

5G AND BEYOND: EXPLORING THE NEXT WIRELESS FRONTIER

VIRTUAL HEARING
BEFORE THE
SUBCOMMITTEE ON COMMUNICATION AND
TECHNOLOGY
OF THE
COMMITTEE ON ENERGY AND
COMMERCE
HOUSE OF REPRESENTATIVES
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5G AND BEYOND: EXPLORING THE NEXT WIRELESS FRONTIER

WEDNESDAY, MARCH 16, 2022

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

The subcommittee met, pursuant to notice, at 10:33 a.m. in the John D. Dingell Room, 2123 of the Rayburn House Office Building, and remotely via Cisco Webex online video conferencing, Hon. Michael F. Doyle, (chairman of the subcommittee) presiding.

Present: Representatives Doyle, McNerney, Clarke, Veasey, McEachin, Soto, O'Halleran, Rice, Eshoo, Butterfield, Matsui, Welch, Schrader, Cárdenas, Kelly, Fletcher, Pallone (ex officio); Latta, Scalise, Guthrie (subcommittee ranking member), Kinzinger, Bilirakis, Johnson, Long, Hudson, Walberg, Carter, Curtis, and Rodgers (ex officio).

Also present: Representative Joyce.

Staff present: Parul Desai, FCC Detailee; Jennifer Epperson, Senior Counsel; Waverly Gordon, Deputy Staff Director and General Counsel; Jessica Grandberry, Staff Assistant; Tiffany Guarascio, Staff Director; Zach Kahan, Deputy Director Outreach and Member Service; Hank Kilgore, Policy Coordinator; Mackenzie Kuhl, Press Assistant; Jerry Leverich, Chief Counsel, Communications and Technology; Dan Miller, Professional Staff Member; Joe Orlando, Policy Analyst; Chloe Rodriguez, Clerk; Andrew Souvall, Director of Communications, Outreach, and Member Services; Johanna Thomas, Counsel; Kate Arey, Minority Content Manager and Digital Assistant; Sarah Burke, Minority Deputy Staff Director; Michael Cameron, Minority Policy Analyst, Consumer Protection and Commerce, Energy, Environment; William Clutterbuck, Minority Staff Assistant/Policy Analyst; Theresa Gambo, Minority Financial and Office Administrator; Jack Heretik, Minority Press Secretary; Nate Hodson, Minority Staff Director; Sean Kelly, Minority Press Secretary; Peter Kielty, Minority General Counsel; Emily King, Minority Member Services Director; Bijan Koohmaraie, Minority Chief Counsel, Oversight and Investigation Chief Counsel; Tim Kurth, Minority Chief Counsel, Consumer Protection and Commerce; Clare Paoletta, Minority Policy Analyst, Health; Olivia Shields, Minority Communications Director; Michael Taggart, Minority Policy Director; Everett Winnick, Minority Director of Information Technology; Evan Viau, Minority Professional Staff Member, Communications and Technology; and Kate O'Connor, Minority Chief Counsel, Communications and Technology.

Mr. DOYLE. The Subcommittee on Communications and Technology will now come to order.

Today the Subcommittee on Communications and Technology is holding a hearing entitled, "5G and Beyond: Exploring the Next Wireless Frontier."

Due to the COVID-19 public health emergency, members can participate in today's hearing either in person or remotely, via on-line video conferencing.

In accordance with the updated guidance issued by the attending physician, members, staff, and members of the press present in the hearing room are not required to wear a mask, although you can do so if you want.

For members participating remotely, your microphones will be set on mute for the purpose of eliminating inadvertent background noise. Members participating remotely will need to unmute your microphone each time you wish to speak. Please note that, once you unmute your microphone, anything that is said in Webex will be heard over the loudspeakers in the committee room, and subject to be heard by the livestream and C-SPAN.

Since members are participating from different locations at today's hearing, all recognition of members, such as for questions, will be in the order of subcommittee seniority.

Documents for the record can be sent to Joe Orlando at the email address we have provided to staff.

VOICE. Yes.

Mr. DOYLE. All documents will be entered into the record at the conclusion of the hearing.

The Chair recognizes himself—

VOICE. Well, I thank you for that—

Mr. DOYLE. Is there—is that noise in the background?

If someone doesn't have themselves muted, please mute your microphones until you are recognized.

The Chair now recognizes himself for 5 minutes for an opening statement.

OPENING STATEMENT OF HON. MIKE DOYLE, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF PENNSYLVANIA

Well, welcome, and thank you all for being here today. A special welcome to our witnesses, and I thank them for their contributions to this discussion.

I am very glad to be holding this hearing on such an important issue. As the subcommittee with jurisdiction over spectrum and Federal and commercial spectrum management, I am heartened that the Communications and Technology Subcommittee has shown such bipartisan leadership and interest on this issue.

Spectrum policy is not an issue on the top of the average consumer's mind, but it plays a significant role in their everyday lives: the average U.S. household has 25 connected devices; smartphone penetration is above 80 percent; and wireless device subscriptions outnumber the U.S. population. We use baby monitors and garage door openers; listen to the radio and watch TV using our mobile devices; and our factories, farms, and transportation systems are ever more connected, many of them wirelessly. All of these users are de-

pendent on spectrum, and the American economy is dependent on spectrum.

And as we push toward 100 percent broadband connectivity at home, spectrum will be necessary for customers, regardless of whether they have a wired or fixed wireless connection. So it is our job, as members of this subcommittee, to make sure spectrum policy continues to enable these uses and opens new opportunities for the next generation technologies and innovations.

Fundamentally, we need to use our Nation's airwaves as efficiently as possible. With an eye on the exponential growth of wireless data usage, we know more spectrum will need to be made available for consumer use. This means the Federal Government, which still holds the majority of this country's spectrum, needs to use its spectrum allocations more efficiently, recognized spectrum sharing as a viable opportunity, and work cooperatively with neighboring commercial spectrum users.

For Congress, we should recognize the spectrum demands of the Federal Government, and give agencies the tools they need in this process. With our commercial spectrum, we must achieve a balance of both licensed and unlicensed spectrum. It is important to make spectrum available to sustain the deployment of 5G and to pave the way for 6G. At the same time, we need to identify spectrum for unlicensed use to sustain the explosive traffic we have seen in Wi-Fi and to fuel the next generation of Wi-Fi, Wi-Fi 7.

I believe the lower three gigahertz band presents an enormous opportunity for making additional, consumer-oriented spectrum available. The Spectrum Innovation Act strikes the right balance between Federal incumbent users' needs and the importance of their missions, and maximizing spectrum for consumer use. With additional spectrum reallocated to the private sector, new opportunities will arise for additional uses in both licensed and unlicensed spectrum bands. And I want to take a moment to thank Ranking Member Latta and his staff for the work they have been doing with my team to find a bipartisan path forward for this bill. I am looking forward to moving it with their support.

Another item that needs swift action by Congress is the extension of the FCC's ability to conduct spectrum auctions. I think it would be a mistake for Congress to let this authority lapse. In addition to how spectrum is used, we also must look at how these spectrum allocation decisions are made, and it is imperative that we re-evaluate our country's spectrum management policies.

Congress is taking steps, such as with the Spectrum Coordination Act, and NTIA and the FCC are acting, as well, as their announcement on increased cooperation demonstrates. So, with Ranking Member Latta, I recently laid out some principles that should help guide us.

NTIA must continue to be recognized throughout the Federal Government as the entity tasked with balancing the needs and concerns of the Federal Government.

Clear rules and expectations for all spectrum users will lead to better outcomes. These rules and processes should be based on science and engineering.

And last, the Federal Government needs to speak with a clear, unified voice when making spectrum decisions.

Recommitting ourselves to these principles will lead to better management policies and, ultimately, better outcomes for both the Federal and non-Federal users of spectrum. And while these are weighty topics, how we approach them will affect our constituents greatly, and it will also affect how our economy can function and grow.

So I look forward to hearing the witnesses' expert testimony, and their thoughts and concerns—and the thoughts and concerns of my colleagues. And now—thank you to our panelists.

[The prepared statement of Mr. Doyle follows:]

PREPARED STATEMENT OF HON. MIKE DOYLE

Committee on Energy and Commerce

Opening Statement as Prepared for Delivery
of

Subcommittee on Communications and Technology Chairman Mike Doyle

Hearing on "5G and Beyond: Exploring the Next Wireless Frontier"

March 16, 2022

Welcome and thank you all for being here today. A special welcome to our witnesses, and I thank them for their contributions to this discussion. I'm very glad to be holding this hearing on such an important issue.

As the subcommittee with jurisdiction over spectrum, and federal and commercial spectrum management, I'm heartened the Communications and Technology Subcommittee has shown such bipartisan leadership and interest on this issue. Spectrum policy is not an issue on the top of average consumers' minds, but plays a significant role in their everyday lives.

The average U.S. household has 25 connected devices, smartphone penetration is above 80 percent, and wireless device subscriptions outnumber the U.S. population. We use baby monitors and garage door openers; listen to the radio and watch TV using our mobile devices; and our factories, farms, and transportation systems are ever more connected, very often wirelessly. All of these uses are dependent on spectrum – and the American economy is dependent on spectrum.

And as we push towards 100 percent broadband connectivity at home, spectrum will be necessary for customers regardless of whether they have a wired or fixed wireless connection. It is our job, as members of this subcommittee, to make sure spectrum policy continues to enable these uses and opens new opportunities for the next-generation technologies and innovations.

Fundamentally, we need to use our nation's airwaves as efficiently as possible. With an eye on the exponential growth of wireless data usage, we know more spectrum will need to be made available for consumer use. This means the federal government, which still holds a majority of this country's spectrum, needs to use its spectrum allocations more efficiently, recognize spectrum sharing as a viable opportunity, and work cooperatively with neighboring commercial spectrum users.

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March 16, 2022

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NTIA must continue to be recognized throughout the federal government as the entity tasked with balancing the needs and concerns of the federal government; Clear rules and expectations for all spectrum users will lead to better outcomes; Those rules and processes should be based on science and engineering; And lastly, that the federal government needs to speak with a clear, unified voice when making spectrum decisions.

Recommitting ourselves to these principles will lead to better management policies, and ultimately better outcomes for both the federal and non-federal users of spectrum. While these are weedy topics, how we approach them will affect our constituents greatly and how our economy can function and grow.

So, I look forward to hearing the witnesses' expert testimony and the thoughts and concerns of my colleagues.

Thank you again to our panelists and I will now yield to Ranking Member Latta.

Mr. DOYLE. And I am now yielding to my friend, Ranking Member Latta, for his opening statement.

**OPENING STATEMENT OF HON. JERRY LATTA, A
REPRESENTATIVE IN CONGRESS FROM THE STATE OF OHIO**

Mr. LATTA. Well, thank you very much, Mr. Chairman, my friend. Thank you very much for holding today's hearing. And also I want to thank our witnesses for being with us today. It is so great to look out and see you all out, and your smiling faces today. So it is wonderful to be all in the same room together.

For decades, the U.S. has pioneered innovative ways to manage one of our Nation's most valuable resources: access to the airwaves. Decisions on how best to utilize these airwaves to maximize their potential has led to the growth of Wi-Fi; multiple generations of mobile technology, from 2G to 5G; the app economy; and so much more. The massive benefits that these technologies have had have been truly transformational to our economy and our way of life.

A recent report estimates that unlicensed spectrum generates over \$95 billion per year in the connected technology market. I am a co-chair of the Wi-Fi Caucus, and when Wi-Fi was first created no one could have predicted the impact that it would have on our economy.

The same is true for licensed spectrum use. In the 1990's Congress exclusively provided the FCC the authority to auction off a licenses to use portion a of the airwaves. Since then, the FCC has held over 100 auctions for various slices of the airwaves to power everything from 3G to the radio.

In addition to ushering in a new way to harness the efficiency of the free market, the FCC auction authority has played a critical role in paving the way for new innovative services. By auctioning the licenses for certain portions of the airways, users have certainty that they can invest upwards of tens of billions of dollars in the infrastructure necessary to use those airwaves without fear of being interfered with. The last two auctions alone have netted over \$100 billion to the U.S. Treasury.

