

DEFENDING AMERICA'S WIRELESS LEADERSHIP

HEARING

BEFORE THE

SUBCOMMITTEE ON COMMUNICATIONS AND
TECHNOLOGY

OF THE

COMMITTEE ON ENERGY AND
COMMERCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED EIGHTEENTH CONGRESS

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DEFENDING AMERICA'S WIRELESS LEADERSHIP

FRIDAY, MARCH 10, 2023

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON COMMUNICATIONS AND TECHNOLOGY,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 9:01 a.m., in the John D. Dingell Room 2123, Rayburn House Office Building, Hon. Bob Latta (chairman of the subcommittee) presiding.

Members present: Representatives Latta, Bilirakis, Walberg, Carter, Dunn, Curtis, Joyce, Weber, Allen, Balderson, Fulcher, Pfluger, Harshbarger, Cammack, Obernolte, Rodgers (ex officio), Matsui (subcommittee ranking member), Clarke, Veasey, Soto, Eshoo, Cárdenas, Craig, Fletcher, Dingell, Kuster, and Pallone (ex officio).

Staff present: Sarah Burke, Deputy Staff Director; Slate Herman, Counsel, Communications and Technology; Nate Hodson, Staff Director; Tara Hupman, Chief Counsel; Noah Jackson, Clerk, Communications and Technology; Sean Kelly, Press Secretary; Peter Kielty, General Counsel; Emily King, Member Services Director; Giulia Leganski, Professional Staff Member, Communications and Technology; John Lin, Senior Counsel, Communications and Technology; Kate O'Connor, Chief Counsel, Communications and Technology; Michael Taggart, Policy Director; Evan Viau, Professional Staff Member, Communications and Technology; Jennifer Epperson, Minority Chief Counsel, Communications and Technology; Waverly Gordon, Minority Deputy Staff Director and General Counsel; Tiffany Guarascio, Minority Staff Director; Dan Miller, Minority Professional Staff Member; Elysa Montfort, Minority Press Secretary; Joe Orlando, Minority Senior Policy Analyst; Greg Pugh, Minority Staff Assistant; Michael Scurato, Minority FCC Detailee; and Johanna Thomas, Minority Counsel.

Mr. LATTA. Well, the Subcommittee on Communications and Technology will come to order. And the Chair recognizes himself for 5 minutes for an opening statement.

But before we do, I just want to take a point of personal privilege to say to our former chairman of the full committee, Mr. Walden, glad to see you here.

OPENING STATEMENT OF HON. ROBERT E. LATTA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OHIO

And a good—again, good morning and welcome to today's hearing on "Defending America's Wireless Leadership." What we are talk-

ing about today impacts Americans in every part of our country, and properly managing our Nation's spectrum resources is an important responsibility. These public resources fuel our economy, enable communication services, empower important Federal missions. As technology develops, it is important that spectrum policy keeps pace and efficiently maximizes the use of these finite resources by unleashing innovation and protecting our national security.

Over the past year, this committee worked to improve U.S. mspectrum policy. Last Congress, I co-led the Spectrum Innovation Act to accelerate commercial access to the lower 3 gigahertz band and extend the FCC's spectrum auction authority. This range of frequencies is prime band spectrum that will improve mobile broadband speeds. The legislation included a measure championed by our good friend from Kentucky, the chair of the Subcommittee on Health, that would modernize our Federal spectrum management process by establishing an incumbent-informing capability at NTIA to enhance commercial access to Federal frequencies. Last week, the House passed the—our full committee chair's legislation. The gentlelady from Washington would extend the FCC's auction authority to May 19th, and we are going to be talking about that, I'm sure, today and what happened last night.

Unfortunately, the Senate failed to pass both the Spectrum Innovation Act and Chair Rodgers' extension measure. We must now work quickly to agree on a long-term extension of spectrum auction authority that preserves congressional oversight of spectrum policy and directs auction proceeds to reduce the deficit and fund important initiatives. I look forward to continuing working on this important issue. It is also important to note that good spectrum policy is good for our economy.

Our leadership in 4G added billions to our GDP, created tens of thousands of new jobs, and led to the development of the app economy. Leading the world and future generations of wireless services ensures greater investment in next-generation technologies. This means we will have more job and development opportunities right here in the United States.

But the economic benefits do not end there. Auctioning spectrum resources also yields significant monetary benefits. Recent FCC auctions have netted over \$100 billion for the U.S. Treasury, money that can be used to reduce our Nation's deficit and fund important priorities. In addition to making more licensed spectrum available, we must also look for opportunities to make unlicensed spectrum available. The majority of American internet usage happens indoors, and the use of unlicensed spectrum, such as Wi-Fi, plays a crucial role in providing connectivity for homes and businesses.

One report estimates that unlicensed spectrum generates over \$95 billion per year in a connected technology market. Good spectrum policy is not only important for our economy, but it is essential for American economic and national security. American leadership on spectrum policy can lead to the private sector setting technology standards that benefit American technological leadership. It means trusted companies that can—that develop economies of scale, create jobs, ensure that the technology of the future promote American values and priorities.

As we develop our spectrum policy, we need to help keep—we need to keep a number of principles in mind. First, we need a balanced approach between licensed and unlicensed use of spectrum. Both licensed and unlicensed spectrum are key to bolstering U.S. technological leadership, and each provides economic benefits for the American public. Next, we need to ensure we are utilizing every tool at our disposal to make spectrum available for commercial use. Advances in technology have made spectrum-sharing more feasible, which will become more important as the process for identifying bands for auction, exclusive use, becomes more complex, lengthy and expensive.

Finally, we need to restore trust through the interagency spectrum coordination process. While Federal missions must be protected, the executive branch must speak with one unified voice so that spectrum management decisions are not called into question. As we look to extend spectrum auction authority and develop our spectrum policy, we need to ensure that all stakeholders are involved early in the process and that, when decisions are made, agencies respect those decisions. I look forward to hearing from our witnesses. And again, I want to thank all of our witnesses for appearing before us today.

[The prepared statement of Mr. Latta follows:]

Opening Statement of Chairman Robert E. Latta
Subcommittee on Communications and Technology
“Defending America’s Wireless Leadership”
March 10, 2023
(As Prepared for Delivery)

Good morning, and welcome to today’s hearing on Defending America’s Wireless Leadership.

What we are talking about today impacts Americans in every part of our country, and properly managing our nation’s spectrum resources is an important responsibility. These public resources fuel our economy, enable communications services, and power important federal missions. As technology develops, it is important that spectrum policy keeps pace and efficiently maximizes the use of these finite resources by unleashing innovation and protecting our national security.

Over the past year, this committee worked to improve U.S. spectrum policy.

Last Congress, I co-led the Spectrum Innovation Act to accelerate commercial access to the lower 3 gigahertz band and extend the FCC's spectrum auction authority. This range of frequencies is prime midband spectrum that will improve mobile broadband speeds. The legislation included a measure championed by Mr. Guthrie (KY-2) that would modernize our federal spectrum management process by establishing an incumbent informing capability at NTIA to enhance commercial access to federal frequencies.

Last week, the House passed Chair Rodgers' legislation to extend the FCC's auction authority to May 19.

Unfortunately, the Senate failed to pass both the Spectrum Innovation Act and Chair Rodgers' extension measure.

We must now work quickly to agree on a long-term extension of spectrum auction authority that preserves Congressional oversight of spectrum policy and directs auction proceeds to reduce the deficit and fund important initiatives. I look forward to continue working on this important issue.

It's also important to note that good spectrum policy is good for our economy. Our leadership in 4G added billions to our GDP, created tens of thousands of new jobs, and led to the development of the app economy. Leading the world in future generations of wireless services ensures greater investment in next generation technologies. This means we will have more job and development opportunities right here in the United States.

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Treasury—money that can be used to reduce our nation’s deficit and fund important priorities.

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American leadership on spectrum policy can lead to the private sector setting technology standards that benefit American technological leadership. It means trusted companies can develop

economies of scale, create jobs, and ensure that the technologies of the future promote American values and priorities.

As we develop our spectrum policy, we need to keep a number of principles in mind. First, we need a balanced approach between licensed and unlicensed uses of spectrum. Both licensed and unlicensed spectrum are key to bolstering U.S. technological leadership, and each provides economic benefits for the American public.

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Finally, we need to restore trust in the interagency spectrum coordination process. While federal missions must be protected, the executive branch must speak with one, unified voice so that spectrum management decisions are not called into question. As we look to extend spectrum auction authority and develop our spectrum policy, we need to ensure that all stakeholders are involved early in the process and that when decisions are made, agencies respect those decisions.

I look forward to hearing from our witnesses.

Thank you, and I yield to the Ranking Member of the Subcommittee, the gentlelady from the Seventh District of California.

Mr. LATTA. And at this time, I yield back and will recognize the ranking member of the subcommittee, the gentlelady from the Seventh District of California, for 5 minutes.

OPENING STATEMENT OF HON. DORIS O. MATSUI, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Ms. MATSUI. Thank you very much, Mr. Chairman. To say this hearing comes at an unprecedented time is no overstatement. We are here today under alarming circumstances during a lapse in the FCC's auction authority, something that has never happened before. Simply put, this is a failure. And it was a completely avoidable failure. Two weeks ago, the House passed a bipartisan bill to extend the FCC's auction authority through May 19th.

This extension was intended to give us time to continue negotiating while preserving the vital authority of the Commission. Unfortunately, that bill fell on deaf ears. Not only did the Senate decline to vote on the bill, but it declined to vote on any extension. This is, in part, because Senators have been receiving conflicting messages from the executive branch, a problem that has been plaguing administrations of both parties for years.

A little more than 2 years ago, I sent my first letter to the incoming administration. It was a letter to then-President-Elect Biden urging him to develop a unified approach to spectrum policy and a clearly articulated process resolving interagency disputes. I'll be entering this letter into the record. It's just as relevant today as it was when I sent it 2 years ago.

Mr. LATTA. Without objection.

[The information appears at the conclusion of the hearing.]

Ms. MATSUI. As I noted in the letter, more intensive use of spectrum has a potential to cause friction among Federal agencies and commercial users. And to some extent, this is unavoidable and healthy. Thoughtful debate about how to best utilize our limited spectrum resources will lead to better outcomes and more efficiency. But what can start as collaboration can quickly turn to conflict.

When disagreements do arise, it is vital that all agencies are aware of administration policy and understand how to provide feedback in a constructive manner. But when this process breaks down or doesn't exist, we end up where we find ourselves today. The consequences of this lapse hold the potential to be severe and far-reaching. It undercuts economic growth and long-term national security. Companies with service footprints across the country are eager to put spectrum they acquired in the recent 2.5 gigahertz band to—but this lapse jeopardizes that.

T-Mobile alone is waiting for the FCC to approve over 7,000 licenses with a collective value of more than \$300 million. In my district, they are waiting on five licenses that could—supporting home broadband and connecting underserved areas. But of course, the problem just doesn't stop there. The global race to 5 and 6G is still quite hot.

Satellite broadband service is taking off, and Wi-Fi is set to make strides that will be massive with consumers. If the U.S. cedes ground to our global competitors in any one of these spaces, the

consequences can be measured in American jobs and national security. On the heels of the Mobile World Congress, we should all be reminded of just how competitive the global wireless communications marketplace is. If the United States and other market economies aren't setting the pace for global harmonization, standard setting, and innovation, we create a vacuum that China would happily fill.

And while the FCC's auction authority isn't alone responsible for these issues, letting it lapse sets a dangerous precedent for our Government's values. Throughout this debate, people have asked me, "Would letting this authority lapse really be that bad?" My response has always been, "I'm extremely concerned, and I think you should be too." I'm concerned about the impact on licenses waiting to be signed to slow erosion of long-standing jurisdictional boundaries and the United States standing as the global innovation leader.

But I also think there is cause to be hopeful. This subcommittee has shown a bipartisan willingness to tackle tough issues that reinforce U.S. leadership, like extending the FCC's auction authority, for example. So I believe we have a chance to continue that track record to promote economic growth and national security. First and foremost, we need to assure the Federal Government is a driving force in maintaining a healthy spectrum pipeline. That means reasserting the NTIA's role as statutory manager of spectrum and developing a unified administration approach to spectrum policy. We need to keep the U.S. as anchor of innovation to stay ahead of our global competitors. I really want to thank the witnesses for being here today, and we can decide to dive in for what will be a timely and productive conversation. With that, I yield back the balance of my time.

[The prepared statement of Ms. Matsui follows:]

Committee on Energy and Commerce
Opening Statement as Prepared for Delivery
of
Subcommittee on Communications & Technology Ranking Member Doris Matsui
Hearing on “Defending America’s Wireless “Leadership.”

March 10, 2023

Thank you, Chairman Latta.

To say this hearing comes at an unprecedented time is no overstatement.

We’re here today under alarming circumstances – during a lapse in the FCC’s auction authority. Something that has never happened before.

Simply put, this is a failure. To add insult to injury, it was a completely avoidable failure.

Two weeks ago, the House passed a bipartisan bill to extend the FCC’s auction authority through May 19th. This extension was intended to give us time to continue negotiating while preserving the vital authority of the Commission. Unfortunately, that bill fell on deaf ears. Not only did the Senate decline to vote on the bill; it declined to vote on any extension.

This is in part because Senators have been receiving conflicting messages from the executive branch. A problem that has been plaguing Administrations of both parties for years.

A little more than two years ago, I sent my first letter to the incoming Administration. It was a letter to then President-elect Biden, urging him to develop a unified approach to spectrum policy and a clearly articulated process for resolving interagency disputes.

I’ll be entering this letter into the record. It’s just as relevant today as when I sent it two years ago. As I noted in the letter, more intensive use of spectrum has the potential to cause friction among federal agencies and commercial users.

To some extent this is unavoidable and healthy. Thoughtful debate about how to best utilize our limited spectrum resources will lead to better outcomes and more efficiency. But what can start as collaboration can quickly turn to conflict.

When disagreements do arise it’s vital that all agencies are aware of Administration policy and understand how to provide feedback in a constructive manner. But when this process breaks down or doesn’t exist, we end up where we find ourselves today.

The consequences of this lapse hold the potential to be severe and far reaching. It undercuts economic growth and long-term national security.

March 10, 2023

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Companies with service footprints across the country are eager to put spectrum they acquired in the recent 2.5 GHz band to use but this lapse jeopardizes that. T-Mobile alone is waiting for the FCC to approve 7,156 licenses with a collective value of more than 300 million dollars.

In my district they're waiting on 5 licenses that could be put to use supporting home broadband and connecting underserved areas. But of course, the problems don't stop there.

The global race to 5 and 6G is still white hot, satellite broadband service is taking off, and Wi-Fi is set to make strides that will be massive for consumers. If the U.S. cedes ground to our global competitors in any one of these spaces, the consequences can be measured in American jobs and national security. On the heels of the Mobile World Congress we should all be reminded of just how competitive the global wireless communications marketplace is.

If the United States and other market economies aren't setting the pace for global harmonization, standards setting, and innovation, we create a vacuum that China will happily fill. And, while the FCC's auction authority isn't alone responsible for these issues, letting it lapse sets a dangerous precedent for our governance values.

Throughout this debate people have asked me – "would letting this authority lapse really be that bad?" My response has always been "I'm extremely concerned, and I think you should be too."

I'm concerned about the impact on licenses waiting to be assigned, the slow erosion of longstanding jurisdictional boundaries, and the United States' standing as THE global innovation leader.

But I think there's also cause to be hopeful. This Subcommittee has shown a bipartisan willingness to tackle tough issues that reinforce US leadership. Like extending the FCC's auction authority for example!

So, I believe we have a chance to continue that track record to promote economic growth and national security.

First and foremost, we need to ensure the federal government is a driving force in maintaining a healthy spectrum pipeline. That means reasserting NTIA's role as statutory manager of spectrum and developing a unified Administration approach to spectrum policy.

We can also be taking steps now to encourage innovative governance models that allow for more intensive use of spectrum. And we need to keep the U.S. as the anchor of innovation to stay ahead of our global competitors.

I appreciate our witnesses being here today under what can only be described as difficult circumstances. I'm excited to dive in for what will be a timely and productive conversation.

With that I yield back the remainder of my time.

Mr. LATTA. Thank you very much.

The gentlelady yields back, and at this time, the Chair will now recognize for 5 minutes the chair of the full committee, the gentlelady from Washington.

**OPENING STATEMENT OF HON. CATHY McMORRIS RODGERS,
A REPRESENTATIVE IN CONGRESS FROM THE STATE OF
WASHINGTON**

Mrs. RODGERS. Good morning, everyone. Thank you, Mr. Chairman. Special welcome to the former chairman of this committee, Mr. Walden, and it's great to have your portrait on this side of the hearing room. Mm-hmm. Thank you to the witnesses for providing your expertise today.

Today's hearing on "Defending America's Wireless Leadership" will help inform the Energy and Commerce Committee's work on spectrum policy, which is crucial to maintaining U.S. economic and national security. For the first time ever, the FCC's spectrum auction authority has expired. On February 27th, the House passed bipartisan legislation led by myself and Ranking Member Pallone to extend the FCC's authority to issue spectrum licenses until May 19th.

This would have given Congress enough time to come to an agreement on a more comprehensive package addressing many issues in the communications and technology space. For reasons unknown to me, certain Senators decided to risk U.S. wireless leadership over a date change. A date change. It is unacceptable. We must come together and develop strong spectrum policy here in the United States that is informed by our values that support human flourishing and innovation.

We cannot afford to cede leadership to China and other authoritarian countries who abuse their technology to suppress freedom and assert command and control over people's lives. I urge the Senate to act swiftly to pass H.R. 1108 to extend the FCC's auction authority through May 19th so that we can come together and pass a longer-term solution to this issue. It's the Senate's only option on the table right now to get us back on track.

Make no mistake: Getting this right will be key to defending America's wireless leadership. For decades, American policies rooted in promoting economic security and competition have yielded breakthroughs in wireless technology. Thirty years ago, Congress and the FCC pioneered a bold new way to manage spectrum by auctioning spectrum instead of giving it away through a lottery system.

This light-touch regulatory framework has brought billions of dollars into the U.S. Treasury through fierce competition and ensured that entities who have a spectrum license invest in technologies that utilize that spectrum as efficiently as possible. This approach has fostered innovation in everything from faster broadband speeds, precision agriculture, self-driving cars and vehicles, and smart manufacturing.

While the demand for commercial spectrum continues to rise, so do the needs of our military, our border agents, and our researchers. In each new generation of technology, we find innovative solutions to balance these needs and utilize spectrum resources in a

way that fits our Nation's best interest. Spectrum policy is crucial to our national security policy. And we must stay true on the principles that have enabled our success in wireless technology, including by continuing to make spectrum available for commercial use.

But our future economic competitiveness cannot rest on our past success. The Chinese Communist Party and other adversaries seek to undermine U.S. leadership, and they will stop at nothing for their domination. China, Russia, and other authoritarian countries have put forward a competing vision for technology built on a foundation of surveillance and control.

State-backed companies seek to write the rules of the road that would use wireless technology to suppress free speech, surveil their citizens, and thwart the economic competitiveness of the United States and our allies. Their governments use top-down command-and-control policies to make spectrum available on a moment's notice. They provide prescriptive regulations and guidance to where and when state-backed entities should deploy service. That is not how the United States operates.

We believe in private-sector innovation. And spectrum policy is at the heart of technological innovation. If we do not take a leadership role in writing our wireless future, China will. And writing our wireless future starts here at home with comprehensive spectrum policy. I look forward to today's hearing. It is extremely timely as we again remind individuals in the Senate on the importance of America's spectrum leadership.

[The prepared statement of Mrs. Rodgers follows:]

**Opening Statement of Chair Cathy McMorris Rodgers
Subcommittee on Communications and Technology
“Defending America’s Wireless Leadership.”
March 10, 2023**

(As Prepared for Delivery)

Good morning, and thank you, Mr. Chairman.

Thank you to our witnesses for providing your expertise.

Today’s hearing on Defending America’s wireless leadership will help inform the Energy and Commerce Committee’s work on spectrum policy...

...which is crucial to maintaining U.S. economic and national security.

Spectrum Auction Authority

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For reasons unknown to me, certain Senators decided to risk U.S. wireless leadership over a date change. A date change. That is unacceptable.

We must come together and develop strong spectrum policy here in the United States that is informed by our values that support human flourishing and innovation.

We cannot afford to cede leadership to China and other authoritarian countries who abuse their technology to suppress freedom and assert command and control over people's lives.

I urge the Senate to act swiftly to pass H.R. 1108 to extend the FCC's auction authority through May 19 so we can come together and pass a longer-term solution to this issue.

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Make no mistake: getting this right will be key to defending America's wireless leadership.

U.S. Leadership

For decades, American policies rooted in promoting economic security and competition have yielded breakthroughs in wireless technology.

Thirty years ago, Congress and the FCC pioneered a bold new way to manage spectrum by auctioning spectrum instead of giving it away through a lottery system.

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...and ensured that entities who have a spectrum license invest in technologies that utilize that spectrum as efficiently as possible.

This approach has fostered innovation in everything from faster broadband speeds, precision agriculture, self-driving cars and vehicles, and smart manufacturing.

While the demand for commercial spectrum continues to rise, so do the needs of our military, our border agents, and our researchers.

In each new generation of technology, we find innovative solutions to balance these needs, and utilize spectrum resources in a way that fits our nation's best interest.

Spectrum policy is crucial to our national security policy, and we must stay true on the principles that have enabled our success in wireless technology...

...including by continuing to make spectrum available for commercial use.

But our future economic competitiveness cannot rest on our past success.

Competition with China

The Chinese Communist Party and other adversaries seek to undermine U.S. leadership, and they will stop at nothing short of domination.

China, Russia, and other authoritarian countries have put forward a competing vision for technology built on a foundation of surveillance and control.

State-backed companies seek to write the rules of the road that could use wireless technology to suppress free speech...

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...and thwart the economic competitiveness of the United States and our allies.

Their governments use top-down, command and control policies to make spectrum available on a moment's notice.

They provide prescriptive regulations and guidance to where and when state-backed entities should deploy service.

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If we do not take a leadership role in writing our wireless future, China will.

And writing our wireless future starts here at home, with comprehensive spectrum policy.

Closing

I look forward to today's hearing. It is extremely timely as we again remind individuals in the Senate on the importance of America's spectrum leadership.

Thank you, and I yield back.

Mrs. RODGERS. Thank you, and I would like to yield to the lady from Florida.

Mrs. CAMMACK. Thank you, Chair Rodgers and Chairman Latta. Just as a point of personal privilege, I would like to recognize a very special guest today in the room with us. Yesterday, she was at the White House receiving the International Woman of Courage award. This is Brigadier General Bolor. She is the first general of the Mongolian Armed Forces. I met her several months ago. I met her several months ago in Mongolia at one of our training facilities, and she has been an inspiration not to her own country but to women and girls all across the world. So thank you so much for being here today, and thank you to the chair and chairman for allowing me the—a moment to introduce her. Thank you.

Mr. LATTI. Well, thank you. And the gentlelady from Washington yields back. At this time, the Chair will now recognize the gentleman from New Jersey, the ranking member of the full committee, for 5 minutes.

OPENING STATEMENT OF HON. FRANK PALLONE, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. PALLONE. Thank you, Chairman Latta. And it is good to see Chairman Greg Walden here today. Good to see you.

Spectrum is one of our country's most underrated and economically valuable natural resources. For the last three decades, Congress has given the FCC the authority to make these airwaves available through the use of competitive bidding or auctions. Granting the FCC this authority has served both the public and the Nation well. And today, the U.S. is a global leader in delivering 5G, advanced Wi-Fi, Bluetooth and other next-generation wireless technologies to consumers across the country.

And at the same time, spectrum auctions, which have raised over \$200 billion for the Federal Government, have helped fund important public safety communications priorities. Yesterday, for the first time—as my colleagues have mentioned—since the agency gained this authority 30 years ago, Congress failed to extend it when the Senate refused to act. The Senate—the House did its work. We unanimously passed a bipartisan bill introduced by me and Chair Rodgers last month to extend the spectrum auction authority to May 19th.

Our legislation would have prevented this lapse in authority. Now, I must say I am not—I am often a critic of the Senate. So I was not surprised that the Senate did not pass the House's bipartisan bill. They have a basic problem passing any legislation. In case any of you didn't know that, I'll reiterate it. But we cannot give up, and our work continues. And that's why I'm pleased that we are here today in a bipartisan fashion to shed some additional light on how our airwaves benefit consumers on a daily basis and keep Americans safe both here and abroad.

Now, some Americans may not know that wireless calls—that wireless calls travel over spectrum as therefore the essential building block for connecting family and friends, providing access to emergency services during times of need, and delivering education and health services to Americans around the country.

Without spectrum, we would not have wireless emergency alerts, the app economy, smart phones, messaging services, the Internet of Things, drones, and so many other things. Many of these technological advances were developed by American innovators because the U.S. was on the cutting edge pushing the limits of how spectrum could be used in new and exciting ways. And these are remarkable achievements of services people rely on every day.

But our country's past performance in aggressively deploying wireless technology does not guarantee future success. Simply because our Nation led the world in providing consumers with access to 4G wireless technology and Wi-Fi does not mean that we'll achieve the same result of 5G, 6G, or Wi-Fi 7. And the stakes could not be higher. Chairwoman Rodgers mentioned this. The failure to replenish the commercial spectrum pipeline and extend the FCC auction authority risks our Nation falling behind our counterparts across the globe, particularly China. And that's because, you know, in producing cutting-edge consumer innovations and enhancing our national security capabilities, we have to be ahead of China.

Unlike the United States, the Chinese Communist Party does not govern with the fundamental values of democracy, free speech, and human rights in mind. So time is of the essence. We can't rest on past successes when China has already reportedly made three times as much spectrum available for 5G compared to the United States. Now, leading the world in advanced wireless technology must also include ensuring that these advancements are delivered equitably to all Americans regardless of income or ZIP Code.

Unfortunately, too often, rural, Tribal, and low-income areas are left behind as next-generation technologies are deployed. And leaving these areas without these essential services denies them the many benefits that these technologies bring to others, including job and educational opportunities, health services, and so many other things that we've all come to depend on.

Fortunately, programs like the Affordable Connectivity Program that was established in the bipartisan infrastructure law are helping connect these communities and the families living in them. The Affordable Connectivity Program has been incredibly successful since it was rolled out, connecting nearly 17 million families to high-quality and affordable broadband. In fact, every single Member on this subcommittee on both sides of the aisle represents thousands of families that are benefiting from this program today.

And this is especially important to highlight given that low-income families are more likely to rely on a smart phone and a mobile plan than a home broadband subscription. So I look forward to hearing from our witnesses. Obviously, we have a lot to do, and with that, I yield back, Mr. Chairman, the balance of my time.

[The prepared statement of Mr. Pallone follows:]

Committee on Energy and Commerce
Opening Statement as Prepared for Delivery
of
Full Committee Ranking Member Frank Pallone, Jr.
Communications and Technology Subcommittee
Hearing on “Defending America’s Wireless Leadership”
March 10, 2023

Spectrum is one of our country’s most underrated and economically valuable natural resources. For the last three decades Congress has given the Federal Communications Commission (FCC) the authority to make these airwaves available through the use of competitive bidding, or auctions.

Granting the FCC this authority has served both the public and the nation well. Today, the United States is a global leader in delivering 5G, advanced Wi-Fi, Bluetooth, and other next-generation wireless technologies to consumers across the country. At the same time, spectrum auctions, which have raised over \$200 billion for the federal government, have helped fund important public safety communications priorities.

Yesterday, for the first time since the agency gained this authority 30 years ago, Congress failed to extend it when the Senate did not act because of the objections of one Senator. The House did its work – we unanimously passed a bipartisan bill introduced by me and Chair Rodgers last month to extend the spectrum auction authority to May 19th. Our legislation would have prevented this lapse in authority.

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I am disappointed that the Senate did not pass the House's bipartisan bill, but we cannot give up and our work continues. That's why I am pleased that we are here today in a bipartisan fashion to shed some additional light on how our airwaves benefit consumers on a daily basis and keep Americans safe both here and abroad.

Some Americans may not know that wireless calls travel over spectrum. It is, therefore, the essential building block for connecting family and friends, providing access to emergency services during times of need, and delivering education and health services to Americans around the country. Without spectrum, we would not have wireless emergency alerts, the app economy, smartphones, messaging services, the internet of things, or drones. Many of these technological advancements were developed by American innovators because the United States was on the cutting edge, pushing the limits on how spectrum could be used in new and exciting ways.

These are remarkable achievements of services people rely on every day, but our country's past performance in aggressively deploying wireless technology does not guarantee future success. Simply because our nation led the world in providing consumers with access to 4G wireless technology and Wi-Fi does not mean we will achieve the same result in 5G, 6G, or Wi-Fi 7.

The stakes could not be higher. Failure to replenish the commercial spectrum pipeline and extend the FCC's auction authority risks our nation falling behind our counterparts across the globe, including China, in producing cutting-edge consumer innovations and enhancing our

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national security capabilities. And unlike the United States, the Chinese Communist Party does not govern with the fundamental values of democracy, free speech, and human rights in mind.

Time is of the essence. We cannot rest on past successes when China has already reportedly made three times as much spectrum available for 5G compared to the United States. Exploring and opening up our airwaves to allow for new uses takes time. That means we must begin now, and we must extend the FCC's auction authority, to prepare for the wireless technologies of tomorrow.

Leading the world in advanced wireless technology must also include ensuring that these advancements are delivered equitably to all Americans regardless of income or zip code. Unfortunately, too often rural, tribal, and low-income areas are left behind as next-generation technologies are deployed. Leaving these areas without these essential services denies them the many benefits these technologies bring to others, including job and educational opportunities, health services, and so many other things we have all come to depend upon.

Fortunately, programs like the Affordable Connectivity Program that we established in the Bipartisan Infrastructure Law are helping connect these communities and the families living in them. The Affordable Connectivity Program has been incredibly successful since it was rolled out, connecting nearly 17 million families to high-quality and affordable broadband. In fact, every single member on this Subcommittee, on both sides of the aisle, represents thousands of families that are benefitting from this program today. This is especially important to highlight

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given that low-income families are more likely to rely on a smartphone and a mobile plan than a home broadband subscription.

We have a lot to discuss today, especially as we continue to work with our Senate colleagues to retain America's wireless leadership by securing our wireless future. I look forward to hearing from our witnesses. And I yield back the balance of my time.

Mr. LATTA. Well, thank you very much. The gentleman yields back, and that concludes our opening statements. We have now—we will now hear from our witnesses today. But the Chair would like to remind Members that, pursuant to committee rules, all Members' opening statements will be made part of the record. And again, thanks for coming to testify before us today because, again, this is a day that you've heard from several of us already how important it is, especially with our spectrum auction authority.

Today's witnesses will have 5 minutes to provide an opening statement, which will be followed by a round of questions from our Members. Our witness panel for today's hearing will include Mr. Brad Gillen, executive vice president with CTIA—The Wireless Association; Mr. James Assay—Assey, the executive vice president with NCTA—The Internet and Television Association; Dr. Monisha Ghosh, professor at the University of Notre Dame College of Engineering and former FCC Chief Technology Officer; and Mr. Clete Johnson, senior fellow at the Center for Strategic and International Studies.

And at this time, we will start. And I'm also going to apologize about my allergies. As soon as they opened up that plane door the other day, 10 minutes later, they are here. But Mr. Gillen, you are recognized for 5 minutes. Thank you very much for being with us.

STATEMENT OF BRAD GILLEN, EXECUTIVE VICE PRESIDENT, CTIA-THE WIRELESS ASSOCIATION; JAMES ASSEY, EXECUTIVE VICE PRESIDENT, NCTA-THE INTERNET AND TELEVISION ASSOCIATION; MONISHA GHOSH, Ph.D., PROFESSOR, DEPARTMENT OF ELECTRICAL ENGINEERING, UNIVERSITY OF NOTRE DAME; AND CLETE D. JOHNSON, SENIOR FELLOW, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES

STATEMENT OF BRAD GILLEN

Mr. GILLEN. Thank you, Mr. Chairman, Ranking Member Matsui. And on behalf of the U.S. wireless industry, thank you for having a hearing on our favorite topic, spectrum, even if it is a bad day for spectrum policy. It was actually 50 years ago this year, a U.S. engineer walking down the streets of New York made the first phone call with one of these [holds up cell phone]. We led the world in wireless that first day. We lead today, and that is because of American ingenuity like that. It is also because of American investment.

