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High Band Spectrum

The Key to Unlocking the Next Generation of Wireless

Thomas K. Sawanobori

SVP and Chief Technology Officer, CTIA

Paul V. Anuszkiewicz

Vice President, Spectrum Planning, CTIA

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The United States is the global leader in the 4G LTE mobile ecosystem, and we stand on the cusp of the next wireless revolution, the rise of 5G wireless services. This revolution – driven by innovations in technology and the availability of high-band spectrum – will transform our economy, our health care, education, and transportation systems, and many other aspects of how we live. In the early 1980s, experts famously predicted that there would be fewer than a million mobile phones in the U.S. by 2000, an estimate that turned out to be less than one percent of the actual total.[1] Today there are nearly 380 million wireless connections in the U.S. and the wireless industry generates $400 billion in U.S. spending and millions of jobs.[2] And we are just scratching the surface.

To deliver on the promise of 5G and IoT, the Federal Communications Commission should act this summer to provide access to new high-band spectrum.

With 5G services, innovators are exploring the integration of mobile services with high capacity, speeds, and responsiveness into nearly every aspect of how we work and live. With the benefit of hindsight we can see the full impact of the ubiquitous adoption of mobile phones, and with 5G, we expect the impact to be equally seismic.

To meet new demand and maintain U.S. leadership in the next generation of wireless – 5G – policymakers must move quickly to allocate new spectrum. Fortunately, technologies are emerging to open up the next frontier for mobile broadband spectrum: bands above 6 GHz, known as “high-band” spectrum.

The Federal Communications Commission (FCC) has launched the Spectrum Frontiers proceeding to make swaths of this high-band spectrum available for 5G. We need to act this summer to unleash the next phase of U.S. wireless leadership.

High-band spectrum is uniquely suited to support key elements of 5G: significantly higher speeds, far quicker response times, and the ability to serve many more devices including Internet of Things (IoT)-enabled devices. 5G will support consumer and enterprise applications from ultra HD and augmented reality to driverless cars and remote operations.[3]

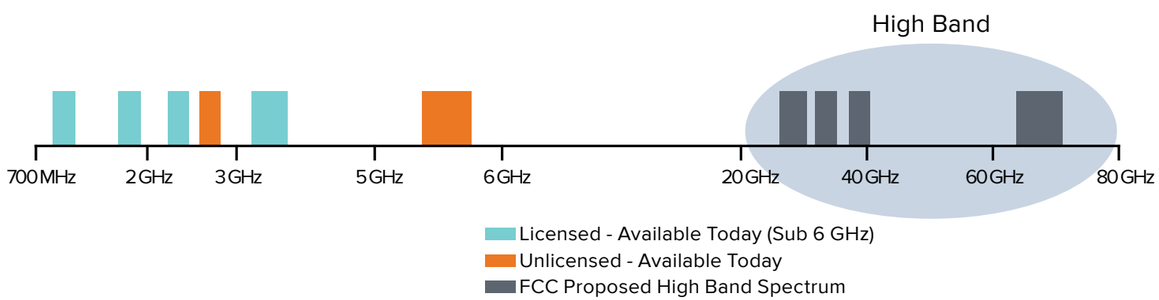
Other countries view 5G as an opportunity to seize the mantle of leadership in mobile. South Korea and Japan, for example, are each dedicating significant resources to launch 5G as they host the Olympics in 2018 and 2020, respectively. In the United States, wireless carriers and vendors are already building 5G solutions in the lab and engaging in field trials, but they need access to key bands of spectrum to make 5G a reality.[4] This is where the FCC comes in.

In the case of 4G LTE, the United States gained first mover advantage, in large part because the FCC held critical spectrum auctions in 2006 (AWS-1) and 2008 (700 MHz) that fueled investment in 4G LTE networks. A similar spectrum campaign is needed for 5G.