However, as more and more of the spectrum is being used, auctioning spectrum has become more complex. As new commercial uses are introduced, the possibility of those use cases raising the potential for harmful interference has put a spotlight on how the FCC makes such a decision.

These concerns are magnified when Federal agencies are using a band adjacent to a new commercial user. Over the years we have seen challenges with how agencies coordinate their plans for introducing new services and studying the potential for harmful interference. As the Energy and Commerce Committee continues to build on its work to improve the spectrum management process, we should be looking at how these decisions will build trust in the engineering and certainty in the licensing process that, when a decision is made, all users can accept the result, not work to further undermine it.

With the FCC's authority expiring at the end of the Fiscal Year to conduct an auction and issue licenses, it is important that the Energy and Commerce Committee review what has worked, what

has not, and is able to provide necessary direction to the FCC as the spectrum issue becomes more difficult.

I look forward to hearing from our witnesses today on the opportunities and challenges that lay ahead for smartly managing our spectrum resources.

Again, I want to thank our witnesses for being with us. I want to thank my friend, the chairman, for holding this hearing today.

[The prepared statement of Mr. Latta follows:]

PREPARED STATEMENT OF HON. BOB LATTA

**Opening Statement of Republican Leader Bob Latta
Subcommittee on Communications and Technology
“5G and Beyond: Exploring the Next Wireless Frontier”
March 16, 2022
(As Prepared for Delivery)**

Good morning, and welcome to today’s hearing on wireless spectrum.

For decades, the U.S. has pioneered innovative ways to manage one of our nation’s most valuable resources: access to the airwaves. Decisions on how best to utilize these airwaves to maximize their potential has led to the growth of Wi-Fi, multiple generations of mobile technology from 2G to 5G, the app economy, and so much more. The massive benefits these technologies have had have truly been transformational to our economy and our way of life.

A recent report estimates that unlicensed spectrum generates over \$95 billion dollars per year in the connected technology market. I am a Co-Chair of the Wi-Fi caucus, and when Wi-Fi was first created, no one could have predicted the impact it would have on our economy.

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able to provide necessary direction to the FCC as spectrum issues become more difficult.

I look forward to hearing from our witnesses today on the opportunities and challenges that lay ahead for smartly managing our spectrum resources.

Thank you, and I yield back.

Mr. LATTA. And I would like to yield the remaining balance of my time to my good friend from Louisiana, Mr. Scalise.

Mr. SCALISE. I thank the gentleman from Ohio, Mr. Latta, for yielding.

Mr. Chairman, thank you for hosting—holding this hearing. I really appreciate the witnesses being here.

When you look over the years, Congress, and especially this subcommittee and the Energy and Commerce Committee, have led the way in bringing forth bipartisan action to assert U.S. global leadership in wireless innovation. It is one of those times where we actually do come together to get some really good things done, and it starts right here in this room.

Under the leadership of former FCC Chairman Pai with President Trump, the FCC auctioned off several spectrum bands for commercial use, leading to great consumer benefit and huge strides in innovation. Additionally, these auctions have generated billions of private-sector investment, with the most recent C-Band auction generating a record of more than \$80 billion in revenue.

And by the way, that \$80.9 billion that was generated far exceeded the Congressional Budget Office's estimates of 20 to 35 billion. So they thought it would generate 20 to 35 billion, and with the private sector stepping up and putting forth their own capital, over \$80 billion was generated. We want to see that continue, so it is critical that our Nation's spectrum management process work efficiently.

As Congress considers reauthorizing the FCC's spectrum authority action, it is important to allow the FCC to complete pending auctions, as well—and you look at the 2.5 gigahertz band, that is one area—but also to continue to give the private sector even more opportunities to build out their networks.

Moving forward, it is imperative we do what we can to avoid needless delays in deployment. And we also need to allow providers to operate in the spectrum that they have paid for, and encourage further investments so that America can continue to lead the world, while also heading off the threat posed by China. And this committee has taken specific action to address that, as well.

Mr. SCALISE. So I will look forward to hearing from the witnesses. And thank you again, Mr. Chairman.

Mr. Latta, I yield back the balance of my time.

Mr. LATTA. Mr. Chair, we yield back the balance of our time.

Mr. DOYLE. The gentleman yields back. The Chair now recognizes Mr. Pallone, chairman of the full committee, for 5 minutes for his opening statement.

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

Mr. PALLONE. Thank you, Chairman Doyle. This committee has a long tradition of working together in a bipartisan fashion to lay the groundwork for technological innovation in this country, and this hearing is no exception.

Today we begin exploring the next frontier of wireless technology, and I believe it is more important than ever that we lay

the foundation for our Nation to continue to lead the world in critical technological advancements.

There is no question that our Nation's airwaves are the engine that has powered so much technological growth. Without them, we would not have wireless emergency alerts, the app economy, smartphones, messaging services, the Internet of Things, and, of course, drones. So just imagine that for a moment. So much of this technology we rely on every day simply would not exist.

These are remarkable achievements, but our past success does not always dictate the present or the future. Our nation's global leadership in providing consumers with access to 4G wireless technology and Wi-Fi does not guarantee we will see the same result in 5G or next generation wireless technology such as 6G and Wi-Fi 7. The stakes could not be higher. Failure to replenish the commercial spectrum pipeline risks the United States falling behind our counterparts across the globe, including China, in producing cutting-edge consumer innovations and enhancing our national security capabilities.

And since transitioning our airwaves to allow for new uses takes time, we have to start to put the necessary pieces together now, so that the U.S. can be ready for the wireless technologies of tomorrow. And this is especially important, because China has already reportedly made three times as much mid-band spectrum available for 5G, compared to the United States. Mid-band spectrum delivers the best of both worlds when it comes to wireless broadband, faster speeds, less buffering, and access to a signal indoors. And these are the airwaves that will fuel advancements in telehealth services, public safety, manufacturing, and supply chain management.

But it is not enough to simply make our airwaves available for commercial use. We must have the ability to place these radio waves in the hands of innovators who can put them to good use for the public's benefit. So since 1994, the Federal Communications Commission has accomplished this feat through its spectrum auction program and through truly remarkable and innovative, unlicensed spectrum policies.

The FCC's auction program has been a resounding success, raising \$200 billion in Federal revenue since its inception. And now the FCC spectrum auction authority must be extended, or it will expire in about six months. And without an extension, the FCC may not be able to complete at least one mid-band spectrum auction, and auctions that have already occurred may not be able to properly close.

And so, for these reasons, I urge my colleagues to work in a bipartisan way to extend this authority once again. We must do this well before the FCC begins its planned auction of the 2.5 gigahertz band in July. Otherwise, the auction will be disrupted.

And Congress would also be able to put auction proceeds to good use by funding priorities, like promoting digital equity, next generation 911, or the replacement of suspect communications equipment.

So we must also ensure that the Federal Government speaks with one voice when it comes to our airwaves, and that is why Chairman Doyle and Ranking Member Latta's Spectrum Innovation Act is so key. It will help clarify how important spectrum auc-

tions are on the horizon should operate to keep our processes streamlined (sic).

I am also pleased to see that the new leaders at the National Telecommunications and Information Administration and the FCC have already started making some headway toward ensuring the two agencies speak with one voice. Both agencies recently announced a new spectrum coordination initiative that aligns with legislation this committee unanimously reported to the House back in November. And this initiative will also produce a national spectrum strategy, which I strongly support. And creating this important guidepost will better position NTIA and the FCC to meet the current and future spectrum demands of consumers, commercial carriers, and Federal agencies alike.

So obviously, we have a lot to discuss today as we explore the next wireless frontier. And I welcome our panelists, and look forward to hearing from them.

[The prepared statement of Mr. Pallone follows:]

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Committee on Energy and Commerce

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of
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This is especially important because China has already reportedly made three times as much mid-band spectrum available for 5G compared to the United States. Mid-band spectrum delivers the best of both worlds when it comes to wireless broadband – faster speeds, less buffering, and access to a signal indoors. These are the airwaves that will fuel advancements in telehealth services, public safety, manufacturing, and supply chain management.

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March 16, 2022

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And now the FCC's spectrum auction authority must be extended, or it will expire in about six months. Without an extension, the FCC may not be able to complete at least one mid-band spectrum auction, and auctions that have already occurred may not be able to properly close.

For these reasons, I urge my colleagues to work in a bipartisan way to extend this authority once again. We must do this well before the FCC begins its planned auction of the 2.5 Gigahertz (GHz) Band in July, otherwise the auction will be disrupted. Congress would also be able to put auction proceeds to good use by funding priorities like promoting digital equity, next generation 9-1-1, or the replacement of suspect communications equipment.

We must also ensure that the federal government speaks with one voice when it comes to our airwaves, and that's why Chairman Doyle's Spectrum Innovation Act is so key. It will help clarify how important spectrum auctions on the horizon should operate to keep our processes streamlined.

I am also pleased to see that the new leaders at the National Telecommunications and Information Administration (NTIA) and the FCC have already started making some headway toward ensuring the two agencies speak with one voice. Both agencies recently announced a new spectrum coordination initiative that aligns with legislation this Committee unanimously reported to the House back in November.

This initiative will also produce a national spectrum strategy, which I strongly support. Creating this important guidepost will better position NTIA and the FCC to meet the current and future spectrum demands of consumers, commercial carriers, and federal agencies alike.

We have a lot to discuss today as we explore the next wireless frontier. I welcome our panelists to the Committee and look forward to hearing from them. And I yield back the balance of my time.

Mr. PALLONE. And with that, Mr. Chairman, I yield back.

Mr. DOYLE. The gentleman yields back. The Chair now recognizes Mrs. Rodgers, the ranking member of the full committee, for 5 minutes for her opening statement.

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

Mrs. RODGERS. Thank you, Mr. Chairman.

Before I begin, we just heard from President Zelenskyy, a strong and courageous leader for the freedom-loving people of Ukraine. America must stand and support Ukraine's call for freedom and self-determination—and that includes countering Putin's evil and unjust attacks by ending his ability to use energy to fund this war—by flipping the switch on for energy dominance in America and for our allies. This committee has the opportunity to lead and to answer President Zelenskyy's call to do more, and I continue to urge us to do that.

Now to the topic of today, the success of our Nation's wireless future. It depends on good management of our spectrum resources. The United States is the world leader in wireless technology. We led in deploying 4G. And today our witnesses and our wireless carriers are working to make sure we lead in fifth generation technology.

I just climbed a 180-foot tower with Commissioner Brendan Carr, and made the first 5G call in eastern Washington. 5G is going to be a game changer for rural communities. To win the future, we must continue to make spectrum available, promote innovation, and keep up with the demands for new and improved wireless technologies.

The efficient use of our spectrum resources will be essential to keep up with the demand for wireless devices. Under President Trump, the FCC made an unprecedented amount of spectrum available for commercial use, including over 3,400 megahertz of licensed millimeter wave spectrum, 280 megahertz of licensed spectrum in the C-Band, and an additional 100 megahertz of valuable mid-band spectrum in the 3450 to 3550 megahertz band. This brought in over 100 billion. Wireless carriers also worked closely with Federal incumbents and the NTIA on developing technology in the 5.—or 3.5 gigahertz band known as the Citizens Broadband Radio Service band, the CBRS, which auctioned license spectrum, while protecting Navy radars using the frequencies.

The FCC also made 1,200 megahertz of unlicensed spectrum available in the 6 gigahertz band. We are starting to see next generation technologies being developed to utilize that spectrum. We must build on this success.

Providing certainty to both industry and government agencies for spectrum reallocations and auctions is a top priority. This includes addressing the FCC's expiring auction authority to ensure auctions such as the 3.45 and the 2.5 gigahertz bands are successful and able to be completed, and making sure that costly fights like we have had between the FCC, NTIA, FAA, and industry over C-Band do not become the norm. Without that certainty, we cannot expect

industry to invest the billions of dollars needed to clear spectrum bands in the future.

To maintain U.S. leadership in wireless technology we need a national spectrum strategy that outlines goals, objectives, and actions that can be taken by Federal agencies and industry to ensure the most efficient use of spectrum. That said, even with a national strategy, repurposing spectrum is becoming more difficult. It is crucial that the FCC, NTIA, Federal agencies, and wireless stakeholders work together.

