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Hearing on

The Race to 5G: Exploring Spectrum Needs to Maintain U.S. Global Leadership

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Chairman Thune, Ranking Member Nelson, and distinguished Members of the Committee, thank you for inviting me to testify before you today. I am Tom Stroup, President of the Satellite Industry Association (SIA). SIA is a U.S.-based trade association providing representation of the leading satellite operators, service providers, manufacturers, launch services providers, and ground equipment suppliers. Before joining SIA in late 2014, I served as CEO of Shared Spectrum Company (SSC), a leading developer of spectrum intelligence technologies. For a little more than ten years, I also served as the President of the Personal Communications Industry Association (PCIA). I have also founded and run several companies in the technology industry, including Columbia Spectrum Management, P-Com Network Services, CSM Wireless, and SquareLoop.

In an age when high speed broadband is quickly becoming the most transformative technology of our time, enabling pervasive reliable high-speed access everywhere has not only become an opportunity equalizer, learning enabler, and innovation accelerator, but an economic imperative. U.S. policymakers recognize the transformative satellite broadband opportunities on the horizon and the critically important role that informed spectrum policy plays in enabling it. FCC Chairman Ajit Pai recently explained: *"I've often said that in order to bring digital opportunity to all Americans, we need to use all of the tools in the toolbox. Satellite broadband service is one of those tools. Next-generation satellites are bringing new competition to the broadband marketplace and new opportunities for rural Americans who have had no access to high-speed Internet access for far too long."* Whether it's NTIA Administrator Redl, Commerce Secretary Wilbur Ross, or White House Space Council Executive Secretary Scott Pace, there is a growing recognition (as shown in Appendix A) that satellite technologies are driving transformative new benefits. To take advantage of future opportunities, we need to be thinking proactively about the vitality and availability of satellite spectrum resources.

Today, I would like to discuss the benefits, innovations, digital inclusion, and related spectrum policies for enabling satellite broadband as part of the race for 5G and next generation services under U.S. global spectrum leadership.

I. Benefits of Satellite Broadband

We can already see the enormous benefits that satellite broadband is delivering.

Investment in Technology. The satellite industry has invested tens of billions of dollars to innovate and increase connectivity in the United States and across the globe and is continuing to make significant investments. As early as 2012, satellite downloads speeds reached 12 Mbps,

above the national average at the time. But the industry did not stop there. New services are launching every year, and in the last several years began broadly providing users across the United States with lightning fast 25/3 Mbps service. This year the industry reached a new milestone, providing up to 100 Mbps download speeds. Across the country today, about 2 million fixed broadband customers and millions more flying on aircraft are already taking advantage of reliable satellite broadband services at reasonable rates and speeds that meet and surpass the FCC's definition of broadband service, with faster speeds and greater capacity on the horizon. The investments that enable satellite broadband speeds and services include U.S. manufacturers of spacecraft, antennas, and other satellite communications components, reflecting U.S. global leadership in the sector.

Expanding Capabilities. Spectrum enabled satellite capabilities are continuously expanding and improving. Soon satellite broadband operators will be delivering fiber-like speeds using satellites that are under construction today, with the ability to reach speeds of up to a gigabit per second and simultaneously process a terabit of data per second. These high throughput geostationary satellites will provide orders of magnitude capacity increases and resulting consumer broadband benefits, remaining competitive with terrestrial offerings. At the same time tens of thousands of new non-geostationary satellites from multiple providers will soon be launching into Low-Earth and Medium-Earth orbits to provide low-latency, high-speed broadband across the globe.

Spectrum Efficiency. Satellite services are designed to utilize spectrum efficiently. Satellite service providers have shared the use of spectrum bands amongst themselves and other communications services for decades. Frequency re-use and spot beam technology are examples of efficiency innovations that increased output using the same amount of spectrum. For example, high throughput satellites rely on frequency re-use and spot beam technology to produce increased output factors upward of 100 times that of traditional satellites. And these existing high throughput satellites currently support the delivery of 3G and 4G services, as well as enable global machine-to-machine communications. As we move into the future, satellite fleets will continue to be a part of a system architecture that delivers new 5G, IoT, and intelligent, connected transportation services to consumers everywhere.

Ubiquity. The capabilities of satellite include extending digital opportunity to people wherever they may live, work or play, and helping transform businesses, which is one of the reasons that demand for satellite service is at an all-time high.