The wireless industry invested just \$35 billion just last year, 4 years of record growth. That has benefited Americans with 5G 1.5 times faster than we benefited from 4G a generation ago. The other key, as alluded to in the opening statement, is this committee, your leadership. Thirty years ago, you created the FCC spectrum auction as the best way to allocate spectrum for commercial use. It has been replicated around the world, even won the Nobel Prize. We raised an astonishing \$233 billion for the U.S. Treasury. It's helped drive everything we do from 2G to 3G, 4G to now 5G.

Now, spectrum policy gets way too wonky way too fast, as that last sentence indicates. At its core, spectrum is the fuel. It makes this go [holds up cell phone] and, as a number of the opening statements alluded to, it increasingly makes our economy go. We are

projecting over 4.5 million new jobs this decade thanks to 5G innovation, from manufacturing to healthcare to agriculture and more. It is also creating entire new industries like 5G home, a new fixed broadband solution that is bringing more choice and is bringing—helping close the digital divide.

The two fastest-growing home broadband solution providers today are not fiber companies. They are actually wireless companies. So that's the good news. It's actually the great news. We are really in a good place. The challenge is we are almost out of fuel—spectrum—at exactly the wrong time. You can see it is always easier with pictures. On the first slide, you can see on the left-hand side how much more data we used from the 2010 to 2021. It is in the purple.

We used more and more each and every year. Where we are now starting in 5G economy here, we are going to have growth five times more over the next—by 2027. That is a staggering amount of growth. It indicates just how much more we are going to use all these devices. And the challenge we have as a nation is we do not have five times the amount of spectrum to build that cliff.

In actuality, as the—you have already identified, we have zero more spectrum coming. And that really is the challenge we face. There are no FCC spectrum auctions planned today. And that is particularly important with respect to something we call midband spectrum. FCC Chairwoman Rosenworcel calls it the ideal blend of capacity and coverage. It is. It goes far, and it carries a lot. It is the key to what we need to do. The challenge is today our spectrum allocation, as you can see on the next slide, is not in balance. When it comes to this key midband spectrum, we have 12 times more of it assigned to government users. We had seven more—times more to our license and Wi-Fi friends.

And we do that little blue dot that's assigned to 5G today. We hope we can work with this committee to address this imbalance because we see other countries doing that right now.

On the next slide, you can see what's happening around the globe. Other countries are moving more quickly to get 5G midband in folks' hands. And this is also part of their—they want to supplant U.S. leadership. Make no mistake. They see what it meant—is meant here, and they want to replicate it back home where they are. Currently, our deficit is over 300 megahertz. That is roughly two major FCC auctions. And the hatch marks you can see by 2027, that deficit will grow to over 500. Absent corrective action, China has plans to aggressively move forward and could have over 400 percent more spectrum than available to the commercial sector in the United States by 2027.

Now, a number of the solutions of how we fix this, you have already alluded to. And that was great to hear. The three things stand out in our minds.

The first is today is the first day in the last 30 years the FCC does not have the basic tool to run auctions. That is an unfortunate thing. We need to quickly—and thank your leadership for all you did to keep—preserve that leadership. We need to get the FCC the authority back.

And as key in doing that, the second piece is we need to have a pipeline of auctions to go with it. The FCC needs auctions to ac-

tually make this go. This committee in 1997 and 2006, in 2012, designated specific auctions along with auction authority. It is critical to our success in the past and can be so again. Accenture has identified three bands that we believe are prime candidates for future use. Welcome the chance to talk about those today.

And the third, it really goes to we need better coordination. We need to empower the FCC and NTIA to speak with one voice. They need to call balls and strikes and be the experts that they are.

Too much of the challenges we have had the last few years is we have been looking backwards, relitigating past disputes, not looking forward as to how all of these things can push us forward, can help grow the economy, our economic security, our national competitiveness and our national security. There's very little things Congress can do other than spectrum policy to really move this country forward.

We look forward to working with you and thank you for having us today.

[The prepared statement of Mr. Gillen follows:]

Testimony of

Brad Gillen

Executive Vice President

CTIA

on

Defending America's Wireless Leadership

before the U.S. House

Committee on Energy & Commerce

Subcommittee on Communications and Technology

March 10, 2023



Chairman Latta, Ranking Member Matsui, members of the Subcommittee, on behalf of CTIA and the wireless industry, thank you for the opportunity to testify today.

CTIA thanks this Subcommittee for its bipartisan commitment to crafting sound spectrum policy for our nation's future. I especially want to recognize your recent legislative efforts to address the FCC's auction authority, and your clear focus on identifying and repurposing spectrum for 5G. The United States leads the world in wireless—both licensed and unlicensed—thanks to your longstanding focus on spectrum matters.

And we need your leadership again, now more than ever. We have the opportunity to secure our leadership in next-generation 5G and the industries of the future through a clear national commitment to spectrum policy built on mid-band spectrum with a focus on future full-power licensed access. Ensuring a leading role will promote both our global competitiveness – particularly against China – as well as our national security.

This morning I want to address three key policy issues:

1. We need to ensure the FCC has spectrum auction authority to secure U.S. international spectrum leadership.
2. We should create a schedule of future spectrum auctions. Right now we have no planned spectrum auctions in the queue to help us meet the significant demand for mobile and fixed wireless services.
3. We should empower the nation's spectrum experts—the FCC and NTIA—to enhance government-wide coordination and make interagency spectrum decisions in the best interests of our nation.

But first, let's recap the extraordinary benefits that 5G is delivering.

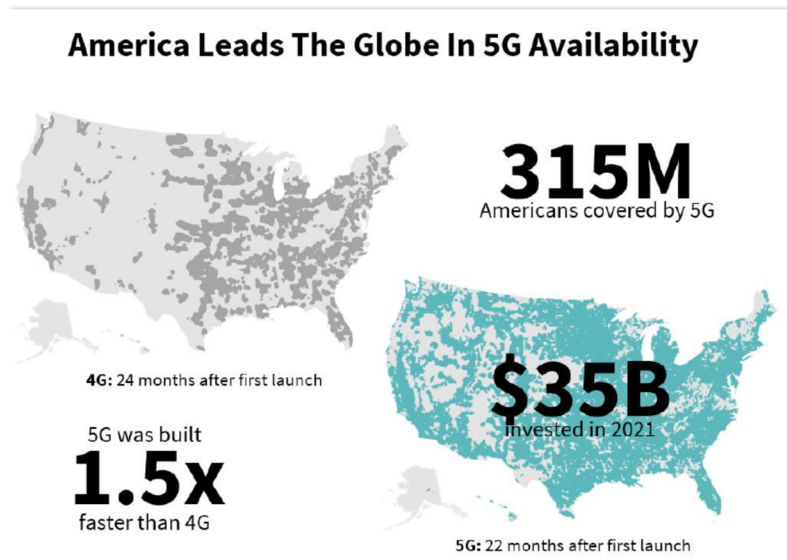
5G's Positive Impact on the Broadband Marketplace and Our Nation.

I testified before this Subcommittee in 2018 about what 5G could be. I'm pleased to be back to talk about what 5G is today thanks to your leadership.

5G is the most powerful and secure wireless technology, and we are already seeing average speeds of over 128 Mbps, over six times faster than speeds available in 2016. Enhanced latency and advanced security measures promise the reliable and secure connections families and businesses need to unlock new innovations in health care, agriculture, transportation, manufacturing, and so much more.

5G today already covers 315 million Americans, and we're deploying this new technology across the country nearly twice as fast as 4G. The wide availability of 5G is the result of record-breaking investment. Wireless providers invested more than \$35 billion to build out 5G in 2021 alone. In this, we lead the world: U.S. wireless investment accounted for 19% of the world's total mobile capital expenditures even though the U.S. has just 4% of the world's population.

U.S. 4G global leadership helped drive a generation of cutting edge innovation around the app and sharing economy. Thanks to the remarkable private investment in our nation's infrastructure from AT&T, T-Mobile, UScellular, Verizon and dozens more operators, we are poised to see similar opportunities happen here for 5G as well.



Boston Consulting Group projects 5G will be a powerful engine for our nation's future economic growth by adding \$1.5 trillion to our economy and 4.5 million new American jobs this decade. The benefits are more than economic. Deloitte projected over \$300B in health savings annually thanks to 5G innovation. Accenture similarly found that 5G-related innovation will help achieve 20 percent of the nation's carbon reduction targets—that's the equivalent of taking 72 million cars off the road for a year.



Thanks to this historic investment, we are now seeing the first wave of 5G innovators and entrepreneurs leveraging this platform to help solve problems facing our nation:

Transportation. Anad Nandakumar started Halo in Nevada to deliver an all-electric driverless car powered by 5G. The key for his business' growth is more 5G deployment.

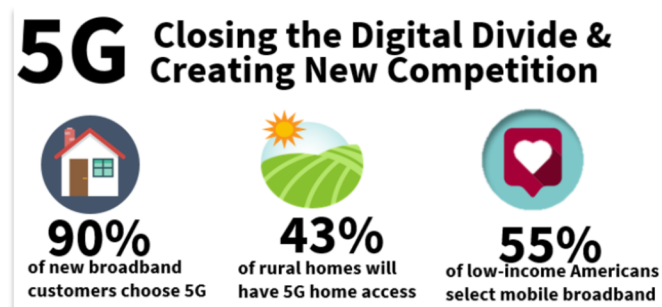
Education. Kai Frazier is a Title I teacher in Oakland, and she started Kai XR to provide an immersive virtual reality experience built from 5G for kids without resources for field trips to see the world.

Agriculture. Liz Buchen started Trellis in Georgia to deploy advanced sensors to help family farmers increase their yield and better manage irrigation resources all supported by 5G.

Public Safety. Sonia Kastner founded Pano AI in California. She is using 5G and AI to provide early wildfire detection tools to help firefighters and communities.

We also see companies like Ericsson and Samsung investing in 5G-powered manufacturing that promises to help support new manufacturing jobs across the nation. The government through the Department of Veterans Affairs is investing in 5G solutions to help improve health outcomes for our veterans. The Defense Department is also partnering with wireless companies to deploy 5G solutions for planning, training, and operations, as well as managing smart warehouses, and command and control operations. Excitingly, each day we see more companies and organizations finding innovation ways to use 5G to help Americans.

One of the most exciting 5G developments is bringing competition to the home broadband market. “5G Home” leverages the advanced capabilities of 5G to deliver fixed broadband solutions to homes and small businesses in rural, suburban, and urban areas. Accenture projects 5G Home will reach 43 percent of rural households. Both national and regional operators are providing this new competitive choice and helping close the digital divide today. In fact, 90 percent of new broadband customers in 2022 selected a 5G fixed wireless solution. As a result, the two fastest growing broadband companies today are wireless companies. We are bringing the competitive spirit of the mobile market to this new arena, and this service will only get more powerful with access to more spectrum.



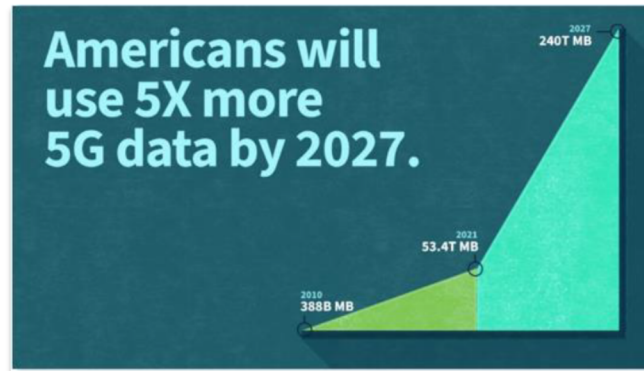
We see great opportunities to serve more Americans with affordable and high speed 5G services. We recognize there is much work to be done to ensure all residents from Ohio to California, and from Washington state to New Jersey, have access to both robust mobile and fixed solutions. Over 55 percent of Americans under the Affordability Connectivity Program are staying connected thanks to mobile service today, and we support congressional efforts to ensure that program is available for years to come. We also support congressional efforts to ensure the technologically neutral approach enshrined in the Infrastructure Act is reflected when states start to distribute their Broadband Equity Access and Deployment funding. We will need all technologies to close the digital divide as quickly as we can, and 5G Home is a scalable, cost-effective solution that can help extend the reach of finite federal dollars.

Of course, all of the benefits that 5G is delivering in the U.S.—expanding digital inclusion, economic growth, job creation, smart cities, and improvements in public safety, health care, and our environment—are predicated on the availability of spectrum.

And there is more to do on that front with your help.

America's Growing Demand for Wireless and the Need for More Licensed Mid-Band Spectrum.

New 5G uses cases—as well as America's ever increasing use of smartphones and other wireless devices—are driving extraordinary traffic growth on wireless networks. America's wireless networks carried over 53 trillion MBs in 2021, and the year-over-year growth was almost double that compared to 2020. Wireless usage is projected to increase fivefold by 2027 as 5G evolves and improves.



To meet this demand and keep up with the 5G needs of American consumers, the wireless industry will continue to invest tens of billions of dollars in more efficient technologies, and build denser networks in more communities with a mix of traditional cell towers and new small cell technologies. We will also need Congress's help to make available additional spectrum to meet the moment.

Wireless networks rely on licensed spectrum sold at auction to deliver the reliable and secure services Americans demand. Since Congress first authorized the FCC to conduct spectrum auctions back in 1993—the first-ever spectrum auctions anywhere—the United States has led the world in spectrum policy. Auctions have proven to be the most successful means to assign the interference-protected, exclusive-use, flexible rights spectrum licenses that are the bedrock of 5G and mobile wireless communications.

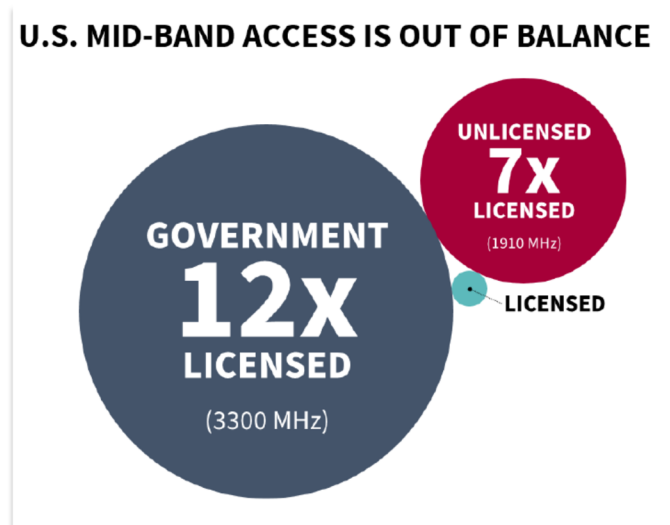
The key spectrum being used for 5G around the world is mid-band spectrum. FCC Chairwoman Jessica Rosenworcel has long championed the need for more U.S. mid-band access because it is the “ideal blend of capacity and coverage ... key to delivering on the promise of 5G services and ... reach[ing] as many people as possible.”

Congress took significant steps in 2018 and 2021 to jump start commercial access to mid-band spectrum resulting in the C-Band and 3.45 GHz auctions. Together, these two auctions raised over \$100 billion in winning bids from national and regional providers as well as new entrants. This reflects the extraordinary demand for mid-band spectrum. These spectrum

bands will be the backbone of wireless investment over the next few years. We are already seeing jumps in speed and capabilities as these bands are made available.

The challenge we face today is there are no additional auctions planned. Our ability to deliver better 5G each and every year is dependent upon a reliable and known pipeline of new spectrum.

Roughly two-thirds of key mid-band spectrum in the U.S. right now is controlled by the federal government. In all, government agencies today have 12 times more spectrum than 5G. Together, we can find a better balance that enables government agencies to meet their missions—including national defense—while enhancing and expanding commercial access. Similarly, unlicensed spectrum has 7 times more mid-band spectrum than does the wireless industry, underscoring the need for an immediate focus on licensed access.



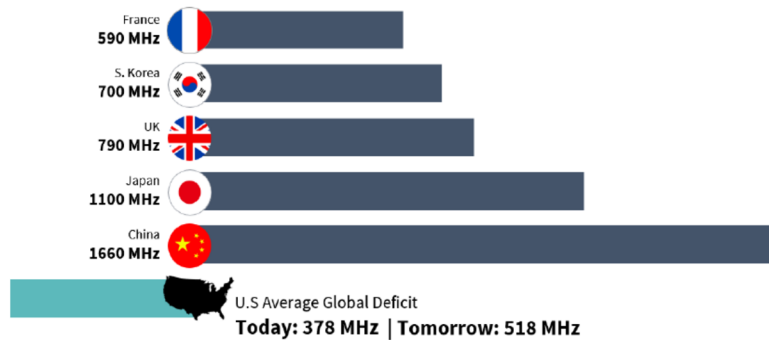
In contrast, our global rivals are acting now to get ahead of skyrocketing wireless use by freeing up more spectrum. Today, we have a global deficit of over 370 megahertz of mid-band spectrum compared to our key rivals, which is roughly the size of the 3.45 GHz and C-Band auctions combined. Japan today has over 1100 megahertz assigned, and the United Kingdom almost 800 megahertz.

This global dynamic is further complicated by our rivals' plan for even greater access by 2027. China is a good example. Chinese wireless operators already have greater access to mid-band today than the U.S., and they are looking to aggressively expand access by 2027. They may soon have over 4 times the commercial licensed mid-band as the U.S. Overall, we

project a global deficit of over 500 megahertz in four years, which would jeopardize our global leadership in future innovation. China is also seeking to build new wireless ecosystems around the globe in Africa, Asia, and elsewhere in bands currently unavailable in the U.S. This risks a divide in terms of our global influence over future technologies, and the benefit of scaled internationalized harmonized solutions. This Committee is best positioned to address this deficit now, and help ensure continued U.S. leadership.

Global Rivals Extending Their Mid-Band Advantage

U.S. Deficit Could be Over 500 MHz by 2027



Three Recommendations to Empower U.S. Wireless Leadership and Enable Cutting Edge Wireless Services to All Americans.

We thank this Committee for its ongoing commitment to advancing U.S. wireless interests, and we need your continued leadership now more than ever.

We have three recommendations for Congress: maintain the FCC's auction authority; replenish the 5G spectrum pipeline; and revitalize interagency coordination. With these actions, Congress will help ensure the U.S.'s continued global leadership in wireless.

Empowering the FCC. Reauthorization of the FCC's auction authority is key to maintaining America's wireless leadership. The lessons of the 1997, 2006, and 2012 auction authority extensions demonstrate the critical role of Congress in spectrum policy through packaging extensions of authority with designated future FCC auctions. In each of those instances, Congress mandated specific auctions along with extending the FCC's authority. The last extension directed the FCC to hold the then-record breaking AWS-3 auction, the 600 MHz broadcast incentive auction, and the H Block auction. Depriving the FCC of auction authority runs the risk of stunting 5G growth, impeding U.S. investment and innovation, and sending our international rivals the wrong message about U.S. wireless leadership.

Overall, spectrum auctions have resulted in over \$200 billion in revenue for the U.S. taxpayers, and tens of billions of auction proceeds have been used to modernize systems for the Department of Defense and other agencies that have repurposed spectrum for commercial use. We thank Chair Rodgers and Ranking Member Pallone for leading the efforts to address the FCC's auction authority in a manner that provides all stakeholders the time to contribute towards the development a new spectrum pipeline that can be combined with a longer-term auction authority extension.

Replenishing the Spectrum Pipeline. It is in our nation's economic and national security interest to identify a pipeline of bands to be auctioned, particularly now that there is no more 5G spectrum set to be made available. The Committee is uniquely situated to address this shortfall, and this effort should focus on our mid-band deficit in a manner that ensures key government spectrum-based services are preserved, if not enhanced, with new more efficient state-of-the-art technologies and systems. The Department of Defense and other agencies are important users of spectrum, and must continue to have access to sufficient spectrum to deliver mission critical services. We are confident with this Subcommittee's direction, we can identify opportunities for win-win scenarios benefiting both commercial and government spectrum users.

1

Extend FCC Auction Authority

2

Enact a Future Pipeline of Spectrum

3

Enhance Agency Coordination

Specifically, Accenture has identified three federal bands that should be central to that review: the lower 3 GHz, 4 GHz, and 7/8 GHz bands. We also support FCC Chairwoman Rosenworcel's call to investigate the 7-15 GHz range for future commercial access.

KEY FUTURE SPECTRUM BANDS



Lower 3 GHz Band. The lower 3 GHz band (3.1-3.45 GHz) is a 350 megahertz block of spectrum, immediately adjacent to other full-power licensed commercial spectrum (3.45 GHz band). The band today is used by the federal government, predominantly the Department of Defense. It is a great fit to provide large channels and faster throughput, and the top portion of this band is already used in China and around the globe for 5G services. Congress has also already identified this band for study, and this Committee's focus on the band has helped jumpstart both industry and government review of how to best utilize the band going forward. The successful 3.45 GHz auction in 2021 provides all stakeholders with a roadmap for success that is driven by a system-by-system review of government systems. That auction resulted in DoD receiving \$14 billion to upgrade and move some of their systems. We encourage Congress to ensure that the Department of Defense's ongoing review of this band is similarly comprehensive and considers all options, including retuning equipment, repacking existing use into other frequencies, and relocating specific systems.

4 GHz Band. The 4 GHz band (4.4-4.9 GHz) is a band used by multiple federal agencies that also warrants greater government review for future commercial access. China and others are using the 4.8-4.99 GHz band for 5G services today, and we expect other countries to follow suit. Here too, we do not expect a one-size-fits-all approach to different government systems and uses, and believe detailed study is warranted to identify the best portion of the band for future commercial use.

7/8 GHz Band. The 7/8 GHz band (7.125-8.4 GHz) is another prime government-held mid-band resource that NTIA has already identified as underutilized. Like the 4 GHz band, this large block of spectrum is ripe for detailed congressional review to identify the best opportunities for future commercial access to meet America's need for more wireless data and preserve key government services.

As Congress considers future commercial access, it is important to keep at the forefront the need to ensure 5G can reach rural and exurban communities and deliver the security and reliability 5G applications will require. We urge Congress to seek solutions that provide full power commercial access without the risk of federal preemption over commercial use. That is why traditional FCC auctions are the best approach and the Committee should be wary of calls to prematurely expand the CBRS spectrum experiment at 3.5 GHz to new bands. That complex sharing system has not yet worked as envisioned and its low power design means

operators need to build as many as seven times more towers in rural areas to reach the same community, increasing the cost to serving rural Americans. That experimental system also requires all commercial use to stop if federal users seek to use the band, undermining its ability to serve as the backbone for key new services that demand greater reliability, security, and quality of service.

Revitalizing a Unified Government Voice on Spectrum Issues. We applaud the Committee's focus on enhancing interagency coordination and avoiding future spectrum disputes. We need to empower the FCC and NTIA to adjudicate spectrum matters and leverage their expertise to address spectrum interference concerns. We need to avoid other stakeholders from re-litigating decisions after spectrum auctions conclude or trying to unilaterally set the terms of future commercial spectrum access. NTIA must speak on the Executive Branch's behalf and with a single unified voice, and Congress can send all stakeholders a clear signal about NTIA's critical role by elevating the Administrator's position to the Under Secretary level within the Department of Commerce. We also support each agency's deeply talented and committed spectrum experts and welcome efforts to further enhance the resources available to them to navigate disputes. I'm hopeful with Congressional direction we can forge a more collaborative approach going forward and avoid disputes that have not benefited any stakeholders.

* * *

Thank you again for this opportunity to testify, and I look forward to your questions.

Mr. LATTA. Well, thank you very much, and Mr. Assey, you are recognized for 5 minutes.

STATEMENT OF JAMES ASSEY

Mr. ASSEY. Thank you. Good morning, Chairman Latta, Chairwoman Rodgers, Ranking Member Matsui and members—I'm sorry—Ranking Member Pallone and members of the subcommittee. My name is James Assey, and I am the executive vice president of NCTA—The Internet and Television Association. And thank you for the opportunity to testify today on this important topic. You know, over the past decade, the cable providers have invested over \$172 billion to build, upgrade and extend fiber-rich networks all across America that reach over 100 million homes today with gigabit technology.

In the future, we will see that capability increase as 10G technology rolls out. But the reason I'm here is because the wire really only tells part of the story. The proliferation of internet-enabled devices, the consumer's unyielding desire for data, has fueled cable's investment in seamless connectivity. For over a decade, Comcast, Charter, and Cox have deployed millions of hotspots to deploy cable's secure Wi-Fi service.

Smaller cables like Midco are using wireless to extend the reach of broadband in rural communities. And most recently, cable providers are offering highly competitive mobile services at attractive prices that deliver significant savings to customers. Comcast and Charter, each with over 5 million subscribers, are the fastest growing retail wireless companies in the marketplace. And Cox has just announced the launch of its mobile service in January.

As this subcommittee considers how best to manage the spectrum resources, I would like to just focus on three points. First, demand is going to rise, and we have to rise to meet that challenge. Faster broadband, more users, more devices, a wealth of innovative applications will feed consumers' endless appetite for data. Network investment and technological innovation will help us meet those demands.

But promoting robust, seamless connectivity all the way down to the device will also require renewed efforts to support commercial use and balance the needs of government users. Fortunately, Congress has long recognized the importance of a spectrum pipeline. The FCC and NTIA play key roles in identifying and studying new bands for commercial use. And NCTA strongly supports their continued coordination to identify additional spectrum and develop new strategies.

Second, we have to have an all-of-the-above approach to spectrum management that includes exclusive license, shared license, and unlicensed spectrum models. These models are complementary. Exclusively licensed spectrum gives a single entity the exclusive right to use certain frequencies. It is used primarily by traditional wireless carriers, with the three largest carriers controlling 78 percent of all licensed spectrum below 6 gigahertz. Shared license spectrum is an innovative way to enable commercial use in Federal spectrum bands without moving incumbent government users. It was adopted in the FCC's framework for commercial broadband radio service and supports government use on a priority basis with

commercial use managed through dynamic sharing with licensees and general users. With 4.6 billion collected from the auction and over 285,000 base stations deployed, the CBRS approach demonstrates how a shared spectrum model can bring new spectrum online, attracting a diverse range of bidders to usher in new competition and support new commercial uses while protecting critical government facilities.

Finally, unlicensed spectrum. For many, it is the internet in the form of Wi-Fi. It remains the engine behind many of today's most popular consumer technologies. And it is the rock that supports America's freedom to connect. The power and the ubiquity of unlicensed technologies generates substantial benefits to consumers and contributes well over a trillion dollars annually to the U.S. economy. As new innovations in Wi-Fi usher in better security, lower latency and multi-gigabit speeds, it is critical we support America's continued leadership and expansion in this space.

Finally, our wireless leadership will not be served by an approach that puts all our eggs in one basket. We support this committee's work in extending FCC's auction authority. But the benefits of shared and unlicensed spectrum clearly demonstrate that exclusive licensing can't be the sole focus of spectrum policy. The most effective way to defend and maintain America's wireless leadership will continue to be through a balanced spectrum policy that addresses commercial opportunities on a band-by-band basis and promotes ongoing competition and innovation.

Thank you very much. Look forward to your questions.

[The prepared statement of Mr. Assey follows:]

TESTIMONY OF JAMES ASSEY

**EXECUTIVE VICE PRESIDENT
NCTA - THE INTERNET AND TELEVISION ASSOCIATION**

**before the
United States House of Representatives
Committee on Energy and Commerce
Subcommittee on Communications and Technology**

“Defending America’s Wireless Leadership”

March 10, 2023

Introduction

Good morning, Chairman Latta, Ranking Member Matsui, and Members of the Subcommittee. My name is James Assey, and I am the Executive Vice President of NCTA – the Internet and Television Association. Thank you for the opportunity to testify today on the important topic of defending America’s wireless leadership.

NCTA is the principal trade association for the U.S. cable industry, representing cable operators serving approximately 90 percent of the nation’s cable television households and more than 200 cable program networks with a rich history of creating award-winning programming. The cable industry is also a leading provider of broadband service. Over the past 10 years, cable companies have invested more than \$172 billion in fiber-rich broadband deployment and upgrades, including in low-income, rural, and remote areas. Fast and affordable broadband networks have made America a leader in today’s digital economy, and cable operators are proud to support this critical mission.

As consumer connectivity demands have grown, the cable industry has evolved to meet them, beginning with always-on broadband in the 1990s to today’s multigigabit, 10G technology. In order to meet consumer needs for ubiquitous broadband over a myriad of devices, cable companies have increasingly invested in wireless connectivity to expand the reach and capabilities of their broadband networks. Most recently, some of our members have begun to offer mobile wireless service to their customers.

NCTA welcomes this important hearing on spectrum policy, as the Subcommittee reviews the future needs of both the public and private sectors and determines how best to meet these diverse needs, while continuing to drive wireless competition across the country. Of particular importance, I appreciate the opportunity to discuss the virtues of a balanced spectrum

policy that includes shared-licensed and unlicensed spectrum as well as exclusive licenses, to best promote economic growth, competition, and innovation in wireless services.

Cable Companies Have Made Investments to Become Important Providers of Wireless Services

NCTA's members have a deep interest in spectrum policy because they provide wireless connectivity and services in meeting the needs of their customers. For more than 10 years, Comcast, Charter, and Cox have provided their broadband customers with CableWiFi® service over a wireless network of millions WiFi hotspots across the nation. Smaller cable providers like Midco have likewise invested in fixed wireless solutions to extend broadband service to places where traditional network buildouts are costly, like farms that are often miles apart from each other.

Beginning in 2015, cable companies began offering mobile wireless service. Today, Comcast and Charter are the fastest growing retail wireless companies in the marketplace, each with over five million mobile subscribers and growing faster than the incumbent mobile wireless providers. And Cox Communications announced the national launch of its mobile service in January of this year. Cable companies offer consumers another choice for mobile services at competitive prices.

Critically, cable's wireless offerings integrate licensed 5G and unlicensed WiFi networks to deliver robust high-capacity service. Charter's Wi-Fi network, as an example, carries 450 million IP devices and 85 percent of the mobile traffic consumed on Spectrum Mobile phones. Likewise, more than 80 percent of traffic from Xfinity Mobile phones is carried on Wi-Fi. And our members continue to invest in their wireless businesses. In the Federal Communications Commission's 2020 auction for licenses in the Commercial Broadband Radio Service ("CBRS"), Charter, Comcast, and Cox were three of the top five winning bidders, respectively spending

\$464 million, \$458 million, and \$212 million to acquire 210, 830, and 212 licenses that will help enable them to meet the growing demand for wireless connectivity.

Technological Innovation, Competition, and Forward Planning on Spectrum Policy Will Continue to be Essential

The need for new spectrum continues unabated, driven by innovative applications like the Internet of Things, robotics, and virtual and augmented reality technology. These applications not only require the broadband connectivity provided by cable networks but will unquestionably require policymakers to find new ways to make more of the radio spectrum available to support these uses. Access to spectrum is essential to cable's ability to compete and continue to innovate, and indeed for any small, rural, or non-traditional wireless provider to be able to develop and deliver new connectivity services to meet the data, automation, and industrial needs of the future.

The FCC's Communications Marketplace Report notes that AT&T, T-Mobile, and Verizon Wireless, together held approximately 78% of all the spectrum included in the Commission's spectrum screen, measured on a MHz-POPs basis. Making more spectrum available is essential to introducing more competition into the wireless marketplace. Spectrum is also increasingly critical for private networks, which are being used to for industrial automation, artificial intelligence, and predictive maintenance, in environments ranging from warehouses, ports, factories, airports, and office buildings, in rural as well as densely populated areas, supporting supply chain efficiency.

