September 11, 2020

The Honorable Glenn Thompson  
U.S. House of Representatives  
400 Cannon House Office Building  
Washington, DC 20515

Dear Congressman Thompson:

Thank you for your letter regarding the Commission’s unanimous, bipartisan Order and Authorization permitting Ligado Networks LLC to deploy a low-power terrestrial nationwide network in support of 5G and Internet of Things services. Despite the clear and lengthy order the Commission adopted, there appears to be substantial confusion regarding what was decided in that order and why. I appreciate this opportunity to clarify the record.

Let me start with the definition of “harmful interference” the Commission relied on in the Ligado Order. As we explained there, the Commission’s decision was based on its long-standing definition of “harmful interference” codified in the Commission’s rules, which is the very same definition of “harmful interference” used by the National Telecommunications and Information Administration. Indeed, the Commission codified this definition of harmful interference in section 2.1 of our rules in 1984 based on the definition adopted by the International Telecommunications Union—so the assertion that the definition we used “was developed by outside experts through the FCC’s Technical Advisory Council” is simply incorrect.

You ask why the Commission did not accept as the standard the 1 dB C/N0 interference metric preferred by some government agencies. The answer is simple: The Commission declined to adopt the 1 dB C/N0 metric because the record demonstrated that it was a poor indicator of harmful interference. First, data in the record indicated that a 1 dB C/N0 degradation does not correlate to any significant error in a GPS device’s reporting of position. In other words, a 1 dB C/N0 degradation does not correlate with harmful interference. Second, the model used to apply the metric is not reliable. Studies in the record showed that the variability (error) in reported C/N0 can be significant, as much as 2-3 dB, due to technical variances in the C/N0 estimators incorporated in GPS receivers and the algorithms used to calculate C/N0. That is, the error in measuring the change in performance can be significantly more than the metric itself that one is trying to apply! For some implementations, the data showed that the C/N0 estimator provided erroneous C/N0 estimates more frequently than it provided accurate ones. Indeed, the Commission found that the data “strongly suggest that the C/N0 estimators are generally not capable of accurate and reliable detection of a 1 dB change in the noise power component of the C/No.” Third, on top of all this, variations in this metric can occur even without a signal from Ligado—for example, a GPS receiver may experience a 1 dB or 2 dB degradation through natural occurrences. And finally, the Commission has never before applied this metric for
determinations of harmful interference to adjacent bands. Similarly, the International Telecommunications Union has not recommended that a 1 dB interference protection criterion be used to set emissions levels to protect against harmful interference in adjacent bands.

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Please let me know if I can be of any further assistance.

Sincerely,

\[signature\]

Ajit V. Pai
The Honorable Collin C. Peterson  
U.S. House of Representatives  
2204 Rayburn House Office Building  
Washington, DC 20515

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Sincerely,

[Ajit V. Pai]

Ajit V. Pai
The Honorable Anthony Brindisi  
U.S. House of Representatives  
329 Cannon House Office Building  
Washington, DC 20515

Dear Congressman Brindisi:

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Sincerely,

V. Pai

Ajit V. Pai
The Honorable Trent Kelly  
U.S. House of Representatives  
1005 Longworth House Office Building  
Washington, DC  20515

Dear Congressman Kelly:

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Sincerely,

Ajit V. Pai
The Honorable Cindy Axne  
U.S. House of Representatives  
330 Cannon House Office Building  
Washington, DC 20515

September 11, 2020

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Please let me know if I can be of any further assistance.

Sincerely,

[Signature]

Ajit V. Pai
The Honorable Alma Adams  
U.S. House of Representatives  
222 Cannon House Office Building  
Washington, DC 20515

Dear Congresswoman Adams:

Thank you for your letter regarding the Commission’s unanimous, bipartisan Order and Authorization permitting Ligado Networks LLC to deploy a low-power terrestrial nationwide network in support of 5G and Internet of Things services. Despite the clear and lengthy order the Commission adopted, there appears to be substantial confusion regarding what was decided in that order and why. I appreciate this opportunity to clarify the record.

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Sincerely,

Ajit V. Pai
The Honorable Marcia L. Fudge  
U.S. House of Representatives  
2344 Rayburn House Office Building  
Washington, DC 20515  

Dear Congresswoman Fudge:  

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Sincerely,

Ajit V. Pai
The Honorable Mike Bost  
U.S. House of Representatives  
1440 Longworth House Office Building  
Washington, DC  20515

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Ajit V. Pai
The Honorable David Scott  
U.S. House of Representatives  
225 Cannon House Office Building  
Washington, DC  20515

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Sincerely,

Ajit V. Pai
The Honorable Vicky Hartzler  
U.S. House of Representatives  
2235 Rayburn House Office Building  
Washington, DC 20515

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Please let me know if I can be of any further assistance.