Federal agencies have legitimate spectrum needs for their systems. However, the timeline for upgrading their systems to be more efficient does not keep pace with commercial technology. As spectrum repurposing has become more difficult, many Federal agencies have resorted to public fearmongering, rather than work through established spectrum management process. During recent high-profile spectrum disputes we have seen agencies, such as the Department of Transportation, attempt to assert its authority over commercial spectrum bands where their agencies do not hold licenses.

These costly interagency battles threaten our ability to lead the world in NextGen communications. We must have trust in the expertise at NTIA and the FCC, and confidence in the established process as we continue to push for stable spectrum pipelines.

Meanwhile, adversaries like China and Russia are trying to undermine our leadership. China is actively trying to use international standard-setting institutions to set standards that favor their technology over ours. We must work together to enhance the participation by U.S. companies in setting international standards. My colleague, Mr. Walberg, is leading legislation that requires NTIA to do just that.

I also strongly support Doreen Bogdan-Martin's candidacy to become the Secretary General of the International Telecommunications Union. Doreen is running against a candidate from the Russian Federation. Given recent atrocities by Russia, it is essential that we stand behind Doreen, and help keep the internet open and safe.

[The prepared statement of Mrs. Rodgers follows:]

PREPARED STATEMENT OF HON. CATHY McMORRIS RODGER

**Opening Statement of Republican Leader Cathy McMorris Rodgers
Subcommittee on Communications and Technology
“5G and Beyond: Exploring the Next Wireless Frontier”
March 16, 2022
(As Prepared for Delivery)**

Thank you, Mr. Chairman.

Before I begin, we just heard from President Zelensky, who is showing strong, courageous leadership for the freedom-loving people of Ukraine.

America must continue to stand and provide support for Ukraine’s destiny for freedom... that includes countering Putin’s evil and unjust attacks by ending his ability to use energy to fund this war and flipping the switch on our energy dominance for America and our allies.

This Committee has the opportunity to lead and I continue to urge that we do.

Now, to the topic of today. The success of our nation’s wireless future depends on good management of our spectrum resources.

The United States is a world leader in wireless technology. We led in deploying 4G, and today, our wireless carriers are working to make sure we lead in fifth-generation technology.

I climbed a 180-foot tower with Commissioner Brendan Carr and made the first 5G call in Eastern Washington. 5G is going to be a game-changer for rural communities.

To win the future, we must continue to make spectrum available, promote innovation, and keep up with demands for new and improved wireless technologies.

The efficient use of our spectrum resources will be essential to keep up with demand of wireless devices.

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The FCC also made 1,200 megahertz of un-licensed spectrum available in the 6 gigahertz band. We are starting to see next generation technologies being developed to utilize that spectrum.

We must build on this success. Providing certainty to both industry and government agencies for spectrum reallocations and auctions is a top priority.

This includes addressing the FCC's expiring auction authority to ensure auctions, such as the 3.45 and 2.5 gigahertz bands, are successful and able to be completed, and making sure that costly fights, like we had between the FCC, NTIA, FAA, and industry over C-Band, do not become the norm.

Without that certainty, we cannot expect industry to invest the billions of dollars needed to clear spectrum bands in the future.

To maintain U.S. leadership in wireless technology, we need a national spectrum strategy that outlines goals, objectives, and actions that can be taken by federal agencies and industry to ensure the most efficient use of spectrum.

That said, even with a national strategy, repurposing spectrum is becoming more difficult. It's crucial that the FCC, NTIA, federal agencies, and wireless stakeholders work together. Federal agencies have legitimate spectrum needs for their systems.

However, the timeline for upgrading their systems to be more efficient does not keep pace with commercial technology. As spectrum repurposing has become more difficult, many federal agencies have resorted to public fearmongering rather than work through the established spectrum management process.

During recent, high-profile spectrum disputes, we've seen some agencies such as the Department of Transportation attempt to assert its authority over commercial spectrum bands where those agencies do not hold licenses.

These costly interagency battles threaten our ability to lead the world in next-gen communications. We must have trust in the expertise at the NTIA and the FCC, and confidence in the established process as we continue to push for a stable spectrum pipeline.

Meanwhile, adversaries like China and Russia are trying to undermine our leadership.

China is actively trying to use international standards setting institutions to set standards that favor their technology over ours. We must work together to enhance the participation by U.S. companies in the setting of international standards. My colleague, Mr. Walberg, is leading legislation that requires NTIA to do just that.

I also strongly support Doreen Bogdan-Martin's candidacy to become the Secretary General of the International Telecommunication Union (ITU). Doreen is running against a candidate from the Russian Federation. Given recent atrocities by Russia, it is essential that we stand behind Doreen and help keep the Internet open and safe.

I look forward to hearing from the witnesses, and I yield back.

Mrs. RODGERS. I look forward to hearing from all our witnesses. I yield back.

Mr. DOYLE. The gentlewoman yields back.

The Chair would like to remind members that, pursuant to committee rules, all Members' written opening statements shall be made part of the record.

So now it gives me great pleasure to introduce our witnesses for today's hearing, starting with Greg Guice, director of government affairs, Public Knowledge; Von Todd, chief executive of corporate strategy and analytics, HTC, Incorporated, and director of the Competitive Carriers Association board of directors; Jayne Stancavage, global executive director, product and digital infrastructure policy with Intel; Scott Bergmann, senior vice president, regulatory affairs, CTIA; and Mary Brown, senior director, government affairs, Cisco Systems, Incorporated.

As you know, you all have 5 minutes for your opening statements. There is a little box there in front of you that, when you have 1-minute left, will turn yellow. And then, at the end of 5 minutes, it will turn red. And if you speak longer than that, a trap door opens up under your chair, and you are whisked down to the Rayburn subway and out of here.

[Laughter.]

Mr. DOYLE. So let's try to stay to the 5-minute rules, and we will try to enforce it up here with our colleagues, too. So, with that, I want to thank everyone.

And Mr. Guice, you are now recognized for 5 minutes.

STATEMENT OF GREG GUICE, DIRECTOR OF GOVERNMENT AFFAIRS, PUBLIC KNOWLEDGE; VON TODD, CHIEF EXECUTIVE OF CORPORATE STRATEGY AND ANALYTICS, HTC, INCORPORATED, DIRECTOR, COMPETITIVE CARRIERS ASSOCIATION BOARD OF DIRECTORS; JAYNE STANCAVAGE, GLOBAL EXECUTIVE DIRECTOR, PRODUCT AND DIGITAL INFRASTRUCTURE POLICY, INTEL CORPORATION; SCOTT BERGMANN, SENIOR VICE PRESIDENT, REGULATORY AFFAIRS, CTIA; MARY L. BROWN, SENIOR DIRECTOR, GOVERNMENT AFFAIRS, CISCO SYSTEMS, INCORPORATED

STATEMENT OF GREG GUICE

Mr. GUICE. Thank you, Chairman Doyle and Chairman Pallone, Ranking Members Latta and McMorris Rodgers, thank you very much for inviting me to testify here today. I really do appreciate it. My name is Greg Guice, and I am director of government affairs at Public Knowledge. We are a public interest organization dedicated to promoting freedom of expression, and open internet, and access to affordable communications and creative works.

As members of this committee are well aware, we are in the midst of a connectivity revolution. As more devices and services demand spectrum resources, the policy to satisfy that demand is becoming increasingly challenging. To meet that challenge, we must first use all of the tools in the toolbox to provide access—that is licensed, unlicensed, open access, sharing.

Second, as this committee just recognized, we have to insist on expert coordination led by the FCC and NTIA.

And third, we need to emphasize the public interest, first and foremost, in our spectrum policy.

Supporting those structural components will allow policymakers to address the spectrum needs to secure opportunities for all Americans, and to maintain our collective global competitiveness.

As Ranking Member McMorris Rodgers just noted, demand for connected devices and access efforts to meet that demand means that there are few greenfield opportunities remaining. Everyone has to work to enhance efficient use of spectrum, and policymakers will need to focus on issues such as spectrum utilization by incumbents and tightening of technical parameters, including receivers.

In addition, we need to use all the tools in the toolbox when it comes to access. Back in 2009 and 2010, when I was honored to serve as counsel on this committee under then-Chairman Waxman, he, Representative Doyle, Representative Eshoo, and a number of other folks on this committee made the case that we do not need to frame our spectrum policy in terms of a fight between licensed and unlicensed. Rather, they were calling then for what we now know is the sounder framing, a mix of access regimes that promotes spectrum efficiency and a healthy, vibrant wireless sector.

An example of that—an example that brings that into focus is the FCC-CBRS proceeding. There, the FCC, through great coordination, chose a three-tiered access regime that brought—that balanced the needs of protecting ongoing incumbent use, while creating opportunities for commercial license services, as well as open access spectrum use. They did it all without interference. CBRS and other successful sharing efforts show that policymakers, when they do focus, should focus on remaining open to the idea of exploring the full suite of access regimes when considering any spectrum band.

As members of this committee, you are also well aware of the importance of spectrum coordination and interagency process. As Chairman Doyle and Ranking Member Latta wrote in their op ed last week, it is essential that the interagency coordination process be followed, and that it be made clear NTIA is the agency to hear concerns of Federal agencies and the agency that is meant to address those concerns.

We are also encouraged, as was just recognized, that the FCC and NTIA are working on their spectrum coordination update. They have re-established high-level meetings, they are updating the memorandum of understanding, promoting evidence-based spectrum compatibility analysis, and developing a nation—national spectrum policy. All of this is critical to restoring our interagency process.

As this committee and the FCC explores new spectrum opportunities, we must ensure that every allocation serves the public interest, convenience, and necessity. This means more than simply making spectrum available for new services. It ensures—it includes ensuring that members of our society, all members, including rural communities, low-income communities, and communities of color, enjoy the benefits of these spectrum technologies, both as consumers and as creators and innovators.

Simply put, spectrum policy should serve the public interest, as Congress has directed.

I wanted to spend some time this morning discussing access regimes, inter-agency coordination, and the need to focus on public interest, because those elements are key to the next phase of exploring the wireless frontier. In my written testimony I go over five opportunities in detail, but just to briefly mention them here in closing—so that I don’t fall through the trap—to advance the public interest need, Congress should renew the FCC’s auction authority, and should support public interest needs with those auction revenues.

The committee should consider how auction revenues could advance public interest objectives such as digital equity, something Chairman Pallone just recognized, and that Public Knowledge and other public interest groups have joined in coalition to support as part of our Airwaves for Equity campaign. And that doesn’t mean in NG911, a dedicated wireless fund, and other public interest needs can’t be satisfied, as well.

To promote sharing opportunities, the committee should look at the lower three gigahertz band. The Spectrum Innovation Act is a great opportunity to do that work, and we look forward to working with you as that moves forward in this committee.

We also hope this committee will encourage the FCC to think about opening up the 12 gigahertz band for a variety of uses that protect the incumbent satellite opportunities, but also allow for a greater mixed use of that band so that we can fully utilize that.

And finally, I think this committee can support sensing technologies and advances in incumbent and forming capabilities that promote sharing, as well.

Thank you for your consideration. I am pleased to answer any questions. Sorry to go over time.

[The prepared statement of Mr. Guice follows:]



**Testimony of Greg Guice
Director of Government Affairs, Public Knowledge**

**Before the
House Committee on Energy and Commerce
Subcommittee on Communications and Technology**

5G and Beyond: Exploring the Next Wireless Frontier

March 16, 2022

Chairman Doyle, Ranking Member Latta and members of the Subcommittee: Thank you for inviting me to testify on this important topic. My name is Greg Guice and I am the Director of Government Affairs for Public Knowledge, an organization that is dedicated to promoting freedom of expression, an open internet, and access to affordable communications tools and creative works. Public Knowledge is also a member of the Public Interest Spectrum Coalition, which includes national public interest, civil rights, consumer, education, and social justice organizations focused on ensuring that spectrum policies take into account the needs of all users.