Fortunately, Congress and the relevant regulatory bodies have long recognized that a spectrum "pipeline" can assist with forward planning as technology and consumer demand changes. Regularly for the past 30 years, Congress has enacted legislation encouraging expert agencies to identify and study federal government spectrum that could be reallocated to support

commercial uses. Within the federal government, the responsibility for identifying new bands for this purpose falls to the FCC and NTIA, and the NTIA Act specifically requires the Assistant Secretary for Communications and Information and the Chair of the FCC to meet, at least biannually, to conduct joint spectrum planning. Last August, mindful of the need to work together to ensure that spectrum policy decisions promote efficient use of the spectrum by all users, NTIA and the FCC updated their memorandum of understanding regarding spectrum planning. And earlier this year, NTIA Administrator Davidson announced that NTIA will be working with other agencies to develop a National Spectrum Strategy to ensure the U.S. maintains its leadership in spectrum-based services by developing a long-term plan to meet both commercial and federal spectrum needs.

NTIA has also taken on the important task of diversifying the number of wireless network equipment suppliers through Open Radio Access Network (O-RAN) technologies and the Public Wireless Supply Chain Innovation Fund, a goal that NCTA supports. O-RAN will improve the efficiency of the spectrum allocated to commercial use by enabling interoperation between cellular network equipment provided by different vendors. Interoperability will also encourage a more diverse equipment ecosystem, thereby helping improve the security of our wireless networks.

The cable industry is actively engaged in the efforts to develop these technologies. CableLabs, the industry's R&D consortium, was recently selected by NTIA to host an industry-based 5G Challenge event established to measure the compliance of O-RAN vendors with O-RAN standards. In order to meet tomorrow's spectrum needs, allocating additional spectrum must go hand-in-hand with advancing the technology that can make the most of the spectrum resource.

NCTA strongly supports maintaining and enhancing the processes for identifying additional commercial spectrum and developing new strategies to promote greater efficiency and more intensive use of spectrum. There will also continue to be a strong public and consumer interest in the efficient use of spectrum to serve governmental or *non-commercial* interests. The federal government uses spectrum for national defense, weather observation, law enforcement, and more. As such, a successful spectrum policy must balance the future needs of commercial wireless services against future government needs for spectrum. The cooperative shared-spectrum model embodied in the FCC's CBRS rules offers a compelling framework for developing win-win solutions in other spectrum bands that strikes this balance.

A Balanced Spectrum Policy Best Promotes Innovation and Competition

NCTA members use exclusive-licensed, shared-licensed, and unlicensed spectrum to expand the reach of their broadband networks and provide mobile services. Successful spectrum policy must ensure the U.S. supports each of these approaches to meet the needs of the American consumer and drive competition. You are probably most familiar with exclusive licensing of spectrum, which the FCC generally awards through spectrum auctions. Exclusively-licensed spectrum is largely held by the largest, traditional wireless carriers. There are two other approaches that are key to sound spectrum policymaking.

Shared-Licensed Spectrum. Shared-licensed spectrum is a new, innovative way to enable commercial use in federal spectrum bands without incurring the cost or disruption of moving incumbent government users to a different frequency band. Shared-licensing has been implemented in the FCC's framework for Commercial Broadband Radio Service ("CBRS") in the spectrum band between 3.55-3.7GHz. Under the three-tiered CBRS access and authorization framework, federal users were not required to relocate from the band, but instead retain priority

access to the spectrum they need, while non-federal users are awarded individual licenses (“PALs”) by auction as well as “licensed by rule” (“GAA”) access. PALs and GAA licenses enjoy varying levels of interference protection, with commercial use managed through dynamic sharing on an opportunistic basis by Spectrum Access System administrators.

Cable companies were major participants in the auction of CBRS licenses, but auction winners also included a broad range of diverse bidders including traditional wireless carriers, utilities, and manufacturers, demonstrating the value and utility of shared-licensed spectrum. The auction overall was a success, raising \$4.6 billion from 228 diverse winning bidders—almost 10 times the number of winning bidders in the exclusive-use 3.45 GHz band auction. The lower power operations in this band facilitate sharing between commercial operators and federal users, creating an incredibly efficient use of valuable spectrum resources, while expanding 5G services to more consumers across the country.

CBRS is now being used throughout the country, with over 285,000 CBRS base station devices already deployed. A wide array of entities, including school districts, cities, sports stadiums, warehouse complexes, healthcare providers, and the military, now utilize the CBRS band to obtain 5G capability and performance. The FCC has certified 187 different CBRS base station models and 496 different end user client devices, ranging from traditional smartphones and IoT modules and gateways to security cameras, barcode scanners, and building management sensors.

The OnGo Alliance, an industry organization that supports the development, commercialization, and adoption of shared spectrum solutions like CBRS, estimates that the CBRS band alone will directly contribute as much as \$15.6 billion to the U.S. economy while unlocking tens of billions of dollars more in value to consumers. CBRS is particularly

compelling for many enterprise use cases because CBRS provides the flexibility to choose from the broadest range of technologies and service models – driving innovation and competition in the private wireless market. For example, John Deere uses CBRS in its factories to analyze data on welding patterns to train an algorithm on the best welds for future fabrications, and to track equipment location and utilization in the factory to improve operational efficiency. The Port of Long Beach uses private networks to support automated-guided vehicles moving cargo and to improve real-time logistics through faster wireless communications, such as push-to-talk radios. Attached to my testimony is a letter from a wide array of companies who are already utilizing CBRS and who offer further evidence on the value of the shared-licensed spectrum framework.

The FCC conceived of the CBRS shared-licensed model to allow the DoD to avoid band clearing (and its associated costs and time) and continue its critical operations while also allowing a wide variety of commercial operators to use spectrum in the same band. This tiered spectrum sharing model ensures the protection of America's national security interests while allowing other users to make the most of a critical resource. CBRS can serve as a model for unlocking other government-held spectrum for commercial use in a timely fashion to a wide ecosystem of users, as I've described above, without compromising the ongoing spectrum needs of DoD and other government users.

As directed by Congress in the Bipartisan Infrastructure Act, DoD is conducting research and development – with input from commercial stakeholders – into making the 3.1 GHz band available for commercial purposes. NCTA and its members participate in the Partnering to Advance Trusted and Holistic Spectrum Solutions (PATHSS) Task Group, which is a collaboration between DoD and NTIA to work with the FCC and all interested industry stakeholders to analyze how this valuable spectrum can be made available for commercial use

while protecting the critical military operations currently using this spectrum. The 3.1 GHz band represents a key swath of mid-band spectrum critical for the deployment of 5G and other innovative services.

As demonstrated by the CBRS experience, we believe a shared spectrum approach presents a unique opportunity to answer some of the most challenging questions about how to both repurpose the band for more efficient uses while at the same time protecting critically important activities by the Department and other federal agencies. The Lower 37 GHz band and the 12.7-13.25 GHz band hold similar potential for a simple sharing framework that would permit multiple new mobile and fixed operators to share spectrum with federal operators and commercial incumbents. The CBRS experience is already demonstrating that the shared spectrum framework is an ideal mechanism for unlocking new government spectrum for commercial use, meeting growing consumer and business demands, while at the same time fostering innovation, driving down costs, and increasing competition in the wireless marketplace.

Unlicensed Spectrum. Unlicensed spectrum—the wireless building block that is available to all—is behind many of the technologies that American consumers and businesses use and rely on every day. Unlicensed spectrum technologies contribute hundreds of billions of dollars to the U.S. economy annually - \$995 billion in 2021, according to the WiFi Alliance. In the MOBILE NOW Act, Congress itself recognized the importance of unlicensed spectrum, establishing as the “policy of the United States . . . to promote spectrum policy that makes available on an unlicensed basis radio frequency bands to address consumer demand for unlicensed wireless broadband operations.”

The development of cutting-edge technologies like Wi-Fi, Bluetooth, mobile payment solutions, and more, has generated significant benefits to end users and driven enormous global

economic value. For example, the Wi-Fi Alliance estimates that the global value of Wi-Fi will reach nearly \$5 trillion by 2025. Similarly, a report by the Consumer Technology Association in February 2022 estimated that Wi-Fi and other unlicensed wireless technologies together annually generate \$95.8 billion in incremental economic sales annually. As the FCC has explained, “[u]nlicensed devices that employ Wi-Fi and other unlicensed standards have become indispensable for providing low-cost wireless connectivity in countless products used by American consumers.”

For many, Wi-Fi is synonymous with internet access, and for good reason: More than 80% of data traffic consumed on mobile phones goes over Wi-Fi, and an increasing majority of all global internet traffic. Across Comcast households, for example, nearly a billion devices connected to Wi-Fi in 2021, representing a 12X increase since 2018. Wi-Fi also directly benefits cellular network operators by enabling them to offload mobile data traffic from wireless devices to Wi-Fi networks. In fact, industry studies show that more than half of cellular data is offloaded to Wi-Fi networks. The arguments that the incumbent wireless industry is making with regard to the value and viability of shared licensed allocations are similar to the assertions against unlicensed use, but today unlicensed is a key economic driver providing benefits to consumers as well to the wireless industry for offloading.

The FCC’s recent decision to make spectrum in the 6 GHz band available for unlicensed sharing with incumbents demonstrates that new commercial capacity can be created without displacing incumbents. The 7 GHz band is the next critical opportunity to keep pace with the ever-growing demand for unlicensed spectrum by enabling Wi-Fi 7, the next generation Wi-Fi that will support broader channels of spectrum to enable greater capacity and multi-Gigabit speeds. And like the 6 GHz band, 7 GHz can be commercialized without displacing existing

federal and non-federal users, enabling the most efficient use of existing spectrum and avoiding the significant cost associated with moving incumbents.

Exclusive Licensing Through Auctions Is Only One Model for Spectrum Allocation

The goal of defending America’s wireless leadership is best served by a robust, “all of the above” spectrum policy that recognizes the economic, commercial, and consumer benefits of shared-licensed and unlicensed frameworks. Exclusive licensing is also part of spectrum policy, but it should not be the sole focus of that policy. NCTA supports the extension of the FCC’s auction authority, so that it has all the tools necessary to ensure that new spectrum is made available. At the same time, however, we urge Congress to remove the implicit bias toward exclusive auctions that is reflected in budget scoring rules that over-indexes the value of auction receipts over the economic value and competition created by spectrum that is made available through the auctioned shared-licensed framework as well by unlicensed use.

Attaching extremely high auction revenue estimates to spectrum auctions without accounting for the cost-savings and economic benefits of shared-licensed and unlicensed spectrum risks forcing the Commission to conduct auctions based on exclusive licensing spectrum. While a successful spectrum policy will include the use of exclusive licensing, flexible, light-touch unlicensed uses as well as tiered sharing frameworks like those used in the CBRS are essential components of a well-rounded spectrum policy. By contrast, an all-or-nothing reliance on exclusive licensing will limit opportunities for commercial use, skew spectrum policy in favor of incumbents, and impede the innovation, competition, and economic growth made possible by unlicensed and shared-licensed spectrum. Striking the right balance has the power to unleash tools that will enable new entrants to build increasingly efficient ways to connect consumers, lower costs, and promote competition in the wireless marketplace.

Conclusion

Thank you again for inviting me here to speak with you today. NCTA's members welcome this hearing and are committed to working with you to achieve a spectrum policy that will fuel competition in the wireless marketplace and promote the public interest. Championing unlicensed and shared spectrum regimes in a balanced approach will ensure that the United States continues to lead the world in the wireless space.

Mr. LATTA. Well, thank you very much. And Dr. Ghosh, you are recognized for 5 minutes.

STATEMENT OF MONISHA GHOSH, Ph.D.

Dr. GHOSH. Good morning, Chairwoman Rodgers, Chairman Latta, Ranking Member Matsui, Ranking Member Pallone, and members of the committee. Thank you for the opportunity to testify today. My name is Monisha Ghosh, and I believe that I can offer a balanced perspective on the matters before this committee given my years of experience working in the wireless industry, government, and academia.

I am currently a professor of electrical engineering at the University of Notre Dame. I took two recent leaves of absence to serve in government, first at the National Science Foundation and then as the CTO of the FCC. I continue to be actively engaged with both industry and government. I cochaired the FCC's Technological Advisory Council's working group on advanced spectrum sharing in 2022. I am an active member of industry's Next G Alliance, which is developing standards for 6G, and the National Spectrum Consortium's PATH SS Task Group, where industry, academia, DoD, and NTIA are exploring efficient sharing solutions in 3.1 to 3.45 gigahertz.

Finally, I am the policy outreach director for SpectrumX, NSF's Center for Spectrum Innovation, led by Notre Dame. A memorandum of agreement among the NSF, FCC, and the NTIA ensures that the research undertaken in SpectrumX can directly impact policy. My testimony today will address developing a sustainable spectrum strategy, bridging the digital divide, and creating an entrepreneurial wireless ecosystem.

A sustainable spectrum strategy is one that balances the needs of commercial wireless, Federal applications, and scientific uses while exploring all possible spectrum allocation options: exclusive licensing, shared usage, and unlicensed. It is increasingly difficult to relocate incumbent users and, hence, sharing mechanisms must be investigated for both unlicensed as in 6 gigahertz and licensed as in CBRs.

There is no one-size-fits-all solution. And sound spectrum policy should be based on fundamental technical analyses, measurements, and testing, which includes all relevant stakeholders. National institutes like SpectrumX, NIST, and ITS can perform this unbiased technical analysis that is required to determine the appropriate sharing parameters and minimize the probability of interference and maximize spectrum utilization.

We have current sharing schemes in the TV-wide spaces, 6 gigahertz, and CBRs, which are based on database-mediated sharing, which may not be suitable for all situations since it is inherently less dynamic. We must consider newer technical approaches to sharing, such as exploiting the spatial dimension offered by smart antenna arrays. Furthermore, we need 6G-and-beyond standards to be sharing native that is designed from the very beginning to operate in shared frequency bands with incumbents instead of solely in licensed or unlicensed bands.

Here, the U.S., with its rich history of spectrum-sharing innovations in TV-wide spaces, 6 gigahertz, and CBRs all led by the U.S.,

is well positioned to be the worldwide leader in standards development. Bridging the digital divide will require attention to both availability and affordability of broadband. Wireless backhaul, satellite connectivity, and private networks should all be considered as potential solutions in both rural and urban communities. Each may require additional spectrum to fuel their growth—growth trajectories, and the right mix will be important.

The availability of cost-effective spectrum will allow smaller providers and communities to deploy and manage their own wide area networks as bridging the digital divide. The Wireless Institute at the University of Notre Dame advised the city of South Bend to deploy a CBRS network that provides an alternative connectivity option to a thousand families who otherwise would not have access to similar levels of connectivity at an affordable rate.

Newer devices required to access the latest networks are often more expensive, hence efforts such as the affordable connectivity program need to continue as well so that all segments derive equal benefits from the latest technologies. Finally, I would like to talk about creating an entrepreneurial wireless ecosystem that can leverage America's greatest strength: its start-up culture that unfortunately is not currently as vibrant in the wireless space.

Here, Congress must ensure that there are synergies that can leverage the CHIPS and Science Act to encourage innovations in wireless chips. New applications areas for wireless require new chips that do not necessarily have the volumes required by mobile handsets but are an important and growing component of the wireless ecosystem. Disruptive applications in wireless are often harder to bring to the marketplace due to lack of access to chips.

In conclusion, a spectrum strategy that considers all options, enables sharing with incumbents, and creates spectrum opportunities for emerging use cases will provide the best climate for innovation to flourish in the wireless ecosystem. Thank you for the opportunity to share my views, and I welcome your questions.

[The prepared statement of Dr. Ghosh follows:]

Testimony of Professor Monisha Ghosh

Department of Electrical Engineering, University of Notre Dame.

Policy Outreach Director, SpectrumX.

Research Professor (Adjunct), University of Chicago.

Joint Appointment, Argonne National Laboratory.

Before the House Energy and Commerce Committee

Subcommittee on Communications and Technology

Hearing on the Future of Spectrum Management entitled

“Defending America’s Wireless Leadership”

March 10, 2023

Good morning Chairwoman Rodgers, Chairman Latta, Ranking Member Matsui, Ranking Member Pallone, and members of the Committee and Subcommittee. Thank you for the opportunity to testify today on the extremely timely and important discussions regarding the future of spectrum management and how we can continue to grow America's leadership of the entire wireless ecosystem: current technology, future innovation and workforce development.

Introduction

My name is Monisha Ghosh, and I believe that I can offer a broad and balanced perspective on the matters before this Committee, given my years of experience working in the wireless industry, government research and regulatory organizations, and academia.

To summarize my professional background, I am currently a Professor of Electrical Engineering at the University of Notre Dame. I came to academia in 2015 when I joined the University of Chicago after 24 years working in industry on wireless research and development, starting with designing the first High Definition Television (HDTV) broadcast systems at Philips Research in the early 90's and contributing to various generations of Wi-Fi and cellular systems at Bell Labs and Interdigital. I took two recent leaves of absence from academia to serve in government. From 2017 – 2019, I was a Program Manager in the Computer and Network Systems (CNS) division of the Computer and Information Science and Engineering (CISE) directorate at the National Science Foundation (NSF) where I helped manage NSF's research programs in spectrum and wireless and started the first program to study the applications of artificial intelligence (AI) and machine learning (ML) in wireless networks. From January 2020 to June 2021, I was the Chief Technology Officer (CTO) at the Federal Communications Commission (FCC) where I worked primarily on helping craft the rules for unlicensed access in the 6 GHz band and a pilot project with the US Postal Service (USPS), as directed by Congress, to examine the feasibility of automatically gathering broadband coverage data using apps on smartphones mounted in postal vehicles¹.

¹ REPORT TO THE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION OF THE SENATE AND THE COMMITTEE ON ENERGY AND COMMERCE OF THE HOUSE OF REPRESENTATIVES
<https://www.fcc.gov/sites/default/files/report-congress-usps-broadband-data-collection-feasibility-05242021.pdf>

I continue to be actively engaged with both industry and government as an academic. I co-chaired the FCC's Technological Advisory Council's (TAC) working group on Advanced Spectrum Sharing in 2022 where we deliberated on how frequency bands between 7 – 24 GHz could potentially be shared with commercial wireless deployment. I am also an active member of industry's NextG Alliance, developing standards for 6G and beyond, and the National Spectrum Consortium's (NSC) Partnering to Advance Trusted and Holistic Spectrum Solutions (PATHSS) Task Group which partners with the Department of Defense (DoD) to explore efficient sharing solutions that will make more mid-band spectrum, specifically in 3.1 – 3.45 GHz, available for commercial wireless applications.

I am also the Policy Outreach Director for SpectrumX², NSF's Center for Spectrum Innovation, led by the Wireless Institute³ in the College of Engineering at the University of Notre Dame. SpectrumX was initiated in September 2021 with a five year \$25M NSF grant that brings together 41 researchers and staff from 27 universities and a number of Minority Serving Institutions (MSIs) with broad expertise spanning radio technologies, wireless terrestrial and satellite networks, scientific uses of spectrum and economic considerations related to spectrum allocations. A Memorandum of Agreement (MOA) is in place among the NSF, FCC, and the National Telecommunications and Information Administration (NTIA) to ensure that the research undertaken in SpectrumX can directly impact spectrum issues of importance to the nation. In addition to research, major focus areas of the Center are broadening participation in spectrum research and developing a workforce that can continue to expand America's leadership in spectrum policy and wireless technologies.

Disclaimer: The opinions expressed in this testimony are my own and do not necessarily reflect the positions of the various organizations with which I am affiliated.

Summary of testimony

I will focus my remarks today on the following three areas:

- (1) **Developing a Spectrum Strategy** that is sustainable and balances the needs of commercial wireless systems, federal applications and scientific uses while exploring all possible spectrum allocation options, for example, exclusive licensing, shared usage and unlicensed. It is increasingly clear that all these options need to be considered, especially in the next range of coveted mid-bands, 7 – 24 GHz.

²SpectrumX: <https://www.spectrumx.org/>

³ Wireless Institute at Notre Dame: <https://wireless.nd.edu/>

America needs to continue its wireless leadership in all areas that require access to spectrum: commercial, scientific and national security applications.

- (2) **Bridging the digital divide** will require attention to both availability and affordability of broadband to ensure that there is equity of services available between rural, inner-city urban and suburban residents across America. As broadband speeds increase, essential networked applications like remote learning and videoconferencing incorporate features that do not deliver the same experience over lower-quality connections. By not having parity between broadband performance and availability across the nation, we risk disadvantaging large sections of the population, often the most vulnerable. Wireless backhaul, satellite connectivity and private networks should all be considered as potential solutions to this problem.. Each of these options may require additional spectrum to fuel their growth trajectories, and the right mix of allocations and flexibility will be important.
- (3) **Creating an entrepreneurial wireless ecosystem** that can leverage America's greatest strength, its start-up culture that unfortunately is not currently as vibrant in the wireless space as it is in, for example, the software and biomedical industries. Here, Congress must ensure that there are synergies that can leverage the CHIPS and Science Act to encourage innovations in wireless chips and semiconductor systems. New application areas for wireless, such as drone control, precision agriculture, connected healthcare and vehicles, and smart manufacturing require new chips that do not necessarily have the volumes required by mobile handsets, but are an important and growing component of the wireless ecosystem.

Detailed testimony

(1) **Spectrum Strategy**

America has long led the world in innovative spectrum policies from allocating spectrum for unlicensed services in the eighties, to developing auction mechanisms and sharing mechanisms in bands like the Citizens Broadband Radio Service (CBRS) in 3.55 - 3.7 GHz. The US was the leader in recognizing that the wide bandwidths available in the millimeter-wave (mmWave) bands (> 24 GHz) could be harnessed for multi-Gbps throughputs. However, it is increasingly clear that in order to continue progressing the wireless ecosystem, new frequency bands need to be made available. As Chairwoman Rosenworcel has often stated, the swath of frequencies between 7 and 24 GHz need to

be examined to determine how they can be better utilized for developing the next generation of wireless systems.

While commercial wireless expansion is extremely important, as a nation we also need to ensure that services that are critical to our nation's security continue to have access to the spectrum that is indispensable to their operations and mission. The recent incursions into US air space were detected by Airborne Warning And Control System (AWACS) radars that operate in dedicated spectrum bands. Scientific uses of spectrum are equally important: the awe-inspiring photographs of the black hole at the center of our galaxy were taken by radio telescopes operating at 230 GHz, and these telescopes are becoming even more sensitive. Our weather forecasts have become increasingly accurate due to the number of different frequencies that the sensors use to measure moisture content and other relevant parameters. It will be challenging to balance all of these very vital needs with the growing demands of wireless broadband, not just from consumers but verticals such as manufacturing, healthcare and automotive.

How should we proceed to address these increasingly complex requirements? Exclusive licensed spectrum will continue to be the backbone for delivery of mobile broadband and we must find ways to allocate more of it. If spectrum needs to be exclusively licensed, it needs to be cleared of all incumbents. In some cases, such as C-band, the number of incumbents (satellite) were small enough that the cost to relocate them to other bands was an effective way to make those bands available for 5G. In other cases, like 6 GHz, the sheer number of incumbent licensees (~70,000) would have complicated the process of relocation and hence the approach of creating rules for unlicensed low-power indoor (LPI) usage with no restrictions and standard power unlicensed outdoor usage with Automatic Frequency Control (AFC) was deemed the best way forward. Many countries around the world have since followed the US lead on unlicensed use of 6 GHz. The 3-tiered sharing strategy employed in CBRS is yet another innovative way of sharing spectrum between federal and commercial users that was pioneered in the US. The combination of exclusively licensed, unlicensed and shared spectrum has been used in recent standards developed by the 3rd Generation Partnership Project (3GPP) e.g., License Assisted Access (LAA) and 5G NR-U (5G New Radio Unlicensed) to allow deployments that can intelligently and strategically aggregate any of these bands to provide multiple 100s of Mbps to consumers, without requiring all of the spectrum to be licensed. Our research and measurements in Chicago on deployed cellular networks demonstrate

the effectiveness of these approaches⁴. The US leads the world in such deployments due in large part to innovative spectrum policies: this needs to continue.

Challenges to spectrum sharing: When spectrum sharing is being considered, there will be co- and adjacent channel interference concerns that need to be addressed. Even when spectrum is exclusively licensed, adjacent channel concerns such as in C-band and 24 GHz need to be recognized and addressed in a timely fashion. There is no one-size-fits all solution to these potential interference scenarios and sound spectrum policy should be based on fundamental technical analyses, measurements and testing which includes all stakeholders, such as the federal agencies (e.g., FCC and NTIA) and spectrum stakeholders (commercial wireless, DoD, scientists). National centers and institutes such as SpectrumX, the National Institute on Standards and Technology (NIST) and NTIA's Institute for Telecommunication Sciences (ITS) have an important role to play in performing the **unbiased technical analyses** that are required to determine the appropriate power levels, filter roll-offs and other parameters both at transmitters and receivers that are crucial to ensuring that the probability of potential interference is minimized, and spectrum utilization is maximized. The advanced spectrum sharing group in the FCC's TAC began the work of examining the 7 – 24 GHz band to determine suitability for sharing. However, since there are mainly federal incumbents in this range of frequencies, close coordination and cooperation with NTIA is required before meaningful progress can be made on how these bands can be shared or reallocated.

Potential solutions to spectrum sharing: Most of the current spectrum allocations that share between incumbent services and new entrants (e.g., Television White Spaces (TVWS), 6 GHz and CBRS) employ some variants of a spectrum-use database to assign channels so that the incumbent is protected. These methods rely on predicted propagation and interference based on models, and often do not take into account many of the details of the systems. Interference protection contours are thus often set to satisfy worst-case interference scenarios which may have a low probability of occurrence resulting in overprotection and spectrum-underutilization. Database-mediated sharing is a proven technique for a number of frequency bands, but may not be suitable for all situations since this method is inherently less dynamic and does not react in a timely fashion to actual propagation

⁴ M. I. Rochman, V. Sathya, N. Nunez, D. Fernandez, M. Ghosh, A. S. Ibrahim and W. Payne, "A Comparison Study of Cellular Deployments in Chicago and Miami Using Apps on Smartphones," ACM WiNTECH 2021.

and interference conditions. The FCC TAC in 2022 published a whitepaper on lessons learnt from CBRS⁵ that summarizes how future centralized spectrum management systems based on databases could be improved.

More advanced technical approaches for spectrum sharing can be developed that leverage specific characteristics. For example, modern wireless systems, both cellular and Wi-Fi, use smart antenna array systems that tailor the transmitted energy optimally in 3-dimensional space towards intended users. The same systems could also be adapted to steer energy away from incumbent systems. Such approaches require changes in 6G and beyond standards to be “**sharing native**”, i.e., designed from the very beginning to operate in shared frequency bands with incumbents instead of solely in licensed or unlicensed bands. The US, with its rich history of spectrum sharing innovations in TVWS, 6 GHz and CBRS is well positioned to be the worldwide leader in standards development in this space.

- (2) **Bridging the digital divide** will require harnessing all the policy and technology tools at our disposal to address the twin issues of availability and affordability. In most rural areas the problem is one of availability of broadband, both fixed and mobile. NTIA’s Broadband, Equity, Access and Deployment (BEAD) program will oversee fiber deployments that will bring true broadband (defined as a minimum of 100 Mbps downlink and 20 Mbps uplink, or 100/20) to all “serviceable” locations as identified in FCC’s National Broadband Map. However, this will not solve the problem of broadband availability to serve, for example, the needs of precision agriculture in farmland: a tractor or a field of corn is not a “serviceable” structure. While satellite services can address some of these needs, terrestrial services will still be required for many such rural applications: our research and measurements have shown that sensors in a field of full-grown corn are very difficult to reach even with cellular IoT due to the signal attenuation from the corn biomass⁶. So, alternate architectures need to be explored, for example using satellite backhaul with local distribution over shared spectrum using a private network.

⁵ Recommendations to the Federal Communications Commission Based on Lessons Learned from CBRS, FCC TAC, December 2022, https://www.fcc.gov/sites/default/files/recommendations_to_the_federal_communications_commission_based_on_lessons_learned_from_cbrs.pdf

⁶ S. Balida, G. Grant, X. Zhang, M. Ghosh, S. Guha and R. Matamala, “A Wireless Underground Sensor Network Field Pilot for Agriculture and Ecology: Soil Moisture Mapping Using Signal Attenuation,” *Sensors* 2022.

In areas where fiber cannot be deployed, we must also consider alternate modes of connectivity, often wireless. mmWave and THz links can provide the fiber-like bandwidth required for backhaul services; however, attention must be paid to appropriate coexistence and sharing mechanisms with scientific missions that operate in those bands. Information sharing between incumbent users and new backhaul services can facilitate sharing in these bands. Even when backhaul is available, it may not be cost effective for a commercial provider to serve small numbers of consumers. Spectrum policy that makes available cost-effective spectrum to small providers and communities to deploy and manage their own wide-area networks can be very effective in bridging the digital divide in both urban and rural communities. For example, the Wireless Institute at the University of Notre Dame advised the City of South Bend and South Bend School Corporation to deploy a CBRS network that provides another connectivity option to 1000 families who otherwise would not have access to similar levels of connectivity at an affordable rate, even though South Bend is fairly well served by the major providers⁷. There are many such examples of community networks that are leveraging the innovative spectrum access policies enacted by the FCC to connect their citizens to broadband services. Finally, although 5G networks have increased the available throughputs considerably, newer devices required to access these networks are often more expensive. Hence programs such as the Affordable Connectivity Program (ACP) need to continue to ensure that all segments of the population derive equal benefits from the newest technologies.

- (3) **Creating an entrepreneurial wireless ecosystem:** America is at its best when innovations are incubated in small companies and start-ups. We see evidence of that in the software industry where a vibrant start-up ecosystem in the US has led the world in delivering innovations in many areas. A similar environment needs to evolve in the wireless industry. Disruptive applications in wireless are often harder to bring to the marketplace due to the limited number of options for wireless chipsets and spectrum availability. As the CHIPS and Science Act begins to be implemented Congress must ensure that innovations encouraged by forward looking spectrum policy are not held back due to limited access to chipsets. The FCC has issued a number of Notices of Inquiry (NOIs), Notices of Proposed Rulemaking (NPRMs) and Report and Orders (R&Os) in diverse frequency bands: spectrum

⁷ Bridging the Digital divide in South Bend, <https://www.nd.edu/stories/bridging-the-digital-divide/>

allocations for drones in 5030 – 5091 GHz⁸, sharing of the 4.9 GHz band with public safety⁹, and sharing of the 12.7 – 13.25 GHz band for mobile applications¹⁰. These forward looking actions will result in many applications that will drive innovation, but will require electronic materials and devices, manufacturing and packaging processes, chips, and test and measurement equipment that support these new bands.

Concluding Remarks

America leads the world today in innovations in spectrum policy that have delivered wireless applications that impact all aspects of our life, from broadband connectivity to national security and scientific breakthroughs. Congress, and this subcommittee in particular, must continue its leadership to ensure that we continue to evaluate all options available to create a sustainable spectrum strategy for every system that requires access to spectrum. Exclusive licensing, shared and unlicensed options should all be evaluated in an unbiased manner. This will allow future wireless systems to bridge the digital divide using many complementary options, develop new applications and in the process create a flourishing economy. I thank you for the opportunity to share my thoughts on this very important topic and welcome any questions.

⁸ FCC Starts Rulemaking on Licensed Spectrum for Unmanned Aircraft Use, January 4, 2023

<https://www.fcc.gov/document/fcc-starts-rulemaking-licensed-spectrum-unmanned-aircraft-use>

⁹ FCC Expands 4.9 GHz Band Rules, Seeks Further Comment, January 18, 2023 <https://www.fcc.gov/document/fcc-updates-49-ghz-band-rules-seeks-further-comment>

¹⁰ FCC To Examine 12.7 GHz Band For Next-Gen Wireless, October 28, 2022 <https://www.fcc.gov/document/fcc-examine-127-ghz-band-next-gen-wireless-0>

Mr. LATTA. Thank you. And Mr. Johnson, you are recognized for 5 minutes.