Sincerely,

Ajit V. Pai
The Honorable Angie Craig  
U.S. House of Representatives  
1523 Longworth House Office Building  
Washington, DC 20515

Dear Congresswoman Craig:

Thank you for your letter regarding the Commission’s unanimous, bipartisan Order and Authorization permitting Ligado Networks LLC to deploy a low-power terrestrial nationwide network in support of 5G and Internet of Things services. Despite the clear and lengthy order the Commission adopted, there appears to be substantial confusion regarding what was decided in that order and why. I appreciate this opportunity to clarify the record.

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Sincerely,

Ajit V. Pai

[Signature]
The Honorable Don Bacon  
U.S. House of Representatives  
1024 Longworth House Office Building  
Washington, DC 20515

Dear Congressman Bacon:

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Sincerely,

[Signature]

Ajit V. Pai
The Honorable Cheri Bustos  
U.S. House of Representatives  
1009 Longworth House Office Building  
Washington, DC 20515

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Sincerely,

Ajit V. Pai
The Honorable Ralph Abraham  
U.S. House of Representatives  
417 Cannon House Office Building  
Washington, DC 20515

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Ajit V. Pai

Ajit V. Pai
The Honorable Dusty Johnson
U.S. House of Representatives
1508 Longworth House Office Building
Washington, DC 20515

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Please let me know if I can be of any further assistance.

Sincerely,

V. Pai

V. Pai
The Honorable Ann Kirkpatrick  
U.S. House of Representatives  
309 Cannon House Office Building  
Washington, DC 20515

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Sincerely,

Ajit V. Pai

Ajit V. Pai
The Honorable Doug LaMalfa  
U.S. House of Representatives  
322 Cannon House Office Building  
Washington, DC 20515

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2417 Rayburn House Office Building  
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V. Pai

Ajit V. Pai
The Honorable Abigail Spanberger  
U.S. House of Representatives  
1239 Longworth House Office Building  
Washington, DC 20515

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Sincerely,

Ajit V. Pai
September 11, 2020

The Honorable Xochitl Torres Small
U.S. House of Representatives
2444 Rayburn House Office Building
Washington, DC 20515

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Please let me know if I can be of any further assistance.

Sincerely,

Ajit V. Pai
September 11, 2020

The Honorable Rick Crawford  
U.S. House of Representatives  
2422 Rayburn House Office Building  
Washington, DC 20515

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The Honorable Roger Marshall  
U.S. House of Representatives  
312 Cannon House Office Building  
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September 11, 2020

The Honorable David Rouzer  
U.S. House of Representatives  
424 Cannon House Office Building  
Washington, DC 20515

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The Honorable Jim Baird  
U.S. House of Representatives  
532 Cannon House Office Building  
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Washington, DC 20515

Dear Congressman Hagedorn:

Thank you for your letter regarding the Commission’s unanimous, bipartisan Order and Authorization permitting Ligado Networks LLC to deploy a low-power terrestrial nationwide network in support of 5G and Internet of Things services. Despite the clear and lengthy order the Commission adopted, there appears to be substantial confusion regarding what was decided in that order and why. I appreciate this opportunity to clarify the record.

Let me start with the definition of “harmful interference” the Commission relied on in the Ligado Order. As we explained there, the Commission’s decision was based on its longstanding definition of “harmful interference” codified in the Commission’s rules, which is the very same definition of “harmful interference” used by the National Telecommunications and Information Administration. Indeed, the Commission codified this definition of harmful interference in section 2.1 of our rules in 1984 based on the definition adopted by the International Telecommunications Union—so the assertion that the definition we used “was developed by outside experts through the FCC’s Technical Advisory Council” is simply incorrect.

You ask why the Commission did not accept as the standard the 1 dB C/N₀ interference metric preferred by some government agencies. The answer is simple: The Commission declined to adopt the 1 dB C/N₀ metric because the record demonstrated that it was a poor indicator of harmful interference. First, data in the record indicated that a 1 dB C/N₀ degradation does not correlate to any significant error in a GPS device’s reporting of position. In other words, a 1 dB C/N₀ degradation does not correlate with harmful interference. Second, the model used to apply the metric is not reliable. Studies in the record showed that the variability (error) in reported C/N₀ can be significant, as much as 2-3 dB, due to technical variances in the C/N₀ estimators incorporated in GPS receivers and the algorithms used to calculate C/N₀. That is, the error in measuring the change in performance can be significantly more than the metric itself that one is trying to apply! For some implementations, the data showed that the C/N₀ estimator provided erroneous C/N₀ estimates more frequently than it provided accurate ones. Indeed, the Commission found that the data “strongly suggest that the C/N₀ estimators are generally not capable of accurate and reliable detection of a 1 dB change in the noise power component of the C/No.” Third, on top of all this, variations in this metric can occur even without a signal from Ligado—for example, a GPS receiver may experience a 1 dB or 2 dB degradation through natural occurrences. And finally, the Commission has never before applied this metric for
determinations of harmful interference to adjacent bands. Similarly, the International Telecommunications Union has not recommended that a 1 dB interference protection criterion be used to set emissions levels to protect against harmful interference in adjacent bands.