II. Satellite Broadband Innovation

These satellite services deliver key attributes that are important to the innovation ecosystem:

Competition. Just as the satellite industry already has with radio and television services, satellite broadband services are providing market-based competition to terrestrial broadband services. Satellite broadband brings additional package options, greater capacity for video downloads and streaming, competitive pricing per gigabit, and innovative services to consumers in the United States, often in areas with only a single or low number of terrestrial providers. Satellite broadband is also used by business and government enterprises, for both fixed and mobile purposes, using a range of spectral bands to deliver assured access to broadband

communications. Further, satellites are providing critical backhaul Internet connectivity to local Internet Service Providers and community institutions in remote locations.

Coverage. Spectrum enabled satellite services are extending the powerful benefits of broadband to the 24 million Americans who today lack broadband internet access. High quality and cost-effective satellite broadband is playing an increasingly important role in addressing the digital divide across the United States, including in the most rural and remote areas of the country, where it remains uneconomical for terrestrial services to build. The nature of satellite's wide coverage ensures that all communities within a satellite network's footprint receive the same quality of service, whether they are remote communities or big cities.

Cost-efficiency. Importantly, satellite is reaching rural and remote communities with a geographically-independent cost structure, in many cases taking advantage of the same technologies and similar pricing as satellite subscribers in urban America. Because satellite systems have inherently wide-area coverage there are minimal additional costs to build out to rural and remote areas, aside from opportunity costs from not serving other markets. This is one reason why incentives made to encourage capacity redirection should be technology neutral.

Mobility. Satellite broadband opportunity is literally taking off. When you fly, satellite services are delivering high speed WiFi at 25 Mbps speeds capable of streaming your favorite Netflix show right to your seat. WiFi on aircraft has become so popular that there are often more connected devices than passengers on planes. It's extending urban quality broadband services to rural America, to the seat on your plane, and even war fighters and senior government leaders.

Reliability. Natural and manmade disasters can interrupt terrestrial broadband services that must rely on towers and ground systems. Satellite broadband, however, can quickly come in and restore communications in a disaster aftermath, or prevent the outage in the first place due to the very limited amount of terrestrial infrastructure (i.e., antenna or dish) necessary to connect. The role of satellite in an emergency was recently witnessed in 2017 in the aftermath of the hurricanes where satellite broadband supported FEMA, other government agencies, businesses and residents, so that they could get back to normal.

These technologies don't just have the potential to help connect the unconnected, extend new health, educational and societal opportunities throughout the country, but satellite broadband can help expand economic opportunity everywhere -- on the ground, in the air, across the seas, and around the globe. As the country, and indeed the world, is blanketed with high speed broadband access, the opportunities become even more pervasive, the technologies more transformative, and the impacts even more profound.

Soon the next big thing will be billions of little things connected to sensors that are embedded into everyday devices. As we connect our electric and other grids, our thermostats, our factories, our homes, cars, and cities to broadband, ubiquitous connectivity will transform whole sectors of our economy—from transportation to healthcare, manufacturing and energy. It extends how and where emergent technologies like the Internet of Things, Artificial Intelligence, big data and the cloud, can be used to help us unlock amazing new opportunities to solve problems in ways that we simply never could before or can't even imagine today.

III. Satellite Broadband for Digital Inclusion

Satellite is a vital part of this innovation ecosystem and uniquely situated to solve the digital inclusion challenge:

Farming. Satellite broadband is helping enable a whole new generation of precision agriculture opportunities on the horizon, driven by broadband that enables remote farms especially with livestock sensors, soil monitors, and autonomous farming equipment in rural America, far beyond where cell towers can reach or make economic sense. Autonomous farm equipment, already enabled by satellite positioning technology, often needs connectivity far beyond the line of sight of a cell tower.

Education. At a time when 7 in 10 teachers assign homework that requires internet access, 1 in 3 households across the country with school-aged children and incomes less than $50,000 still do not have broadband. Satellite is helping close this gap at home,and will soon enable school buses on long commutes to become WiFi-enabled mobile study halls.