STATEMENT OF CLETE D. JOHNSON

Mr. JOHNSON. Thank you so much, Mr. Chair, Ranking Member Matsui, Members. Really appreciate you having us here today to discuss American leadership in wireless, which I believe is a strategic imperative for the future of market democracy. And I also have special gratitude for your bipartisan approach. I think the most important and enduring solutions come from bipartisan action. And I am glad that two of our kids, Joe and Crosby, who are here today, get to see the way the Government is supposed to work. I will explain the Senate to them later.

My own introduction to wireless communications was in 1998 when I was a 23-year-old Army lieutenant in Germany and got a Nokia cell phone. Back then, 2G felt like science fiction in real life. Those were really heady days for Germany and Europe and market democracy. The Cold War was won. Berlin Wall was down. Germany was reunified. Europe was more stable and peaceful than any previous era of its history. NATO was bringing in new allies and keeping peace in the Balkans instead of preparing for war with the Soviets.

In the year 2000, Vladimir Putin was elected to lead—was elected; important verb there—elected to lead Russia, and the U.S. and our allies put China on a path to join the WTO. Serbian people overthrew Slobodan Milosevic, who was thought to be Europe's last dictator. And the reunified government of Germany moved back home from Bonn to Berlin.

Back then, we thought this all meant that market democracy would win out once and for all over authoritarianism, and the future would bring previously unimaginable freedom, peace and prosperity. But a lot has changed since then. China is now the most powerful authoritarian state in world history. And with China's OK, Russia launched the first war of conquest in Europe since World War II.

Just before that invasion, President Xi and Putin pledged a friendship without limits. The post-Cold War peace is over. So now the security question of this century is whether we and our market democratic allies can set the world's course or if China and its supplicants will predominate. That question underlies every other policy question that we face. Will the future be freedom and innovation, or surveillance and control?

I think the U.S. approach to 5G, the most secure wireless technology ever, will be central to answering that question. The ubiquitous connectivity driven largely by 5G wireless broadband and the data, AI, advanced analytics that will come with 5G will be a crucial domain for both autocracies and market democracies. Mobile connectivity is essential to modern society, and therefore it must be leveraged for dynamism and innovation. But the social control and information operations from exploitation of this technology is essential to China's autocratic ambitions. And China seeks global influence through this power and control of technology supply chains and information.

China has a plan that it is executing with the brutal efficiency of a dictatorship. China is allocating spectrum, particularly midband, full-power spectrum crucial to 5G, to create an ecosystem for tech national champions like Huawei that it can use to encircle the world with its so-called Digital Silk Road. China sees an advantage in driving 5G deployments into midband spectrum that are—that's available commercially in China, such as the lower 3 and 4 gigahertz bands.

It is crystal clear that China has a plan for the world's wireless future. What is our plan? We and our allies are the greatest source of technological innovation and economic vitality in human history. That is why we won World War II and the Cold War. It is why we are presently leading the global 5G economy. But we are hamstrung by disputes between agencies that have slowed 5G deployments and undermined the market certainty and investment that flows from a robust spectrum pipeline. And as many have noted, now we don't have authority to auction more spectrum.

We formed NATO to protect market democracies after World War II. And now we must apply to today's technology environment the same commitment to principles of market dynamism, innovation, competition, and democracy.

The world's future will be determined by whether the U.S. model of market democracy can harness human ingenuity and progress to prevail over restrictive authoritarians. People inherently crave freedom and opportunity. Market diversity and competition is the beating heart of innovation. And we need to leverage those ideals to our competitive advantage. What that means is we need more spectrum for commercial use. We need coherent government processes to approve commercial deployments, and we need global harmonization of spectrum so the U.S. is not an island.

This is absolutely critical to our national security. We get this right, we will ensure economic and technological vibrancy that undergirds our overwhelming military strength and edge in weaponry. And if we do that, we will lead the world, the free world, in addressing the existential threat from the autocratic exploitation of technology, thereby securing the United States and our—and our allies as market democracies.

Thank you, and I look forward to your questions.

[The prepared statement of Mr. Johnson follows:]

Testimony of Clete D. Johnson

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**U.S. House of Representatives Committee on Energy and Commerce
Subcommittee on Communications and Technology**

Hearing on

Defending America's Wireless Leadership

March 10, 2023

Chairman Latta, Ranking Member Matsui, Chair McMorris Rodgers, Ranking Member Pallone, Members of the Committee, thank you for the opportunity to join you today to share my views on American leadership in wireless communications, which is a strategic imperative for the future of market democracy.

Having been in the policy trenches on these issues through many different Administrations and Congresses, I have special gratitude for the Committee's bipartisan approach to these issues. The most important and enduring solutions to our national security threats come from bipartisan action. I am grateful to be a small part of that dialogue today.

My introduction to wireless communications was in 1998, when I was a 23 year old Army lieutenant stationed in Germany and got a Nokia cell phone. 2G wireless communications felt like science fiction in real life.

Those were heady days for Germany and Europe, beyond leading the world in wireless deployment. Market democracies had won the Cold War. The Berlin Wall had fallen. Germany was reunified. Europe was more stable and peaceful than in any previous era of its history. NATO was bringing in new allies – Poland, Hungary, and the Czech Republic – and remaking its security posture to keep peace in the Balkans, rather than prepare for war with the Soviet Union.

In 2000, Vladimir Putin was elected president of the Russian Federation, and the United States and our allies put China on a clear path to join the World Trade Organization. This was the same year that the Serbian people overthrew Slobodan Milosevic's government – thought to be the last dictatorship in Europe – and the reunified German government completed its move back home from Bonn to Berlin.

We thought all these developments meant that free markets, democracy, and the rule of law would win out once and for all over state-controlled economies and authoritarianism, and the future would continue to bring previously unimaginable freedom, peace, and prosperity.

A lot has changed since then.

China is now arguably the most powerful authoritarian state in world history, and with China's apparent acquiescence, Russia has launched the first full-scale war of conquest in Europe since World War II. Just before the invasion, Presidents Xi and Putin pledged a "friendship without limits" between China and Russia. The post-Cold War peace is now over.

The strategic security question of this century is whether the United States and our market democratic allies can set the world's course, or if China, Russia, and other authoritarian regimes will predominate. That question underlies every other policy question we face. Will the future be one of freedom and innovation, or surveillance and control?

The U.S. approach to commercial wireless communications – and particularly 5G, the most secure wireless communications technology ever – will be central to answering that question.

The ubiquitously connected society driven largely by 5G wireless broadband – providing connected and autonomous vehicles, connected warehouses and logistics, and all the Big Data, AI, and advanced analytics that come with these and innumerable other such services – will be a crucial domain for both autocracies and market democracies in the 21st century. Remote and mobile connectivity is an essential component of a functioning modern society, and if leveraged for dynamism and innovation rather than authoritarian command and control, 5G wireless connectivity provides the foundation for solutions to the world’s most pressing challenges.

In contrast, the social control and information operations from abusive exploitation of ubiquitous connectivity is essential to the autocratic ambitions of China and Russia. Together, these two powers and their supplicant states seek global influence and domestic power through control of natural resources, technology supply chains, and information.

While Russia has no appreciable wireless communications capabilities, China has a plan that it is executing with the brutal efficiency of a dictatorship. China is allocating spectrum – particularly mid-band full-power spectrum that is crucial to 5G – to create a wireless ecosystem of tech national champions like Huawei that it can leverage to encircle the world with its “Digital Silk Road.” China sees an advantage in driving future 5G deployments into mid-band spectrum available commercially in China, such as the lower 3 GHz and 4 GHz bands.

It is crystal clear that China has its plan for the world’s wireless future. What is *our* plan?

The United States and our allies are the greatest source of technological innovation and economic vitality in human history. That is the reason we won World War II and the Cold War. And it is the reason we are presently leading the global 5G economy – even as we are hamstrung by disputes between agencies that have slowed 5G deployments and undermined the market certainty and investment that flows from a robust spectrum pipeline, and even as we have no spectrum auctions planned to allow our innovators to deliver more 5G services and applications.

Just as we formed NATO to protect market democracies after World War II, we now must apply to today’s technological environment the same commitment to principles of market dynamism, innovation, fair competition, democratic processes, rule of law, and human rights.

The world’s future will be determined by whether the U.S. model of competitive, expansive free market democracy can harness human ingenuity and progress to prevail over the restrictive structures of authoritarian governments. If we believe that people inherently crave freedom and equal opportunity to achieve their potential and that market diversity and competition are the beating heart of innovation, then we must pursue policies that leverage these ideals to our competitive advantage.

As the foundational, enabling technology upon which myriad technology innovations of our near and distant future rely, and as the most secure communications network in history, 5G networks will be a bellwether for how our societies – governments, businesses, citizens – fare in the face of authoritarian influences worldwide. Therefore:

We need more spectrum available for commercial use in the United States.

We need coherent government processes for approving commercial wireless deployments.

We need global harmonization of spectrum bands so the United States is not an island, leaving China and Huawei to deploy networks all over the world.

This is absolutely critical to our national security. If we get this right, we will ensure the economic and technological vibrancy that has always undergirded our overwhelming military strength and decisive edge in weaponry – particularly in a future in which AI, quantum computing, and cyber capabilities will predominate in military defense and force projection.

And in doing so, we will lead the free world in addressing the existential security threat emanating from the autocratic exploitation of technology, thereby securing the United States and our allies as market democracies.

Mr. LATTA. Well, thank you very much. And that will conclude our witnesses' opening statements. And at this time, we will proceed with the Members' questions, and they will be—will get 5 minutes. And, you know, I just want to ask a quick question of everyone if you just answer yes or no because, you know, you offered—all been talking. You have also talked about that—and our spectrum authority expired last night. We didn't—you know, we try to get to May the 19th, and we are not there.

Can the United States survive on short-time extensions of our auction authority? Just yes or no. Can we?

Mr. GILLEN. No.

Mr. JOHNSON. No.

Mr. LATTA. Let me ask this next question. You know, through the years I have served on this subcommittee, this question has always come up, that the United States was always leading in 5G. Is the United States leading in 5G today, or are we behind?

Mr. GILLEN. We are leading today. With your help, we can continue to lead.

Dr. GHOSH. I think we are definitely leading.

Mr. JOHNSON. I think we are leading today because of the innovators, and the Government is holding us back.

Mr. LATTA. Well, thank you. Let me, Mr. Gillen, start with something you had said in your testimony. And I think, again, it is important where we are today. In your bullet points, you say we should create a schedule of future spectrum—of auctions. And, you know, one of the things, of course, when you look at Huawei and the rip-and-replace—and we already have 1.9 billion that was already given to the FCC by Congress for the rip-and-replace. But, however, we still need about 3.08 billion more dollars of fully funded.

When you—when you see what Congress is doing, is that what you said that we need to have a schedule of future spectrum auctions?

Mr. GILLEN. I think yesterday showed we have a lot of work to do together to get to that place, that we need the FCC to have the tools to succeed. And I think there—we have bands available that we think could quickly get to auction to fund other government priorities to help support the Treasury. But I think, most importantly, to really make sure that 5G innovations are happening here.

Mr. LATTA. OK. Something—again, when I was reading the testimony last night, something I saw that caught my eye—and sometimes it's always by looking at verbs—verb tenses. And Dr. Ghosh, you said that the U.S. was the leader, recognizing that wide bandwidths were available in the millimeter waves—wavebands can be harnessed.

You know, are we falling behind? What's happening out there? You say that we were. That's all—and when I see those past tense, it always scares me.

Dr. GHOSH. No. I think the U.S. is actually still the leader in millimeter-wave technology. The fundamental research and initial development developing 5G millimeter wave happened in the U.S. I still believe that the U.S. has the maximum number of 5G deployments in millimeter wave.

Mr. LATTA. Thank you.

Mr. Johnson, also, when I was looking at—reading your—going over your testimony last night. You know, you mentioned that you're—in your opening statement that, you know, we need to have more spectrum available for commercial use in the United States and that China has a plan that is executing with brutal—you say “brutal efficiency of a dictatorship.” China is allocating that spectrum, particularly in the midband and how crucial it is to 5G.

Could you just—you know, again, what's happening from China to the United States kind of briefly, between the United States and China when you're looking at those—that issue?

Mr. JOHNSON. I think China has a—as Chair McMorris Rodgers laid out in her opening, China has a strategy and a plan. The one benefit of an authoritarian regime is that they can do exactly what they want on a minute—on a moment's notice. That has significant downsides in other areas. But when you are trying to clear spectrum bands for their purpose of taking over, essentially winning the 5G leadership race, it means that they can target the lower 3 and 4 bands and expect the rest of the world to follow China's lead while the United States is an island and is not deploying 5G in those bands. So it's a methodical and strategic plan that they are executing. And they can because they are a dictatorship.

Our system is a little more complicated. I think it works a lot better over the long term. But we need to have a plan that leverages our strength.

Mr. LATTA. Thank you. And Mr. Assey, I'm sorry. In my last 30 seconds, you said something again. But also reading your statement, we are looking at that. You said about—when you are looking at the unlicensed out there—and that is the engine and the rock out there. And when you look at our—from the Internet of Things, the AVs and everything else, you know, are we able to keep going to make sure we maintain that level? And I'm sorry. I've only got about 10 seconds left.

Mr. ASSEY. No, thank you for the question. I think we have always been the market leader when it comes to unlicensed technology. The action that was taken by the FCC in 6 gigahertz was the first unlicensed band that we had opened up in a decade. And we are poised to extend that leadership not just here but also around the globe. I think there—it is a point where we face a lot of opposition, particularly from China, on a country-by-country basis that sees America's continued leadership on unlicensed technology as a threat. And I think it is an area where we can work to try to counter that influence and continue what has been an incredibly important technology, not just for this country but for the world.

Mr. LATTA. Well, thank you. And my time has expired. And at this time, I'll recognize the gentlelady from California, the ranking member of the subcommittee, for 5 minutes.

Ms. MATSUI. Thank you, Mr. Chairman.

In both Congress and the executive branch, clear delineations of jurisdiction help promote efficiency and productive collaboration. I believe inconsistencies in these jurisdictional lines is in part to blame for breakdowns in spectrum governance.

Mr. Gillen, briefly, in your opinion, does mission creep among Federal agencies affect the Federal Government's ability to speak with one voice on spectrum issues?

Mr. GILLEN. Thank you, Congresswoman. And I greatly appreciate your leadership on this issue for a number of years now. You have really been the one to call out that we need to speak with one voice. And absolutely there has been mission creep. We have too many voices trying to get involved in spectrum discussions. We have expert agencies at the FCC and NTIA. We need to rely on them and let them make their decisions. And too often right now, they are being second-guessed.

And the sooner we get back to letting those experts do their job, the better we are as a nation in terms of addressing all the things Mr. Johnson said is happening around the globe.

Ms. MATSUI. OK. Thank you. I introduced the CHIPS Act with Congressman Michael McCaul to reassert America's leadership in the semiconductor industry. Secretary Raimondo released the first notice of funding opportunity last week, and I'm excited about how this funding will boost advances in wireless communications.

Professor Ghosh, can you describe how the CHIPS Act can encourage innovation and wireless chips and spectrum governance more broadly?

Dr. GHOSH. Thank you for that question. I strongly feel that, even though we made great advances in 5G and unlicensed and the standards have actually helped tremendously, there comes a point where innovations become much harder to get into the marketplace because there is so much of a standardization, you know, channel that—has to go through. So with the lot of the new spectrum that is becoming available, you need new wireless chip sets. Sometimes the 5G can handle those, sometimes they cannot.

But what is happening today, I feel, is that the mobile consumer market is the dominating customer of wireless chips. And if something does not fit into that pipeline, it is much harder. And so you can see that in that there are very few wireless hardware startups and many software startups because they don't face this issue. So I would really like to see how the CHIPS Act could encourage—could create an ecosystem where these alternative wireless chips could be manufactured.

Ms. MATSUI. That is great. We are hoping for that. Professor Ghosh, again, I have been working on draft legislation, which I hope to release soon, that would make important updates to the spectrum relocation fund. This fund helps Federal agencies transition off spectrum to make it available for commercial use. I want to see this fund modernized to give agencies more flexibility and ensure they have the tools they need to meet their missions.

Professor, do you think additional incentives for Federal agencies like upgraded technology could help free spectrum for commercial use?

Dr. GHOSH. Absolutely. I think one of the problems we face when we look at spectrum sharing is you are trying to share between legacy systems, which are sometimes decades old, with very new systems that are much more agile, can share better. And we always have to be backward compatible. And so having funds that allow some of these legacy systems to upgrade or either relocate or even

share better even if you wanted to share better with a co-, you know, allocée—and—that's a word—in the band if you have better front ends and better filters that will allow you to do that better.

Ms. MATSUI. OK.

Dr. GHOSH. So I think we should explore all possibilities—

Ms. MATSUI. Sure.

Dr. GHOSH [continuing]. For doing this. Yes.

Ms. MATSUI. OK. Thank you. Mr. Johnson, can you discuss how spectrum harmonization informs geopolitical competition and what the U.S. can do to advance its interests abroad?

Mr. JOHNSON. Absolutely. And I touched on this in the answer to Mr. Chair's question. Great question, ma'am. It has to do with global scale. It is related to what Dr. Ghosh just said about putting—putting chips and other components out that can reach global scale. If you have global harmonization of spectrum bands, then American and allied companies can compete. And often—almost always in a fair competition, the U.S. and allied companies are going to win that competition.

If they have the global scale, then they are not just selling to one market. They are selling to the world. And that is going to be crucial for the success of the CHIPS Act. We need to have global harmonization of these bands for that to materialize.

Ms. MATSUI. OK. Well, thank you very much, and I am running out of time. And Mr. Assey, I wanted to ask you about scoring, but I will ask that later. Thank you very much. I yield back.

Mr. LATTA. Thank you. The gentlelady yields back, and what you are hearing is the votes are being called. What we are going to do is I am going to run over and vote first and then our vice chair, our good friend from Georgia, is going to sit in the chair as is the vice chairman. I will run over and vote and come right back, and Members are just coming back so we can keep the hearing going. Thank you.

And at this time, the Chair will recognize the gentlelady from Washington, the chairman of the full committee, for 5 minutes.

Mrs. RODGERS. Thank you, Mr. Chairman. The House recently passed our spectrum auction authority extension bill, the H.R. 1108, and it failed to pass the Senate. So now we have FCC's spectrum auction authority expiring for the first time in 30 years. So starting with Mr. Gillen, do you support this bill led by myself and Ranking Member Pallone to reauthorize spectrum auction authority until May 19th?

Mr. GILLEN. Yes. It is critical the FCC has its tool back.

Mrs. RODGERS. Mr. Assey?

Mr. ASSEY. Yes.

Mrs. RODGERS. Thank you. Mr.—

Dr. GHOSH. Yes, yes.

Mrs. RODGERS. Yes.

Dr. GHOSH. I think it's important for both exclusive licensing and shared.

Mrs. RODGERS. Thank you.

Mr. JOHNSON. Crucial to our national security.

Mrs. RODGERS. Thank you. Mister—or Dr. Ghosh, I wanted to just follow up. You know, now we find ourselves needing to work quickly to reauthorize spectrum auction authority, improve inter-

agency coordination on spectrum management actions, and restore trust in the process. The NTIA and FCC are expert agencies when it comes to the management of spectrum decisions. The Infrastructure Investment and Jobs Act authorized the auction of the lower 3 gigahertz band, provided uncertainty to the auction by requiring the Secretary of Defense to approve the auction moving forward.

We need to restore the spectrum management process. NTIA must be at the helm in order to maximize efficient spectrum use. When decisions are made by expert agencies, they also need to be respected by all agencies and industry as final. So from a technical perspective, what can be done to inject confidence back in this process?

Dr. GHOSH. I'm involved, as I mentioned in my testimony, in the discussions happening in part SS. And NTIA, FCC, and DoD are all in the room along with industry and academia. Spectrum decisions take time, unfortunately. And what we are trying to work out in the committee is what is the most appropriate method. Is it shared licensing? Is it exclusive licensing? And the technical analyses are being done as a community.

So I think that process is working. And I hope that at the end of the process, the lead agencies, which are NTIA and FCC, when it comes to spectrum matters, are the ones that will take final decisions about how they proceed in that particular band. But as I said, it is not an easy decision to say that we should or should not do one form of licensing versus another. There is a lot of technical input that needs—

Mrs. RODGERS. Thank you. Mr. Johnson, in your testimony, you argue that the central question to security in the 21st century is whether the future will be one of freedom and innovation or surveillance and control. What are the risks to the United States if we fail to reauthorize spectrum auction authority and create a stable, predictable environment for investing in wireless technology?

Mr. JOHNSON. Madam Chair, I think that if we don't—if we don't authorize more spectrum—more auction and therefore more spectrum—we will not lead in 5G. And if we don't lead in 5G, it is very simple. China and its authoritarian supplicants will predominate in the 21st century. That means an existential threat to market democracy, which means an existential threat to the United States because the future of technology is going to go in one of two ways, as you mentioned in your opening: freedom and innovation, or surveillance and control.

And these two things can't exist together. So it is a crucial matter of national security. And it really goes down to weapon systems and military strength as well. We can't win the future without winning 5G and AI and quantum and everything that goes along with that.

Mrs. RODGERS. Thank you. As a followup, you also note in your testimony that we need global harmonization of spectrum bands so that the United States is not on an island. How would failing to reauthorize spectrum auction authority undermine the United States' efforts to lead on spectrum policy internationally?

Mr. JOHNSON. To give one example, in the lower 3 and lower 4 bands, China is seeking to harmonize the world without the United States. And it's—if they do that, they are—they are—they will have

a distinct advantage over the United States in 5G. I would never bet against us. We are the—as I have mentioned before, we are the most innovative—the biggest source of innovation and advances in world history. But if we are doing it without us playing on the—on the globally harmonized bands, we are doing it with a hand—a hand tied behind our back or worse.

Mrs. RODGERS. Right. Thank you. And thank you all for being here. Very timely. Yield back.

Mr. CARTER. [presiding]. The gentlelady is yield—the Chair now recognizes the ranking member from New Jersey, Mr. Pallone, for 5 minutes.

Mr. PALLONE. Thank you, Chairman. Last week, the Energy and Commerce Committee advanced bipartisan legislation that overwhelmingly passed the House to extend the FCC's auction authority, restore the role of the NTIA as the arbitrator of Federal spectrum holdings, and use auction proceeds to pay for important public safety and national security programs and next-generation 911 and the rip-and-replace program.

More recently, the House unanimously passed a bill extending auction authority to give House and Senate negotiators more time to continue negotiating a package. In both cases, the Senate failed to act on these important bills. So today, we are in a new world where the authority is expired for the first time in three decades, creating doubt and uncertainty about America's governance over spectrum and the ability to continue to lead in wireless innovation.

So Mr. Johnson, does this expiration have the potential to give China and other countries a leg up in their global campaign to dominate the world's wireless future? And in your opinion, is the continued presence of Huawei equipment in U.S. networks a national security threat? And I know you have already talked about this. But I would like to have more detail.

Mr. JOHNSON. I think the short answer is absolutely yes on both counts. And happy to elaborate on either of those. But again, I think the—on the question of Huawei, we need to have a future of trusted suppliers that are based in the United States and our allies, and therefore based in market democracies and operate under the rule of law. And the spectrum authority and the—leading the future of 5G is crucial to that because China has a plan to do—to go the other way and encircle the world with this Digital Silk Road led by Huawei and other national champions like ZTE and others.

Mr. PALLONE. Thank you. And obviously we are going to continue to work on a bipartisan basis here in the House and try to get the Senate to do something.

Mr. Gillen and Mr. Assey, can you both talk about how your members and, in turn, the American public will benefit from the stability of a long-term pipeline of spectrum and FCC auction authority? I'll start, I guess, with Mr. Gillen.

Mr. GILLEN. Thank you, Congressman. Absolutely. The key for so much of the development we want with 5G jobs, with innovations around manufacturing and healthcare come back to, do we have the spectrum to actually support these functionalities? And so we are really excited about what 5G can be. And the key to making

that go is additional spectrum auctions and the certainty this committee can uniquely provide.

Mr. PALLONE. Mr. Assey?

Mr. ASSEY. I think it goes to what I said in my testimony. The demand for data just continues to grow and grow. And we need all available technologies to be able to provide the type of seamless connectivity from providers all the way down not just to the household but to the device in the consumer's hand. We have a great opportunity to do that. But we need to be able to work on a balanced strategy that will unlock new spectrum for commercial use.

Mr. PALLONE. All right. Well, let me get to my last question. As you know, I mentioned in my opening statement that most Americans rely on their wireless devices daily without even thinking about it. And as we consider how to ensure there is a spectrum available for all these uses, we have to ensure that certain communities are not left out of the incredible opportunities that wireless innovation will bring.

In the short time that it's been in place, the Affordable Connectivity Program has helped nearly 17 million Americans afford broadband and ensure that the networks fueled by all this spectrum are put to good use in communities across the country.

So on that note, again, Mr. Gillen, Mr. Assey, do you agree that this program has been successful in connecting people all over the country who might not otherwise be able to afford internet service? You have got about 30 seconds each.

Mr. GILLEN. It's been incredibly helpful. And as you alluded to in your opening, we are very proud that wireless is the on-ramp to the internet for millions of low-income Americans. We are proud that 55 percent of Americans are electing mobile solutions when taking advantage of this program. You see great work, countries—Navajo Nation, Cellular One connecting 40,000 that weren't connected before, expanding that access. So we are greatly appreciative of how that program is bringing more people online.

Mr. PALLONE. I appreciate you mentioning Indian country too, because it's so important to them.

Mr. Assey?

Mr. ASSEY. Yes, we obviously are actively engaged in the ACP program and believe very strongly in broadband adoption. It is important not only to the consumers and the families that are on the program, but it is also important related to the work that this committee and this Congress has done in providing funding to build new infrastructure and to reach the unconnected, because those people are going to need to be online as well, and it is important that we follow through that program.

Mr. PALLONE. All right. Thank you so much. Thank you, Mr. Chairman.

Mr. CARTER. The gentleman's—

Mr. PALLONE. Good to see you in the chair.

Mr. CARTER. The gentleman's time has expired. Chair recognizes the gentleman from Florida, Mr. Bilirakis, for 5 minutes.

Mr. BILIRAKIS. Thank you, Mr. Chairman. I appreciate it very much, and I do hope that the Senate is watching this particular hearing. Before today, we have never seen a spectrum auction authorization lapse before. It has been said several times. And there

are a lot of questions about the extent of the disruption. It goes without saying that the FCC would not have authority to start new proceedings for new auctions.

But my question for Mr. Gillen is, in your opinion, sir, would the FCC still have authority to process auctions that have already taken place to allow auction winners to receive the rights to the spectrum bands they have already paid for?

Mr. GILLEN. Thank you for the question. And as you noted, this is an unprecedented day. We haven't been in this place in 30 years. So I think, unfortunately, the answer is we don't know. There is a lot of uncertainty in industry. There is a lot of uncertainty at the FCC as to what the FCC can and can't do right now. This has been a critical tool in how they operate. It provides 25 percent of the funding for the agency. So the sooner we get the certainty back and we start moving forward, we can get those questions asked. The spectrum you alluded to, the spectrum that has been purchased and can be benefiting Americans today if it was in the hands of the licensee. And so those are some of the challenges that we have today that we have never had before.

Mr. BILIRAKIS. Thank you. As a followup, Mr. Gillen, if it is ultimately determined the FCC did not have authority to process completed auctions, how does this impact private bidding in future auctions and the Government's ability to earn top dollar when licensing future bands when that authority is reinstated?

Mr. GILLEN. It is a great question. Uncertainty is not—does not drive capital. So the more certainty we have that the FCC is going to have the authority to do the auctions, to license the spectrum—and also, a part of what this committee is really key is the certainty when those auctions are coming, what is coming next and actually have a schedule and a plan. And so that is not just giving the FCC the tool, it is also setting a schedule going forward as critical if we want to keep up with what's going around the world, if we want to meet the demand of American consumers. We just need that certainty and actually need the plan of how we are going to get the spectrum out in a way over the next few years that is meaningful.

Mr. BILIRAKIS. Thank you, sir.

Mr. ASSEY, spectrum auctions are one of the few things the Federal Government does that actually raises money. I am particularly interested in ensuring that Americans get the most from industry for these finite resources. The benefits are clear when exclusively licensed spectrum is auctioned off for revenues. But can you articulate how the American taxpayer benefits from shared licensed and unlicensed spectrum usages?

Mr. ASSEY. Thank you for the question. You know, I think if you go back to 1993, that is when auction authority really started. And you have to look at it as one arrow in the quiver, a tool that the Government can use. And for that time, we had a very strange process for assigning rights in spectrum, which was we had a lottery or we had comparative hearings. This was a mechanism for distributing the rights. But it is—there is no question that when you hold an auction, revenues are created when you distribute those rights. But that is a byproduct, not an end in and of itself. And I think one of the things that you have to look at is not just

kind of the short-term upfront revenue that comes in but all the revenue that is created by the innovation that is unlocked when spectrum is made available for commercial use. You know, we talked about the unlicensed economy contributing over a trillion dollars annually to the U.S. economy.

That is of great economic benefit. It is of great economic benefit to let a thousand flowers bloom, to have more competitors in a marketplace and to have a robust ecosystem that can support the development of equipment. That is what will make us successful for the long term.

Mr. BILIRAKIS. I appreciate it very much, and I want to thank all of you for your testimony. Very informative. I yield back the balance of my time, Mr. Chairman.

Mr. LATTA [presiding]. Thank you very much. The gentleman yields back, and the Chair now recognizes the gentlelady from New York for 5 minutes.

Ms. CLARKE. Good morning, and let me start by first thanking our panel of witnesses for joining us today, as well as Chairman Latta and Ranking Member Matsui for convening this hearing on America's wireless leadership at such an important time with the recent lapse in the FCC's spectrum auction authority. I am proud of this committee's previous work to advance thoughtful legislation around spectrum auctions and urge our Senate colleagues to do your job

I mean, what is the problem? Follow the House's lead and pass legislation extending this critical authority.

The wireless industry plays a vital role in our increasingly digital society. Innovation in a desperate—a disparate array of industries, including healthcare, agriculture, autonomous vehicles, gaming, manufacturing, and more, is powered by connectivity. As policy-makers, it is our responsibility to ensure that long-time industry stakeholders and new market entrants alike have access to the resources and information necessary to maintain competitiveness globally and provide Americans with high-quality service.

My first question is intended for Mr. Gillen, but any of our witnesses are welcome to respond as well. Mr. Gillen, given the wireless usage trends in the U.S., can you speak to the consequences from an industry perspective of continued inaction on spectrum auction authority?

Mr. GILLEN. Thank you, Congresswoman. You are exactly right. This uncertainty is going to have a direct impact on American consumers. We expect five times more growth between now and 2027. Our ability to meet that growth will be called into question if we don't get more spectrum. I think the bigger risk, as Mr. Johnson has alluded to, is you risk ceding our leadership and things going forward to China and other countries that are providing spectrum resources more quickly. And so it is really critical both from our global competitiveness but also just creating more jobs with 5G economy that we need to get going now.

Ms. CLARKE. Would anyone else like to respond to that? Dr. Ghosh?

Dr. GHOSH. Yes, I would like to just support that statement and also point out that, when we talk about auction authority, it is not just for exclusive licensing. So even if we go down the route of

shared spectrum, CBRS was auctioned and licensed. So it is—we need the licensed authority so that the FCC can investigate all these different ways of spectrum sharing, whether it's exclusive or not.

Mr. ASSEY. I would agree with that. And I would just underscore that, you know, auction authority is a very useful tool in the toolbox. But the real end here is can we unlock more commercial spectrum. Can we develop new strategies that will allow us to share spectrum, to make more intensive use of spectrum, to become more efficient because that is really the only way that we are going to meet the demand for commercial services but also be respectful and responsive to the needs of government users.

Ms. CLARKE. Mr. Johnson, would you just comment on the global dynamic?