I have been doing telecommunications policy work for the last 24 years and over that period, I have seen spectrum morph from a topic only a few understood (or needed to understand) to a central input of growth in our economy enabling so many services that help consumers learn, work, have fun, stay healthy, and stay connected. The framing of this hearing, the next wireless frontier, calls for a review of where we find ourselves today given that the “frontier” we are exploring is less like the “Oregon Trail” and more like downtown D.C. on a weekday -- congested. As more and more devices and services demand spectrum resources, the policy to satisfy that demand is becoming increasingly challenging. To meet the challenge:

- 1) We must use all of the tools in the toolbox to provide access (like licensed, unlicensed, sharing, and open spectrum access).
- 2) We must insist on good coordination, led by the Federal Communications Commission (FCC) and National Telecommunications and Information Administration (NTIA).
- 3) Decisions about spectrum policy should emphasize the public interest first and foremost.

Supporting those structural components will allow policymakers to address with greater certainty the specific spectrum needs to secure those opportunities for all Americans. I mention a few such needs at the end of my testimony.

Current Environment for Spectrum Opportunities Is Increasingly Challenging

As members of this Committee, you are keenly aware that the environment for exploring spectrum opportunities has greatly evolved over the last few decades. The “connectivity revolution” has changed the way we engage with our world. To get a sense of the scope and speed of this connectivity revolution, the number of connected devices per home rose from 11 in 2019 *to 25* by 2021 – a growth of over 100% in 3 years.¹ That number is shocking until we consider the devices beyond our smartphone and laptop that are now connected. Televisions, watches, earbuds, speakers, doorbells, and alarms all rely on a connection to spectrum, much of which depends on unlicensed technologies.

Similarly, demand for internet access has continued to grow. In a report released by the FCC last week, internet connections overall (fixed and mobile) increased by about 4.7% in 2019 to 449 million, with mobile connectivity increasing by 5.1% to 336 million.² Consumers rely on their mobile devices for so much, spending on average five hours a day on them to check email, shop, make calls, and surf the web.³

That demand on unlicensed and licensed spectrum underscores just how critical it is that we continue to search for new spectrum opportunities using a mix of access regimes. Demand and past efforts to meet it also means that there are few “greenfield” opportunities remaining. This presents a challenge to policymakers because as more and more services are packed closer and closer together, the need to ensure efficient spectrum use practices becomes ever more critical. For example, in the past a receiver could listen out of its band without much consequence, but as services are packed closer together, more efficient use of spectrum means receivers must listen only within their band and reject signals from other frequencies. Additionally, incumbent holders of spectrum need to evaluate what their true needs are and consider whether they may be able to share during times when they are not using it or in geographic places where they no longer need it to further promote more efficient use of spectrum they hold.

Everyone has to work to enhance efficiency.

Mix of Access Regimes Critical To Promote Efficiency and Opportunity

¹ [Connectivity and Mobile Trends Survey: How the Pandemic Has Stress Tested the Crowded Digital Home](#), Deloitte Center for Technology, Media & Telecommunications (2021).

² [Internet Access Service: Status as of June 30, 2019](#), Federal Communications Commission, Industry Analysis Div., Office of Economics and Analytics (Mar. 9, 2022).

³ [45 Mobile Internet Stats You Need to Know](#) (2022).

One of the great developments in spectrum management over the last decade has been a greater awareness of the need to explore alternative access regimes to promote more efficient uses of spectrum overall. Back in 2009 and 2010, when I had the honor of serving as counsel on this Committee for then-Chairman Waxman, he, Representatives Doyle and Eshoo along with others, made the case that we did not need to frame our spectrum policy in terms of a fight between whether we licensed spectrum for exclusive use *or* made it available for unlicensed or sharing opportunities. They were calling then for what we now know is the sounder framing – yes, we need licensed spectrum, but we also need robust unlicensed and sharing opportunities to make certain that we are using spectrum efficiently and to promote a healthy and vibrant wireless sector.

As mobile providers are rolling out their 5G networks, delivering not just faster speeds but also a service that will revolutionize opportunities for Internet of Things and machine-to-machine applications, so, too, are technology companies beginning to deliver Wi-Fi 6 with higher throughput and an ability to allow more connected devices to maintain those faster speeds to better meet consumer needs. These innovations are taking place because Congress and policymakers at the FCC and NTIA have focused our spectrum policy on making sure we explore the full array of access regimes across a range of spectrum bands.

That focus was on display in the FCC’s citizen’s broadband radio service, or CBRS, proceeding. Begun in 2015, the CBRS band demonstrates how technology, engineering, and a commitment from policymakers can open up amazing levels of efficiency and opportunity in a single spectrum band. The FCC’s proceeding in the band resulted in the adoption of a three-tiered access regime that balanced the need to protect ongoing incumbent uses (military radar) while creating opportunities for commercial licensed services (priority access licenses or PALs)⁴ as well as open access spectrum use (where users operate on spectrum throughout the band when the frequencies are not in use).⁵ All of this is coordinated through an automated frequency coordinator known as the Spectrum Access System, which relies on sensing technology to detect use in real-time.⁶ This framework allows for a much higher utilization of the band than would have been possible under any single access regime. It is also worth noting that this three-tier sharing has worked, with over 150,000 network nodes deployed in CBRS and no reported cases of interference.⁷ The takeaway from this is that we don’t need to leave large swaths of spectrum unused so long as policymakers remain open to exploring the full suite of access regimes when looking at any band.

⁴ 47 C.F.R. § 96.25.

⁵ 47 C.F.R. § 96.35.

⁶ 47 C.F.R. § 96.53.

⁷ [Taking Stock of Spectrum Sharing](#), John Leibovitz and Ruth Milkman (Sept. 2021). This paper provides a very thorough and thoughtful set of policy recommendations for considering more spectrum sharing opportunities.

New Spectrum Opportunities Require Close Coordination

The members of this Committee are also all too aware of the importance of the spectrum coordination and interagency process working as Congress designed. Again, thanks to Chairman Doyle and Ranking Member Latta for shining a light on this and making clear that this Committee, on a bipartisan basis, intends to insist that the interagency coordination process be followed. The oversight this committee provides is critical to ensuring that spectrum allocation happens in a timely and efficient manner. In a recent paper I co-authored with Joel Thayer of Digital Progress Institute, we outlined how federal agencies and entities under their regulatory purview execute a well-worn playbook to disrupt and thwart the interagency process.⁸

One such instance of disruption concerning the 5.9 GHz band continues to this day. Originally the band had been designated to only be used by automobile manufacturers for development of intelligent transportation systems. But when it became clear that this band was not being used by the auto industry (and had not been used for almost two decades), the FCC pushed for it to become better utilized by studying whether the band could be opened up for unlicensed use. The FCC and NTIA worked to address concerns raised by incumbent automakers in the band, and after running its public process, the FCC unanimously adopted a band plan that provides an opportunity for mixed use of the band. Automakers continue to use the 30 MHz portion, while permitting unlicensed use in the other 45 MHz. Instead of respecting the decision made by the FCC and NTIA, automakers and the Department of Transportation have chosen to undermine it. The DOT recently announced a study that appears to have no other purpose except an attempt to undermine the FCC's decision. This study was spurred by interests intent on reasserting a claim that the automotive industry should control the entire 5.9 GHz band. DOT is conducting this action without seeking public comment and appears to be relying on improper technical assumptions and methodologies. This is just the type of action that undermines the interagency process.

As we wrote in our paper, "the interagency process, when it works well, provides an opportunity for all stakeholders to come forward in a data-driven process to assist the FCC and the NTIA in building a record of evidence to support efficient spectrum usage by helping these agencies understand what the possibilities and concerns are." Going forward, as the Chair and Ranking Member noted, NTIA is the agency to hear concerns of other federal agencies and is the place for those concerns to be addressed. Further, science and engineering must drive those decisions, not conjecture and fear-mongering. The recent announcement by NTIA and the FCC is very encouraging on this front. It commits the agencies to re-establishing high-level meetings; updating the Memorandum of Understanding recommitting to an evidence-based spectrum compatibility analysis; and developing a national spectrum policy. These efforts will require

⁸ [*The Interagency Process and its Importance in Securing the Future of 5G*](#), Greg Guice, Public Knowledge and Joel Thayer, Digital Progress Inst. (Mar. 2022).

commitment from the whole of government, including federal agencies and Congress, in order to be successful. We are certain that this Committee and its Senate counterpart understand that importance.

Return Focus to the Public Interest

The core of the FCC's responsibility over spectrum is to ensure that every allocation serves "the public interest, convenience, and necessity." This means more than simply making spectrum available for new services. It includes ensuring that all members of society enjoy the benefits of these new spectrum technologies – both as consumers and as creators and innovators. While every American deserves a fiber connection to the home, every American also deserves access to the same level of quality, affordable mobile services. As this Committee is all too aware, rural communities, low-income communities, and communities of color have long suffered from digital exclusion. Congressional and FCC spectrum policy must explicitly focus on mobile digital inclusion as well as bringing fixed broadband into every home.

In addition, the last five years have seen an increase in concentration in wireless services. Thanks to the merger of T-Mobile and Sprint, we have gone from four national, facilities-based carriers to three. The Department of Justice merger conditions attempted to create a new, fourth national carrier by spinning off certain assets to DISH Network. While DISH has invested in building out its new, cloud-based network, it has yet to achieve the intended goal of a new, nationwide competitor. Meanwhile, consolidation in the mobile virtual network operator or MVNO market has eliminated independent MVNOs. Today's MVNO providers are vertically integrated with either existing national wireless carriers (such as AT&T and Verizon) or with cable broadband providers. It remains to be seen whether these vertically integrated MVNOs will provide adequate competition to bring down prices for all Americans.

It is tempting to view promoting digital inclusion and competition as separate from spectrum policy. This would be a tremendous mistake. Spectrum policy should serve the public interest as set forth in Section 1 of the Communications Act to provide access to *all* Americans to wire and radio service, with adequate facilities at reasonable charges.⁹ This focus on the public interest should begin with the distribution of new spectrum licenses and continue throughout the spectrum ecosystem. It includes ensuring that wireless providers build out their networks to all Americans or make room for community-based providers who will serve local communities the larger carriers do not consider adequately profitable. It must include requiring that networks work together to maintain operations during crisis and disasters – both natural and man-made. It must include adequate security in the face of a world populated with both criminals and hostile nations eager to compromise our communications infrastructure to advance their own

⁹ 47 U.S.C. § 151 (emphasis added).

ends. While both Congress and the FCC have taken steps towards these goals over the years, more must be done.

Specific Areas for Future Opportunities

The reason I spent some time discussing access regimes and interagency coordination is because those two elements will be key to the next phase of exploring the wireless frontier and ensuring that the next phase serves the broader public interest. Much of what we need to do next to continue to satisfy consumer demand and promote innovation will need all of us – policymakers, public interest advocates, engineers, technology companies, and other stakeholders – working cooperatively. Here are a few areas where that work needs to start:

1. **Renew FCC auction authority.** The FCC’s auction authority, first granted in 1993 and renewed by Congress prior to its expiration since, is slated to expire at the end of September of this year. The FCC will begin an auction of the 2.5 GHz band this summer. Congress should make certain the authority is extended to ensure that this auction can be completed.
2. **Support public interest needs with auction funds.** Revenues generated by auctions should be considered for advancing public interest needs of the telecommunications sector. One area for targeted funding could be digital equity. The digital divide, as Chairman Pallone has said, requires addressing access, affordability, and adoption. Digital equity (literacy, training, device access) helps promote adoption. Congress provided some funding in the Infrastructure Investment and Jobs Act, but a more sustainable source is needed to advance equity goals. Public Knowledge recently joined with other public interest organizations to launch the “Airwaves for Equity” initiative, which proposes setting aside spectrum auction revenues to fund digital inclusion efforts.¹⁰

But this is only one such public interest need. FCC Chairwoman Rosenworcel recently proposed using auction revenues to support the transition to next-generation 911.¹¹ As the Chairwoman observed, building a modern, digital 911 system will not come cheap, and we must be prepared to spend what is necessary to ensure that all Americans have the ability to call for help, and receive that help, wherever they may be, whoever they are, regardless of race, gender, disability, or income, and without regard to whether or not they speak English. Additionally, Public Knowledge has supported other uses for

¹⁰ See [Airwavesforequity.org](https://airwavesforequity.org).

¹¹ Remarks of Chairwoman Jessica Rosenworcel: FirstNet 10-year Anniversary Celebration, National Press Club, Washington D.C., February 22, 2022, available at: <https://docs.fcc.gov/public/attachments/DOC-380562A1.pdf>

spectrum auction funds. These could include creating both a permanent wireless infrastructure fund and a dedicated fund to support upgrading networks to enhance reliability, as well as using funds to address supply chain security concerns.