Next, the Commission fully considered and addressed the concerns of the high-precision GPS community in the Ligado Order as well as the agreements Ligado made with several major GPS device manufacturers—including manufacturers of high precision receivers such as those used for agriculture (Deere, Novatel, Topcon, and Leica). The Ligado Order explains how the Commission took those concerns and these agreements into account in crafting the restrictions on Ligado’s use of its terrestrial authority. For example, the Commission noted these particular GPS device manufacturers indicated that they were not opposed to Ligado’s terrestrial operations even at significantly higher power levels (more than 99% higher) than the Commission ultimately approved, provided that the Commission also approved certain conditions (e.g., advance notification of Ligado’s deployment), which the Commission did. We also conditioned Ligado’s authorization on separating its downlink operations by 23 megahertz from the Radionavigation-Satellite Service allocation where GPS operations are authorized (in effect, a guard band created within Ligado’s own licensed spectrum). In addition, Ligado will operate at substantially reduced power (99.3% lower than originally proposed), and our decision adopts a number of stringent conditions designed to address the potential for harmful interference as well as requirements for Ligado to remediate any harmful interference that should occur.

The Commission took these actions based on an extensive technical record. As a reminder, when the Commission sought public comment on Ligado’s amended applications in 2016, it specifically referenced its definition of harmful interference and expressly requested commenters to provide relevant technical information about potentially affected GPS receivers and their “performance or functioning,” including the specific effects on position location accuracy. Three test reports were submitted to the Commission—the Roberson & Associates study (submitted May and June 2016), the National Advanced Spectrum and Communications Test Network report (submitted April 2017), and the Department of Transportation report (April 2018). The Ligado Order then extensively discussed and evaluated these reports, finding the National Advanced Spectrum and Communications Test Network report and Roberson & Associates report more persuasive because both provided data based on performance-based metrics, which examined various aspects related to the performance or functioning of GPS devices. Taken together, these studies reviewed a total of 17 high-precision devices (including GPS receivers manufactured by Trimble, NovAtel, Topcon, and Leica). These high-precision GPS receivers included at least six receivers (based on publicly available information) specifically used for agricultural precision farming.

Finally, Federal agencies had actual possession of the draft that the FCC was poised to adopt—and thus an opportunity to comment on it—for almost half a year before the FCC finally adopted it. In October 2019, the FCC sent a draft to NTIA for coordination with the Interdepartment Radio Advisory Committee (IRAC). Led by NTIA, the IRAC’s members include the Department of Defense (the Air Force, the Army, the Coast Guard, and the Navy), the Department of Agriculture, the Department of Commerce, the Department of Energy, the Federal Aviation Administration, the Department of Homeland Security, the Department of the
Interior, the Department of Justice, the National Aeronautics and Space Administration, the National Science Foundation, the Department of State, the Department of Transportation, the Department of the Treasury, the United States Agency for Global Media, the United States Postal Service, and the Department of Veterans Affairs. In the typical situation, the IRAC process provides a three-week period for feedback. But in order to give federal agencies more time to formulate comments on the FCC's draft decision, the Commission agreed to extend that three-week period for an additional month. The federal agencies provided feedback in December 2019, which would have incorporated any input from the Department of Agriculture. The FCC then paused further work on the application until March so that the Department of Defense would have yet another opportunity to share its views with the Commission. Although NTIA did supply additional information from the Department of Defense in April 2020, it did not supply any additional technical analysis for the Commission's consideration, nor any specific input from the Department of Agriculture.

I appreciate that you agree with the need for the United States to be a leader in 5G deployment. That's why the Commission has adopted and implemented the 5G FAST Plan, a comprehensive strategy for ensuring American leadership in 5G. Making new spectrum available for flexible-use, commercial operations is an integral part of the 5G FAST Plan, and I expect to continue to push forward with sound engineering solutions to ensure that all Americans, including American farmers and ranchers, come out ahead.

Please let me know if I can be of any further assistance.

Sincerely,

[Ajit V. Pai]
The Honorable TJ Cox  
U.S. House of Representatives  
1728 Longworth House Office Building  
Washington, DC 20515

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Ajit V. Pai

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The Honorable James R. Comer  
U.S. House of Representatives  
1037 Longworth House Office Building  
Washington, DC  20515

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