Mr. JOHNSON. It is commercial spectrum and more commercial spectrum is indispensable to our economic and technological vitality in the—in the core center of the future of the economy and security. If we don't have it, we can't compete and therefore we can't win the future. I mean, we won World War II because we were the arsenal of democracy. We won the Cold War because market democracy works a lot better than the system that the Soviets had in place. You can just look at West Germany and East Germany, and it is the economy and technology that makes a difference. If we don't have spectrum, we are fundamentally hamstrung.

Ms. CLARKE. Thank you. As cochair of the Smart Cities Caucus, I want to ensure that we are leveraging next-generation technologies to improve lives and enable better living conditions for all. Even major cities like New York face unique challenges that are best addressed through technological advances like the Internet of Things and access to high-speed, affordable Wi-Fi.

Mr. Assey, can you discuss the uses of unlicensed spectrum and other advances in technology that have the potential to power smart cities? And other panelists are welcome to chime in as well.

Mr. ASSEY. Yes, Congresswoman. There is no question that, when we talk about seamless connectivity, we are talking about taking that fiber-rich network that has been built over the past decades and really just going beyond those boundaries and creating connectivity that is ubiquitously available to all. That can be via unlicensed spectrum. That can be via CBRS spectrum. That can be via 5G spectrum. But I think it's an immensely powerful position that we are going to be in to promote partnerships between providers and cities to deal with things like traffic management, to deal with things like sensor networks that will allow it to manage lights, to deal with venues and public information.

This is a great, positive step forward. It is a wonderful set of services that is being developed. We are seeing evidence in the CBRS space. Cox Communications is partnering in Las Vegas to do just this, and we expect more of it in the future.

Ms. CLARKE. And I thank you for your response, and I have to yield back. Thank you, Mr. Chairman.

Mr. LATTA. Thank you very much. The gentlelady yields back. The Chair now recognizes the gentleman from Michigan's Fifth District for 5 minutes.

Mr. WALBERG. Thank you, Mr. Chairman, and thank you to the witnesses for being here today. This Congress I have had the honor to serve as a cochair of both the 5G Caucus and the Rural Broadband Caucus. The road to connection for all Americans will be paved by a number of technologies: wireless, Wi-Fi, fiber, satellites. But our country's full connectivity potential cannot be realized without establishing a coordinated and robust spectrum pipeline. And to that, we all agree.

To that end, Mr. Gillen, Mr. Assey, what are the most underutilized frequencies by commercial or Federal users? And secondly, where should Congress focus its efforts on a spectrum pipeline bill?

Mr. GILLEN. Thank you, Congressman. Thanks for your leadership on the caucus as well. We think the focus needs to be on midband spectrum. It is what is being used around the world. I think there is imbalance today right now in terms of the Government has 12 times more control than available for 5G in the midband. In terms of specific bands, the lower 3, 4, and 7 gigahertz, we think there are opportunities for—win-win opportunities for agencies. Dr. Ghosh alluded to a lot of the agencies are using not the most efficient systems in the world. Through auctions, we can help upgrade those systems and create better outcomes. So there is a lot of spectrum in those bands, and we think there's opportunities for both commercial and government success.

Mr. ASSEY. I would agree that the 3 gigahertz band is an opportunity for us to unlock new spectrum. I think it is going to require sharing techniques that are going to allow us to be able to use for commercial use while respecting the needs of government users. I also think the 7 gigahertz band is an area where we could see that work that we did in 6 gigahertz, opening it up for unlicensed, extended, and pave the way for the next generation of unlicensed Wi-Fi technology, Wi-Fi 7.

Mr. WALBERG. Mr. Johnson, as I said earlier, I am cochair of the 5G and Beyond Caucus. My fellow cochairs recently reintroduced H.R. 1377, the Promoting U.S. Wireless Leadership Act, which would advance U.S. wireless competitiveness by directing the NTIA to promote U.S. participation and leadership in communication standard-setting bodies. Participation in these international groups—at least I believe—it is critical for our country to remain the wireless leader.

If China is successful in setting spectrum policy and moving the rest of the world in a different direction than the United States, does that mean Chinese network gear like Huawei and ZTE will be the standard going forward? And secondly, what does that mean for the security of us and our allies?

Mr. JOHNSON. Thank you, Mr. Walberg. That is a great question. To answer—to take both parts of the question: On the standards processes, U.S. and allied innovators have long set the standard—literally set the standards in 3GPP and in other international standards bodies. China is trying to take kind of a government-centric approach to shape those standards processes. I think there has been a lot of talk about lots of Chinese entities like Huawei and ZTE sort of flooding the zone in these standards processes.

That is a— it is a concern, but the innovation and the technical aspects of standard setting takes place with the best ideas and the

best innovations. So, so long as we are at the—we and our allies are at the—and those—those companies that are based in market democracies are at the table, I feel confident that they will set—literally set the standards in the future. We just need to make sure that they are there and there are a whole host of policy ideas that can make—help make that happen.

On the second part of your question about Huawei and ZTE and other tech national champions from—based in China, the reason that they have a strategic objective to deploy the Digital Silk Road, as they put it, is because if the world is wired with gear and companies that are based in the People's Republic of China, the People's Republic of China can control those networks. It is really that simple. It is not about backdoors or, you know, is there some sort of, you know, espionage capability. Yes, there is, I think. But the real issue is control.

You can think about it like Russia's gas pipelines. If they control the flow of gas to Europe, then they have got a strategic power over Europe. Same thing. That is why we don't want to have China and Huawei wiring the entire world.

Mr. WALBERG. Well, I appreciate that. More could be asked, but right now I guess we appeal for a functioning Senate. You can understand the challenges and at least help us start to get back on track. So thank you. I yield back.

Mr. LATTA. The gentleman yields back. The gentleman from Florida is recognized for 5 minutes.

Mr. SOTO. Thank you, Chairman. 5G is now beaming across much of the Nation. I know how much work it took for a lot of you in this room as well as our partners at the FCC and the Congress and the infrastructural laws extending high-speed internet to rural areas, including in South Osceola County, where I represent. These spectrum auctions have fueled economic growth, advances in technology and communications, and key revenue for critical programs. The spectrum is critical for faster downloads for Central Floridians for all Americans, for better connectivity for devices, advances in artificial intelligence, virtual reality, multiplayer gaming, commercial uses in commercial space, tourism, simulation and training, so many areas that we back home care deeply about.

And we did our part in the House by extending the spectrum auction authority last week, yet the Senate let it lapse due to concerns by the U.S. Department of Defense. We obviously all want a strong defense of the homeland. But I would note that, until recently, this—these auctions have been a holy civilian process by the FCC. So I wanted to start by getting a sense from all of you.

First, we'll start with Mr. Gillen. How well has the civilian process worked, and do you know of any security threats that arose from the process? Like has DoD reached out to you about that, because a lot of this is just coming to a head now.

Mr. GILLEN. Thank you for the question, Congressman. And the FCC process works really well as long as there is access to spectrum to sell. And the challenge we have now is 12 times more of this critical asset is being controlled by the Government than is available to commercial use. So the only source really of spectrum right now is government users.

And I think we have replicated, in this committee's leadership, with AWS-3 auction and the 3.45 auction, that we create opportunities, that we actually strengthen the mission, that a lot of the equipment that our military and agencies are using needs to be upgraded, needs—can be used spectrum more efficiently, and auction proceeds can go do that. So we tend to think, when engineers start talking about these on a system-by-system basis, there are wins-wins. We can increase our warfighting capabilities and deliver advanced services to your constituents.

Mr. SOTO. Thanks. And Mr. Assey, how do you feel the civilian process has worked? And do you know of any security threats that arose from the civilian process to date? Has DoD reached out to the association or your clients about it, or what is your belief on those things?

Mr. ASSEY. I mean, I think the process is—I won't say necessarily messy, but it is probably reflective of the fact that we have a lot of users and a lot of complicated, important national security interests to try to work through. Dr. Ghosh referred to the Path SS process that began over a year ago. My industry, Mr. Gillen's industry, and others are participating with DoD and NTIA and others and trying to work through that process. But it is extremely difficult, and we have some real challenges. There was a report today that, you know, it might take as long as 20 years and \$120 billion to vacate that band.

So, you know, we are going to have to really try to rely on the experts like Dr. Ghosh who have the technical expertise to try to deal with this issue and really do our best to figure out how we can make spectrum available.

Mr. SOTO. And we are going to pivot to Dr. Ghosh now. Can we do both?

Dr. GHOSH. Yes, I believe we can. I think if vacating becomes impossible, we have to look at better ways of sharing. And just to address your question about, you know, has DoD reached out, have they complained? Let's take the example of CBRS. There have been 250,000 CBSDs deployed. As far as we know, there has never been any complaint of interference from the DoD. So clearly, sharing can work. Sharing can work to protect the incumbent, which is the DoD. It can also work in places like South Bend, where now you have, you know, 7 terabytes of data being transferred over CBRS to low-income families, which you wouldn't have been able to do if that spectrum had been locked away.

So we have to investigate how we can best use spectrum. I would encourage, you know, people not to take sides, that it has to be auctioned and licensed. There are many, many innovative ways that we can think about sharing spectrum,

Mr. SOTO. Mr. Chair, I would urge that we hold tight to our jurisdiction, not let this get away from us. This needs to remain a civilian process. And I would encourage us to have DoD be more plain about some of their concerns, that we can resolve this.

Mr. LATTA. Thank you very much. And the gentleman's time has expired.

The Chair now recognizes the vice chair of the subcommittee, the gentleman from Georgia, for 5 minutes.

Mr. CARTER. Thank you, Mr. Chairman, and thank you for scheduling this meeting. The timing is obviously impeccable. Incredibly timely hearing. And as all of you have pointed out, Americans are very dependent on reliable connectivity. And we all understand that. And thank you for being here, and thank you for—for emphasizing that. And it's our job on this committee, in particular, to ensure that the agencies that are tasked with this responsibility of managing the spectrum have the resources that they—they need to be successful. And I'm just looking forward to continuing on that task for this committee.

Dr. Ghosh, I'll start with you. Obviously, as an engineer and a researcher, not unexpectedly, you have highlighted the importance of making the spectrum decisions informed by unbiased and technical analysis. In fact, I will share with you—and I am running the risk of being a little self-serving here—but just 2 days ago this subcommittee voted to advance my legislation, the—to codify the Institute for Telecommunication Sciences, which you note in your testimony plays a crucial role in making spectrum available for commercial use.

And I want to ask you, what role do you think this laboratory will play in America's ability to stay ahead of international competitors like China on spectrum—spectrum policy?

Dr. GHOSH. I think ideas, along with other institutes like NIST and SpectrumX, have a huge role to play here. They have the expertise to actually do testing. Oftentimes, these sharing mechanisms on these systems are designed with very accurate simulations and analyses. But the real world, especially when you talk about RF signal propagation, there is not—you know, follow those analyses very carefully. So we do have to have processes in place where we have a way—platforms that can actually deploy and test some of these really complicated systems that we are developing.

Mr. CARTER. Great.

Dr. GHOSH. So I would definitely encourage, you know, that ITS be central to these discussions as well as other research labs across the country, the universities and other places.

Mr. CARTER. Good. Well, thank you. Thank you. And thank all of you for making the point of how important this is for our—for our competition with China, because I think one of the greatest threats to our country is just that, is China, and the threat that they—that exists there. And all of you have made that quite clear during this hearing today, and I appreciate that.

I am a healthcare professional, a pharmacist, the oldest pharmacist in Congress, by the way. And you know, I have made it one of my top priorities to make sure that we are competitive in the pharmacy world and the pharmaceuticals with China. And we need to be competitive here as well. There is no question about that in the wireless space. But the consequences are great.

Mr. Gillen, I'll ask you. For decades, Congress has designated NTIA to manage Federal agency use of spectrum. When it comes to extending auction authority and making more spectrum available for commercial use, why is it important to have one agency in charge of speaking for the executive branch?

Mr. GILLEN. It is critical that we can't have agencies fighting amongst each other. These are technical things, as Dr. Ghosh has

alluded to, and we need to let the experts make those hard calls and to decide the interference rights and then commercialize the spectrum. And once that auction is sold, we need those that bought the spectrum be able to use it to start delivering services as quickly as possible.

Mr. CARTER. So what would it look like if we had—if each agency managed their own spectrum use?

Mr. GILLEN. I think we could all go home. We would be in a—

Mr. CARTER. Yes, exactly. No question about it. And thank you for making that point. Mr. Assey, I will ask you this. Two recent auctions of Federal spectrum for commercial use are in the CBRs band in the 3.45 to 3.55 gigahertz band. These two spectrum bands both involve spectrum sharing. But each band approaches the issue slightly differently.

Could you please discuss the opportunities and challenges that are presented by each of these type of approaches?

Mr. ASSEY. The CBRs auction, I can talk about.

Mr. CARTER. OK.

Mr. ASSEY. Sure. I think the benefit of the CBRs auction was that we were able to get all manner of people to participate in that auction. We had not just traditional players. We had cable companies, we had schools, we had John Deere and manufacturers, we have the Port of Long Beach. So we are able to get many more people into the system to be able to bid on spectrum, to be able to use the spectrum and compete in providing services. And we are now starting to reap the benefits of that.

Dr. Ghosh talked about the base stations that have been rolled out and the very many different innovative ways in which the spectrum is being put to use, including by wireless carriers. So I think that is an example of how we can have an auction but also recognize the share—the needs of government users and be able to share spectrum efficiently but unlock it for commercial use. If we didn't have that type of an arrangement, we might be at the same stalemate, and we miss the opportunity—

Mr. CARTER. Right.

Mr. ASSEY [continuing]. To get more spectrum in—

Mr. CARTER. Well, I appreciate that. I am about out of time. Mr. Gillen, you want to add something?

Mr. GILLEN. Just real quick. And I do think—we look at sharing solutions. We also have to look at the opportunities lost and that sharing brings low power, particularly the complex sharing we are talking about. If you want to build out to rural America, it is one-seventh the power. It is a lot more time to get to more communities. It is also preemptable.

So if you want to build a secure, reliable service, to know that the Government can come in and say, "You can't use that anymore," it makes it harder to do things we're trying to do vis-a-vis China and driving these forward.

Mr. CARTER. Good, good. And I am out of time, but I would be remiss if I didn't recognize the fact that Mr. Johnson is from the State of Georgia. This is extremely important to our State. So thank you for being here, and thank you for participating.

Mr. LATTA. Well, thank you very much.

Mr. CARTER. Thank you, Mr. Chairman. I will yield back.

Mr. LATTA. Thank you very much. The gentleman's time has expired. And the Chair will recognize now his friend, the gentlelady from California's 16th District, for 5 minutes.

Ms. ESHOO. Thank you, Mr. Chairman. You have really been studious about getting the number of my district correct, so proud of you and thank you. I am the veteran of hundreds of congressional hearings. I want to compliment all the witnesses today because I think you have made this a highly instructive one, so thank you. Mr. Johnson, as—you have made several references to Huawei—and I have been on Huawei for at least a decade, maybe a decade and a half—and I think that the pressure that was brought to bear—first of all, placing a spotlight on them, or—not even a handful were appreciating what Huawei was doing. But I think the tackle and blocking and the cooperation of the FCC and what they put into place on a bipartisan basis, I am quite pleased about.

So to Mr. Assey, I want to go back to this—the CBRS and, you know, what that represents. In your written testimony, you discuss the, you know, the deployment of shared license spectrum to enable obviously commercial use in Federal spectrum bands. You also—bands. You also discuss the FCC's commercial broadband radio service. [A cell phone rings.] I don't have time to shut that off.

Can you build on what you have already shared with us, why you believe it is so effective and what the FCC should be doing to evaluate when considering expanding it?

And then I want to go to Mr. Gillen because, in your written testimony, you showed skepticism of shared spectrum, particularly CBRS and why you think—why do you think Congress and the FCC should be skeptical of it? So away we go.

Mr. ASSEY. I think it is an important model. And as I said, what we are going to need in order to succeed, in order to compete with China, is a balanced approach that really allows us to use every tool in the toolbox to make commercial spectrum available. When we have situations that will not allow for clearing or that will not allow for us to do that in a timely way, we are basically leaving on the table the ability to get spectrum out there and used by thousands of innovators who could use it to build systems and ports, to build networks and schools.

So there is a real benefit to bringing spectrum online as quickly as we can. We obviously need the technologist to basically evaluate these bands. They are getting more crowded. There are lots of competing uses out there. But I think it is a wonderful testament to the ability of our country to innovate and figuring out ways where we can meet the needs of government users, critical government-use needs, but also unlock spectrum that can be put to use quickly and by lots of new competitors to the marketplace.

Ms. ESHOO. But is this kind of a tug of war between different businesses?

Mr. ASSEY. Well, just to follow up, I mean, it is a—

Ms. ESHOO. And I want to get to Mister—

Mr. ASSEY. Yes.

Ms. ESHOO [continuing]. Gillen.

Mr. ASSEY. Sure. I mean, I—look, I think what we are going to have to do is go on a band-by-band basis and determine which approach is the best—is going to best meet consumer needs.

Ms. ESHOO. Mr. Gillen?

Mr. GILLEN. Thank you for the question. And I think everything Mr. Assey said is right. This is a valuable experiment, but it is still very much an experiment. The first in the world to do it. Roughly there are lots of good use cases out there, but it is also less than 5 percent of that spectrum is getting used today. We think we have that sandbox for innovation right now. The places that we need more attention right now is full power spectrum that is licensed. That is where we are really falling behind now.

Ms. ESHOO. I see.

Mr. GILLEN. So I think, in our minds, we have the experiment. Let's focus on things that are full power. Let's focus on things that we know work as we let that experiment continue to develop.

Ms. ESHOO. Thank you very much. I yield back.

Mr. LATTA. Thank you very much. The gentlelady yields back, and the gentleman from Florida is recognized for 5 minutes.

Mr. DUNN. Thank you very much, Mr. Chairman. And I want to say thank you, too, to an unusually talented panel that we have gathered today in front of us. So it is very incumbent on us in Congress to pave a path forward for American commercial enterprise to compete with China's rapid technological development. As most of us know, China's Digital Silk Road and technologies like Huawei are quickly acquiring the building blocks for 5G and digital dominance. There is a lot of talk all through Congress on the Select China Committee where I sit and elsewhere, basically everywhere, about the dangers of TikTok, which is important. However, if China wins 5G and develops a software that rides on top of next-generation networks, I worry that the Chinese Communist Party will leverage that innovation against the entire free world: all sectors, energy, healthcare, transportation, AI, everything.

So I think this is the real risk if we don't make more spectrum available for commercial use. Every person in this room should be concerned about CCP dominance of 5G technology and what that means for national security and the future generations to come in America.

My esteemed colleagues on this committee enjoy a bipartisan, pro-American approach to technological innovation, which is fundamental in finding a solution to this interagency debate and political disputes, you know, that—these things are standing in the way, honestly, in the way of America's global competitiveness. I look forward to finding a real solution that clears both chambers of Congress at this urgent time. With that said, Mr. Johnson, you mentioned in your testimony positive developments in global competitiveness for spectrum use include one more spectrum and two coherent government processes for improving commercial use. Let me say I agree that leveraging American free markets is a key development to a path forward. We hear, however, about China making large amounts of spectrum available through raw government command and control.

Should we be following them down the path to making the same frequencies available, or should we just—can we rely on the market forces to determine what spectrum best serves American interests?

Mr. JOHNSON. Thank you, Congressman. It is a very important question. And also want to commend you for focusing in on the

CCP. When I say China, talking about the Chinese Communist Party, not the Chinese people.

Mr. DUNN. We are sensitive about that on the China Select—

Mr. JOHNSON. It is absolutely—it is absolutely crucial. The Chinese civilization is one of the great civilizations in history. Chinese Americans are going to be a crucial and very important part of our country's future.

But this is about the system of government run by the Chinese Communist Party, as you note. And the short answer to your question about should we do it their way: Absolutely not. What we should do is have a coherent process that, when a decision is made, as I'm—fellow witnesses have said, that the decision sticks and that the U.S. Government process which is collaborative, which is multiagency, when it—when it arrives at a decision, that the decision is final, and we get to deploy in C-band, for instance, and not have a delay. That—and as for the global harmonization, I certainly should—we should not be following China's lead. We should be leading in the harmonization. And, you know, that happens in a variety of places. We have got some incredible public servants who are going to be doing that. Anna Gomez at the State Department. America needs to be leading. But in order to lead, we have to have spectrum available in order to lead the harmonization.

Mr. DUNN. Thank you for making that clear. I want to make sure that, you know, we were on the same page here. Mr. Gillen, the midband spectrum deficit in the U.S. is—was facing, you outlined in your testimony really is concerning. We are told now, by 2027 China is going to have four times as much 5G spectrum as we'll have. Can you explain how China is using spectrum policy to get ahead and what the risk is to the United States economically and to national security, in 30 seconds?

Mr. GILLEN. Absolutely. No problem. It is twofold. One is that they want the innovations that we have led in 4G. They want those innovations that happened there. They understand that spectrum superiority comes with technical superiority. So from a straight softwares perspective, they want robotics—and everything rides on these networks—to happened there first. I think it was all Mr. Johnson said. This is also—in terms of midband access, there are global bands being built around the world. We are absent from a lot of those conversations today. We need this committee to jumpstart us and get us into those discussions because, right now, we are ceding those conversations to China. We are ceding those conversations to the rest of the world.

Mr. DUNN. Thank you very much. It was very succinct. I think our technology will be untrustworthy if we let China lead.

Thank you, Mr. Chair. I yield back.

Mr. LATTA. Well, thank you very much. The gentleman yields back the—his time. And at this time, the gentleman from Texas's 33rd District is recognized for 5 minutes.

Mr. VEASEY. Mr. Chairman, thank you very much.

Mr. Gillen, in your testimony, you talked a little bit about the Affordable Connectivity Program. I was hoping that you could expand on that a little bit and talk about the importance of that program and being able to connect some of these families—I think that 55 percent of Americans under the Affordable Connectivity

Program now have access to reliable high-speed internet—how important and transformational that is for our country.

Mr. GILLEN. It is so critical. Everything we are talking about today is about the connectivity that will empower, improve education, improve healthcare outcomes. It all depends upon people actually being connected. And so ACP has been critical to get millions of Americans to stay on broadband and also millions to get on broadband. We are very proud that 55 percent of Americans are picking wireless solutions. We have always been the on-ramp for the internet for millions of Americans. We think it is something that is very important. And so we very much appreciate the program's focus on making sure that all Americans benefit from the conversation we are having today.

Mr. VEASEY. Thank you very much. I was also hoping that if you could elaborate on a different topic. But the tangible benefits that Americans are receiving because the FCC has—have the authority to conduct auctions in awarding spectrum.

Mr. GILLEN. The most recent one that it brings to mind is 5G Home, because having more spectrum that has more capabilities allowed us to now enter the home broadband market. And that creates more competition. We have 90 percent of new home broadband adds were wireless companies this last year. It also is a great tool to help close the digital divide. Too many kids still outside McDonald's doing homework still today despite a lot of good work. Fixed wireless is a solution that can help address that really quickly. And so that solution is as good as the spectrum we have. And the more spectrum we have, the more robust that can go. And the more full-power spectrum we have, the further into rural America we can deploy that asset.

Mr. VEASEY. No, absolutely. And I know that the FCC's auction authority expired last night. But hopefully they will get that fixed over in the Senate soon and extend that. As Congress looks to a longer-term extension, how important is it going to be for us to create a pipeline of spectrum, and how will this help in reducing the current deficit the U.S. is facing in making midband spectrum available for commercial use as compared to our competitors around the globe?

Mr. GILLEN. It's central. Only this committee can do this. We have seen—each time you have extended auction authority for long term—2012 is the last good example. Because of that, the FCC had something to auction. We can't just give the FCC auction authority and then not have anything for them to sell. And it is critical for this committee to identify those particular bands, particularly midbands that can go far, can carry a lot, that's happened—being used around the world. And really this committee is uniquely situated to not only—as you guys have worked really hard to preserve auction authority but also make sure that we have a plan going forward to deliver on the promise that we are talking about.

Mr. VEASEY. No. Thank you very much.

Dr. Ghosh, I wanted to ask you—you know, really appreciate all the work that you are doing to bring together researchers and staff from universities, including minority-serving universities at SpectrumX. And I was hoping that you could tell us, based on your research and experience working in the wireless field, what work-

force developments are needed to further aid America's leadership in spectrum policy and wireless technologies.

Dr. GHOSH. Thank you for that question. Workforce development is a core activity within our center. And we are taking it down to even the middle school and the high school levels. We need to get kids excited about not just running apps on their phones but what makes phones work. And we are doing that through a number of initiatives. We are creating course content within the center that will—can be used by high school teachers to educate kids in high school. We are creating course content that can be used in community colleges, in four-year colleges, that can be used to educate people about spectrum.

Spectrum is one of those interesting things where there is not one course that you can take that makes an expert on spectrum. It—you need to know about physics propagation. You need to know about electrical engineering. You need to know about software, and bringing all of those competencies together is very, very important. Within SpectrumX, we just kicked off an initiative last week, actually, among four of the MSIs. We are going to have undergraduate students walk around with phones and collect spectrum data, collect signal strengths, look at what the throughputs are so that they get an understanding of these networks that they depend on, how they actually perform in the real world. We feel that is extremely important activity that centers like SpectrumX can do.

Mr. VEASEY. Yes, well, thank you very much. And you also mentioned Affordable Connectivity Program in your testimony. And I really appreciate that. I just can't—I don't think that we can emphasize that enough. So thank you. Mr. Chairman, I yield back the few seconds I have. Thank you.

Mr. LATTA. Thank you very much. The gentleman yields back, and the Chair now recognizes the gentleman from Utah for 5 minutes.

Mr. CURTIS. Thank you, Mr. Chairman. Mr. Gillen and Mr. Johnson, you started off the hearing with your graph, Mr. Gillen, of data usage. And, Mr. Johnson, your 2G phone reminded me of my party line when I was young. Tonight you can go home and explain to your children what a party line—it was not a party, but we literally shared a line with our neighbors, and made me think of my first laptop computer. And I was proud today that I upgraded it from 32K to 64K. It was a RadioShack TRS 80 and certainly highlights the challenge—right?—that's ahead of us.

I'd like to just briefly highlight something everybody in this room knows about, the Spectrum Innovation Act, and remind us that the bill made lower 3 gigahertz band available so that we could improve our 5G network and be competitive. It also tied together auction authority with funding for Next Gen 9-1-1 and rip-and-replace and so that we can take the Chinese telecom equipment out of U.S. networks and replace them with clean and safe equipment.

These programs, I think we should know, were funded with zero taxpayer dollars. It is pretty significant and without adding to our deficit. Unfortunately, as we have discussed today, the legislation didn't pass the Senate. The auction authority just lapsed, and we have still not fully funded rip-and-replace. The delay is costing providers in my State and putting the coverage in rural areas in my

district at great risk. We all talk about beating China, winning the 5G race and beyond, and securing the communication infrastructures. But when it really came down to it, Congress dropped the ball on this.

Let me start with you, Mr. Gillen. One of the issues we are dealing with is making sure that small carriers have resources necessarily to remove and replace Huawei and ZTE from their networks. I understand we have over \$3 billion shortfall. And if not fully funded by July, these carriers will have to make very difficult decisions about securing their networks. Can you help us understand the urgency for fully funding rip-and-replace programs and why July is an important date?

Mr. GILLEN. Thank you, Congressman. This has been a priority of the committee for a long time. And you guys brought the focus on this from a national security perspective. We are greatly appreciative. Greatly appreciative.

Mr. CURTIS. Could you pull your microphone—

Mr. GILLEN. Sorry.

Mr. CURTIS. There. Thank you.

Mr. GILLEN. The challenge we have, as you alluded to, we can do a lot of good things with auction proceeds. And we just need more auctions on the books. And I think whether it's FirstNet that's helped first responders, there is lots of things that you guys decide what ultimately the auction revenues do. We need that spectrum, and we are happy to contribute. It is over \$233 billion to the Treasury. And there's lots of good congressional priorities that that money can get used to—

Mr. CURTIS. Could you just briefly restate why the lapse in auction authority hinders U.S. leadership?

Mr. GILLEN. Yes, sir. Absolutely. It is—when we look at what is happening—not having the ability to have a plan, a set of instructions going forward—is really challenging. It is really problematic. We see our rivals moving forward with haste. They have a plan, and they are executing on it. And I think the concern Mr. Johnson said about us becoming an island is real, particularly when it comes to midband access. And that goes really far. It travels far. It is key to what we want to do to make sure this benefits all Americans. And so the faster we get midband in the hands of innovators, the better things we can do for all consumers.

Mr. CURTIS. Thank you.

Mr. Johnson, good luck explaining a party line to your kids. But for a minute, you know, the irony here is, you know, some of the protection of spectrum is for national security. But can you explain if we don't let go of that, why it hinders national security?

Mr. JOHNSON. Thank you, Congressman. I think that might be the most important question here. And Department of Defense—I was born on an Air Force base, Army veteran, love the Department of Defense. The weapon systems and the services that the Department of Defense and its arm—and its uniformed services provide are obviously the best in the world, crucial to our national security, crucial to world peace, crucial to every aspect of what we do. That includes some of the capabilities that they—that are enabled by their present spectrum holdings. Related to that and underlying that is the economic strength and vitality of the United States and

our allies. If we don't have that—and again, I think to look at—look at the difference between the southern part of Korea and the northern part of Korea, the western part of former Germany, the eastern part. It is economic vitality and technology is what—is what provides us the ability to win strategic competitions and to win wars when necessary.

Mr. CURTIS. Thank you. I'm—

Mr. JOHNSON. So it is absolutely crucial. I don't have—I don't presume to have the answer for how you—how you—how exactly technically we go. We have to find a way for that spectrum to be for commercial use.

Mr. CURTIS. Thank you. Unfortunately, I am out of time. I would just like to quickly add my voice to the many compliments to all of you today for being here with us. And Mr. Chairman, I yield back.

Mr. LATTA. Well, thank you very much. The gentleman yields back. The Chair now recognizes the gentleman from California for 5 minutes.

Mr. CÁRDENAS. Thank you, Chairman Latta and also Ranking Member Matsui for having this very, very important hearing, albeit probably pretty boring to most of the people in America. And hopefully we have at least seven listeners today live, hearing this important discussion. And I would like to thank the witnesses for coming forth with your opinions and your expertise as well and for all the work that you've done. Some of you have been in the private sector for some time, some of you in the universities and also in the public sector as well. So thank you so much for all that you've given to our country and to the progress and process that we are talking about today.

We are talking about wireless networks and technologies that play an incredible role in everyone's life in America, yet at the same time Americans take it for granted. What we don't do here—what I hope and pray that we don't do in Congress—is take it for granted that everything is going to be just fine. We just saw the expiration happen because the lack of cooperation between two bodies, the House of Representatives and the United States Senate.

Hopefully we can get that straightened out soon on behalf of the American people so we can continue to progress. We are not alone in this world. We talked a lot about China. And China isn't the only player on the planet but certainly a very dominant player. But yet again, we have heard, by testimony, that, yes, we have confirmed that the United States still is the dominant player, but we are not alone. And we could fall back, and falling back is not good for security. It is not good for the American people. It is not good for the economy. It is just not good.

So with that, what I would like to do is start off with a question to Dr. Ghosh. In your testimony, you speak about how spectrum policy can help bridge the digital divide. In particular, you said spectrum policy that makes available cost-effective spectrum to small providers and communities to deploy and manage their own wide-area networks can be very effective in bridging the digital divide in both urban and rural communities. Could you tell us more about what the FCC has done to ensure that smaller providers in local communities can access the spectrum and provide better serv-

ice to lower-income and underserved communities like mine in the San Fernando Valley?

Dr. GHOSH. Thank you for that question. So the most recent example of what the FCC has done is through CBRS. By creating 150 megahertz of spectrum in the midbands that can be available either through licensing or even through unlicensed through GAA licensees, you are allowing communities to deploy their own networks, which is exactly what South Bend has done on their city schools.