The point here is that the public interest use of the public airwaves should begin from the moment of distribution of exclusive licenses. Congress should stop thinking of spectrum auctions as merely a “pay for” to reduce the deficit. Distribution of licenses by auction is not intended to raise revenue, but to provide a rational means of distributing licenses to those with both the interest and capacity for using them to offer services to the public.¹² The revenues obtained should therefore be dedicated to serving these same public interest goals.

3. **Add more capacity for unlicensed use of Wi-Fi 6.** In 2020, the FCC designated the 6 GHz band for unlicensed use. Congress, the FCC, and NTIA should begin the process of exploring opportunities to add to the 6 GHz band for unlicensed use by studying whether sharing of the lower 7 GHz band is possible. There are military systems in the band so NTIA would need to coordinate with the Department of Defense and the FCC through the interagency process to work through the engineering.
4. **Facilitate consideration of the lower 3 GHz band (3100-3150 MHz) for commercialization.** Clearing spectrum for auction can be enormously expensive as we saw with the clearing costs associated with auctioning the 3.45-3.55 GHz band – \$14.7 billion for 100 MHz.¹³ If Congress does not mandate that all of this spectrum be auctioned, there may be opportunities for sharing and other access regimes that will produce greater utilization of the band. The Spectrum Innovation Act contemplates just such a structure and we look forward to working with this Committee to get this important legislation completed this Congress.
5. **Promote sharing of the existing 12 GHz band on a secondary basis with mobile services, as proposed in the January 2021 Notice of Proposed Rulemaking in Docket No. 20-443.**¹⁴ The Commission should also authorize an unlicensed underlay in the band and consider rules for other forms of opportunistic sharing. This will promote competition in the mobile space, provide greater access to spectrum for broadband in rural areas, and make critical spectrum available for deployment of gigabit capacity for

¹² See 47 U.S.C. § 309(j)(3) (requirement that auctions promote the public interest goals of Section 1 and other goals enumerated in this section); 309(j)(7)(B) (public interest finding cannot be based “solely or predominantly” on maximizing auction revenue).

¹³ Auction of Flexible-Use Service Licenses in the 3.45-3.55 GHz Band for Next-Generation Wireless Services: 33 Applicants Qualified to Bid in Auction 110, Public Notice, 36 FCC Rcd 9272 (Sept. 17, 2021).

¹⁴ Expanding Flexible Use of the 12.2-12.7 GHz, WT Docket No. 20-443; *Expanding Flexible Use in Mid-Band Spectrum, 3.7-24 GHz*, GN Docket 17-183 (Rel. January 15, 2021).

Wi-Fi 7. Public Knowledge believes these additional uses can be authorized without compromising the existing satellite TV and broadband satellite uses, creating a win-win solution for everyone.

6. **Promote spectrum sharing by supporting sensing technologies and advances in incumbent informing capabilities, or IIC.** Sensing technologies, like those used in the 3.5 GHz band, detect and communicate the presence of a signal from an incumbent user to an automated frequency coordinator in order to facilitate shared spectrum access. Incumbent informing capability is a database management tool that allows incumbent spectrum users, like DOD, to update automated frequency coordination database in real time to convey its use of specific spectrum channels so that lower priority operators, such as schools, that share the band can be informed of the need to move to other frequency channels. Both of these technologies seek to facilitate the same goal – greater, more robust spectrum sharing. As such, Congress should support the development of both sensing technologies and IIC.

We are an increasingly connected nation and spectrum is a critical input to that connectivity. To address the challenges we face in meeting the needs of consumers, we will need to use every access tool available -- including licensed, unlicensed, sharing, and open access -- along with expert coordination by the FCC and NTIA to meet this demand. As we venture into this next phase of the wireless frontier, we should ensure that our spectrum policy prioritizes the public interest needs we face. By ensuring all are connected and have the tools they need, we will help realize the full benefits of greater connectivity.

Thank you. I am pleased to answer any questions you may have.

Mr. DOYLE. I was just going to say your chair was looking lower as you were speaking.

[Laughter.]

Mr. DOYLE. Mr. Todd, you are recognized for 5 minutes.

STATEMENT OF VON TODD

Mr. TODD. Chairman Doyle, Republican Leader Latta, and members of the subcommittee, thank you for the opportunity to testify. I am pleased to represent HTC and serve on the board of directors for the Competitive Carriers Association.

HTC is the Nation's largest telecommunications cooperative, where our local subscribers are our owners. We call them our members. For over 70 years, HTC has been the leading communications provider for coastal South Carolina. I am excited about the role that wireless plays in our future and HTC's efforts to bring the latest communication services to our members throughout our service area. And while the potential of wireless services, including 5G and beyond, is limitless, a key input needed to make that potential a reality is spectrum.

Carriers depend on sustainable and predictable access to spectrum, a finite resource. Congress can support efforts to ensure that all Americans have access to the latest wireless services in three ways: first, by extending the FCC spectrum auction authority; second, by bringing additional bands of spectrum to the market for licensed commercial use; and third, making sure that winning auction bidders can swiftly and efficiently put those spectrum resources to use to serve consumers.

HTC was formed in 1952, and has over 700 employees working to provide the latest services to our over 100,000 local members. We support local economic development and community and educational programs. Even further, HTC returns excess revenues earned back to our members in the form of capital credits, totaling over \$153 million today. We work hard to meet the needs and provide a high level of service to all of our members, serving a geographically and demographically diverse region that stretches from urban tourism destinations to rural farm lands.

The COVID-19 pandemic highlighted the urgent need for access to broadband services and, as a cooperative, HTC made efforts to provide connectivity as part of our COVID response, with bill credits, installing new community and school hotspots, and participating in the EBB program, now the Affordable Connectivity Program. I appreciate and thank the members of this committee for creating and maintaining this important tool to put connectivity within reach for more of our community.

HTC provides a full range of communications services to our members, and wireless connectivity is an important tool in our portfolio, and depends on our ability to access spectrum resources. Wireless services are particularly important to reach more rural and impoverished areas, especially where larger companies will not expand to provide service, as well as more urban areas, where larger companies have us locked out.

The spectrum needed to provide reliable wireless connectivity is only available through license from the Federal Government, most typically obtained through FCC-led spectrum auctions or through secondary market transactions. Importantly, FCC auctions allow for things like smaller license sizes. This is critical for smaller companies like ours.

To continue to bring the latest services to market, we need to know that additional spectrum will be made available, and we need to make sure that Congress extends the FCC spectrum auction authority. This year's 2.5 gigahertz auction will make spectrum available in our markets. Gaining access to this spectrum would provide us with increased confidence in our ability to meet the future data needs of our subscribers, and enhance our ability to compete.

Expansion of auction authority will ensure that carriers like HTC have the certainty needed to fully participate in the upcoming 2.5 gigahertz auction. We strongly encourage Congress and the FCC to maintain a predictable, sufficient supply of spectrum to meet growing wireless demands, including in low, mid, and high bands, and in ways that allow smaller carriers to meaningfully participate.

Finally, while the FCC should make additional spectrum bands available for wireless use, the interagency spectrum coordination process should be improved. I thank members of this committee for working to enhance and restore faith in the process, including efforts to update the memorandum of understanding between the FCC and NTIA.

In closing, 5G and other next generation wireless technologies will rapidly expand connectivity and improve many aspects of everyday life. To ensure our networks can expand and meet the demands of the next wireless frontier, greater access to spectrum is essential.

Thank you, and I welcome your questions.

[The prepared statement of Mr. Todd follows:]

5G and Beyond: Exploring the Next Wireless Frontier

Testimony of Von Todd

Chief Executive of Corporate Strategy and Analytics

HTC

Before the

United States House of Representatives

Committee on Energy and Commerce

Subcommittee on Communications and Technology

March 16, 2022

Chairman Doyle, Republican Leader Latta, and Members of the Subcommittee, thank you for the opportunity to testify at today's hearing on America's wireless future.

I am testifying on behalf of Horry Telephone Cooperative, Inc., or HTC, the nation's largest telecommunications cooperative, where our owners are our local subscribers – we call them our members. For over 70 years, HTC has been the leading communications provider to Northeastern South Carolina, providing data, voice, and video services across copper, coax, fiber, and wireless technologies, to both residential and business markets, while remaining rooted in our community. We have worked to build out wireless cellular coverage to best serve our cooperative members through our partnership with a nationwide provider of advanced mobility. For purposes of today's hearing, I will focus on HTC's need for spectrum to provide the latest wireless services to meet member demand for data throughout our service area, including urban, suburban, and rural areas. I also serve on the Board of Directors for Competitive Carriers Association, the leading association for competitive wireless providers. CCA 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.

I am excited about the role that wireless plays in our future and HTC's efforts to bring the latest communications services to our members throughout our service area. And while the potential of wireless services, including 5G and beyond, is limitless, a key input needed to make that potential a reality is – spectrum. The airwaves needed to bring the next wireless frontier to life are critical, but finite resources. To expand connectivity today and support 5G and new wireless technologies in the future, carriers depend on sustainable and predictable access to spectrum. All carriers, and especially smaller carriers like HTC, must have the certainty that we can access and put additional spectrum bands to use. Congress can support efforts to ensure that all Americans have access to the latest wireless services by extending the Federal Communications Commission ("FCC")'s spectrum auction authority beyond the

end of September 2022, bringing additional bands of spectrum to the market for licensed commercial use, and making sure that after auctions conclude the winning bidders can swiftly and efficiently put those spectrum resources to use to serve consumers.

At HTC, Our Customers are Members

HTC was formed in 1952 and the cooperative is governed by a local board of directors. Currently, HTC has over 700 employees working to provide the latest services to our over 100,000 local members. And membership has its benefits – HTC provides price and service equality across our membership and each member receives equal voting rights. As a vital member of our community, HTC supports local economic development, charities, and educational programs and initiatives. Even further, HTC returns excess revenues earned back to our members in the form of Capital Credits – to the tune of over \$153 million returned since 1979. We work hard to meet the needs and provide a high level of service to all of our members, serving a geographically and demographically diverse region that stretches from urban tourism destinations to rural farmlands.

Like other providers, the COVID-19 pandemic highlighted the critical importance of access to broadband services, and as a cooperative, HTC made efforts to provide connectivity as part of our COVID response. At the onset of the pandemic, we provided our members with \$4 million worth of bill credits and provided free internet service to student households without internet. We installed Wi-Fi hotspots at community centers and schools throughout our service area free of charge, and those hotspots are still operational today. We were also proud participants in the Emergency Broadband Benefit Program and remain participants in the Affordable Connectivity Program, with over 4,500 subscribers enrolled to date. We appreciate and thank the members of this Committee for creating and maintaining this important tool to put connectivity within reach for more of our community.

The COVID spotlight on the need for connectivity demonstrated that to close the digital divide and ensure that all Americans have access to broadband services we must utilize all types of technologies. As previously mentioned, HTC provides a full range of communications services to our members, and wireless connectivity is an important tool in our portfolio – but is one that is limited to and depends on our ability to access the spectrum resources needed to deliver those services. Wireless services are particularly important to reach more rural and impoverished areas, especially where larger companies will not expand to provide service, and more urban areas where larger companies have locked us out of delivering fiber in certain single-family communities through predatory pricing. HTC has and will continue to participate in programs established by Congress and Federal agencies to build and expand broadband deeper into our communities, and we can use wireless technologies to leverage and build upon those investments. And with an eye towards the future, we remain focused on 5G and smart applications that, because of mobility, can only be served through wireless. While fiber connectivity plays a vital role in wireless networks, without sufficient spectrum access, there cannot be wireless connectivity.