All five FCC Commissioners support the Spectrum Frontiers initiative,[5] and Chairman Wheeler has announced the agency will act on it in July.[6] Bold, aggressive FCC action cannot happen soon enough.

What is High-Band Spectrum – and Why is it Important for 5G?

5G will flourish with a mix of spectrum, including high-band. Today's smartphones typically use spectrum under 3 GHz, considered low- to mid-band spectrum. Those wireless signals can travel miles from a large tower in your community or along the highway to your device, providing broad area coverage and capacity. High-band spectrum refers to frequencies typically above 6 GHz in bands that are not used for mobile wireless service today. Thanks to significant research and development, however, we can now start to use high-band spectrum above 24 GHz, known as "millimeter wave," for mobile broadband. Together with low- and mid-band spectrum, high-band frequencies will enable the wide range of uses cases and applications envisioned using 5G technology.



High-band spectrum is different in two key ways.

1 Higher Bands Deliver More Data.

Today, most spectrum blocks are available in 5 to 10 MHz blocks, and in some cases up to 20 MHz blocks. In contrast, high-band spectrum will be available in spectrum blocks that are 200 MHz or larger. These larger blocks will enable operators to carry significantly more traffic in a single channel, at higher speeds, and in support of many more wireless devices.

2 Higher Bands Require More Infrastructure.

While your smartphone signal today may go miles, high-band spectrum only extends 200 meters or so, which is equivalent to city blocks. Carriers will need to deploy thousands of small cells and other infrastructure to take advantage of the new spectrum and provide users with service.

As the FCC's Spectrum Frontiers proposal observes, millimeter wave frequencies historically were viewed as unsuitable for mobile applications because of the more limited propagation capabilities – i.e., shorter distances – at such high frequencies.[7] But technological advances show that high-band spectrum can support offerings that require high-capacity, low latency, and multiple device capability.

What Can High-Band Spectrum Do?

Research by Samsung, Nokia, Ericsson, Qualcomm and Intel has demonstrated that millimeter wave frequencies can provide key feature capabilities that open up this new technology to cutting edge capabilities only dreamed of a few years ago.[8]

Faster Data Rates

High-band spectrum will support average data rates at least 10x the 4G LTE rates, producing throughput over 1 Gbps, and peak data rates up to 100x the current LTE data rate.

Densified Connections

High-band spectrum will enable the ability to connect thousands of devices in very dense use areas like stadiums or other arenas, public transportation stops, and other places with large, concentrated numbers of smart device users.

Reduced Latency

Due to technology enhancements, high-band spectrum will allow 5G end-to-end latency (delay) to be reduced at least 5x compared to today's LTE networks.

What Does High-Band Spectrum Mean for Consumers?

5G represents the future of wireless. Early in the history of wireless service, we had the equivalent of dirt roads and horse drawn buggies – voice only service, with some primitive text messaging. As time has gone on, the road has become wider and paved, and the buggy has become a modern car – now we have voice, text messaging, email, Internet, social media, and streaming video.

	1G	2G	3G	4G	5G
ROAD TYPE:	Dirt road	Paved one lane road	Two lane road	Four lane highway	Ten lane superhighway
CHANNEL SIZE:	30 KHz	200 KHz	1.25 MHz	20 MHz	200 MHz
APPLICATIONS:	Voice	+ Text, Email, Limited Internet	+ Internet, low quality video	+ Social media, streaming video	+ HD video, VR, AR, High-speed data
FREQUENCY BAND:	800 MHz	800/1900 MHz	800/1700/1900 MHz 2.1 GHz	700/800/1700/1900 MHz 2.1/2.3/2.5 GHz	High Band+

The future of wireless will require the equivalent of a ten-lane superhighway and a high-end sports car. That superhighway needs high-band spectrum, and the car is 5G technology.