So we talked a lot about exclusively licensed. We talked a lot about unlicensed. I think we need to explore the space between the two because there are a lot of applications that are not well served by either very well. And shared spectrum, more of that that's available, I know you mentioned the high power. High power is great if you want a nationwide footprint. But a lot of these applications—you have a rural community. You just want to get their citizens covered. Low power is fine for those applications.

And just another concluding remark on that is that, in rural areas specifically, it is not a shortage of spectrum that is creating the digital divide. It is a shortage of infrastructure. And the reason there is a shortage of infrastructure is cost. So we have to balance how much spectrum we have and how do we make sure that infrastructure actually rolls out to the places where it is needed.

Mr. CÁRDENAS. And it can be done. And it can be done. Thank you.

As you know, Dr. Assey, data tells us that certain communities such as Hispanic communities over-index on the use of mobile devices for their primary or sole connection to the internet. Mobile wireless competition in these communities is, therefore, absolutely critical. If any one provider dominates the marketplace, these communities get the short end of the stick. It is important to me that our spectrum policy in this country keeps this in mind and we prioritize intense mobile wireless competition.

How, in your view, does shared license spectrum support mobile wireless competition that might benefit communities that rely heavily on mobile wireless access to the internet?

Mr. ASSEY. Again, I think it goes back to what Dr. Ghosh was saying. It is bringing more providers into the marketplace. In the CBRS auction we had over 250 people who claimed licenses. That was 10 times what we had seen in prior auctions. But, you know, the real—the real acid test, I think, is in the mobile space. We are seeing Comcast and Charter grow. We are seeing them build out that connectivity all around cities and towns. And consumers are benefiting. They are able to provide very attractive rates and savings.

And the other thing I think that's really important too is—and it is the reason that we need the balanced approach is because, when you are using this device [holds up cell phone] in your home, Comcast has 80 percent of the data that is going over here is going over Wi-Fi. It is not going over a licensed network. So we need to make sure that we make commercial spectrum available through all means possible.

Mr. CÁRDENAS. Once again, I think public-private partnerships are key in that effort of connectivity. Thank you, Mr. Chairman. I'm sorry I went over my time.

Mr. LATTA. The gentleman yields back, and the Chair now—pardon me—recognizes the gentleman from Pennsylvania for 5 minutes.

Mr. JOYCE. Thank you, Chairman Latta. Spectrum plays a vital role in connecting Americans, especially those residing in rural areas like I represent in southwestern and south-central Pennsylvania. It ensures that they have the necessary broadband access to work, to farm, to heal, to do their commerce, to learn from home, all which are a vital component of the world that we live in today, which is why the Federal Government must work together to establish an intergovernmental approach to ensure that all parties involved are on the same page when it comes to spectrum policy by having that whole-of-government approach. It sends that clear message to stakeholders that, in the United States, we want to continue to be the leading innovator. It also shows the rest of the world to look to us in America when it comes to all things spectrum.

Mr. ASSEY, can you talk on how having a balanced spectrum policy benefits the constituents in a rural congressional district like I serve in Pennsylvania?

Mr. ASSEY. Absolutely. Obviously, having the availability of unlicensed spectrum is very important. It basically extends the reach of the wired networks that we've built out and will extend the capabilities that your consumers are going to be able to use when they are subscribing to cable service. But it also—these new models, the innovative models like CBRS, are allowing us to take government spectrum that was previously locked away and unlock it and allow a host of different types of manufacturers or towns or schools to be able to build out networks and systems. So I think it is one of these areas where the more we make available to America's innovative spirit, the more we will be able to produce.

Mr. JOYCE. So are you paralleling the ability to have that access to spectrum with the ability of Americans to be the innovators, to be the entrepreneurs that we need?

Mr. ASSEY. Absolutely. There is a reason the U-NII-3 band was called the innovation band, because it unlocked all manner of ideas and technologies that we could only dream of. We hope to replicate that.

Mr. JOYCE. I would like to continue with Mr. Gillen. So recognizing that we are talking about rural areas that are grossly underserved, how do we go home to these areas that are unserved or underserved and talk—particularly as a representative from the Commonwealth of Pennsylvania—how do we assure them that they are going to have the services that they see in Pittsburgh and in Philadelphia?

Mr. GILLEN. It is a great question, and it is a critical priority. All the things that we are talking about need to be available to all Americans. And I think, when we talk about a balanced policy, I share Mr. Assey's goal. We need the Government to have enough spectrum. We need unlicensed to have enough spectrum. We need licensed to have enough spectrum. And right now, unfortunately,

we are imbalanced. Unlicensed has 7 times more than we do. Government has 12 times more. So that is why we are just focused on the full-power license that we are seeing around the world being used. And for us, it is between a full power and a CBRN solution. The difference in power is 7 times over. Our ability to get to more and more communities quickly is all tied to that power level, and that is why it is so important when we have these conversations. We want to get quicker to more communities. A lot of that conversation gets to—Dr. Ghosh is exactly right. It gets to infrastructure. But how much infrastructure you need goes to how strong that signal can go.

Mr. JOYCE. Mr. Johnson, you mentioned in your testimony of the potential danger that the world will face if we allow adversaries like China to lead on commercial wireless communications. How can this body empower domestic industries to ensure that the U.S. continues to be that global leader?

Mr. JOHNSON. Thank you, Congressman. I think this body has done a lot already through the CHIPS Act and the Bipartisan Infrastructure Law. It—this body has done what it needs to do on spectrum authority. My former employer in the Senate needs to—need to make that happen. But it is what I said in my opening. We need more commercial spectrum. We need coherent processes for deployment so that, when spectrum is allocated, innovators can deploy and serve. And then we need to harmonize global spectrum bands.

Mr. JOYCE. I think you recognize that, from a bipartisan basis, from this subcommittee on Energy and Commerce, we are committed to doing that.

Mr. Chairman, I would like to take just a few seconds of personal license if I may. One of my senior staff—this is his last day as part of our team. Mr. Fred Sottnick, who has been an integral part of my role here on Communications and Telecom, came to me over 4 years ago, suffered through a grueling interview, and was able to be part of the leadership team of our legislative staff. He is the son of proud parents, both Lou and Desiree. He hails from Wildwood, New Jersey, but he has made Pennsylvania and his commitment to Energy and Commerce part of his goals. And I would like everyone to join in with me in thanking Mr. Sottnick for—and wish him the best of luck.

[Applause.]

Mr. JOYCE. Thank you, Mr. Chair, and I yield.

Mr. LATTA. Thank you. The gentleman yields back, and the Chair now recognizes the gentleman from Texas for 5 minutes.

Mr. WEBER. Thank you, Mr. Chairman. I am new to the committee, and I wasn't here for a lot of your all's testimony. So I'll probably have some redundancy. That is just a note from the Department of Redundancy Department before I start.

But I want to start with you, Mr. Gillen. You said that—or I'm sorry, Mr. Johnson. You just said with Dr. Joyce here we need more commercial spectrum. And of course I'm coming up to speed on all this infrastructure and all the spectrum and the use of it. How do we—if it is a finite source, or—how do we get more?

Mr. JOHNSON. The most basic answer is we need to have a strategy, a thoughtful, discerning, urgent strategy to free up commercial

spectrum. A lot of that is held in by Federal agencies, including Department of Defense. Department of Defense operates a number of very important capabilities on that spectrum, and we need to find a way to free it up for commercial use because the core strength of our country is the economic and technological vitality that will come from commercial innovation. That feeds into DoD strength. It feeds into national strength. And even in—you know, to get real specific, it feeds into the strength of weapons systems, both defensive and offensive.

Mr. WEBER. Well, let me follow that up with that same—thought. Are there companies that use the spectrum that, indeed, they're commercial companies, whatever you want to call them, that undergird some of the processes of Department of Defense?

Mr. JOHNSON. Oh, absolutely. There is the defense industrial base is—is—

Mr. WEBER. That is a good term.

Mr. JOHNSON [continuing]. A very important sector. It includes a lot of otherwise commercial companies than it includes what we traditionally know as defense contractors. And so absolutely it is a very important part of the—

Mr. WEBER. All right, thank you. Mr. Gillen, I am going to jump over to you. You said that you see full-power licenses around the world, I think was what you said earlier. Elaborate on that. But you don't see it here?

Mr. GILLEN. Not enough, sir. Right now, the focus is on something we call midband spectrum. It goes really far, and it carries a lot. So we talk about how we use these devices more and more every year. It is really helpful to get this out to as many Americans as possible. The challenge we have, as Mr. Johnson just alluded to, the Government controls roughly 12 times more of this than the commercial industry does. And so how do we do what's happening across the world is that we can be—use that spectrum we have more efficiently. We are not making any more. You are exactly right. But we can be more efficient with it.

And I think we have seen, working to this committee, win-win opportunities where we can help agencies get more efficient systems, get new systems, and give a space—have commercial operations at the same time.

Mr. WEBER. Are there leaders and more efficient systems today?

Mr. GILLEN. I would say the commercial wireless industry has improved its efficiency 40 times over this last decade. I think it is something that, when you paid billions of dollars for something, you get everything you can out of it. So I think there is a huge amount of investment to use this as efficiently and effectively as we can.

Mr. WEBER. At some point, that radio frequency highway becomes super crowded and has rush-hour traffic. How far off from that are we?

Mr. GILLEN. Without this committee's leadership, we are way too close to that. I think we are—we are in a good place right now. But what you see, what's happening around the world, we need to keep getting spectrum out to commercial users to keep up with all the things we want these networks to do.

Mr. WEBER. Mr. Assey, I'm going to come to you. If you were the Chair of FCC, what would you do?

Mr. ASSEY. You know, that is like lobbyist 101 is not to tell the Chair of the FCC what to do but, look, I think——

Mr. WEBER. The Chair is not listening.

Mr. ASSEY. The Chair is always listening. You know, as I mentioned in my testimony, I think the basic mechanism that we have, we have the FCC that looks at the civilian uses of spectrum. We have the executive branch and NTIA, which deals with the competing uses among all the different government users and agencies. You know, that is the right structure.

The problem we face is they are not making any more spectrum. Consumers are demanding data. Government users are demanding data. We all need it all the time everywhere, and we have to figure out new strategies that will allow us to be able to do both. You know, we——

Mr. WEBER. Let me break in. I have got 9 seconds.

Mr. ASSEY. Sure.

Mr. WEBER. Is there a model to follow, whether it is China, the way they deal with spectrum, or any other country? Is there a model to follow?

Mr. ASSEY. We have the best model, which relies on——

Mr. WEBER. Well, that is not encouraging.

Mr. ASSEY. Well, it—we can make it work. I believe we can make it work.

Mr. WEBER. OK. Well, I appreciate that. I am 7 seconds—Mr. Chair, I yield back. Thank you.

Mr. LATTA. Thank you. The gentleman yields back—excuse me—and the Chair now recognizes the gentlelady from New Hampshire for 5 minutes.

Ms. KUSTER. Thank you, Mr. Chair, and thank you to our witnesses for being here today to discuss the future of wireless networks in America. Unfortunately, that future and our Nation's ability to remain a global wireless leader came into question last night when the FCC's authority to auction spectrum was allowed to expire. As we discussed today, this is literally the first time that Congress has failed to protect this critical function of the FCC, and it is simply unacceptable.

Spectrum is the backbone of our Nation's communication networks that millions of Americans rely upon every single day for work, for telehealth, for school, for education, for entertainment, and, most importantly for many of us, to connect to our loved ones. Mr. Assey, I appreciate your testimony and the importance of unlicensed spectrum to provide Americans with everyday technologies like Wi-Fi. Can you speak further to the FCC's role in ensuring that sufficient unlicensed spectrum remains available for this important service?

Mr. ASSEY. Sure. This is an area where I think the FCC really showed itself to be a trailblazer and put us on a path back in the '80s to really open up this band for innovators and other people who could develop technologies and services that would use this technology. As I mentioned most recently, the FCC's action in opening up the 6 gigahertz band promises to usher in a whole new wave of innovation in this space. We have gone part of the way. We have

developed rules that govern low-power indoor devices that provide 3 times the amount of bandwidth, lower latency, more security. Companies like—cable companies like Comcast are actively rolling out those technologies to customers. And we have further advances in Wi-Fi technology that are going to be yet another step change and unlock a whole new series of applications when we get to things like virtual reality and augmented reality. So the future is bright.

And the benefit of unlicensed spectrum is that we can all participate in it, and we can all produce in it. And that is why we have always been a leader in the unlicensed space as a country. And that is why I think we have a great stake in the success of unlicensed, particularly not just at home but around the world as well.

Ms. KUSTER. Thank you. Thank you for sharing your expertise. In my district in New Hampshire, homes in rural communities are often spread far from the nearest town or city center. This makes it difficult to provide fast, reliable broadband services to these households, to say nothing of the geography and Mount Washington in the middle. I want to ask Mr. Gillen, if I could, how wireless can help to close the digital divide for hard-to-reach rural areas. And it's not relevant in my district, but I'll add for my colleagues Tribal areas.

And now that the FCC's auction authority has lapsed, how will this impact the ability of your wireless companies to provide broadband services to my constituents in New Hampshire or to other rural parts of the country?

Mr. GILLEN. Thank you for the question. It is critical. Spectrum is—we are only as good as, as much spectrum as we have. And as everything Mr. Assey said about the FCC trailblazing and unlicensed access, we would like that same focus now on license, that we want that same amount of spectrum that would be able to innovate and grow with. And I think fixed wireless is now a solution that can get to more and more homes quickly, that it is an opportunity now with 5G Home.

We are seeing opportunities. Accenture projects that with additional spectrum that this could reach 43 percent of rural Americans in the next few years. And time is critical because those folks don't have connectivity today. And it also goes back to the BEAD Program that this committee drove, a technologically neutral approach. The implementation, we're worried, is not focusing on all the solutions available. We think that fiber is a place for that program. We also think wireless does too. Every community is going to need to make a difference between quickness, speed, what's available, and the finite amount of money that's available to them.

So I think the more solutions we put towards rural America, the better we are because it is hard. And we all need to be working towards that because we need everyone connected to do all the things we want to do.

Ms. KUSTER. Is there any technological benefit of wireless over wired, if you will, for geography, for mountainous areas, for hard-to-reach places?

Mr. GILLEN. Every community is different. Every mix is different. I think absolutely that, if you have to get fiber all the way to the house, wireless has a benefit if it can be from a tower. There

is topography and other challenges. There's other ways of doing it, but it really gets down to these hard-to-reach communities are absolutely hard to reach. But absolutely wireless, if you can do it more quickly with—with a—you don't have to get all the way to the house, particularly in really expensive areas. That's a solution.

Ms. KUSTER. Great. Thank you very much. My time is up, and I yield back.

Mr. LATTI. Thank you very much. The gentlelady's time has expired, and the Chair now recognizes the gentleman from Georgia for 5 minutes.

Mr. ALLEN. Thank you, Chair Latta, and thank you to our witnesses for being here today. Obviously, we are all disappointed that last night the FCC's authority to auction spectrum expired. You know, it looks like we have got a lot of players in this whole process, and trying to get everybody on the team has been difficult. As we work to make up for this lost time and developing—improving our spectrum technologies, obviously the agencies need to become more flexible, which is a bit of a problem everywhere in this administration. And responsive to the needs of our private partners, of course this latest development has moved us in the exact opposite direction. I understand that we are in a global race here.

And I am proud that the House last week did pass H.R. 1108. And I hope the Senate will hurry along with that as well. But tell me about the midband spectrum. And how does—can it ensure the U.S. retains global leadership in the wireless industry, Mr. Gillen?

Mr. GILLEN. It absolutely can. It is critical. And why midband is important is that it is a blend of both capacity, that it can carry all the healthcare, everything we are trying to do with the spectrum. It can go further. We need to get from Augusta to Evans and beyond. And beyond is about—midband gets us there. Full-power midband is really the key to a lot of what the rest of the world is using because of those propagation characteristics. So a lot of the conversation is around midband because we don't have a lot of it available commercially in the United States. We see others using it. We think it is a key part of the solution to meet America's needs going forward.

Mr. ALLEN. Well, now that the FCC's auction authority has expired, we must reauthorize it so that the FCC can take action on pending applications to provide service in the 2.5 gigahertz band. Isn't 2.5 gigahertz valuable midband spectrum that combines capacity and coverage, meaning it is particularly valuable to my rural areas in my district?

Mr. GILLEN. Yes, sir.

Mr. ALLEN. OK. Mr. Assey, how does spectrum sharing work, and what are the challenges or opportunity with spectrum-sharing technologies to get us out of this current restriction that we are dealing with?

Mr. ASSEY. I think spectrum-sharing technologies have the ability to create win-win solutions when the alternative is kind of somebody has to lose. I think this is one of the great developments we have seen. And, you know, frankly we are not just seeing here, we are also seeing a lot of work going into this around the world as well. And the reason is because the uses that we have, both on the commercial side and the governmental side, continue to in-

crease. And this is a promising technology of unlocking spectrum quickly so that we can get it to use rather than waiting around for, you know, the fifth of never.

So the other—the other piece of that is that, you know, these technologies, particularly with CBRS, have the ability to bring many more people into the ecosystem to really develop that richness, that rich, competitive ecosystem in the wireless industry that not only benefits consumers but will benefit, you know, the broader industry as well. And that is a way in which we can support these types of experiments through a balanced policy that focus on everything.

Mr. ALLEN. Mr. Johnson, is it possible that—of course we have got, you know, the private and then the public users of spectrum. Is it possible that the public users could get into sharing as well to free up some of that space?

Mr. JOHNSON. I think it is not only possible, it is imperative. And I'm—you do not want to—a lawyer determining how you divvy all this up. But we have to have spectrum available for commercial use as a national security imperative. There are ways to do that, and we will let the experts to my right determine how that happens. But the key point is more commercial spectrum and as a crucial national security imperative.

Mr. ALLEN. Exactly. But we can't lose this race—

Mr. JOHNSON. No.

Mr. ALLEN [continuing]. As I see it. Is that correct? Does everyone agree with that? OK.

Mr. JOHNSON. I don't think it's an overstatement to say that, if we lose this race, we lose market democracy.

Mr. ALLEN. OK. All right. Well, thank you so much for your time. And Chairman, I yield back.

Mr. LATTA. Thank you. The gentleman yields back. The Chair now recognizes the gentleman from Idaho for 5 minutes.

Mr. FULCHER. Thank you, Mr. Chairman, and thank you, panel, for your time and expertise here today. A question for Ms. Ghosh. I look at your resume, and you have got electronic engineering training, experience in the private sector, government, and academia. And that poses a background that I would like to explore in terms of your perspective on something.

5G and its networking capability and access is something that is very exciting to me. Artificial intelligence and its potential processing capacity is very exciting to me. The potential of those two being combined is frightening to me. Can you take about a minute and tell me if my fears are warranted or not.

Dr. GHOSH. So artificial intelligence, the way I look at it in terms of 5G and wireless, is really another tool that we can use to manage the performance of the networks much better. So I think the parts of artificial intelligence that we have to be very careful about is when you go into the human aspect of it. You know, are there biases being created? Is the artificial intelligence way of optimizing a network somehow going to automatically disadvantage people in a lower-income neighborhood because they are not paying, you know, top dollar for their services?

So we definitely have to make sure that we are aware of the pitfalls of using artificial intelligence without any restrictions on it. But it is a powerful tool.

Mr. FULCHER. If I could ask you, because I have some questions for the others: Are you frightened of that combination?

Dr. GHOSH. No, I'm not.

Mr. FULCHER. OK. Thank you.

Dr. GHOSH. I am very hopeful that we will work out a way.

Mr. FULCHER. OK.

Dr. GHOSH. Yes.

Mr. FULCHER. Thank you. I'm shifting gears now, and I would like to ask just a little bit less than a minute on this from each of our other panelists, please. If innovation and a free-market competitive environment is our goal, what is the proper role of government in achieving that in your industry? And what is a bridge too far? I will start with Mr. Gillen. A little less than a minute, please.

Mr. GILLEN. Absolutely. Thank you, Congressman. Access to spectrum is number one for us, is creating—empowering the FCC to auction spectrum, identifying spectrum for auction and then letting the highest bidder win and to take advantage of—and then leverage that to deliver service for America. So that is the key for us. That is the input we need to make a difference.

Mr. FULCHER. Thank you. Mr. Assey?

Mr. ASSEY. I would say auction is one tool. But at a broader sense, it is making commercial spectrum available using a balanced approach that includes all of the above and also addressing the needs of government users and coordinating amongst many different government agencies.

Mr. FULCHER. Thank you. Mr. Johnson?

Mr. JOHNSON. Agree. And just stated maybe a different way, it is setting up the innovators for success. That means giving them the spectrum that they need. It means giving them processes that are coherent and final. And it means helping harmonize those bands globally.

Mr. FULCHER. Thank you. And to the panelists, just—I'll just close with this comment. I am not a veteran on this committee. I have had some experience in the technology sector and in academia. But I am very sensitive and I think we as a committee are very sensitive to where those boundaries are for regulation. So easily sometimes we can stifle innovation and competitiveness. So finding that happy medium, finding that place where it's necessary but encouraging to competition and innovation is where we are trying to be. Please help us get there. Mr. Chairman, I yield back.

Mr. LATTA. Thank you. The gentleman yields back. The Chair now recognizes the gentlelady from Tennessee for 5 minutes.

Mrs. HARSHBARGER. Thank you, Mr. Chairman, and thank you to the witnesses for being here. Listen. This has been invaluable to me. I am a new Member as well, and I am the other pharmacist on the panel, the youngest. You know, when reading Mr. Johnson's statement about China allocating spectrum, it caused me to look into—a little deeper into 6G research. And I read an article that stated at the end of 2021, China's government had built the largest 5G mobile infrastructure in the world with 1.43 million base stations accounting for over 60 percent of the global total.

And it also stated that, after having its 5G network up for a month, Beijing officially launched R&D into the 6G ahead of schedule. And this was probably the most frightening for me. It also stated that China has the most 6G patents in the world, and it has 40.3 percent of the 6G filings, mainly focused on 6G infrastructure. Now, this is a question for the whole panel. At the end of the day, Americans—you know, they can sell all the spectrum in the world. But if we can't build our infrastructure out, it is worthless.

So my question is, how important is permitting reform to ensuring that any newly released spectrum results in a better and more effective experience? And I guess we can start with you, Mr. Gillen.

Mr. GILLEN. Thank you. It is a really important question. And I think when you look at—in China, if they want to deploy a cell tower, they do it that day.

Mrs. HARSHBARGER. That day.

Mr. GILLEN. There is no zoning. There is no anything. It just happens. That is not necessarily what we need to replicate. But we need to do faster here too.

Mrs. HARSHBARGER. Yes.

Mr. GILLEN. Too many communities, it costs too much, it is too complex to process, and there's not time frames involved to make sure the communities' interests are addressed but also to let us get out and build faster. It also goes to the power and the propagation of these signals that there is some spectrum that just works better in rural areas than others, and we need to make sure we are focusing on those. And on your question about 6G, we have really smart engineers starting that conversation.

Mrs. HARSHBARGER. Mm-hmm.

Mr. GILLEN. Right now, we are in the first inning of 5G. This is really just the beginning of what we are doing. And so I think that we need to stay focused on 5G. There is absolutely the right engineers working towards what 6G future is. And you are exactly right in terms of patents, in terms of standards. China is trying to take a leadership role, and we need to be aware of that. You know, Mr. Johnson's call for warning on all those things is exactly right.

Mrs. HARSHBARGER. Well, let's hope the Senate watches this hearing so they will get on the stick. Yes, sir,

Mr. Assey?

Mr. ASSEY. I would agree with what Mr. Gillen said. I mean, spectrum is obviously an input. But really it is not—spectrum is only as good as the infrastructure—

Mrs. HARSHBARGER. Absolutely.

Mr. ASSEY [continuing]. It's going to ride over. And we have to be able to build infrastructure efficiently with government permitting as well. But it is actually much broader than that because, you know, as Mr. Gillen said, if in China—they can basically make it happen and put the pole up, you still have to get the pole—the wire attached to the pole. So there are a lot of other things that can impede our execution of actually following through and building on broadband. And permitting is one, access to poles is another, supply chain, and it goes on. So it is a—it is a very difficult problem we face. But in talking about spectrum, we should not lose focus on the need to execute on these strategies and actually build the infrastructure.

Mrs. HARSHBARGER. Absolutely. I don't even think deadlines would—they would respond to deadlines, as Mr. Gillen said. Yes, Doctor?

Dr. GHOSH. Yes. There's a lot of 6G initiatives happening already in the U.S. I am part of the Next G Alliance that is already working on 6G standards, 6G interest groups in the National Spectrum Consortium. So I'm pretty comfortable that the U.S. is still in a leadership position on 6G. Going to infrastructure, I think that, especially when you are talking about rural areas and underserved areas, to me the fundamental problem of infrastructure there is one of lack of backhaul. You know, you cannot get fiber fast enough to most places. So we have to start thinking about alternative ways of getting backhaul. Satellite is one.

Mrs. HARSHBARGER. Yes.

Dr. GHOSH. Fixed point-to-point links using, you know, the high frequencies where there is a lot of bandwidth and others. So we have to, you know, take a whole approach to spectrum and how it is best used.

Mrs. HARSHBARGER. Yes, because we have to make decisions. I serve a rural area, and there is not broadband in a lot of the counties. And, you know, we have struggled on how to do that temporarily or do you do a—you know, an infrastructure that is good for a long, long time? So understand that. Yes, sir?

Mr. JOHNSON. Same thing. Yes, ma'am. And I'm—we live—we presently live in Northeast Georgia—

Mrs. HARSHBARGER. Oh.

Mr. JOHNSON [continuing]. Close to Tennessee.

Mrs. HARSHBARGER. You are right up my—I'm—

Mr. JOHNSON. That's right.

Mrs. HARSHBARGER. Yes. I get there in 4 hours.

Mr. JOHNSON. We live in a little valley where we have—I still have—I have DSL internet.

Mrs. HARSHBARGER. Oh, my gosh. Son, you need to move.

Mr. JOHNSON. Works OK, but it's—you know, there—there are times where the layout of the mountains and valleys—

Mrs. HARSHBARGER. Yes.

Mr. JOHNSON [continuing]. Is going to determine what works best.

Mrs. HARSHBARGER. It absolutely does.

Mr. JOHNSON. So many on our—my fellow witnesses have said, it takes different approaches and different topographies. And so particularly the BEAD program, the implementation of the Bipartisan Infrastructure Law, needs to account for that. Not every valley—

Mrs. HARSHBARGER. Yes.

Mr. JOHNSON [continuing]. Is the same so—

Mrs. HARSHBARGER. No. I mean, East Tennessee is absolutely not like Chicago.

Mr. JOHNSON. Yes.

Mrs. HARSHBARGER. Are you kidding?

Mr. JOHNSON. And they all have to have broadband. Where we live, a lot of—a lot of kids do their homework in the McDonald's parking lot. It is not OK. It is not good. Back to my point, it is not

good for national security if a big part of our country doesn't have access to broadband.

Mrs. HARSHBARGER. I think he's tapping out. So with that, I yield back.

Mr. LATTA. The gentlelady's time has expired, and the gentlelady from Florida is recognized for 5 minutes.

Mrs. CAMMACK. Well, thank you, Mr. Chairman, and thank you to all our witnesses for appearing before the committee here today. I think it is pretty clear it is essential for us to lead as the United States on spectrum policy to remain competitive not just today but for tomorrow as well. And I am going to piggyback off of what my colleague from Tennessee was saying. So I represent North Florida, North Central Florida, the heart of the Sunshine State, and I also serve as a member of the House Ag Committee. So I am optimistic about the world that spectrum, both licensed and unlicensed, can play to support efficient production through precision agriculture. So I would like to direct this question to both Mr. Gillen and Mr. Assey.

Can you speak to some of the current cases of spectrum in the agricultural production and future potential benefits in the sector? I'll start with you.

Mr. GILLEN. Thank you. One of the things we are excited about, the impact this can have on farming. I think to the conversation we just had, there has to be connectivity first.

Mrs. CAMMACK. Yes.

Mr. GILLEN. That we can have the best solutions in the world. Until there is connectivity—we don't need that. So we need to make sure there is spectrum available. In terms of actually what is happening in precision agriculture, we see a new wave of innovators seeing what 5G can do. Some of the AI capabilities that the doctor spoke about a minute ago, that Trellis is one in Georgia that is helping farmers stay on their land, helping drive yield, increasing irrigation that helps—gives the sensors—give them the tools to actually do their job in real time. And so we are seeing some of this first wave of innovators.

You know, in 4G, we saw the sharing economy, app economy. We saw all those things happen on the 4G platform. 5G can do so much more in the enterprise space and to help businesses do their job. So we are just scratching the surface. But companies like Trellis give us a lot of encouragement we are on the right path.

Mrs. CAMMACK. Excellent.

Mr. ASSEY. Yes. I think it is an exciting area for innovation to kind of take hold. And it kind of goes to what I spoke in my testimony about the industry looking at not just getting broadband to the house but really creating the cloud around which you live. You know, we are going to use the BEAD program, and hopefully we're going to connect a lot of farmhouses. We're going to want to be able to go beyond that farmhouse to cover the fields and to help the farmers provide the information, the technology that they are going to need in the modern age.

And I think that there is no one solution. You know, 5G will be a solution in some places. Unlicensed spectrum can be used to extend connectivity out of doors. And the—and CBRS is a great ex-

ample of where we can bring more people into this ecosystem and allow them to develop the solutions that best meet their own needs.

Mrs. CAMMACK. So I know this has been kind of touched on a couple different ways. But I think just to make it concise and clear, why is it so important that NTIA remain the sole manager of Federal spectrum rather than separate, independent management of agency spectrum? And we'll start here and go down the line.

Mr. JOHNSON. I think what we saw in the C-band issue with deployment of 5G and FAA, the danger is that that plays out in every sector of the economy and therefore every regulator, every Federal agency. We all have, in—the further we get into the 5G era, the further we are going to be in an era where every sector has equities in spectrum. And we have to have coherent processes that determine how it's allocated. And once that process is finished, it needs to be finished.

Whether it is Federal with the NTIA or commercial with the FCC, we have to have processes that end, and then deployment can begin.

Mrs. CAMMACK. Absolutely.

Dr. GHOSH. So the U.S. is the only country in the world that even has two agencies that regulate spectrum, one for commercial and one for Federal. It is bad enough, right? And now if you take every agency that NTIA represents and if they were all going to have a separate voice, it is just not manageable. So we have to be able to have a cohesive picture to the world. It makes the U.S. look very indecisive if we are not able to resolve, you know, our own conflicts between spectrum domestically. So absolutely, it is absolutely essential that the NTIA is the only agency that represents the Federal interests. Thank you.

Mr. ASSEY. I don't think I can really add to that, but we have a lot of Federal users, and we need some way in the executive branch to coordinate the varying interests they have.

Mr. GILLEN. I agree with everything said. Just add the key to why it is important is certainty. If you are asking companies to spend billions of dollars on these assets, you need to know that what you actually bought, you are going to be able to use. And so having that one agency—or as Doctor correctly noted, we do have two, that we do—that in a way that creates certainty across the ecosystem for both agencies and the commercial sector.

Mrs. CAMMACK. Absolutely. Thank you for making that point crystal clear. And thank you again to the chairman. I yield back.

Mr. LATTA. Thank you. The gentlelady yields back, and the Chair recognizes the gentleman from California for 5 minutes.

Mr. OBERNOLTE. Thank you very much, Mr. Chairman.

Mr. Gillen, I would like to start with you. First of all, let me thank you for delivering your comments extemporaneously and not merely reading. I feel like when we are having a hearing like this, we do a much better job being evocative with each other if we don't merely just read to each other. I just want to let you know that we notice, and I appreciate it.

You showed, at the beginning of your testimony, a graphic that I thought was really compelling showing a 5 times increase in consumer demand for data by the year 2027. And that is a theme that has been echoed in the testimony that we have heard today. In

fact, I think Mr. Assey referenced consumers' endless demand for data, is the way you put it. And I think that is an important discussion to have because, as Congresswoman Clark mentioned when you and she were having a discussion, that really is what is driving the need for more commercial spectrum, which is kind of underpinning the theme of today's hearing.

