, 2018), at 7–8, http://research.rewheel.fi/downloads/Rewheel%20trying%20Elisa's%205G%20network%20in%20Tampere_17082018_PUBLIC.pdf (“*Elisa Network Test*”).

locations.⁶ Resolving these coverage issues while preserving the data capacity and download speeds promised by 5G requires embracing lower mid-band spectrum and its favorable propagation characteristics. Indeed, Elisa’s network experts expressly recognized that a combined solution of lower and higher mid-band spectrum could solve the coverage issues experienced in commercial testing.⁷

However, the solution presented by lower mid-band spectrum is not merely theoretical. Nokia, one of the largest global vendors of wireless infrastructure solutions and a leading contributor to the development of 5G standards, completed a 5G Technical Study in June 2019 that found that “[c]ombined use of spectrum in the lower mid-band and higher mid-band categories offers significant economic and operational advantages for 5G as compared to higher mid-band only deployment alternatives.”⁸ A June 2019 technical study by Ericsson, also one of the largest global vendors of wireless infrastructure, yielded similar results.⁹ Ericsson studies have also demonstrated that combining L-band spectrum (1-2 GHz) with C-band spectrum (3.7-4.2 GHz) can provide a larger coverage area for any given site, providing a real-world example of how lower mid-band can address and resolve the issues presented by a 5G deployment utilizing primarily higher frequencies.¹⁰

⁶ See *In Verizon 5G Launch City, Reviewers Have Trouble Even Finding a Signal*, Ars Technica (Apr. 8, 2019), <https://arstechnica.com/information-technology/2019/04/in-verizon-5g-launch-city-reviewers-have-trouble-even-finding-a-signal/>.

⁷ See *Elisa Network Test* at 8 (“Elisa’s network experts confirmed our views that . . . the indoor coverage challenge is solvable by using lower LTE bands for uplink.”).

⁸ See *Nokia’s Study on Ligado Lower Mid-Band Spectrum Solution to Address 5G Deployment Challenges*, at 4, Nokia Corporation (June 2019) (“*Nokia Study*”).

⁹ See *Study of Ligado’s L-Band Spectrum to Address C-Band Deployment Challenges*, Ericsson (June 2019).

¹⁰ See *Ligado UL and DL Decoupling Study*, at 2, Ericsson (June 6, 2019) (“*Ericsson Decoupling Study*”).

As these studies—and early commercial testing—make clear, lower mid-band spectrum is vital to the advancement to 5G. NTIA should accordingly take steps to include in the implementation of its National 5G Strategy all available lower mid-band spectrum, including the 35 MHz of L-band spectrum authorized to Ligado.

II. LIGADO’S SPECTRUM IS WELL SITUATED TO PROVIDE CRITICAL LOWER MID-BAND SPECTRUM AND SUPPORT AN ACCELERATED 5G DEPLOYMENT.

Following the Federal Communications Commission’s April 2020 granting of Ligado’s license modification applications, there is now mid-band spectrum available to provide a resource of lower mid-band spectrum that will prove so vital to the 5G transition. Ligado’s L-Band license covers 30 MHz, and coupled with its access to the 1670-1675 MHz band, Ligado has a total of 35 MHz of spectrum between 1-2 GHz. Access to this underutilized band provides an opportunity for commercial and technical innovations without the delay and complexity that comes with repurposing spectrum already used in 4G networks. Key industry stakeholders—as well as the FCC—have identified Ligado’s spectrum as a clear target for 5G deployments, and the company is now undertaking the necessary work with industry partners to modify the “Band 24” specifications in the 3rd Generation Partnership Project (“3GPP”) and standardize this spectrum for 5G-NR. These capabilities and efforts position this spectrum as a key potential contributor to NTIA’s rollout of the National 5G Strategy.

Unlike spectrum already committed to other uses, the spectrum covered by the FCC’s recent Order does not require relocation of incumbent users and thus will be available in a timely manner for 5G use. Consequently, this spectrum provides considerable operational and technical advantages, since re-farming already-deployed 4G spectrum requires burdensome 4G/5G coordination. By comparison, Nokia has found that greenfield spectrum like Ligado’s can “add

network capacity immediately while reducing operational challenges, allowing for accelerated 5G deployments with no impact to existing 4G LTE networks.”¹¹ Moreover, today’s network grids are designed around sub-2 GHz spectrum, allowing rapid and economical deployment of new sources of mid-band spectrum. Given the lack of need for relocation, this L-band spectrum is perfectly situated for this sort of accelerated, cost-efficient deployment.

Additionally, the FCC and key providers of telecommunications infrastructure technology have already identified Ligado’s spectrum as an important contributor to the nation’s 5G buildout. For example, the FCC cited the potential of Ligado’s spectrum for 5G as a key public interest justification for granting Ligado’s license modifications,¹² and FCC Commissioner Brendan Carr’s statement supporting the grant specifically recognized the importance of Ligado’s spectrum in supporting 5G deployments.¹³ Key industry participants share this view. Nokia and Ericsson—two of the largest 5G technology vendors in the world—have completed studies assessing commercial implementation paths for Ligado’s spectrum,¹⁴ and each of these vendors has also collaborated separately with Ligado on specific commercial development efforts. Ligado and Nokia have developed prototype base stations and engaged in

¹¹ See *Nokia Study* at 3.

¹² See *Order* at 3773 ¶ 1 (noting that the grant of Ligado’s license modification applications “promotes more efficient and effective use of our nation’s spectrum resources by making available additional spectrum for advanced wireless services, including 5G”).

¹³ See *id.* at 3844 (“[S]tudies show that allowing the private sector to combine this mid-band spectrum with other airwaves already targeted for 5G builds will produce a more robust and cost-effective network in the U.S.”) (statement of Commissioner Brendan Carr).

¹⁴ See Letter from Gerard J. Waldron, Counsel to Ligado Networks LLC, to Marlene H. Dortch, FCC Secretary, IB Docket No. 11-109, at 6 (Aug. 6, 2019) (“*Ligado Aug. 6, 2019 Letter*”); see also, e.g., *Nokia’s Study on Ligado Spectrum Deployment*, Nokia Corporation (Feb. 2019).

network simulation analysis focused on Ligado's 1526-1536 MHz downlink band,¹⁵ and Ligado has worked with Ericsson to develop a satellite adaptation of standards-based technology aimed at supporting the 5G requirements of network redundancy and ubiquitous coverage in the industrial Internet of Things market.¹⁶

In the wake of the FCC's recent decision, Ligado has again engaged with 3GPP and global standards-based technologies generally, which will align this L-band spectrum with the National 5G Strategy's emphasis on promoting participation in international standards development. Ligado's development of technology and network services leveraging 3GPP technology will enable new, terrestrially-based services such as private networks, which will offer more customization and control of vital security principles for 5G infrastructure. Furthermore, Ligado's existing participation in international standards development initiatives fulfills the 5G Strategy's commitment to "promote and support increased participation by the private sector" in standards-setting organizations.¹⁷

CONCLUSION

Ligado agrees that 5G will be a primary driver of the nation's prosperity and security in the decades ahead. The company shares NTIA's interest in ensuring the core principles and lines of effort articulated in the National Strategy for 5G are implemented swiftly and securely. Successfully executing this strategy will require the use of critical lower mid-band spectrum, and

¹⁵ See *Ligado Aug. 6, 2019 Letter* at 6.

¹⁶ See *id.*

¹⁷ *National Strategy to Secure 5G of the United States of America*, Office of the President (Mar. 2020), <https://www.whitehouse.gov/wp-content/uploads/2020/03/National-Strategy-5G-Final.pdf>.