High-band spectrum offers boundless applications. To the average U.S. consumer, high-band spectrum will mean faster broadband data traffic, reduced response times for existing applications, and a platform for new services and applications that have yet to be thought of today. Some examples of these new wireless services are:

High-Speed Data Zones

High-band spectrum will support very high-speed data zones at airports, train stations, and other public venues, as well as high-speed broadband zones that stream ultra-high definition (4K or 8K) video movies or other media content. High-band spectrum can also enable residential broadband to be delivered wirelessly at higher speeds than being delivered today.

mHealth and Telemedicine

Remote monitoring of patients can become a reality. Imagine a doctor being able to monitor a patient's vital signs, gather data from the patient's wearable, and video conference with the patient simultaneously. This will help improve health care access and outcomes, enabling Americans to live longer, healthier lives.

Smart Cities and Smart Traffic Management

Cities will use systems of wireless sensors and devices to connect everything from trash cans and street lights to water systems and roads/bridges. This pervasive connectivity will unleash new ways of delivering municipal services more efficiently and at lower cost. For example, smart sensor networks will provide the opportunity to reimagine public transportation, creating a system that can "react to the situation" by taking sensor data from a variety of sources in real time, summarizing that information, and suggesting alternative routes.

Virtual and Augmented Reality (VR/AR)

Ultra-high definition video and low latency (delay) will enable a host of applications that today can only be contemplated. Imagine a new and better way to train medical students, who will be able to observe a new procedure being performed through the eyes of the doctor in real time. Or imagine walking down city streets using an Augmented Reality (AR) set of glasses (or contact lenses) that project digital data overlaid on the real-world landscape – such as navigation and landmarks, tourist and historical sites, and nearby friends – directly onto the user's retina. These VR/AR devices will require real-time telemetry and

near continuous 3-D HD video feeds to every active user.[9]

The technology for these uses cases is maturing rapidly in parallel with standards development processes. Trials have started, and high-band spectrum's wider channel bandwidth and ultra-low latency hold the promise of enabling and supporting these applications.

What Do We Need to Do to Make High-Band Spectrum a Reality?

The FCC should act this summer on the ***Spectrum Frontiers*** initiative. By moving swiftly to make high-band spectrum available for 5G, and adopting a regulatory framework for these bands as close as possible to the rules used for the record-setting AWS-3 auction, the FCC can establish a spectrum environment conducive to 5G investment. Wireless operators are ready to invest in new infrastructure to introduce 5G in high-band spectrum under rules that are proven to support mobile broadband services. Acting this summer can ensure the U.S. remains the global mobile leader.

The ***Spectrum Frontiers*** order should license the 28 GHz, 37 GHz, and 39 GHz bands on an exclusive-use, flexible-rights licensed basis, enabling mobile broadband and 5G. Because use of high-band spectrum for 5G is technically difficult, the rules need to be as simple as possible to allow the emerging 5G ecosystem to innovate with network infrastructure, end-user devices and other related technologies. The FCC should avoid experimental sharing or other non-exclusive, untested access arrangements, as these bands are too important to use as trial bands. The Order should include a framework that protects the satellite and federal incumbents in the band while also maximizing the spectrum available for consumer services, and the FCC should also include a mix of unlicensed spectrum focused on the 64-71 GHz band.

Beyond *Spectrum Frontiers*, there are other critical policy priorities to support 5G

Enable small cell siting to support high-band deployment.

Wireless carriers are planning to deploy more than 100,000 small cells over the next 5 years to support mobile traffic growth.[10] In order to leverage high-band spectrum, policymakers need to adopt common sense siting policies for small cells and small cell backhaul that are foundational to this new technology. These include:

- **Continue to streamline the historic preservation review for small wireless deployments.**

In order to better enable the swift deployment of facilities that will support 5G, the FCC should further streamline historic preservation review of small wireless facilities. The FCC should complete this work no later than October 2016.