Healthcare. With too many Americans living in areas with only sporadic and even diminishing access to quality healthcare, satellite broadband technologies that span distance are extending connected care everywhere. No one should be forced to put their life at risk simply because they live too far from a doctor. Satellite technology is cost-effectively overcoming a rural physician shortage, extending experts to where they are needed most, and delivering services regardless of where the doctor or patient are physically located. In addition, satellite broadband can help connect the elderly when they need it most.

Mobility. The ubiquity of satellite coverage provides access to areas across the globe that are otherwise unreachable – keeping us connected in the air, on the move, and in the sea. These spectrum-enabled capabilities are enabling our warfighters to protect us by land, sea or air, providing agencies with state-of-the-art technologies to protect our national security, and connecting our embassies and government leaders with secure communication options.

IV. Satellite Broadband Spectrum Policy

Of course, all of the breakthroughs we've seen because of satellite broadband technologies should not be taken for granted. Satellite innovations depends on our industry's ability to reliably access spectrum. In order for our industry to continue to innovate and meet the continuous demand for more and faster satellite broadband speeds, and to power the mission critical solutions that require satellite technology, we need continuous access to more spectrum. The following principles are essential for good spectrum management.

Spectrum Pipeline Must Include Satellite Spectrum. Satellite broadband networks need spectrum, just as terrestrial wireless systems do. This can be done in a way that ensures the United States will benefit from the broadest range of technological opportunities. This means that satellites must also be able depend on having certainty of access to existing spectrum resources, including the millimeter wave bands. Satellites may be good sharing partners in both federal and non-federal spectrum with compatible technologies and uses.

Technology Neutrality in Spectrum Policy is Critical. The United States cannot win the race for broadband deployment with just one technology having exclusive access through regulation. Successful and innovative broadband services result from multiple technologies and all need more spectrum access. In some cases, this may require exclusive spectrum allocations, and in other cases, when needed and technically demonstrated, adoption of co-existence and sharing arrangements.

We recognize that the Federal Communications Commission is actively seeking to identify additional bands for terrestrial 5G. As part of this process, it must carefully consider how to protect incumbent satellite operations and the critical services they provide. Space-to-earth downlink spectrum is particularly susceptible to interference as these signals are relatively weak by the time they hit the ground. Satellite operators have invested billions of dollars in dozens of satellites serving the United States and currently provide important services to American consumers, either directly or indirectly, as well as to the USG. Sound spectrum policy will account for this reality and avoid allocations that disrupt this delicate infrastructure.

ITU World Radio Conference (Fall 2019). Spectrum policy does not stop at national borders. It requires coordination with the rest of the world. While terrestrial 5G spectrum access is an important agenda item for the upcoming World Radio Conference, including proposals to add 5G in long-standing satellite bands, there are also important satellite spectrum proposals. Based on technical compatibility studies, the satellite proposals will expand mobile satellite broadband for aircraft, trains, cars, and ships. Still other technical proposals will address spectrum co-existence and sharing environments for new non-geostationary satellite systems. In addition, because satellite capacity is critical for the deployment of 5G, satellite and satellite operators will need continued access to millimeter wave bands to meet the demand for broadband services.

For satellite networks, there are two ground components - user terminals and gateways. User terminals, that connect the user to the satellite, require dedicated spectrum because they need to operate ubiquitously, either fixed or mobile. Gateways, or antennas that connect the satellite to fiber backhaul and the Internet, are fixed in place for a long time and can co-exist more easily with other spectrum services.

The satellite industry has been sharing spectrum through technical rules and coordination of individual systems for decades. The FCC and the ITU international rules require close spacing of geostationary orbit satellites to permit frequency reuse at multiple orbital locations, so the satellite industry has been an industry leader in spectrum use and reuse. The satellite industry has also worked with regulators and others industry spectrum users to study how earth stations can operate with minimal impact in bands where spectrum is shared with other services.

U.S. policymakers, including the Members of the Committee, the FCC, NTIA and others, have within their reach an opportunity to ensure the US leadership in 5G ecosystem, to include satellite broadband operators and terrestrial wireless stakeholders, by driving seeking cooperation from all spectrum users to develop and enable technical solutions to meet future demands. When necessary, enabling policymakers should get all parties to work together or seek and implement solutions that will promote spectrum efficiency and opportunities for all. The ultimate winners will be the American public and broadband consumers.

