Testimony to Senate Committee on Commerce, Science and Transportation
Craig Cowden, Senior Vice President of Wireless Technology, Charter Communications
July 25, 2018

Introduction

Good morning, Chairman Thune, Ranking Member Nelson and distinguished members of the Senate Committee on Commerce, Science and Transportation.

Thank you for inviting me this morning to discuss topics that are critical to our country's future: how we can harness the power of wireless technologies, why U.S. leadership is important, and what we need to do to keep driving innovations that will spur continued economic growth and help millions of people across the nation connect to each other and to the world.

I am Craig Cowden, Senior Vice President of Wireless Technology at Charter Communications, which markets its products throughout the country under the Spectrum brand. I lead the team responsible for the network architecture and engineering for all of our wireless initiatives. This includes WiFi, mobility, and innovative fixed and mobile technologies including 5G. Charter is investing in all of these elements along with innovating its advanced fiber and coax based network infrastructure, with the goal of providing customers access to any content, anywhere, on any supported device with a leading wired-wireless connectivity experience.

The future of connectivity is at hand, but can be hard to grasp. To put it simply, a variety of innovative wireless access technologies which includes 5G, 4G LTE, and enhanced WiFi will increase today's broadband speeds by as much as 1,000 times while reducing network latencies down to less than a millisecond. This connectivity will transform our daily lives; allowing us to connect billions of devices, communicate with the Internet of Things (IoT), make communities and government services "smarter" and more efficient, enable patients to receive real-time, comprehensive medical care, and create new forms of entertainment using augmented and virtual reality.

This distinguished Committee is at the center of policy discussions that are critical not only to the future of communications but to the future of our country as a whole. Policies that ensure continued innovation and investment in our networks, while expanding broadband access to more communities, are essential to our country's continued economic growth and global competitiveness.

We thank the Committee for its efforts to date, and look forward to continuing to work together to increase the availability of licensed and unlicensed spectrum and create forward-looking policies that promote competition and provide regulatory certainty, all of which will help ensure the United States retains its leadership in the 5G era.

Charter's Advanced Network

Our goal at Charter is to deliver ubiquitous connectivity to all of our customers – those living in urban, suburban *and* rural communities. With more than 97,000 employees serving 41 states, Charter is making the investments needed to meet the connectivity needs of our customers today, tomorrow, and every day after that.

Since 2014, we have invested more than $27 *billion* in technology and infrastructure. These investments have enabled us to significantly extend the reach of our network and enhance our service offerings. We are building out our broadband network in communities across the country; in big cities and small towns, in places that are underserved and in some cases unserved altogether. We now have 840,000 miles of fiber and coax-based network infrastructure passing 50 million homes and businesses. Last year alone, we expanded the reach of our network to an additional one million homes and small businesses.

Charter's Emerging Wireless Leadership

Charter has invested these billions of dollars in fiber and densifying our networks in part to offer the fastest broadband speeds in the market, and in part to prepare for the bandwidth needs of 5G. The IoT and the advanced video and virtual reality applications that individuals and communities want depend on combining ultra-fast WiFi with innovative wireless technologies like 5G - all powered by a robust high capacity, high compute, low latency broadband infrastructure.

While the term "5G" is used to describe a wide variety of technologies, 5G architecture is fundamentally different than all of the previous generations of wireless infrastructure (2G, 3G, 4G,) that have come before it. With 5G, wireless connectivity is transforming from a traditional macro network based on large towers with broad coverage to a network of at least hundreds of thousands of small cells strung closely together which, because of spectral re-use, produces significantly higher bandwidth at much lower latency. Cable companies like Charter, with fiber-based wireline networks covering all kinds of neighborhoods in cities and towns, suburban communities and rural areas, are well suited to meet future 5G small cell architecture requirements. With our pervasive networks, we can integrate multiple access technologies such as WiFi, 4G/LTE and 5G millimeter wave radios with great efficiency, enabling us to provide consumers with wireless connectivity at a good value.

1. **Enhanced WiFi**

Charter has long been a "wireless company" by virtue of our robust WiFi network. Our WiFi network currently serves more than *280 million* wireless devices. Many of those wireless

devices are smart phones provided by cellular companies yet *80%* of the data used on those phones goes through our WiFi network.

With the vast majority of our customers' wireless traffic running on our WiFi network, we need it to be the most robust it can be to ensure the best experience for them. We are currently deploying WiFi devices that enable speeds approaching 1 Gigabit, among the fastest in the country.

We are also excited to announce this week that we are now the first WiFi provider to use the latest WiFi technology, called 802.11ax. Compared to previous WiFi standards, this is a game changer. It increases speeds, improves coverage, furthers the ability of many devices to run at the same time, further improves our already robust video streaming and provides better battery life.

Our pervasive WiFi network therefore is the starting point for our mobile strategy. Charter's is an "Inside-Out" strategy, focusing first on wireless solutions inside the home and office, and then providing connectivity outside the home to meet growing customer demand for connectivity when they are on-the-go.