- **Design and implement faster small cell deployment processes at the state and local level.**

This will require educating policymakers that small cells have a smaller footprint than traditional macro cell sites. For example, the City of Los Angeles is installing 100 small cell light poles, with plans for another 500 to be deployed next year. As Mayor Eric Garcetti observed, this initiative will enhance mobile broadband connectivity while generating new revenue for the city. This innovative approach highlights what municipalities can do to facilitate better broadband connectivity and lays the groundwork for smart cities.

- **Define and implement reasonable siting timelines for siting on Federal facilities.**

Mobile usage in and around Federal facilities like National Parks and military installations continues to increase each year. Additional siting of wireless facilities at these Federal locations would help address growing usage and aid in public safety. Despite efforts to speed such deployments, it can take up to 3 years to site a wireless facility on Federal lands. The Administration and Congress can assist in streamlining this process.

Identify low- and mid-band spectrum for mobile broadband.

America's global leadership in mobile depends on spectrum. While large swaths of high-band spectrum are required to support localized 5G "hotspots," additional low- and mid-band spectrum is also needed to enable 5G technology to support much higher device density throughout wide coverage areas. As countries around the world look to 5G as a key input for economic growth, we must do the same and continue to make spectrum available in all band segments – or risk innovation and investment being exported overseas.

America's global leadership depends on spectrum.

Action by the FCC this summer to unleash high-band spectrum will lay the foundation for continued productivity, job growth, and innovation.

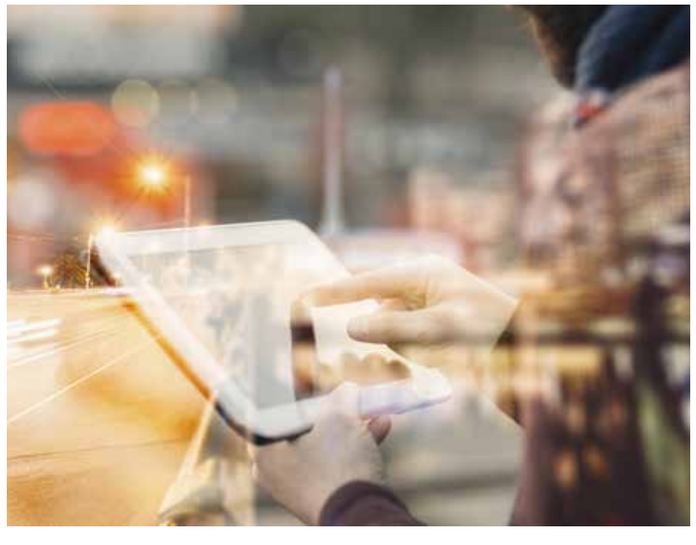
Conclusion

The FCC needs to complete its high-band proceeding this summer so that U.S. wireless companies will have access to the spectrum they will need for the United States to lead in 5G next-generation networks and the Internet of Things. High-band spectrum will be the initial platform for 5G development and deployment, enabling a new era of innovation that is poised to transform entire industries and the way we live and work.

U.S. leadership in 5G will depend on policies that make it possible for the next generation of wireless technologies to be rapidly and efficiently deployed. That takes not just high-band spectrum to enable the high-speed and low-latency that will be the hallmarks of 5G, but also low- and mid-band spectrum to support the higher device density that will support these innovations.

It is important that the FCC act this summer to make available all four Spectrum Frontiers bands, and to begin to explore additional bands for advanced wireless services. The FCC should promote investment in these bands through clear and proven service and licensing rules, and enable wireless providers to quickly deploy this spectrum by adopting common sense siting policies that recognize the new wireless networks needed for 5G.

For every day of delay, the U.S. will begin to feel the charge of other nations to equal and then surpass U.S. wireless leadership. The FCC has already taken steps to put the nation's wireless industry in a position to take the lead in 5G. Action by the FCC this summer to unleash high-band spectrum will lay the foundation for continued productivity, job growth, and innovation that will transform our daily lives in many ways that we can only imagine today.



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