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The Honorable David J. Redl
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National Telecommunications and Information Administration
U.S. Department of Commerce
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5G Americas is pleased to submit this cover letter and attached *5G Spectrum Vision White Paper* to NTIA in the proceeding on developing a Sustainable National Spectrum Strategy. NTIA's press release on its request for comments on developing this Strategy states the "strategy must accomplish several goals, including increasing spectrum access, improving spectrum sharing, enhancing spectrum management, and leveraging ongoing research and development activities."¹ 5G Americas,² whose mission is to advocate for and facilitate the advancement of 5G and the transformation of LTE networks across the Western Hemisphere, comments today primarily on the importance of increasing spectrum access in order to leverage the substantial amount of R&D that has been done by the wireless industry.

The attached *5G Spectrum Vision White Paper* outlines the spectrum inventory opportunities for 5G across the world. The White Paper reviews 5G spectrum considerations in the Americas, Europe, East Asia, and Australia. This review is followed by a discussion of the characteristics of different bands and the challenges of and opportunities in using different bands for 5G. The paper also makes recommendations on mechanisms for spectrum clearing, spectrum sharing, and necessary industry and regulatory actions toward more licensed spectrum for 5G in North America, including in the mid-band of 3450 – 3550 MHz. The 3.4 – 3.8 GHz band is becoming a key band for 5G globally. All or a significant portion of the 3.7 – 4.2 GHz band

¹ Press Release, NTIA, *NTIA Seeks Comment on Development of a National Spectrum Strategy* (Dec. 20, 2018).

² 5G Americas is currently chaired by T-Mobile USA, and its Board includes AT&T, Cable & Wireless, Cisco, CommScope, Ericsson, Intel, Kathrein, Mavenir, Nokia, Qualcomm, Shaw, Sprint, Telefonica and WOM.

should be made available as soon as possible for licensed flexible deployment. At the same time, 5G spectrum opportunities below 3 GHz must continue to be considered. Likewise, licensed use of the spectrum in the range 7 – 24 GHz must also continue to be explored. For the U.S. to lead in 5G, it is imperative that the U.S. make sufficient, internationally-harmonized spectrum available for exclusively-licensed use.

As the President recognized in his National Spectrum Strategy Memorandum,³ it is imperative that America be first in 5G wireless technologies.⁴ 5G will become a critical tool utilized across the national economy to drive productivity, innovation, and opportunity to a far greater degree than 4G. Leading countries around the world recognize the strategic imperative of 5G. America was first in 4G because it made new spectrum available to mobile operators, which gave significant momentum to 4G network technology development inside the U.S. and gave birth to the applications sector. For operators, the availability of new low-band spectrum in the U.S., coupled with previously assigned spectrum enabled America to be first in 4G, both in terms of first to deploy, but also the deepest market penetration and most intense customer use. Similarly, being first in 5G will require the U.S. government to make new spectrum available for commercial use, in low-, mid-, and high-band spectrum. 5G will cover a range of use cases, from enhanced consumer broadband, to industrial Internet of Things (IoT), to ultra-reliable, low-latency applications that are mission critical, like autonomous vehicles and remote surgery. Since 5G will cover a range of use cases, it will require spectrum in a range of bands, low-, mid-, and high.

5G Americas has published several white papers on what applications are optimal for which frequency bands across the low-, mid- and high-band range.⁵ 5G will encompass a range of new applications, including enhanced mobile broadband, massive machine-type communications, often referred to as the Internet of Things, and applications where low-latency and reliability are mission-critical. It is imperative that the U.S. lead on all development paths of 5G, but the low-latency, ultra-reliable applications are seen by many to be of particular strategic importance in advancing national goals. Relative to ultra-reliable, low-latency critical applications, the U.S. being first to 5G can have profound economic and national security effects. Ultra-reliable low latency 5G is one of the enabling technologies in the fourth industrial revolution. Typical industrial automation use cases requiring ultra-reliable low latency performance include factory, process, and power system automation. Use cases involve communication transfers enabling time-critical factory automation that are required in many industries, such as metals, semiconductors, pharmaceuticals, electrical assembly, and food and

³ Presidential Memorandum on Developing a Sustainable Spectrum Strategy for America's Future, 2018 Daily Comp. Pres. Doc. No. 00730 (Oct. 25, 2018) ("Presidential Memorandum").

⁴ *Id.* at Section 1, p. 2.