But I want to ask you about that because I don't see how—why that should necessarily be true. If you look at the evolution of cellular data technology, we start with sending texts to each other. We—that grows to graphics when we had the bandwidth to do that. That grew to photographs. And then recently, video is commonplace, and we don't even think twice about viewing a video or a sports game on a phone.

But what I see in the generation after this is the explosion of technology is like AI. It is very exciting to me that hobbyists have succeeded in getting AI stacks similar to ChatGPT to run on cell phones. So that is going to be amazing. But that doesn't necessarily mean that we need more data bandwidth to the device. So to what do you attribute this fivefold increase in demand in the next couple of years?

Mr. GILLEN. Sure. A couple things, and it is a great question. The—part of it is—as you alluded to, we just use these devices more and more every day. So as the device has more speeds and capabilities, we just use them more in a way that we didn't 2 or 3 years ago and continuing. What we are seeing with 5G is the proliferation of devices. It is not just this we are talking about. It is a lot of the sensors and other things we have talked about today, that this is the proliferation of devices, the Internet of Things we all talk about. This is the connectivity. Some of the connectivity is going to be 5G. Some of the connectivity is going to be unlicensed but that we are going to see an explosion of demand as enterprises take advantage of this information and connectivity that it is just going to be more and more devices talking to the network, not necessarily each individual device using infinitely more.

Mr. OBERNOLTE. But just to play devil's advocate—

Mr. GILLEN. Sure.

Mr. OBERNOLTE [continuing]. We can only use one device at a time, so it is not like my refrigerator is going to watch the 49ers game, right? I'm watching it on my phone. I'm only doing it one—you know, I might switch to my iPad. I might switch to my computer. I might switch to my TV. But it is not clear to me that, you know, my refrigerator is going to have that same appetite for data.

Mr. GILLEN. Absolutely, and I think it is—we sort of talked about the precision agriculture example a little bit before. Those aren't using a lot of data, but those sensors are feeding data back in real time without our involvement at all. And so I think some of the things are the information—energy company using it to evaluate leaks in their system. There is going to be constant information flow coming, so absolutely. Us individually as individuals, it is all the things that we are going to be empowering with this technology that really drive that usage.

Mr. OBERNOLTE. All right. Continuing on that topic, Mr. Assey, you know, we have been using this rise in demand for data as a reason why we need to allocate more spectrum to commercial use.

However, at the same time, we are pursuing new technologies that make more efficient use of the spectrum that we already have, things like better spectrum sharing, beam-conforming technologies, larger phased or raised antennas, you know, that really potentially—especially in the 5G world have a potential to be game changers.

How much do you think of this increased demand those technologies can satisfy rather than needing more bandwidth?

Mr. ASSEY. I should probably defer to Dr. Ghosh on that.

Mr. OBERNOLTE. I'll allow you to.

Mr. ASSEY. But I just—I will make the one point, which is that, you know—and it doesn't matter whether you are a wired network or a wireless network. We are both kind of hybrids of the same. But it is going to be in our interest to be able to be able to push more data through the mediums that we have because the alternative is to have to basically devote more capital to expanding and expanding and expanding. So there is a real market incentive for us to try to be more efficient. And that is why, you know, cable's next generation of technology, 10G technology, is going to be even more efficient than the ones we have seen previously.

Mr. OBERNOLTE. Well, I think that this is a discussion that obviously we are going to continue to have. Let's look forward to taking the first step, which is to regain FCC authority to actually auction spectrum. And fingers crossed that the Senate—they will have another opportunity next week. John Dingell used to call them the Cave of Winds. I think they have an opportunity to prove him wrong. Let's hope they do it. I yield back.

Mr. BALDERSON [presiding]. Thank you. Well, next up, I'd like to recognize myself. It just so happened I came up to the chair, but it was my turn. Sorry, Mr. Pfluger. But thank you all for being here today.

And the question—my first question is for the doctor. Representative Kuster and I introduced a bill that would increase coordination between NTIA and FCC and require them to update their spectrum MOU regularly. I am glad our bill was approved earlier this week during our subcommittee markup, and I am hopeful this will help prevent future issues like we saw with C-band. I would like to start, and then also hear from other witnesses. Outside of regularly updating their MOU, do you have any recommendations, Doctor, on how the FCC/NTIA can improve coordination on its spectrum issues?

Dr. GHOSH. Thank you for that question. So I think one of the key points of debate that arise when you are talking about spectrum issues is the underlying technical reasons assumptions. As I mentioned in my testimony, centers like SpectrumX actually have joined MOUs with the NTIA and the FCC. So we actually convene both agencies together to really talk about what are the fundamental technical issues that need to be discussed.

I think more regulations like that should be encouraged along with more dialogue between the agencies directly. Involving the broader community can only help make these decisions proceed better.

Mr. BALDERSON. OK. Thank you, Doctor. Would anybody else on the panel like to add to that? Mr. Gillen?

Mr. GILLEN. I would really echo the doctor's comments. I think when you look—we want these folks to be our spectrum experts. They need the resources to do that. It is the ITS lab in Boulder. We need to empower these experts to be able to—one to make the calls and that everyone trusts that process. So it is critical that we have the underlying research and capabilities.

Mr. BALDERSON. Thank you. In your testimonies, many of you referred to the importance of spectrum pipeline and including the lower 3 gigahertz band in that pipeline. As you all know, and we have talked about it a little bit, the lower 3 is being used in Europe, China, and other countries across the globe for 5G, but it is not being used for the purpose in the United States.

Can any of the witnesses explain the benefits of the global harmonization of spectrum bands and why it is so important? Mr. Johnson?

Mr. JOHNSON. Yes, sir. It bears repeating, I think, that if the United States can serve that band, it—and it has—it has global scale, then U.S. companies and allied-based companies that have large presence in the United States can compete and win. If we are not in that band, then China and Huawei, etc., have the advantage. And it is just that simple.

Mr. BALDERSON. It is. Agree. Doctor, would you like to—

Dr. GHOSH. Yes. So I think it is important to realize that economy scale are really important. And not being in that band, I would—I would modify that statement a bit. I think pretty much all 5G technology that is being developed in the U.S. is actually capable of operating in that band. They don't because we don't have the license to do that. And I would reiterate that, actually, if we can even develop ways of sharing in that band, that puts the U.S. ahead. None of these other countries really have developed the sharing capabilities and expertise that the U.S. has. And we should leverage that more, whether it is in the lower 3 or in other bands to expand our capabilities.

Mr. BALDERSON. OK. Mr. Assey, would you like to add anything?

Mr. ASSEY. Yes. No, I would agree with that. I mean, we have challenges in that band from a governmental sense that other nations may not. So we have to work through them. But the most important thing is, can we focus on ways that we can make commercial spectrum available? And can we develop these types of sharing win-win solutions that will allow us to open the band up sooner rather than waiting to do it later?

Mr. BALDERSON. OK. Mr. Gillen, please?

Mr. GILLEN. It is a large block of spectrum. There is a lot of opportunities to both meet DoD's needs and meet the commercial needs, and that when we look—we need spectrum that, from a security reliability standpoint, is preemptable. A lot of the complex sharing we are doing today, Federal Government takes precedent and commercial sector can't use it. So if we want spectrum, we want to invest \$35 billion a year in, we need to know we are going to be able to use it. And I think these experiments are really important for us going forward. But we also have to recognize the full power, nonpreemptable spectrum, is key to do a lot of things we wanted to do too.

Mr. BALDERSON. OK. Thank you all very much. I am going to stop right there and yield myself back.

Next up, the gentleman from Texas, Mr. Pfluger.

Mr. PFLUGER. Thank you, Mr. Chairman, for saving the best for last. And I appreciate all of your testimony and your written testimony. I will apologize right now, Mr. Johnson, Dr. Ghosh. A lot of the questions that I was intending to ask you I think have already been asked. And so I am going to focus a little bit—little bit differently. And let me just ask, for the two of you in the associations, that 3.1 to 3.7 gig range—former Air Force pilot, spent a lot of time with spectrum, understand, you know, the dual use, the commercial versus the military very well. What are we competing against in the DoD side there that is—I don't want to get stuck on this one but—

Mr. GILLEN. In terms of what the military is—

Mr. PFLUGER. Yes.

Mr. GILLEN [continuing]. Looking for? It is largely a radar band, both ground and air. So you have—AWACS is a big user of that. And that is one of those—when you talk about a system that is ripe for advancement and innovation, it is—

Mr. PFLUGER. Yes.

Mr. GILLEN [continuing]. One of those that we think—the win-win situations come, is that we can get Wedgetail, use Wedgetail to use different spectrum than they are using today, that we have some more opportunities to open it up. But at its core, 3.1 to 3.7 has been a radar band.

Mr. PFLUGER. It is largely AI.

Mr. GILLEN. Yes.

Mr. PFLUGER. Yes. And you think that with the Wedgetail and with some of the other innovations—I mean, is there an opportunity to share it?

Mr. GILLEN. There is absolutely options to share. I think there is geographic sharing.

Mr. PFLUGER. Yes.

Mr. GILLEN. There is more complex sharing that there—that we have heard about as well.

Mr. PFLUGER. OK.

Mr. GILLEN. I think it really comes down to—and what we find this committee is really helpful at is, system by system, engineer to engineer, what is the right solution? Some may retune. Some move. Some stay the same.

Mr. PFLUGER. Very quickly, because I want to jump to another one.

Mr. ASSEY. And I was just going to say—and this is exactly what engineers like Dr. Ghosh are trying to sift through, through that—process.

Mr. PFLUGER. OK. It sounds like, from what I have heard and what I have read in your testimonies today, that there is kind of an all-of-the above approach. You know, there is an auction that's needed. There is, you know, other approaches, licensed and unlicensed. And I will just say, look, we spent billions of dollars the last couple years. And in an area like mine where we are truly a national security area, we produce the most energy out of any geographic region in the entire country.

We have a tremendous amount of agriculture. But the density of population is very, very low. And I find myself driving through my own district, going “What happened?” You know? And so how do we—you know, how do we get to the point where we actually do compete with China, where we are actually doing what we said we were going to do and provide that coverage to that last mile? This is 1930 with a lack of electricity in those farmhouses. I mean, how do we do it, because I’m worried about it.

Mr. GILLEN. Exactly right. I think part of it is spectrum. But as the panel has talked about, it gets down to infrastructure, and the cost in rural areas can be prohibitive. And so what is the role of government? The BEAD program is part of it. Right now, that is only going to be fiber. So it is not going to fix wireless or mobile wireless. The FCC promised a 5G fund in 2011, I believe. We still haven’t gotten money dedicated to building out wireless in those really expensive areas. So it—really going to take a partnership between government and industry to really reach all of those Americans while we continue to push forward.

Mr. PFLUGER. Because a lot of the—you know, we hear, “Well, this is for rural broadband, and this money was for rural broadband.” And I’m like, “I live in a rural area. Where is my broadband?”

Mr. ASSEY. Yes. No, I think it is a great point. And the BEAD program provides us with a great opportunity. There is a lot of capital out there, but as you say, you know, we have kind of heard this before in the sense that money that is going to rural America never gets to rural America. And it is one of the reasons I think we have to stay laser focused on making sure that the capital that the Government has provided is actually dedicated to those unserved and underserved areas that have been so long without infrastructure and where the economics to serve are so hard.

Mr. PFLUGER. So am I to understand that the—the money has not been appropriated for those areas like Highway 158 between Garden City and Midland?

Mr. ASSEY. The program has—we have allocated the money, and we are in the process currently. The Department of Commerce is about to allocate that money further among the States. And then it will be up to the States to distribute those funds pursuant to the rules that the Department of Commerce has set. And, you know, I think Congress showed great leadership when it passed that legislation to make sure when we say “unserved and underserved America,” we mean it.

Mr. PFLUGER. Well, thank you for that. And, you know, obviously this is a very—I believe a lot of what has been said today, we have to compete. We have to do it well, even in areas that may be more difficult and are not quite as economic to the companies that you represent. We still have to provide the coverage there, because they are actually providing something that is in the public interest, and that is energy and food. And we want people to move to those areas. And without coverage, many of the families don’t do it because their kids can’t learn, you know, in the school settings or their spouses can’t work. They are remote. So I am very worried about that.

I appreciate you all being there and going through the end. I think we are starting a second round of questions here shortly. I yield back, Chair.

Mr. BALDERSON. Thank you, Mr. Pfluger, for your humor also. All Members have been recognized. Seeing there are no further Members wishing to be recognized, I would like to thank all of the witnesses today for being here. Promise you don't have another round of questioning.

I ask unanimous consent to insert the record the documents included on the staff hearing document list. Without objection, that will be the order. Without objection, so ordered.

[The information appears at the conclusion of the hearing.]

Mr. BALDERSON. Pursuant to committee rules, I remind Members that they have 10 business days to submit questions for the record and ask the witnesses to respond to the questions promptly. Members should submit their questions by the close of business on March 24th.

Without objection, the subcommittee is adjourned.

[Whereupon, at 11:54 a.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

November 17, 2022

The Honorable Jessica Rosenworcel
Chairwoman
Federal Communications Commission
45 L Street, NE
Washington, D.C. 20230

The Honorable Alan Davidson
Assistant Secretary and Administrator
National Telecommunications and Information Administration
1401 Constitution Avenue, NW
Washington, D.C. 20230

Dear Chairwoman Rosenworcel and Administrator Davidson,

Wireless spectrum is essential to America's future technology leadership, industrial might, and global competitiveness. That's why a remarkably broad swath of companies and organizations – representing manufacturing, automotive, agriculture, energy, retail, commercial real estate, communications, media, and supply chain industries, as well as schools, libraries, and civil society groups – support an inclusive approach to spectrum policy. America needs a balanced policy that considers the needs of an extraordinarily diverse range of spectrum stakeholders who are investing in advanced networks to power the "5G economy".

As we consider new spectrum options that can be made available to serve the American people, we urge you to build on the demonstrated success of the Citizens Broadband Radio Service (CBRS) spectrum sharing model. The innovative CBRS licensing framework has driven innovation in the next generation of wireless networks. These networks advance investment, protect critical U.S. leadership and security by enabling ongoing Department of Defense (DoD) and Federal missions in shared bands, drive innovation and competition, and maximize efficient use of the limited yet essential spectrum resource. Every day, more devices, services, and organizations require access to a wider array of spectrum resources. Implementing approaches that promote a wide variety of advanced communications applications will powerfully advance the public good.

Spectrum Sharing Advances Investment

The Federal Communications Commission (FCC) first authorized commercial equipment in the CBRS band just three years ago and completed its auction of shared licenses just two years ago. In that short timeframe, CBRS is now being used throughout the country with over 285,000 CBRS base station devices (CBSDs) already deployed in under three years. For comparison, the commercial wireless industry has built 418,887 cell sites *over its entire 40-year history*. (During the same three-year period that CBRS has been active, cellular providers built 69,543 [cell sites](#) – of which more than [10,000 use CBRS](#).) As further evidence of a dynamic equipment ecosystem, the FCC has certified 187 different CBRS base station models and 496 different end user client devices, ranging from traditional smartphones and IoT modules and gateways to security cameras, barcode scanners, and building management sensors. Use of the CBRS band is vibrant and growing at an impressive pace.

Spectrum Sharing Drives Innovation

The CBRS framework provides users with flexibility to choose from the broadest range of technologies and service models, driving innovation and competition in the private wireless market. Because CBRS spectrum is accessible to a wide variety of operators, it provides options for operators in suburban, rural and remote areas

that are not adequately served by traditional carriers, while also enabling private network users to customize networks to meet their needs.

CBRS is emerging as the home spectrum band for a myriad of advanced wireless use cases. For example:

- CBRS-powered networks are improving the efficiency of supply chains, warehouses, and critical seaports.
- CBRS is enabling advanced manufacturing techniques that enhance worker productivity and safety, helping American firms maintain their competitive edge.
- Farms are using CBRS to increase efficiency, yields, and cost savings.
- Transportation and shipping hubs are using private networks to support automated-guided vehicles moving cargo and to improve real-time logistics through faster wireless communications.
- Schools and libraries are using CBRS to close the digital divide and homework gap for underserved communities.
- Hospitals are using CBRS to triage and monitor patients, including by connecting outdoor hotspots to indoor networks, so nurses can test and triage patients outside the hospital setting.
- Airports, entertainment venues, and stadiums are using private CBRS networks to improve the guest experience by providing additional and dedicated bandwidth for venue operations.

These and many other use cases demonstrate that CBRS networks – along with complementary technologies like industrial automation, artificial intelligence, precision agriculture, and edge computing providers – are essential to enabling an enterprise technology stack that propels American innovation and advanced industrial practices.

Spectrum Sharing Spurs Competition

CBRS enables “converged” delivery models that both compete with and bolster traditional wireless network services provided over exclusively licensed spectrum. It is also proving complementary to Wi-Fi. No single private entity or industry should hold the key to an enterprise, university, or other entity’s ability to access the public airwaves needed to deploy an innovative, purpose-built network. The CBRS framework helps ensure that does not happen. This competition drives still more innovation, creating a virtuous cycle.

Spectrum Sharing Maximizes Efficiency of a Limited Resource

CBRS uniquely combines auctioned and non-auctioned authorizations into a single frequency band, maximizing the scale of the equipment ecosystem to the benefit of many different types of users. The FCC conceived of the CBRS shared-license model to allow the DoD to avoid band clearing (and its associated costs) and continue its critical operations while also allowing a wide variety of commercial operators to use spectrum in the same band. This tiered spectrum sharing model ensures the protection of America’s national security interests while allowing other users to make the most of a critical resource.

Both the auctioned (Priority Access License, or PAL) and non-auctioned or licensed-by-rule (General Authorized Access, or GAA) portions of the CBRS bands have demonstrated substantial success. The PAL auction resulted in 228 diverse winning bidders – almost *10 times the number of winning bidders in the exclusive-use 3.45 GHz band*. PAL winners included wireless internet service providers and electric utilities, cable operators, and

nationwide and regional mobile network operators. The GAA portion of the band hosts nearly 900 different [users](#), including factories, cities, school districts, hospitals, research centers, schools, public libraries, utilities, and other critical infrastructure. Most importantly, unused PAL spectrum does not lie fallow, and can be efficiently put to use by GAA spectrum users.

That all of these different user types can “cohabitate” in a single spectrum band is an achievement to be celebrated and replicated. At the same time, as new technologies and techniques become available to make the CBRS automated dynamic sharing regime even more efficient, it provides a framework for iterative improvement over time.

Spectrum Sharing Is Internationally Recognized

CBRS has become a model for spectrum sharing around the world. Recognizing the value of midband private 5G networks, other countries are also working to make spectrum available in new ways for new users and uses. For example, Germany, France, the United Kingdom, Japan, Brazil, Sweden, and other countries have all designated substantial amounts of shared midband spectrum for private and local networks.

- In [Germany](#), the [Frankfurt Airport](#) is working toward deploying a private 5G network to “control data and voice communication autonomously.”
- In Japan, [Sony](#) is working to deploy internet service that will minimize “service disruptions caused by heavy traffic” in certain residential complexes.
- In the U.K., [Verizon](#) is using shared midband spectrum to develop a private 5G wireless network for the Associated British Ports.
- In Europe, [CEPT](#) is studying CBRS-like dynamic sharing of low/medium power networks with satellite systems in the 3.8-4.2 GHz band.

With CBRS, the United States has shown the world that spectrum can be made available without requiring inefficient allocations for a wide variety of different uses. In light of other countries’ moves toward greater spectrum sharing, the United States should extend its leadership by nurturing and growing CBRS.

Conclusion

The undersigned parties believe that the CBRS allocation has fulfilled its promise as the “innovation band” in an incredibly short period of time. The framework should be advanced for future spectrum allocations, including in the lower 3 GHz band, to enable greater competition, innovation, efficiency and American leadership. Thank you for continuing to support a spectrum policy that demonstrates America’s inventive spirit at its finest.

Sincerely,

Airspan Networks
American Library Association
Celona Inc.
Comcast Corporation
Deere & Company

Amazon.com Services LLC
CalChip Connect
Charter Communications, Inc.
Cox Communications, Inc.
Dynamic Spectrum Alliance

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Federated Wireless	Hewlett Packard Enterprise Company (HPE)
HRMavenir Systems, Inc.	JBG SMITH Properties
Midcontinent Communications	Motorola Solutions, Inc.
NCTA – The Internet & Television Association	Open Technology Institute at New America
Pollen Mobile LLC	Public Knowledge
Purdue Research Foundation	Shure Incorporated
The Schools, Health & Libraries Broadband Coalition (SHLB)	US Ignite
Weavix	WISPA – Broadband Without Boundaries

CC: The Honorable Brendan Carr, Commissioner, Federal Communications Commission
The Honorable Geoffrey Starks, Commissioner, Federal Communications Commission
The Honorable Nathan Simington, Commissioner, Federal Communications Commission

SPECTRUM SHARING IS DRIVING INNOVATION IN INDUSTRY AND MANUFACTURING



Industrial and manufacturing environments have unique needs that can be well-served by private 5G networks. CBRS spectrum provides flexibility for private networks to use licensed shared spectrum (Priority Access Licenses), opportunistic use spectrum (General Authorized Access), or a combination of both – without the enormous and prohibitively expensive costs required by traditional carriers attempting to recoup the expense of exclusive spectrum and proprietary solutions.

CBRS-powered private 5G networks offer advanced features to industrial operators, including: the ability to customize their network's security protocols, data capabilities, capacity, and Quality of Service for different users and devices.



ADVANCED MANUFACTURING

JOHN DEERE USES CBRS IN ITS FACTORIES TO:

- ▶ Analyze data on welding patterns to train an algorithm on the best welds for future fabrications
- ▶ Measure torque using sensors on handheld power drills to ensure bolts are optimally tightened
- ▶ Enable private LTE networks that will allow for more flexible, nimble and connected facilities, transforming the manufacturing process with a safer, more efficient workspace
- ▶ Develop predictive maintenance services using the collected sound and vibration data from machines and applying AI algorithms
- ▶ Track equipment location and utilization throughout the factory to make operations more efficient
- ▶ Implement 5G technologies to turn its factories into smart and connected manufacturing facilities



WAREHOUSING AND LOGISTICS

THE UNITED STATES MARINE CORPS USES 5G IN SUPPORT OF THEIR SMART WAREHOUSE TO:

- ▶ Improve supply receipt, storage, issuance, auditability, and inventory control
- ▶ Support augmented reality, virtual reality, and holographic warehouse applications
- ▶ Meet U.S. Military security and privacy requirements
- ▶ Foster robotic/automated functions in the warehouse



WORKER SAFETY

A FURNITURE FACTORY IN MICHIGAN USES A PRIVATE WIRELESS NETWORK – POWERED BY CBRS – TO:

- ▶ Monitor and track employee compliance with safety protocols, including confirming that workers are wearing safety gear (i.e. goggles, gloves, headwear, etc.) and automatically shutting off machinery if they are not
- ▶ Detect abnormal behavior in close proximity to machinery
- ▶ Enforce COVID-19 safety protocols, such as social



TRANSPORTATION AND SHIPPING HUBS

TRANSPORTATION AND SHIPPING HUBS – SUCH AS THE PORT OF LONG BEACH –
USE PRIVATE WIRELESS TO:

- ▶ Support automated guided vehicles moving cargo without a human driver
- ▶ Improve real-time logistics through faster and rich wireless communications services, such as push-to-talk/video
- ▶ Monitor inventory in real time using CBRS-enabled wireless sensors
- ▶ Track and route equipment, vehicles, and cargo to improve speeds and workplace safety



SMART CITIES PURDUE RESEARCH FOUNDATION'S "DISCOVERY PARK" IS BUILDING A CBRS-POWERED NETWORK TO:

- ▶ Provide dedicated wireless connectivity to manufacturers, researchers, businesses, retailers, and residents across a 400-acre parcel of land on Purdue University's campus
- ▶ Experiment with next-generation smart city technologies, such as smart sensors and AI-based applications
- ▶ Support other 5G use cases that require network slicing, such as semiconductor fabrication, health care, and aviation



AGRICULTURE TRILOGY'S RURAL CLOUD INITIATIVE IS USING CBRS TO POWER IOT DEVICES THAT:

- ▶ Support digital sensors that monitor temperature and soil moisture in greenhouses to improve crop yield
- ▶ Improve herbicide usage by identifying weeds in fields with a drone-mounted camera
- ▶ Track crop growth and monitor inventory to identify efficiencies and reduce costs



EDUCATION

SCHOOLS AND LIBRARIES – LIKE SALT LAKE CITY'S MURRAY CITY SCHOOL DISTRICT – ARE IMPLEMENTING PRIVATE CBRS NETWORKS TO:

- ▶ Close the "homework gap" by providing internet to students at home
- ▶ Improve school safety with wireless cameras, sensors, alarms, emergency phones, and more
- ▶ Support the implementation of new technology in classrooms, such as AR/VR, smart boards, and video streaming



HEALTH CARE

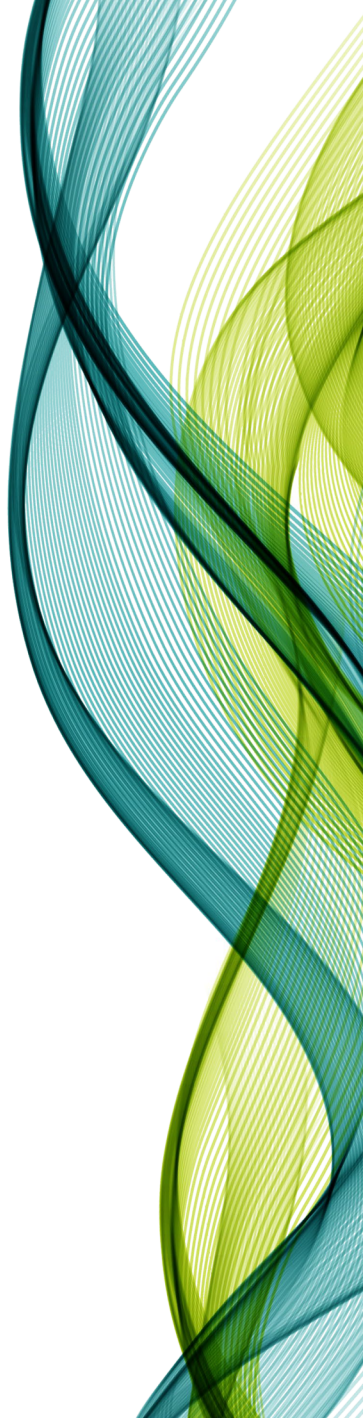
MEMORIAL HEALTH SYSTEM CLINIC IN SPRINGFIELD, ILLINOIS LAUNCHED A PRIVATE 5G NETWORK TO:

- ▶ Provide connectivity to a makeshift triage tent during the peak of the COVID-19 pandemic
- ▶ Track mobile diagnostic equipment, surgery tools, and other medical equipment throughout the hospital complex
- ▶ Provide a dedicated channel for critical communication between doctors, nurses, and other hospital staff

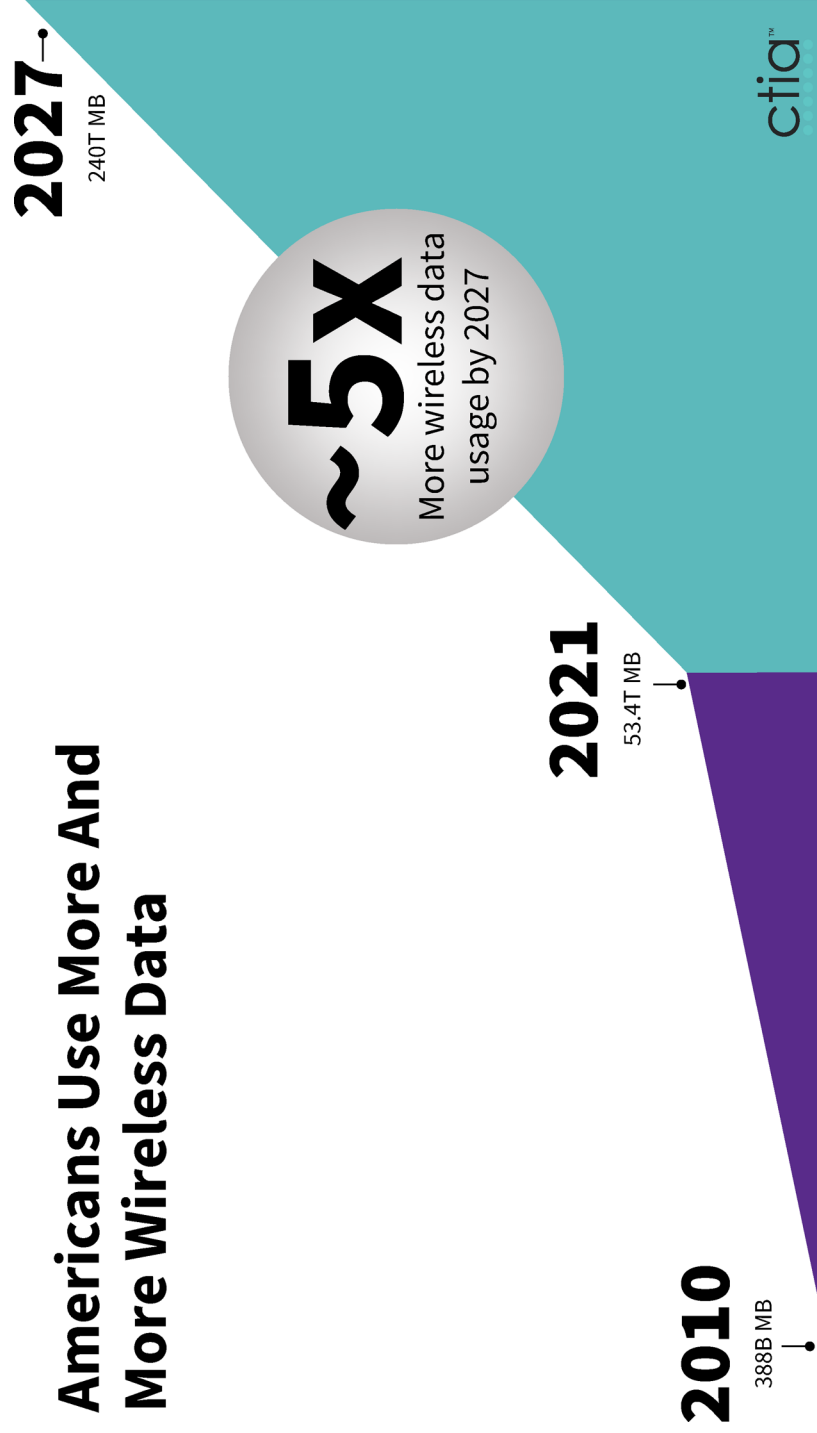


Defending America's Wireless Leadership

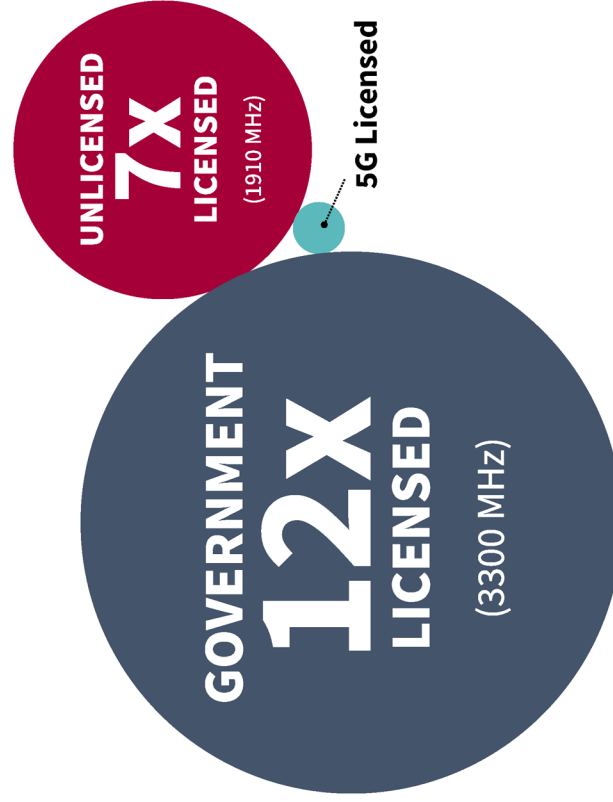
March 2023



Americans Use More And More Wireless Data

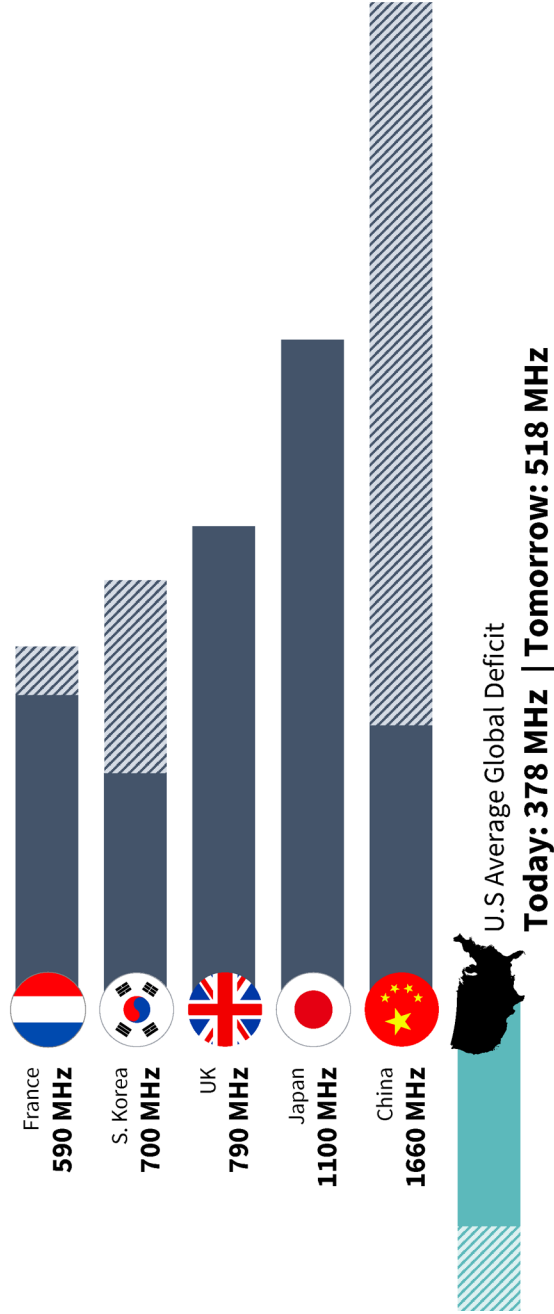


U.S. Mid-band Access Is Out Of Balance



5G Licensed

Global Rivals Have Access to More 5G Spectrum





March 10, 2023

The Honorable Cathy McMorris Rodgers
Chair, House Committee on Energy and
Commerce

The Honorable Frank Pallone
Ranking Member, House Committee on
Energy and Commerce

The Honorable Bob Latta
Chair, House Subcommittee on
Communications and Technology

The Honorable Doris Matsui
Ranking Member, House Subcommittee on
Communications and Technology

On behalf of the Public Safety Next Generation 9-1-1 Coalition, we thank you for your strong and sustained support for federal Next Generation 9-1-1 (NG9-1-1) funding legislation. As you consider the national security implications of spectrum policy at today's hearing entitled "Defending America's Wireless Leadership," we respectfully highlight the corresponding national security imperative of NG9-1-1.