2. Mobile

Technology has evolved to enable the combination of WiFi with licensed cellular spectrum. Last month we began offering Spectrum Mobile, bringing more competition to the wireless marketplace in the 41 states we serve.

Spectrum Mobile customers enjoy the same ubiquitous mobile coverage they get from traditional wireless companies, but their connections are through a WiFi-first MVNO that incorporates our robust indoor and outdoor WiFi network with Verizon's cellular network. The result is a high quality mobile experience at a great value. The data switchover from our WiFi to Verizon's network is seamless and not noticeable to customers, yet it can save them money.

The next step in our mobile evolution will be to deploy LTE licensed small cells and then 4G LTE and 5G wireless access technologies and integrate them with our existing infrastructure. We are conducting extensive trials using small cells in Tampa, Florida and Charlotte, North Carolina, and will expand this testing to Los Angeles and New York City within the next few months. These trials will inform how we will leverage these innovative technologies to improve our wireless products.

3. Fixed Wireless

We also have been exploring how 5G and other new wireless technologies can be used to deliver significantly improved broadband services to homes and businesses small and large.

For over a year, Charter has been conducting tests around the country using millimeter-wave 5G spectrum, the 28 GHz band, in Orlando, Florida; Bakersfield and Los Angeles, California; Reno, Nevada; Clarksville, Tennessee; Columbus, Ohio; and Grand Rapids, Michigan. The results to date have been promising and we are continuing to test how we can use this high-band 5G spectrum in conjunction with our fiber network to cost-effectively deliver 5G services to homes and businesses for things like multiplayer AR/VR interactive gaming, multiple simultaneous 4K-quality video streaming, and "Desktop-as-a-Service" models that push compute functions to the network cloud but require large bandwidth and low latency.

We have also been testing fixed wireless technologies in the 3.5 GHz bands in locations near Lexington, Kentucky; Bakersfield, California; Tampa, Florida; Denver, Colorado and Coldwater, Michigan. We believe this lower-frequency spectrum could be used to extend the reach of our network and provide cost-effective, wireline-like connectivity to less densely populated areas. Results of these trials have been promising; we're seeing speeds that significantly exceed the FCC's definition of high speed broadband in most circumstances, allowing for video streaming and the use of multiple apps simultaneously. Charter plans to continue its investigation of fixed wireless solutions using 3.5 GHz to expand rural broadband.

The Wireless Future

The success of 5G requires a full range of wired and wireless technologies and a full toolkit of spectrum that includes licensed and unlicensed, high-band, mid-band and low-band spectrum.

We appreciate the attention of the Committee and the Federal Communications Commission to identify policies that promote the deployment of 5G and the continued expansion of broadband infrastructure. Adopting technology-neutral policies that promote competition and innovation is critical, as are efforts to make available additional unlicensed and licensed spectrum, both of which are necessary to support 5G.

1. 5.9 GHz

Opening the 5.9 GHz band, which has been unused for more than 20 years, for unlicensed use is one of the most immediately impactful steps policymakers can take to help meet the growing demand for WiFi and other unlicensed technologies. WiFi already securely powers home security systems, medical devices and services in and out of hospitals, hundreds of billions of

dollars of financial transactions, essential education and workforce services, and critical machine communications. It also generates billions of dollars for the U.S. economy each year.

The 5.9 GHz band lies right next to the most-used WiFi band in the country, making it the gateway to revolutionized WiFi speeds and innovation in Gigabit WiFi. Opening up this band for unlicensed use will unleash continued innovation and economic growth. Additionally, WiFi providers could bring advanced WiFi services to the market immediately, without needing time consuming and costly new equipment.

2. 3.5 GHz

3.5 GHz is another spectrum band that offers tremendous potential for unlicensed use or General Authorized Access. We have encouraged the FCC to make the unlicensed part of the band available quickly and to adopt licensing rules that preserve an innovative approach to spectrum sharing in the band. This will encourage efficient use of that spectrum, lower barriers to entry for new competitors, and promote rural broadband deployment.

3. 3.7GHz – 4.2GHz

The lower C-band spectrum (3.7GHz – 4.2GHz) also holds promise as it provides both meaningful bandwidth and RF propagation that could enable ubiquitous 5G mobility. At the same time, it is currently relied upon by C-Band satellite video providers to deliver video services to millions of consumers. Therefore it is essential that those customers and consumers they serve are protected and compensated for any costs associated with a reallocation to mobile.

Conclusion

Whether it's testing 5G technologies, investing in broadband infrastructure or expanding the reach of our wired network, Charter is working to deliver the next generation of broadband. We appreciate this Committee's commitment to developing smart policies that will advance these efforts, and we look forward to continuing to work with you.

I thank the Committee for its time and look forward to answering your questions.

Thank You.