⁵ See 5G Americas, *5G Spectrum Recommendations 24-25*, Table 15 (April 2017), available at http://www.5gamericas.org/files/9114/9324/1786/5GA_5G_Spectrum_Recommendations_2017_FINAL.pdf

beverage.⁶ Traditionally, industrial control systems are mostly based on wired networks, because earlier wireless technologies could not meet the industrial latency and reliability requirements. Replacing the currently-used wires with radio links can bring substantial economic benefits, including reduced cost of manufacturing, installation, and maintenance; higher long-term reliability as wired connections suffer from wear and tear in motion application; and inherent deployment flexibility.

Being first to deploy ultra-reliable low latency and other 5G use cases will not only improve the global competitiveness of the wireless industry, an outcome the Presidential Memorandum seeks,⁷ but the global competitiveness of the entire U.S. economy. The President's Memorandum states it is the policy of the United States to use spectrum to meet not just our economic goals, but our national security, science, safety, and other Federal mission goals now and in the future.⁸ 5G use cases can help meet those goals in a variety of ways. Public safety and disaster response communications require robust and reliable communications in case of natural disasters such as earthquakes, tsunamis, floods, and hurricanes.⁹ The use cases may require accurate position location and quick communication exchanges between users and systems. The efficiency gains in user battery consumption and network communications are critical in these use cases. 5G will bring public safety organizations enhanced and secured communications with real-time video and the ability to send high-quality pictures in real-time.

Urgent health care is another important area of both public safety and science. 5G will enable remote diagnosis, treatment and patient monitoring.¹⁰ 5G devices will measure vital signs such as ECG, pulse, blood glucose, blood pressure, and temperature. The remote treatment and response based on monitored data can be life-critical for a patient, requiring immediate, automatic or semi-automatic response. 5G can facilitate remote surgical consultations and remote surgery. In a mobile scenario, such as in ambulances or disaster situations in remote areas, surgeons require precise control and feedback communication mechanisms that are low latency, highly reliable, and secure. The "Tactile Internet", enabled by 5G, also has applications in patient care.

The Presidential Memorandum also notes that wireless technologies can, in addition to offering safety benefits and saving lives, reduce the cost of transportation incidents.¹¹ 5G's realization can empower several technological transformations in the transportation industry, including automated driving, road safety, and traffic-efficiency services.¹² These transformations

⁶ 5G Americas, *New Services & Applications with 5G Ultra-Reliable Low Latency Communications* § 2.2 (November 2018), available at http://www.5gamericas.org/files/1115/4213/2248/5G_Americas_URLLLC_White_Paper_Final_updateJW.pdf.

⁷ Presidential Memorandum at Section 4(e).

⁸ *Id.* at Section 1.

⁹ 5G Americas, *supra* note 6, at § 2.6.

¹⁰ *Id.* at § 2.7.

¹¹ Presidential Memorandum at Section 1.

¹² 5G Americas, *supra* note 6, at § 2.8.

will fully connect cars, allowing them to react to increasingly complex road situations by cooperating with other nodes rather than relying on their local information. These trends will require information to be disseminated among vehicles reliably within extremely short time duration. For example, in fully automated driving with no human intervention, passengers will benefit by the information received by the vehicle from roadside infrastructure or other vehicles. The typical use cases of this application are automated overtake, cooperative collision avoidance, and high-density platooning, which require stricter end-to-end latencies and high reliabilities.

To assist NTIA in its preparation of a long-term National Spectrum Strategy, 5G Americas attaches its recent white paper on *5G Spectrum Vision*.¹³ As the President recognized, “access to spectrum is a critical component of the technological capabilities that enable economic activity and protect national security. Wireless communications and associated data applications establish a foundation for high wage jobs and national prosperity. While American industry continues to extract greater and greater value from spectrum, each technological leap also increases demands on its usage.” The attached White Paper on *5G Spectrum Vision* addresses immediate needs and sets goals that will carry the U.S. well into the future, so that the Nation can build a long-term, sustainable spectrum access framework. In addition to bands that the FCC has proposed for flexible use in both the mid-band and high-band ranges, these goals include repurposing the 3450 – 3550 MHz band for shared commercial access. Only by maintaining the momentum behind making new mid-band spectrum available will the U.S. be able to lead globally in 5G, as well as keep pace with further U.S. demand for traffic capacity as 5G services are deployed and new innovative 5G applications are developed.

5G Americas hopes this *5G Spectrum Vision* White Paper will assist NTIA and the agencies on the President’s Spectrum Strategy Task Force in developing and implementing a National Spectrum Strategy that improves the global competitiveness of the U.S., increases spectrum access, efficiency and effectiveness, and unleashes innovation broadly across diverse sectors of the economy.

Best regards,



Chris Pearson
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¹³ 5G Americas, *5G Spectrum Vision* (February 2019), available at http://www.5gamericas.org/files/4015/4958/3330/5G_Americas_5G_Spectrum_Vision_Whitepaper.pdf.