Congress Should Extend FCC Spectrum Auction Authority

The spectrum needed to provide reliable wireless connectivity is only available through license from the federal government, most typically obtained through participation in FCC-led spectrum auctions or through business transactions on the secondary market with subsequent FCC approval. Since Congress first directed the FCC to make spectrum licenses available through auction in 1993, the FCC has conducted over a hundred auctions, reallocating spectrum for commercial use while generating hundreds of billions of dollars in return for use as directed by Congress. For smaller providers, auctions have an additional important Congressional requirement to support disseminating licenses to a wide variety of applicants, including rural communications companies and small businesses. To meet this Congressional mandate, the FCC has and should continue to make spectrum available using sufficiently

small geographic license sizes so that smaller carriers have a meaningful opportunity to compete while ensuring appropriate power levels to maximize service, as well as promote rural and small business bidding credits, interoperability, and reasonable spectrum aggregation limits.

In recent years, HTC participated in the 700 MHz auction and subsequent wireless spectrum auctions since then, securing spectrum in the 600 MHz, 24 GHz, 28 GHz, CBRS, and C-Band. Each different band of spectrum has different propagation and other characteristics, and access to low-, mid-, and high-band spectrum supporting a full range of wireless services across our footprint. As a cooperative that serves a geographically and demographically diverse region, from urban tourism destinations to rural farmlands, we need access to spectrum to adequately meet the needs of both communities. In recent years, this includes expanded wireless connectivity to community centers as well as partnering with densely populated areas and smaller communities on smart technologies. As wireless services expand and power new services, including sustainability initiatives, electric vehicles, and new innovations not yet realized, wireless data use will continue to grow, and it is critical that we have access to the spectrum assets needed to support new deployments and technological advancements.

To continue to bring the latest services to market, we need to know that additional spectrum will be made available, and to do that we need to make sure that Congress does not allow FCC spectrum auction authority to expire. For HTC, this is not an abstract concept. Within our markets, there will be spectrum inventory available in the 2.5 GHz band in the upcoming Auction 108, that FCC Chairwoman Jessica Rosenworcel recently announced would begin in July. Were HTC to have access to this spectrum, it would provide HTC with increased confidence in our ability to meet the future data needs of our members and enhance our ability to compete in those markets. If Congress does not extend auction authority, and if proceedings around Auction 108 last beyond the current expiration of auction authority at the end of September, uncertainty creeps into our planning and could hamper our ability to marshal the resources needed to plan and participate in the auction. Expansion of auction authority will ensure

that carriers like HTC have the certainty needed to fully participate in the upcoming auction and invest in securing spectrum licenses.

Beyond the 2.5 GHz band, we strongly encourage Congress and the FCC to maintain a predictable and sufficient supply of spectrum to continue to meet growing wireless demands, including in low-, mid-, and high-bands, and in ways that allow smaller carriers to meaningfully participate in auctions with an opportunity to gain access to new spectrum resources. While we may not yet know the must have applications for 5G and beyond, or the bandwidth required to support them, we do know that more spectrum will be needed and that we do not want to be left behind, especially in rural areas that stand to benefit from new innovations most.

Interagency Spectrum Coordination is Essential

While the FCC should work to make additional spectrum bands available for wireless use, the interagency spectrum coordination process should be improved. Simply put, smaller carriers cannot afford to spend limited capital on spectrum licenses if we cannot put them to use according to service rules established ahead of the auction. To confidently participate in future auctions, we must have the certainty that we can put spectrum to use as anticipated. Recent disputes among individual executive branch agencies have presented claims of potential interference concerns after auctions have been completed, contrary to studies based on science and outside of the typical spectrum coordination processes. These claims can distract from important policy goals and undercut bidders' confidence as they rely on FCC-adopted rules to participate in an auction. Smaller carriers are not positioned for unexpected costs or other clearing challenges after the conclusion of an auction and may lack the scale and/or the resources to satisfy conditions raised after the conclusion of an auction. Additionally, companies that work to develop the equipment and services to support deployment must have the certainty needed to create and grow an equipment ecosystem.

We support efforts to improve interagency spectrum coordination and thank members of this Committee for work to enhance and restore faith in the process, including efforts to update the Memorandum of Understanding between the FCC and the National Telecommunications and Information Administration. Importantly, ensuring that FCC spectrum auction authority is extended can support the FCC's role in mitigating spectrum disputes between commercial and federal users.

5G and other next generation wireless technologies have the potential to rapidly expand connectivity and improve many aspects of everyday life, particularly in rural areas. To make sure our networks can expand and meet the demands of the next wireless frontier, greater access to spectrum is essential. Congress can support making this potential a reality through extending the FCC's spectrum auction authority, working with the FCC and other federal agencies to identify additional spectrum bands that can be reallocated for commercial wireless use, and improving the spectrum coordination process to restore faith that licensees will be able to fully utilize their spectrum assets. Thank you for the opportunity to participate in today's important hearing and your leadership on these issues. I welcome any questions you may have.

Mr. DOYLE. Thank you, Mr. Todd.
The Chair now recognizes Ms. Stancavage for 5 minutes.

STATEMENT OF JAYNE STANCAVAGE

Ms. STANCAVAGE. Chairman Doyle, Ranking Member Latta, and members of the subcommittee, thank you for inviting me today to provide a global perspective on spectrum policies to enable 5G, next generation Wi-Fi, and 6G.

I am responsible for Intel's global policy efforts related to digital infrastructure, including connectivity, 5G, Wi-Fi, and 6G, AI, AVs, and IoT, including smart cities and healthcare. I have extensive experience working in—at the national, regional, and global level, including the ITU and the World Radio Communication Conferences.

Intel is one of only three semiconductor manufacturers in the world using advanced nodes. Intel semiconductor products are foundational to personal, cloud, quantum, and high-performance computing, AI, IoT, AVs, and most importantly for today's hearing, 5G and Wi-Fi. 5G runs on Intel. We are a leading—a silicon provider for infrastructure. And Intel is also a leader in Wi-Fi and Bluetooth technology solutions for the PC market. Intel plays an active role throughout the wireless technology lifecycle, from developing wireless standards to enable infrastructure and end user devices.

With respect to spectrum pipeline considerations, it is crucial to replenish the U.S. spectrum pipeline for mobile broadband technologies in low, mid, and high bands to meet near-term and long-term deployment goals for consumers and a wide range of businesses. As FCC Chairwoman Rosenworcel recently stated, for 6G we need to start planning now to identify spectrum in the 7 to 15 gigahertz range. 6G may also utilize high bands, including bands above 95 gigahertz, as well as low bands.

Replenishing the spectrum pipeline requires not just deciding which bands to study, but also ensuring the timely results of study and commercial availability of the spectrum, including bands, for example, such as the lower 3 gigahertz bands. Making decisions on spectrum in a timely manner is crucial to enabling a U.S. leadership role in wireless globally. For example, the FCC's decision to open the 6 gigahertz spectrum for Wi-Fi has been transformative, with over 60 countries following the U.S. lead.

So what is a timely manner? To provide some perspective on this issue, the ITU targeted completion of 5G high-band spectrum process in November 2019. To enable commercialization, the Intel team completed our internal analysis of the status of availability, as well as technical characteristics 4 years prior to that, in September 2015. The FCC issued its first report and order making high-band spectrum available over 3 years before the target date. Over the next few years, other leading countries also took steps on 5G spectrum. As a result of the FCC's early action, when the international treaty deliberations occurred much of U.S. high-band spectrum was harmonized for use for mobile broadband technologies at the World Radio Communication Conference 2019.

For 6G the process is scheduled to be completed in 2030. Looking back at the previous timeline, the question I have is, do we think the U.S. is on track to make spectrum available for 6G by around mid-2016—26, sorry, we will get an extra ten years. Unless we move rapidly now, the U.S. will not be in a position to take a leadership role to help define which spectrum ranges will be utilized globally for 6G.

Moving on to the importance of inter-agency cooperation—coordination, NTIA must be empowered to represent the Federal agencies to ensure, together with the FCC, that the Nation's spectrum resources are managed in the public interest.

Additionally, extension of the FCC's spectrum auction authority will be important for continued U.S. broadband deployment efforts.

Finally, despite the crucial nature of semiconductors underpinning all of this technology, America has lost significant share of semiconductor production to Asia over the last 30 years, creating a 30 percent cost disadvantage for chip-making in the U.S. Federal investment is urgently needed to reverse this erosion by leveling the playing field for America's semiconductor industry. Congress took the first step by authorizing the CHIPS for America Act early last year. And while Intel is doing its part to invest in American technology leadership, Congress must finish the job by conferencing the bills containing CHIPS Act funding as soon as possible. This investment will bolster the U.S. semiconductor capacity that underpins the deployment of 5G and other digital infrastructure.

Thank you for holding a hearing on this important topic, and we look forward to working with the committee, the FCC, NTIA, and other Federal agencies to ensure the spectrum pipeline continues to flow to support U.S. broadband development and deployment.

[The prepared statement of Ms. Stancavage follows:]

**House Committee on Energy and Commerce
Subcommittee on Communications and Technology
“5G and Beyond: Exploring the Next Wireless Frontier”**

Testimony of Jayne Stancavage

Global Executive Director, Product and Digital Infrastructure Policy, Intel Corporation

March 16, 2022

Chairman Doyle, Ranking Member Latta, and Members of the Subcommittee, thank you for inviting me today to provide a global perspective on policies to enable the deployment of 5G, next-generation Wi-Fi, and 6G. I serve as Global Executive Director of Product and Digital Infrastructure Policy at Intel Corporation. In this role, I am responsible for Intel’s policy efforts related to digital infrastructure, including 5G, 6G, and Wi-Fi connectivity; Artificial Intelligence (AI); autonomous vehicles; and Internet of Things (IoT). My responsibilities also include representing Intel in certain global forums, including the World Radiocommunication Conferences (WRC) and the International Telecommunications Union (ITU). I currently chair the Federal Communication Commission’s (FCC) WRC-23 Advisory Committee Informal Working Group for terrestrial services and serve as a member of the Department of State’s International Digital Economy and Telecommunication Advisory Committee. I also serve on the Board of Directors for the Open RAN Policy Coalition and the US Telecom Training Institute and am a member of the Global mobile Suppliers Association (GSA) Spectrum Group management team.

I. Executive Summary

Given the tremendous growth in adoption of wireless technologies fueled by innovation in many existing and emerging applications, it is imperative to replenish the spectrum pipeline for mobile broadband technologies for both near-term and long-term deployment needs. For example, extended mid-band spectrum ranges, below 3.45 GHz and within 7.125 GHz to ~15 GHz, and high bands, including spectrum above 95 GHz, should be explored to support the capacity, speed, and latency requirements of new and emerging applications. Making new spectrum bands available for use in a timely manner is crucial to establishing a U.S. leadership role in wireless. Given the lengthy process involved in making spectrum available for commercial use, the U.S. must move quickly to consider which bands can be studied to ensure U.S. leadership in next generation deployments. Further, with the FCC’s auction authority set to expire this year, extension of the FCC’s spectrum auction authority will be important to ensure the spectrum pipeline can continue to flow to enable future U.S. broadband deployment efforts. Finally, Intel looks forward to partnering with the federal government through the CHIPS Act programs to enhance domestic semiconductor R&D and manufacturing.

II. Background

Intel Corporation is one of the world's largest semiconductor manufacturers, employing over 110,000 people globally, with approximately half in the United States. Intel's headquarters are in Santa Clara, California, with innovation hubs in Oregon, Arizona, California, New Mexico, and Texas. As an integrated device manufacturer (IDM), Intel both designs and manufactures products within its own leading-edge manufacturing and advanced packaging network. In 2021, Intel invested \$18.7 billion in capital expenditures and \$15.2 billion in R&D,¹ ranking sixth among publicly-traded U.S. companies in individual R&D investment.²

Intel is making unprecedented new investments in U.S. semiconductor manufacturing capacity. In the past year, Intel announced \$43.5 billion in investments for the construction of new semiconductor fabrication facilities in Arizona and Ohio³ and for the manufacturing of advanced semiconductor packaging technologies in New Mexico.⁴ These announcements demonstrate Intel's ongoing commitment to leadership investments in manufacturing and R&D in the United States.

Intel is one of only three semiconductor manufacturers in the world manufacturing semiconductors using advanced nodes and the only one with R&D anchored in the United States. Intel's processors, memory, storage, and other products power much of the world's computing capability. Intel semiconductor products are foundational to personal computing, cloud computing, AI, IoT, autonomous vehicles, quantum computing, high-performance computing – and most important for today's hearing – 5G and Wi-Fi.