The NG9-1-1 legislation you've developed in collaboration with the public safety community would provide the funding needed to deploy NG9-1-1 in a fully interoperable, comprehensive, secure, innovative, and reliable manner throughout urban and rural areas, ensuring no community is left behind.

As you know, we were grateful that last year the NG9-1-1 legislation was included as part of the Spectrum Innovation Act, a bill that received strong bipartisan and bicameral support that would have directed the revenue from spectrum auctions managed by the Federal Communications Commission to fund NG9-1-1 implementation.

Federal support for NG9-1-1 remains an urgent need. The cyberthreats are outpacing our public safety agencies' defenses. Every day that passes means 9-1-1 professionals and emergency responders lack the advanced communications tools and cybersecurity resources they need to best protect life and property. NG9-1-1 will begin saving lives in our communities the moment it is deployed.

Achieving NG9-1-1 as soon as possible is a national security imperative, for the following reasons:

1. Enhanced Response to Disasters and National-level Threats

During natural disasters or terrorist attacks, time is of the essence and critical decisions need to be made with the best information available. The current 9-1-1 system is limited to voice calls and basic text messages, preventing citizens from sharing multimedia content and other information that could provide real-time actionable intelligence to emergency responders. Upgrading 9-1-1 systems to allow for the exchange of data, photos, and videos will provide local, state, and national officials with improved situational awareness, resulting in faster and more effective responses and better outcomes for the public and first responders.



2. Protection Against Cyberattacks, Including State-Sponsored Attacks

The current 9-1-1 system already suffers cyberattacks, which disrupt emergency response capabilities and put lives at risk. In most cases, a single 9-1-1 emergency communications center serves numerous responding agencies. Thus, an attack on a 9-1-1 center has a cascading effect on multiple emergency response chains, making it a prime target for cybercriminals and state-sponsored attacks. NG9-1-1 requires a modern cybersecurity architecture that provides end-to-end IP-based intrusion detection and prevention capabilities. Federal funding is needed to implement this upgrade on a national scale and ensure that emergency services are available when they are needed most.

3. Support for National Defense Efforts

The 9-1-1 system is an important part of the nation's defense infrastructure. In the event of a national emergency or attack, the first line of defense is 9-1-1. Multiple civilian and defense agencies and departments would be involved in the response effort. The capabilities of a fully implemented NG9-1-1 network would be vital to improving coordination and ensuring clear, secure, and resilient communications capabilities for national security and defense.

We look forward to continuing to work with you and the committee to finish the job and enact this needed legislation.

Respectfully,

Mel Maier
Spokesman
Public Safety Next Generation 9-1-1 Coalition

DORIS O. MATSUI
8th DISTRICT, CALIFORNIA
COMMITTEE ON ENERGY
AND COMMERCE
SMITHSONIAN INSTITUTION,
BOARD OF REGENTS

Congress of the United States
House of Representatives
Washington, DC 20515-0506

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<http://matsui.house.gov>

January 8, 2021

The Honorable Joseph R. Biden, Jr.,
President-elect 1401 Constitution Avenue, N.W.
Washington, D.C. 20230

Dear President-elect Biden,

The global wireless communications marketplace has reached a pivotal moment: 5G, Wi-Fi 6, and satellite broadband are in the early stages of deployment and have the potential to create significant economic opportunities for American workers. For the United States to maintain its global leadership in these technologies, the federal government must have a national spectrum strategy that is consistent, concerted, and effective. As Vice Chair of the Energy and Commerce Subcommittee on Communications and Technology and a Co-Chair of the Congressional Spectrum Caucus, I believe it is imperative that your Administration's strategy include a unified approach to spectrum policy and a clearly articulated process for resolving interagency disputes.

Over the past four years, significant conflicts between federal agencies have caused costly delays in making needed spectrum available for commercial use while also creating severe uncertainty for both federal and non-federal users. These frequent, public conflicts encouraged a combative rather than collaborative posture among federal agencies and often necessitated congressional intervention. This spectrum management approach is untenable. Non-federal users deserve the certainty needed for long-term strategic investments and, as federal stewards, agencies deserve the requisite resources to fulfil their mandates.

As demand for spectrum increases, more intensive use of federal spectrum will be necessary. This will require new coexistence and sharing techniques that have the potential to cause friction between federal agencies and non-federal users. When these conflicts arise, it will be important that all federal agencies involved are aware of Administration policy and understand how to provide feedback in a constructive manner. A well-defined collaborative process will help prevent individual agencies from pursuing policies that benefit themselves alone or that come at the expense of other federal users.

To that end, the 2012 report from the President's Council of Advisors on Science and Technology entitled *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth* recommended that any framework for dispute resolution should be dependable, timely, and efficient. While this recommendation was intended for interference disputes, the features outlined in the framework could also be applied to allocation decisions. I

encourage you to incorporate these three principles when implementing your Administration's dispute resolution process.

A unified Administration spectrum policy will also be valuable when there are disagreements between federal and non-federal stakeholders, subject to the oversight of the National Telecommunications and Information Administration (NTIA) and the Federal Communications Commission (FCC), respectively. NTIA's role as manager of the federal government's use of spectrum is vital and should be respected and supported. This role allows NTIA to effectively represent federal interests before the FCC and also ensures that the FCC is not forced to interpret divergent messages from individual federal agencies. The relationship between the two agencies is critical and may benefit from a reevaluation of the existing Memorandum of Understanding to determine whether updates are or are not needed to ensure a transparent, consultative process.

For the United States to remain a global leader in wireless communications technology, the federal government must be a driving force in spectrum policy. For that to occur, coordination, collaboration, and consistency are necessary. As Congress works with your Administration to Build Back Better, I believe a unified approach to spectrum management will support innovation and economic growth. I appreciate your consideration of this request and look forward to working with you on this important issue.

Sincerely,



Doris Matsui
Member of Congress



NATIONAL ASSOCIATION OF STATE 911 ADMINISTRATORS

March 8, 2023

The Honorable Cathy McMorris Rodgers
Chair, House Committee on
Energy and Commerce

The Honorable Bob Latta
Chair, House Subcommittee on
Communications and Technology

The Honorable Frank Pallone
Ranking Member, House Committee
on Energy and Commerce

The Honorable Doris Matsui
Ranking Member, House on
Subcommittee on Communications
and Technology

On behalf of the National Association of State 911 Administrators (NASNA), we are reaching out to you about your upcoming hearing on March 10, 2023; "Defending America's Wireless Leadership." NASNA appreciates the importance of establishing effective spectrum policies and the relationship of those policies to national security. However, we believe ensuring effective emergency response systems for our citizens is equally important to our nation's security and safety. Fortunately, the two are not mutually exclusive.

Last year, Congress considered legislation as part of the Omnibus bill that would have advanced both of these important goals. It would have extended the FCC's auction authority and established a spectrum pipeline to promote continued U.S. leadership in wireless communications, while also using the proceeds from spectrum auctions to provide funding for Next Generation 911 (NG911) for US states, tribal nations, and territories. We strongly supported that legislative framework late last year, and we urge Congress to consider it this year.

Our nation's 911 systems are vital to our citizens, visitors, and our nation's infrastructure. Each and every day, people across the country depend on our 911 systems to get the help they need. However, most of our 911 systems today rely on outdated technologies that can't meet the requirements of today's digital communications systems. As NASNA members work to maintain the present legacy 911 systems while working our way to NG911, we see the legacy systems failing at an increasing rate, which places our citizens and our nation's security at risk. Nationwide implementation of NG911 must be considered a national priority. Enactment of the legislative framework considered last December would ensure that it is.

As your Committee considers spectrum policies in the current Congress, we urge you to please include provisions that would use spectrum auctions to fund NG911. Federal funding is needed to ensure that all citizens across the country have access to effective, reliable, and secure emergency response systems. A failure to address this critical issue puts our nation at risk.

Respectfully,

A handwritten signature in dark ink, appearing to read "Harriet Rennie-Brown", written in a cursive style.

Harriet Rennie-Brown
Executive Director, NASNA

Cc: House Subcommittee on Communications and Technology

Industry Council for Emergency Response Technologies, Inc.

March 8, 2023

The Honorable Cathy McMorris Rodgers
Chair, House Committee on Energy and
Commerce

The Honorable Frank Pallone
Ranking Member, House Committee on
Energy and Commerce

The Honorable Bob Latta
Chair, House Subcommittee on
Communications and Technology

The Honorable Doris Matsui
Ranking Member, House Subcommittee on
Communications and Technology

On behalf of the Industry Council for Emergency Response Technologies (iCERT), I write to you in reference to the House Communications and Technology Subcommittee hearing scheduled for March 10, 2023: “Defending America’s Wireless Leadership.” iCERT agrees with the Committee Chair that commercial spectrum policy is national security policy. Wireless innovation has always been a significant driver in the development of advanced communications systems to promote national security. Providing a spectrum pipeline for the future is a necessary and critical step in ensuring that U.S. global leadership in this area continues.

Enabling continued wireless innovation, however, is not the only way that effective spectrum policies can promote national security. By extending the FCC’s authority to auction spectrum licenses, Congress can use auction proceeds to advance other critical national security objectives. One such objective was included in the Spectrum Innovation Act of 2022 (H.R. 7624), which passed the House last year on a strong bipartisan basis. That legislation would have funded the nationwide implementation of Next Generation 911 (NG911) to ensure our nation’s emergency response systems are effective, reliable, and protected against cyber threats.

While H.R. 7624 was not considered by the Senate, comparable provisions were considered as part of a draft “four corners agreement” to be included in the Omnibus spending bill last December. Those provisions would have established a sound spectrum policy framework to secure our nation’s wireless future, while also funding NG911 and other priorities. iCERT strongly supported that legislative framework and was disappointed it was not ultimately included in the Omnibus bill which passed. We continue to believe these provisions warrant strong support again as the Energy and Commerce Committee considers spectrum policy in the current Congress.

Our nation’s 911 systems are critical parts of our national security infrastructure. Their effective and reliable operations are a national imperative. Unfortunately, most of our 911 systems today rely on outdated technologies that are increasingly failing and susceptible to cyber-based attacks.

Put simply, they place our citizens, our communities, and our nation at risk. Prompt attention to this critical issue is necessary to ensure our nation is safe and secure. Nationwide implementation of NG911 must be a national priority, and we urge Congress to fully fund its deployment.

Respectfully,

A handwritten signature in black ink, appearing to read "G. Kelemen", written on a light-colored rectangular background.

George Kelemen
Executive Director

NENA The 9-1-1 Association

1700 Diagonal Road | Suite 500 | Alexandria, VA 22314

March 8, 2023

The Honorable Cathy McMorris Rodgers
Chair, House Committee on Energy and
Commerce

The Honorable Bob Latta
Chair, House Subcommittee on
Communications and Technology

The Honorable Frank Pallone
Ranking Member, House Committee on
Energy and Commerce

The Honorable Doris Matsui
Ranking Member, House Subcommittee on
Communications and Technology

On behalf of the National Emergency Number Association (NENA), I write in reference to your upcoming hearing on March 10, 2023; "Defending America's Wireless Leadership." NENA has long appreciated the importance of establishing effective spectrum policies and the relationship of those policies to national security. However, we believe ensuring effective emergency response systems for our citizens is equally, if not more, important to our nation's security. Thankfully, ensuring a reliable and secure communications network and improving public safety, can be accomplished together.

Last year, Congress considered legislation as part of the Omnibus bill that would have advanced both of these important goals. It would have extended the FCC's auction authority and established a spectrum pipeline to promote continued U.S. leadership in wireless, while also using the proceeds from spectrum auctions to provide funding for Next Generation 9-1-1. We strongly supported that legislative framework last year, and we urge Congress to consider it this year. This agreement had bipartisan support in both houses of Congress.

We understand and appreciate that the upcoming hearing is singularly focused on spectrum policies, including extension of the FCC's auction authority, and not on how proceeds from the auctions would be used. However, due to the importance of funding for Next Generation 9-1-1 systems, we are asking for your vocal support in your opening statement for auction revenue to support public safety and funding for Next Generation 9-1-1 – "public spectrum for public safety."

Our nation's 9-1-1 systems are vital to our communities. Each and every day, our citizens depend on these critical systems to get the help they need. Unfortunately, most of our 9-1-1 systems today rely on outdated technologies that can't meet the requirements of today's communications systems. Moreover, these systems are failing at an increasing rate, which places our citizens and our nation at risk. Nationwide implementation of Next Generation 9-1-1 must be considered a national priority. Enactment of the legislative framework considered last December would ensure that it is.

NENA
The **9-1-1** Association

1700 Diagonal Road | Suite 500 | Alexandria, VA 22314

As your Committee considers spectrum policies in the current Congress, we urge you to include provisions that would use spectrum auctions to fund Next Generation 9-1-1. Federal funding is needed to ensure that all citizens across the country have access to effective, reliable, and secure emergency response systems. A failure to address this critical issue puts our nation at risk.

Respectfully,



Brian Fontes
Chief Executive Officer
National Emergency Number Association



March 10, 2023

The Honorable Bob Latta
Chairman
Committee on Energy & Commerce
Subcommittee on Communications &
Technology
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Doris Matsui
Ranking Member
Committee on Energy & Commerce
Subcommittee on Communications &
Technology
U.S. House of Representatives
2322 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Latta and Ranking Member Matsui:

Competitive Carriers Association (“CCA”) respectfully submits this Letter for the Record for today’s Energy and Commerce Subcommittee on Communications and Technology’s hearing “Defending America’s Wireless Leadership.” CCA is the leading trade association for competitive wireless carriers, and represents carrier members ranging from small, rural providers serving fewer than 5,000 customers to regional and nationwide providers serving millions of customers, as well as vendors and suppliers that provide products and services throughout the wireless communications ecosystem. Spectrum is the lifeblood of wireless networks, and access to spectrum is fundamental for advancing ubiquitous connectivity and U.S. competitiveness regardless of where Americans live, work, or travel. Today’s hearing comes on the heels of the Federal Communication Commission’s (FCC) spectrum auction authority expiring for the first time in three decades. Continued U.S. leadership in the wireless industry and ongoing efforts to expand ubiquitous wireless connectivity depend on swift action from Congress to reinstate auction authority as rapidly as possible.

CCA appreciates the Subcommittee’s historic leadership and commitment to wireless issues, which has spurred innovation, connectivity, and opportunity in the United States. Spectrum access is vitally important for continued operations and growth for all carriers, including CCA’s members. Equitable and reasonable opportunities to access spectrum are a cornerstone of achieving ubiquitous connectivity. Congress, and especially this Committee, can advance ubiquitous connectivity and U.S. global competitiveness through proactive spectrum policy by re-establishing and re-affirming the Federal Communications Commission’s (“FCC”) spectrum auction authority, ensuring additional spectrum bands are made available for licensed, terrestrial use in ways that support greater competition and expanded access to wireless broadband services, and protecting U.S. networks and consumers by fully funding the Secure and Trusted Communications Networks Reimbursement Program (“Program”).

Reinstating Federal Spectrum Auction Authority

COMPETITIVE CARRIERS ASSOCIATION
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CCA strongly supports efforts to reinstate the FCC's auction authority. The expiration of the FCC's spectrum auction authority is detrimental not only to wireless providers, but also to consumers and small businesses that rely on wireless connectivity. A prolonged lapse could have serious consequences to U.S. wireless competitiveness.

Spectrum auctions have been a resounding success and have provided significant benefits to our country, generating \$230 billion in revenue since 1993 and fueling American competitiveness. FCC-led spectrum auctions give all carriers meaningful opportunities to access spectrum, including opportunities for smaller and rural carriers to secure licenses to provide the latest wireless services in communities that may otherwise be left behind. Smaller carriers can compete with larger, nationwide carriers through appropriately structured spectrum auctions, in turn allowing them to serve their communities, create jobs, and innovate. Expiration of the FCC's spectrum auction authority injects uncertainty into a critical process and undermines America's authority as a technological leader in the world. Extending the FCC's auction authority without delay restores certainty in the auction process and supports continued wireless deployments throughout America.

Further, Congress has helped to facilitate participation in spectrum auctions by carriers of all sizes by requiring disseminating licenses to a wide variety of applicants, including rural providers and small businesses. By directing the FCC to create auction rules and frameworks promoting competition, smaller carriers and consumers directly benefit from policies such as rural bidding credits, appropriately sized geographic license areas, interoperability, reasonable spectrum aggregation limits, and opportunities for secondary market spectrum transactions. FCC-led spectrum auctions, along with Congressional guidance and oversight, can ensure all carriers have meaningful opportunities to compete for this valuable resource.

Meeting Future Spectrum Needs

All carriers depend on access to spectrum to maintain, expand, and strengthen networks across America. To meet those needs and best ensure America's continued wireless leadership, additional spectrum must be made available for licensed, terrestrial use. Wireless carriers need visibility into potential spectrum opportunities as they plan for the future of their networks. This means knowing which spectrum frequencies will become available, and when they will be auctioned and available for use, to manage networks and plan for consumer demands and continued expansion.

To keep up with insatiable demands for increased wireless coverage, use cases, and speeds, Congress should continue to explore options for freeing up additional spectrum for commercial terrestrial wireless services or otherwise provide additional flexibility within existing spectrum bands where appropriate. This includes directing federal agencies to expeditiously explore new opportunities to reallocate spectrum for terrestrial wireless use. To ensure that rural and regional carriers can access spectrum, Congress should particularly ensure that additional spectrum is made available in ways that support services in rural America.

Prioritizing consideration of spectrum with characteristics suitable for rural areas, policies that support equitable opportunities for smaller or regional carriers to access and use spectrum, and programs that expand competitive 5G across the nation will advance U.S. wireless competitiveness. Care should also be paid to frequencies with existing equipment ecosystems or global harmonization to promote U.S. competitiveness internationally and continue to lead in new technology developments.

Securing Wireless Networks

Spectrum access is essential to expanding broadband and closing the digital divide. Another key element to America's wireless leadership is ensuring that networks operating throughout the nation are secure. CCA urges Congress to act immediately to address a national security mandate created by Congress that leaves wireless networks vulnerable. Congress must immediately provide full funding for the Secure and Trusted Communications Networks Reimbursement Program to remove, replace, and destroy untrusted communications equipment from our domestic networks.

Members of this Committee were instrumental in passing the Secure and Trusted Communications Networks Act (P.L. 116-124) and providing funding for the "Rip & Replace" program. The Program funds the removal of Chinese-made equipment and services deemed to pose a national security risk from U.S. telecommunications networks and the replacement of that equipment with equipment and services from trusted vendors. At the direction and advice of Congress and the FCC, carriers began the process of removing such equipment with the understanding that they would be fully reimbursed. However, many are now stranded mid-effort.

Congress provided approximately \$1.9 billion to fund the program in late 2020, but there is a shortfall of approximately \$3.08 billion based on approved applications from the FCC. The FCC allocated funding proportionately, providing approximately 40 percent of needed funds to each applicant. Partial funding is insufficient to complete the removal, replacement, and destruction of untrusted equipment. Furthermore, because the FCC's timeline to complete this work began in July 2022, the window is closing on this high-priority and accelerated Program. The FCC cannot provide additional resources for this Program – only Congress can provide funding to resolve the shortfall. Every day that passes without addressing this national security threat is another day that American networks remain at risk.

Failure to fund the Program leaves a Congressionally-mandated national security directive incomplete, with untrusted equipment still in service today, threatening the security and availability of advanced communications services to primarily rural residents, visitors, workers, military bases, and strategic national security installations. Further, without immediate funding, some impacted carriers may be forced to shutter their businesses entirely, threatening the availability of advanced communications in their service areas. Impacted carriers have been largely prohibited from servicing or upgrading their networks for years, increasing chances for network degradation or even failure, and leaving their communities behind as technology

evolves to 5G and beyond. Failure to fully fund the Program threatens the availability of advanced communications across the country, particularly in rural America, where ubiquitous connectivity challenges already abound.

CCA appreciates this Subcommittee's efforts to fully fund the Program through future spectrum auction revenues. Congress must make this a top priority to ensure the continuity of connectivity in communities across America as well as the security of American networks. America's wireless leadership depends on it.

CCA thanks the Subcommittee for its leadership on spectrum policy. Congress must continue pressing these issues forward to maintain America's ability to compete and lead on wireless issues on a global scale. 5G and successor generations of wireless technologies hold vast potential for American leadership and life changing opportunities in rural America. CCA looks forward to working with Congress to advance spectrum policies needed to advance coemption and connectivity.

Sincerely,



Tim Donovan
President and CEO
Competitive Carriers Association

cc:

The Honorable Cathy McMorris Rodgers, Chair, House Committee on Energy & Commerce
The Honorable Frank Pallone, Jr., Ranking Member, House Committee on Energy & Commerce

Response by Brad Gillen (CTIA) to Question for the Record from the Honorable Anna G. Eshoo**QUESTION:**

Each witness at the Subcommittee on Communications and Technology hearing entitled, “Defending American’s Wireless Leadership” on March 10, 2023, testified to the increasing demand for spectrum and the balance that must be made between federal and commercial uses. The Departments of Commerce and Defense have agreed to a process that allows for an ongoing and thorough study examining the potential impact of opening 3 GHz spectrum to commercial use on existing Federal missions.

For the record, please indicate whether you support the position of the Department of Commerce and Department of Defense regarding spectrum auction authority and spectrum availability as described in the enclosed letter dated March 5, 2023.

RESPONSE:

Thank you, Rep. Eshoo. The wireless industry was pleased to see the joint Department of Commerce (DoC) and Department of Defense (DoD) letter highlighting the U.S. is and has long been the global leader in wireless. We appreciate DoC and DoD’s focus on lower 3 GHz, which is a cornerstone of 5G globally. Commercial wireless access to spectrum in the 3.1-3.45 GHz band is critical for U.S. economic and national security interests.

As the DoC and the DoD continue work on the study referenced in your question, known as the “Partnering to Advance Trusted and Holistic Spectrum Solutions” study, we urge you and the Committee on Energy & Commerce to ensure the report fully reflects Congress’s intent to examine all of the spectrum sharing tools available to DoD, including those successfully leveraged in the successful AWS-3 and 3.45 GHz auctions. That study should also account for how coordination efforts used in allied countries throughout the world could be used domestically to support our national security and robust 5G wireless services. It is also critical that the report accounts for future DoD system plans and how new government systems could significantly enhance future commercial opportunities.

We also commend the fact that the joint letter reinforces the importance of the DoC – and specifically NTIA – having a central role in U.S. spectrum management decisions in partnership with the FCC. NTIA is best suited to adjudicate spectrum matters amongst federal agencies and we must allow NTIA to speak on the Executive Branch’s behalf and with a single unified voice.

This study, the Subcommittee’s hearing, and your question all underscore the critical need for Congress to restore the FCC’s auction authority and identify future bands to refill the spectrum pipeline as soon as possible with 5G ready full-power spectrum. CTIA is committed to working with all interested stakeholders and Congress to ensure that mission critical government

operations are preserved while also unlocking future commercial access that is key to our economic security, national security, and global competitiveness.

HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON COMMUNICATIONS AND TECHNOLOGY
“Defending America’s Wireless Leadership”
March 10, 2023

Questions for the Record from Representative Eshoo to James Assey

In their March 5, 2023 letter, the Department of Commerce and Department of Defense express support for Title I of the Spectrum Auction Reauthorization Act. Among other things, Title I addresses the commercial licensing of 3.1 to 3.45 GHz and requiring any decision on the band “to be contingent on the outcome of an ongoing and thorough study examining the potential impact on critical Federal missions.”

As I testified on March 10, NCTA supports the continued authority of the FCC to conduct spectrum auctions. Further, NCTA supports a balanced spectrum policy, which takes an all-of-the-above approach to spectrum licensing, including exclusive licensed spectrum, shared licensed spectrum, and unlicensed spectrum. NCTA was pleased to see Title I of the Spectrum Auction Reauthorization Act support that balance, and not put the thumb on the scale for any particular licensing regime.

Finally, NCTA participates in the Department of Defense’s “Partnering on Advancing Trusted and Holistic Spectrum Solutions (PATHSS) Task Group” and supports the efforts of this public-private working group to finalize its recommendations for the 3.1 GHz band. NCTA believes that the PATHSS process has allowed for a helpful dialogue between industry and the Department of Defense and could be a good model for other government encumbered bands going forward.

Response to Additional Question For the Record From the Honorable Anna G. Eshoo

Professor Monisha Ghosh

Department of Electrical Engineering, University of Notre Dame.

Policy Outreach Director, SpectrumX.

Research Professor (Adjunct), University of Chicago.

Joint Appointment, Argonne National Laboratory.

April 11, 2023

Question

Each witness at the Subcommittee on Communications and Technology hearing entitled, "Defending America's Wireless Leadership" on March 10, 2023, testified to the increasing demand for spectrum and the balance that must be made between federal and commercial uses. The Departments of Commerce and Defense have agreed to a process that allows for an ongoing and thorough study examining the potential impact of opening 3 GHz spectrum to commercial use on existing Federal missions.

For the record, please indicate whether you support the position of the Department of Commerce and Department of Defense regarding spectrum auction authority and spectrum availability as described in the enclosed letter dated March 5, 2023.

Response

I support the position of the Department of Commerce and Department of Defense regarding spectrum auction authority and spectrum availability as described in the enclosed letter dated March 5, 2023.

As stated in my testimony, I am an active member of the National Spectrum Consortium's (NSC) Partnering to Advance Trusted and Holistic Spectrum Solutions (PATHSS) Task Group which partners with the Department of Defense (DoD) to explore efficient sharing solutions that will make more mid-band spectrum, specifically in 3.1 – 3.45 GHz, available for commercial wireless applications. I have submitted proposals on potential sharing schemes and am engaged with discussions on the technical analyses being undertaken. I remain confident that a sharing solution that enables commercial wireless to utilize the spectrum without impacting crucial DoD operations in the band can be developed in a timely fashion, with the collaboration and cooperation of FCC, NTIA, industry and academia. My technical opinion is that sharing mechanisms using low or medium power is the best way to proceed in this band: this will allow DoD operations to continue without disruption while enabling innovations in wireless, similar to the CBRS band. High-power, exclusive use of spectrum is not the only way to drive innovations in wireless. In fact, the opposite: cellular networks today are optimized for one application: mobile broadband to consumers, while private networks in CBRS are serving a wide variety of use cases.

Question for the Record from Rep. Anna Eshoo
Response of Cleve D. Johnson
April 13, 2023

Question:

Each witness at the Subcommittee on Communications and Technology hearing entitled, “Defending American’s Wireless Leadership” on March 10, 2023, testified to the increasing demand for spectrum and the balance that must be made between federal and commercial uses. The Departments of Commerce and Defense have agreed to a process that allows for an ongoing and thorough study examining the potential impact of opening 3 GHz spectrum to commercial use on existing Federal missions.

For the record, please indicate whether you support the position of the Department of Commerce and Department of Defense regarding spectrum auction authority and spectrum availability as described in the enclosed letter dated March 5, 2023.

Johnson response:

As I testified to the subcommittee on March 10, 2023, I believe that U.S. leadership in wireless communications is a strategic imperative for the future of market democracy and therefore for the security of the United States. Spectrum availability for commercial wireless – particularly lower 3GHz and other mid-band spectrum that is ideal for 5G deployments – is indispensable to that leadership, and spectrum auction authority is indispensable to that spectrum availability.

The United States and our allies are the greatest source of technological innovation and economic vitality in human history. That is the reason we have the most advanced weapons and the most powerful military in the world. It is the reason we won World War II and the Cold War. It is the reason we are presently leading the global 5G economy – even as we are hamstrung by disputes between agencies that have slowed 5G deployment and dried up the spectrum pipeline.

The world’s future will be determined by whether the U.S.’s model of competitive, expansive free market democracy can harness human ingenuity and progress to prevail over the command-and-control, restrictive structures of authoritarian governments. As the foundational, enabling technology upon which myriad technology innovations of our near and distant future rely, and as the most secure communications network in history, 5G networks will be a bellwether for how our societies – governments, businesses, citizens – fare in the face of authoritarian impulses. Therefore, we need more spectrum available for commercial use, which depends on spectrum auction authority. We need coherent processes for commercial wireless deployments. We need global harmonization of spectrum bands so the United States is not an island.

This is crucial to our national security. If we do this, we will ensure the economic and technological vibrancy that has always undergirded our military strength and edge in weaponry – particularly in a future in which AI, quantum computing, and cyber capabilities will predominate in military defense and force projection. And in doing so, we will secure the United States and our allies as market democracies. This is an existential national security issue.