For the United States to ensure its continued global leadership in next generation satellite broadband, and to meet our national security communication needs, agency leaders are beginning

the process of ensuring the protection and stewardship of spectrum to support commercial satellite activities. For spectrum policy to work for satellites, because of their global reach, we need leadership at home and abroad. The FCC must continue to ensure satellite and 5G can advance their spectrum needs by providing leadership at the upcoming World Radio Conference that recognizes the global dimensions of satellite spectrum requirements.

V. Conclusion

With enormous opportunities on the horizon, policymakers need to think broadly about the entire innovation ecosystem. It takes pragmatic policies that:

- Foster win-win solutions enabled by equitable dedicated spectrum and spectrum sharing where necessary with technical solutions.
- Continue to advance technology neutral broadband policies that let consumers and the market decide on technologies
- Ensure U.S. government agencies can take full advantage of the latest spectrum enabled communications technologies. Satellites offer resilient and ubiquitous communications that keep America safe. Policymakers have an opportunity to maximize the use of spectrum by using cutting-edge commercial satellite communications technologies to grow their capacity while giving taxpayers their greatest bang for their buck.
- And because these are global services, it's vital that our policymakers provide spectrum leadership around the globe, including for the upcoming World Radio Conference in 2019. We encourage regulators to continue to allocate sufficient spectrum for satellite use, both domestically and via United States support at the upcoming World Radiocommunications Conference.

I appreciate the opportunity to appear before you and I am happy to answer any questions.

APPENDIX A

Policy leaders are coming to recognize the vital role satellite plays and the critical role that satellite spectrum plays in enabling opportunity

NTIA Administrator David Redl:

"There is no doubt that the United States needs a vibrant satellite sector. This industry creates tens of thousands of high-paying jobs and enables millions more in the larger economy. In the next few years, a new era in satellite coverage will strengthen our nation's broadband infrastructure and power advanced services that will improve people's lives… As the agency that is principally responsible for advising the President on telecommunications and information policy, NTIA can help create an environment that allows for continued global leadership in the market for satellite-based services and manufacturing. This includes the important role satellites will play in delivering 5G and ensuring that the United States stays on the cutting edge of wireless technology."

FCC Chairman Ajit Pai:

"I've often said that in order to bring digital opportunity to all Americans, we need to use all of the tools in the toolbox. Satellite broadband service is one of those tools. Next-generation satellites are bringing new competition to the broadband marketplace and new opportunities for rural Americans who have had no access to high-speed Internet access for far too long. … Breakthroughs are already happening. … Viasat began offering 100 Mbps broadband service in the United States with unlimited data. This was made possible by high-throughput satellites that use spot-beam technology and frequency re-use to dramatically increase capacity… it's so important for the federal government to set rules that encourage innovation in [the satellite] industry rather than regulatory roadblocks to progress.""

White House Space Council, Executive Secretary Scott Pace:

"The United States has a strong and entrepreneurial satellite communications industry, available to engage in global competition. To ensure we retain the strategic advantages afforded by space services, the United States needs to continue to open and promote competitive markets and protect spectrum allocation for space services to compete. Since radio waves, as you know, don't stop at borders, unfettered terrestrial wireless network [like 5g} use in one country could certainly preclude the use of satellite services in neighboring countries. That would harm the global economy, and a global approach is necessary to protect U.S. space commerce."… "it's for these reasons the National Space Council is examining how the Department of State, Commerce and FCC can better coordinate to ensure the protection and stewardship of spectrum necessary for space commerce – and, again, not just for space purposes and it's unique uses, but also to make sure that we're competitive in terrestrial areas, as new technologies like 5G come along."

Director of the Office of Policy Planning at the Department of Commerce, Earl Comstock:

"[F]rom the secretary's point of view, and certainly from the fact that it's recognized in the recent Space Council documents, there is a concern within the administration that we need to make sure that, as we go forward, and we obviously want to facilitate 5G, we want to facilitate

broadband, but we also want to keep an eye on the future of if we're going to have this expanding space market, we don't want to discover that we've basically stunted the growth of that market by denying the spectrum that might be needed for those transactions. So it's going to be a balancing act. It's going to be something that people have to take a hard look at. But we are very cognizant of the fact that when you're looking at the space regime, we are looking to the future. We're looking at an expansion of this. It's a very significant expansion. And so we want to move very carefully in terms of any changes that might end up shortchanging that ability to move forward in space."