One of Intel's roles as a leader in 5G is to supply high-volume and high-quality products to telecom equipment manufacturers. 5G runs on Intel: through our Network Edge Group, we are a leading silicon provider for 5G infrastructure. Intel also ignited the wireless revolution by integrating Wi-Fi™ into laptops in 2003. Since 2016, Intel has been the market leader of Wi-Fi and Bluetooth solutions for the Personal Computer (PC) market through our Client Computing Group. Intel also holds leading positions in major standards and industry organizations, spearheading the development of wireless technologies. Intel employees hold leadership positions in 3GPP, IEEE, and ATIS Next G Alliance, as well as Working Groups in the ITU,

¹ Intel Corporation Annual 10-K for Fiscal Year Ending December 25, 2021, available at <https://www.intel.com/filings-reports/all-sec-filings/content/0000050863-22-000007/0000050863-22-000007.pdf>.

² Intel's Impacts on the US Economy," Report Issued April 2021, using data for FY 2019, available at <https://www.intel.com/content/www/us/en/newsroom/news/us-economic-impact-study.html?wapkw=economic%20impact#gs.tptln6>.

³ Intel Press Releases available at <https://www.intel.com/news-events/press-releases/detail/1501/intel-breaks-ground-on-two-new-leading-edge-chip-factories>; <https://www.intel.com/content/www/us/en/newsroom/news/intel-announces-next-us-site-landmark-investment-ohio.html>.

⁴ Intel to Invest \$3.5 Billion to Expand New Mexico Manufacturing Operations, Press Release available at <https://www.intel.com/content/www/us/en/newsroom/news/new-mexico-manufacturing.html>.

including WRC preparatory efforts. In short, Intel is active through the wireless technology life cycle, from helping drive the development of wireless standards, to powering the network from the core to the edge, enabling access on laptops and IoT devices, and driving transformation in 5G networks, Artificial Intelligence, autonomous vehicles and data centers.

III. Spectrum Pipeline Considerations

Given the tremendous growth in adoption of wireless technologies fueled by innovation in many existing and emerging applications, it is imperative to replenish the spectrum pipeline for mobile broadband technologies, for both near-term and long-term deployment needs. Future needs will include spectrum in low bands (with excellent propagation characteristics for wider coverage areas), high bands (with potentially wider channel bandwidths for higher data rates), and mid bands (which combine favorable propagation and potential for wider channel bandwidths). As FCC Chairwoman Jessica Rosenworcel recently stated at Mobile World Congress, for “6G we need to start planning now to identify spectrum in the 7-15 GHz range that can support faster speeds and wider coverage.”⁵ Considering the importance of providing varied spectrum for 5G and beyond, we should not forget the need for additional spectrum in the extended mid-band ranges both below 3.45 GHz and above 7.125 GHz. In particular, spectrum bands up to around 15 GHz should be considered to identify sufficient spectrum bands to support new and emerging applications while protecting incumbent services. In the context of very high bands, studies in the ITU may open up possibilities for larger, contiguous bandwidths for future terrestrial applications.⁶ Replenishing the spectrum pipeline requires not just deciding which bands will be studied, but also ensuring the timely results of studies, and making spectrum available for commercial use. For instance, progress on the 37-37.6GHz band, which was set aside for “coordinated co-primary shared access between Federal and non-Federal users” years ago, could be beneficial.

Intel has a long history of supporting spectrum allocations for use by both licensed (*e.g.*, 5G) and unlicensed (*e.g.*, Wi-Fi) technologies. As a leading technology company, Intel takes a technical approach to evaluating potential spectrum use by existing and future technologies to determine which technologies we believe would be most appropriate for a given band and maximize spectrum efficiency. For example, we consider the characteristics of incumbent services with respect to the potential for sharing or clearing spectrum within geographic areas; wide-area exclusively licensed operations generally require clearing/relocating incumbents from the spectrum (often over large geographies), while licensed-shared or unlicensed operations could be more appropriate when clearing incumbents is not possible or suboptimal. We also consider the proximity of the spectrum band to other spectrum ranges already used by the same technology,

⁵ <https://www.fcc.gov/document/chairwoman-rosenworcel-remarks-mobile-world-congress-2022>

⁶ Consideration of Sharing and Adjacent Band Compatibility Between Passive and Active Services above 71 GHz, <https://www.itu.int/oth/R0A060000A1/en>

which impacts the ease of incorporating it into existing devices. Another important consideration we take into account is the amount of spectrum needed, as increasingly wider channel bandwidths are utilized to support ever-increasing data throughput requirements. As we look to the future, it is important to recognize that a range of spectrum characteristics will likely be needed; some emerging applications require significant bandwidth but over a short range (*e.g.*, precision positioning or sensing), while other applications (*e.g.*, wide area mobile broadband) require larger coverage areas.

IV. Global Spectrum Policy Perspectives on Spectrum Pipeline

Other countries also recognize the pivotal role broadband technologies play in connecting members of our society and forming an increasingly foundational role in our economies. The U.S. benefitted from being the first nation with widespread 4G coverage, which led to innovations developed in the U.S. that many of us use every day on our smartphones, such as ordering rides, buying groceries, checking in for flights, reading books, and watching shows. 5G, in addition to enhancing the mobile broadband capabilities of 4G, is expected to enable similar types of benefits for businesses and consumers in many different industries, such as industrial IoT in manufacturing, mining, agriculture, healthcare, and more. The importance of broadband has become increasingly apparent over time, especially during the pandemic and to underserved communities, leading to numerous countries/markets competing to ensure they can benefit from a leading role in deployments. Making new spectrum bands available for use in a timely manner is crucial to establishing a leadership role in wireless.

During my career at Intel, I have seen incredible technology advances, including in areas that facilitate more efficient use of spectrum and coexistence such as advancements in radio design, modulation and coding, antennas, etc. However, consumer demand for higher data rates and other broadband applications has also led to the need for wider channels and larger spectrum blocks.

For the majority of my two decades at Intel, I have been actively involved in international spectrum policy deliberations at the regional, national, and global levels. In addition to serving on many U.S. delegations to ITU meetings over the past decade, I also participated in multiple WRCs, including as the Spokesperson for the Americas Region (CITEL) on an Agenda Item considering spectrum access for unlicensed technologies in 5 GHz during WRC-19.

Every three to four years, the WRC reviews and, if necessary, revises the Radio Regulations, the international treaty governing the use of radio frequency spectrum. In the context of wireless technology, it should be noted that the ITU (the United Nations specialized agency for ICTs) Radiocommunication Sector generally focuses more on policy (*e.g.*, “WRC preparations, the development of Recommendations” and “Reports”) related to spectrum sharing studies, band

plans, technologies, *etc.*, while 3GPP, IEEE, O-RAN Alliance, and Wi-Fi Alliance are industry-led efforts focused on technology standards development.

These international deliberations traditionally focused on the goal of “harmonization” of the use of spectrum bands across different geographies and bands to facilitate global roaming, economies of scale, and reduced device complexity. In the past, different products needed to be developed for even minor differences in spectrum bands. Today, however, consumers and businesses can also benefit from harmonization of “tuning range” solutions covering adjacent or nearly-adjacent bands in which equipment can be reconfigured to operate over multiple bands within the same tuning range. While tuning range harmonization has practical limits due to technology capabilities, it has improved the harmonization prospects in many key bands.

The dynamics of international spectrum policy decision-making processes are increasingly interconnected to U.S. domestic processes. For example, the FCC’s decision to open the 6 GHz band for unlicensed use has been transformative to Wi-Fi technology around the world. In the two years since the FCC decision, over 60 countries have followed FCC’s lead to open 6 GHz spectrum to Wi-Fi. At the 2015 WRC (“WRC-15”), the U.S. was able to secure an allocation to the Mobile Service in ~600 MHz (low band), which was crucial to enabling the FCC’s successful \$20 billion incentive auction to repurpose broadcast spectrum for mobile broadband use. Similarly, WRC-15 also adopted provisions for the Americas region to enable the 3.4-3.6 GHz (mid-band) to be utilized for mobile broadband. During WRC-19, deliberations included topics such as unlicensed (*e.g.*, Wi-Fi) and licensed (*e.g.*, 5G) broadband technologies; in addition to changes in 5 GHz regulations, much of the U.S. high-band spectrum was also identified for harmonized use by mobile broadband technologies. WRC-23 will also address key frequency bands for broadband technologies.

Technical work has already begun on the next generation of technologies including “Advanced 5G”, “6G”, “Wi-Fi 7,” and “Wi-Fi 8”. Innovation in radiocommunication technologies goes through a well-known development and investment cycle, from research to prototypes, trials, and finally commercialization of products, which could take several years. Research and development of new generations of technologies in turn relies on the availability of associated components such as radios, filters, *etc.* Technology developers need to know which frequency ranges to design for; therefore, early indications of which spectrum bands might be available, followed by early availability of spectrum, facilitates technology leadership. It is important that regulations are put in place in a timely manner, so spectrum availability intercepts the product cycle at the appropriate time.

In summary, given the lengthy process involved in making spectrum available for commercial use, consideration of spectrum bands which could be studied is urgently needed if the U.S. wants to ensure it has a leadership position on next generation deployments. For example, now is the

time to make progress on which low, mid (*e.g.*, within 7-15 GHz), and high bands (*e.g.*, including new spectrum ranges above 95 GHz) might be available for use by both early 6G deployments as well as the next generations of unlicensed technologies. Alternately, if the U.S. does not make timely progress of identifying potential spectrum bands and subsequently making spectrum available, then the U.S. will not be in a position to take a leadership role in helping define which spectrum ranges will be utilized; it is crucial to intercept the development and investment cycles to ensure timely commercialization of products for the U.S. market.

V. Importance of U.S. Interagency Coordination

Spectrum is an important resource, relied upon by many different services and applications. With many competing demands for spectrum, developing technical regulations is a lengthy and often contentious process. While the FCC is responsible for managing commercial (or non-Federal) spectrum access, the National Telecommunications and Information Administration (NTIA) within the Department of Commerce is responsible for managing Federal spectrum use. In the context of developing U.S. positions on international spectrum issues, the FCC and NTIA likewise are responsible for representing non-Federal and Federal spectrum use, respectively. NTIA must be empowered to represent the various Federal agencies' views both domestically and internationally to ensure that the domestic preparatory process can function as intended. The development of WRC positions impacts both federal and commercial users of spectrum. Deliberations of these positions should have balanced representation of both federal and commercial interests. When balanced, the process can work well; otherwise, issues can arise. The recent joint announcement from FCC Chairwoman Jessica Rosenworcel and Assistant Secretary Alan Davidson that the agencies will increase their spectrum coordination efforts is a positive step forward.

VI. FCC's Spectrum Auction Authority

The FCC has been a world leader in spectrum auctions, starting with Congressional action in 1993 giving the FCC authority to use competitive bidding systems. These auctions fueled innovation leading to significant economic growth and technology leadership for the United States. Other countries have also closely followed U.S. activities, including innovations such as the incentive auction of the 600 MHz band, leading to improvements in other markets as well. With the FCC's auction authority set to expire this year, extension of the FCC's spectrum auction authority will be important for continued U.S. broadband deployment efforts. Congress can also use this opportunity to identify spectrum bands that could be utilized for broadband deployment and can consider directing future auction revenue could fund public interest priorities.

VII. CHIPS for America Act

In addition to the steps outlined above, critical to maintaining the goal of U.S. leadership in connected technologies is a secure supply of semiconductors across many nodes. Semiconductors are fundamental to U.S. technology development, our economy, and national security. They represent the fourth largest U.S. export sector, and the pandemic only accelerated the adoption of digital infrastructure powered by semiconductors. Recent supply chain disruptions due to COVID-19 and widespread chip shortages illustrate the risks to our economy and the danger of losing our ability to make advanced chips in the United States.

In addition to the steps outlined above, critical to maintaining the goal of U.S. leadership in connected technologies is a secure supply of semiconductors across many nodes. Semiconductors are fundamental to U.S. technology development, our economy, and national security. They represent the fourth largest U.S. export sector, and the pandemic only accelerated the adoption of digital infrastructure powered by semiconductors. Recent supply chain disruptions due to COVID-19 and widespread chip shortages illustrate the risks to our economy and the danger of losing our ability to make advanced chips in the United States.

Despite the critical nature of semiconductors, America lost significant share of semiconductor production to Asia over the last 30 years. For decades, countries in Asia have provided substantial incentives to build domestic semiconductor champions, driving a decrease in U.S. share of global chip manufacturing and creating a 30 percent cost disadvantage for chipmaking in the U.S. Since 1990, that share dropped from 37 percent to 12 percent, and it is projected to erode further to 9 percent by 2030.

Federal investment is urgently needed to reverse this erosion by leveling the playing field for America's semiconductor industry. Over one year ago, thanks in great part to the leadership of Congresswoman Matsui, Congress took a critical step by authorizing new semiconductor manufacturing and R&D programs through the *CHIPS for America Act*. The House and Senate separately approved \$52 billion in appropriations for the so-called *CHIPS Act*, but now Congress must finish the job by conferencing the bills containing *CHIPS Act* funding as soon as possible. We thank the Members of this committee for your support for this initiative. Intel is doing its part to invest in American leadership, and we look forward to partnering with the federal government through the *CHIPS Act* programs to enhance domestic semiconductor R&D and manufacturing.

VIII. Conclusion

Identifying additional low, mid, and high band spectrum to study and quickly make available for commercial use is essential to ensuring U.S. leadership in the next generations of licensed and

unlicensed wireless technologies. Thank you for holding a hearing on this important topic, and we look forward to working with the Committee, the FCC, and other federal agencies to ensure the spectrum pipeline continues to flow to support U.S. broadband development and deployment.

Mr. DOYLE. Thank you very much.
 Mr. Bergmann, you are recognized for 5 minutes.

STATEMENT OF SCOTT BERGMANN

Mr. BERGMANN. Chairman Doyle, Ranking Member Latta, members of the committee, thank you for the opportunity to be with you and testify today. I am Scott Bergmann, and on behalf of CTIA and the wireless industry, I want to thank you for your focus on creating smart spectrum policies for 5G and our country's future.

In particular, we commend the Committee for its longstanding practice of identifying specific bands for the FCC to auction. For example, in the 2020 Beat CHINA for 5G Act and the Act of 2018.

Fueled by a remarkable record of investment, 5G wireless broadband networks are transforming the way that we live and work. 5G is also helping to protect our planet. According to a recent Accenture study, 5G will enable a 20 percent contribution toward our Nation's carbon emission reduction targets, helping the country to meet our climate change goals. And now fixed wireless 5G, with its expanded capabilities, is helping to bridge the digital divide and bring competitive choice to the home broadband market.

Of course, every benefit that we are experiencing with 5G in the U.S.—expanding digital inclusion, job creation, smart cities, and improvements in public safety, healthcare, and our environment—is predicated on the availability of spectrum. With demand for fixed and mobile 5G services increasing exponentially, we need to free up additional spectrum, especially licensed mid-band.

FCC Chairwoman Rosenworcel should be commended for moving quickly on the 3.45 gigahertz auction last year, as directed by this committee. And her recent announcement of the 2.5 gigahertz auction is a welcome sign. After this auction, however, the spectrum pipeline goes empty.

In the meantime, other nations understand that global leadership in wireless hinges on access to spectrum. Leading nations are making available, on average, approximately 650 megahertz of licensed mid-band, more than twice what we have in the U.S. today. We are playing catch-up. But with the right policies, we can maintain our global wireless leadership. We offer to the committee today four recommendations to keep the U.S. as the global leader in wireless.

First, the FCC's auction authority is slated to expire in September, and congressional action is needed to ensure that the agency can auction and license spectrum that will deliver 5G to U.S. consumers and businesses. Auctions have proven to be the bedrock of 5G and U.S. mobile wireless networks. Since 1993, when Congress established our first-in-the-world spectrum auction authority, it has never allowed that authority to lapse. On five occasions Congress has granted broad auction authority, and in all but one—a short-term, 1-year extension—it has used these opportunities to direct auctions of specific bands. CTIA urges Congress to do the same this year.

Second, it is in our national interest to identify a spectrum pipeline of bands that can be auctioned for exclusive licensed use. The

lower 3 gigahertz band is a top priority. This band is adjacent to existing full-power commercial spectrum, and offers the ability to provide large channels, making it an ideal fit for Congress—for 5G. And Congress can now take steps to streamline this access. And we support the Spectrum Innovation Act, which would enhance the process to bring that critical band to auction.

Congress should also take steps to identify and set clear deadlines for future access to other mid-band spectrum, as well as low and high bands, at the same time that it extends auction authority. Congress has long leveraged congressionally directed spectrum auctions to advance other key national priorities, including deficit reduction and FirstNet. We, of course, defer to the committee on how auction proceeds should be spent, and welcome the opportunity to collaborate.

We would note that Chairwoman Rosenworcel recently proposed using proceeds for NG911 purposes. That is an important goal, and worthy of all our support. Paired with a clear pipeline of 5G-friendly spectrum options, such an approach could provide a much-needed boost to our Nation's 911 system and our wireless leadership.

Third, CTIA supports calls for a national spectrum strategy, which can help to meet this challenge and provide guideposts for advancing US 5G leadership.

Finally, there is much that we can do to revitalize a unified government voice on spectrum management. While the U.S. Government spectrum process generally works well, it broke down in the C-Band altimeter debate. We commend the recent FCC NTIA Spectrum Coordination Initiative as an important first step.

As a Nation, we can and must do better. Thank you again for the opportunity to testify, and I look forward to your questions.

[The prepared statement of Mr. Bergmann follows:]

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Testimony of

Scott Bergmann

Senior Vice President

CTIA

on

5G and Beyond: Exploring the Next Wireless Frontier

before the

U.S. House of Representatives

Committee on Energy & Commerce

Subcommittee on Communications & Technology

March 16, 2022



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

CTIA commends the Committee, Congress, the FCC, and the Administration for their ongoing leadership in identifying and repurposing spectrum for 5G. I especially want to thank this Committee for its commitment to crafting smart spectrum policies for 5G and our country's future. Every benefit that we are experiencing with 5G in the U.S.—expanding digital inclusion, economic growth, job creation, smart cities, and improvements in public safety, health care, and our environment—is predicated on the availability of spectrum.

And—of course—there is more to do. The FCC's auction authority is slated to expire on September 30, 2022, and Congressional action is needed to ensure the agency can auction and license spectrum that will deliver 5G to American consumers and businesses. Beyond extending this authority, it is in our national interest to identify a spectrum pipeline of bands to be auctioned for exclusive use—after the July 2022 auction of the 2.5 GHz Band there will be no more 5G spectrum in the pipeline.

We commend lawmakers from both parties for the long-standing practice of identifying specific bands for the FCC to auction, for example in the 2020 Beat CHINA for 5G Act and the MOBILE NOW Act of 2018. Even with this Congressional impetus, we find that the U.S. is falling behind our global competitors' 5G mid-band allocations, putting us at risk of ceding leadership in wireless and missing out on some of the economic and job creation benefits of 5G. A national spectrum strategy can help to meet this challenge and provide

guideposts for actions to advance 5G and U.S. global leadership in wireless. And finally, as a nation we can do much to revitalize a unified government voice on spectrum management, and CTIA commends the recent FCC-NTIA Spectrum Coordination Initiative as an important first step.

5G is Delivering for American Consumers and Businesses, in the Fight against Climate Change, and as a New Competitive Force in Home Broadband

5G wireless broadband networks are transforming the way we live and work, with speeds up to 100 times faster than 4G networks, network responsiveness five times quicker, and network capacity that can handle 100 times the number of devices. In 2020, U.S. wireless providers continued a remarkable and sustained record of wireless investment: wireless providers invested nearly \$30 billion, the third straight year of increasing capital expenditures to power America's world-leading wireless networks and deliver 5G across the nation.¹

With these network investments, the Boston Consulting Group projects that 5G will add \$1.5 trillion to America's economy and create 4.5 million new jobs over the next decade.² 5G is updating and building the industries of the future, including healthcare, smart manufacturing, transportation, logistics, and agriculture.

5G is also contributing to protecting our planet, according to a recent Accenture study that quantifies the impact of 5G wireless services on climate change.³ Accenture concluded that in the U.S., 5G-enabled use cases are expected to enable a 20 percent contribution toward carbon emission reduction targets, helping the country meet its climate change goals. Accenture finds that 5G use cases will have the same effect as taking nearly 72 million cars off the road for a year.

And America’s wireless industry is now bringing its competitive energy to the home broadband market, with impressive success. In the fourth quarter of 2021, one wireless provider’s residential broadband solution led all broadband offerings (including cable and wired competitors) with the most new subscribers, according to a recent Morgan Stanley report.⁴ This is possible due to the greatly expanded capacity and capabilities of 5G, enabled by access to new spectrum. 5G for home broadband is currently available to tens of millions of American households, and competing 5G home providers will offer service to over 200 million homes by 2025.⁵ And 5G for home broadband could be decisive in delivering broadband to rural America, as a recent study finds that 5G could serve 8.4 million rural households—nearly half the rural homes in the U.S.—with a future-proof broadband solution with faster speeds and lower prices.⁶ Indeed, the Infrastructure Act recognized the value of fixed wireless 5G as part of NTIA’s \$42.5 billion broadband grant program when it identified “priority” projects as those that, among other things, are scalable to meet evolving connectivity needs and “support the deployment of 5G, successor wireless technologies, and other advanced services.”⁷

Americans’ Growing Demand for Wireless and the Need for More Mid-Band Spectrum

Americans are consuming more wireless service than ever before and wireless providers are investing billions in efficiency-enhancing technologies and new 5G networks—but to keep up pace with demand for new fixed and mobile 5G use cases and services, the U.S. needs to free up additional spectrum, especially licensed mid-band spectrum.

In 2020, mobile wireless data traffic topped 42 trillion megabytes, more than three times the amount of wireless data reported just four years earlier in 2016.⁸ Over the past decade, America's wireless users have driven a 108x increase in mobile data traffic. And Americans are connecting with more and more devices, about 1.4 devices per person, for a total of 468 million wireless devices.

The demand for spectrum—in particular, mid-band spectrum—is also skyrocketing. Mid-band spectrum is the “sweet spot” of spectrum innovation and is a key factor for 5G, as it provides high speeds over a broad coverage area, making sure no one gets left out of the New Economy.

Last year, the FCC conducted two auctions for full-power mid-band spectrum, one for 280 megahertz of C-Band spectrum from 3.7-3.98 GHz, and the other for 100 megahertz from 3.45-3.55 GHz. Together, these two auctions raised over \$102 billion in winning bids, and will be the backbone of wireless investment over the next few years. Contrast these auctions to the auction of 70 megahertz of CBRS spectrum that sits between the 3.45 GHz band and the C-Band: primarily due to far lower authorized power levels and a complicated sharing structure in CBRS, that spectrum sold for only \$3.2 billion, less than a quarter the amount of C-Band based on a per-MHz-PoP basis. CBRS requires five times as many cell sites for coverage in suburban areas, and at least seven times as many in rural areas—significantly increasing costs, the time to deploy, and slowing 5G network buildout.⁹ The CBRS sharing regime also took about 8 years from FCC proposal to auction, far longer than C-Band (3 years) and 3.45 GHz (2 years).

Wireless data projections—a 24 times increase in 5G subscriptions by 2026 and an over 500 percent increase in wireless data use over the same period¹⁰—demand several hundred megahertz per wireless provider to support the long-term speed and capacity needs of U.S. fixed and mobile 5G.

FCC Chairwoman Jessica Rosenworcel should be commended for moving quickly on the 3.45 GHz auction last year consistent with a bipartisan congressional directive. Similarly, her recent announcement of the 2.5 GHz auction is a welcome sign for another auction this July. There is, however, no other spectrum in the FCC's 5G pipeline.

In the meantime, other nations understand that global leadership in wireless—and the billions of dollars in economic growth and millions of jobs in the industries of tomorrow—hinges on access to prime spectrum. Leading nations around the world are making on average approximately 650 megahertz of licensed mid-band spectrum—from 3–7 GHz—available by the end of 2022.¹¹ But in the United States, we will have just 270 megahertz of licensed mid-band spectrum available by the end of 2022 (100 megahertz of 3.7–3.8 GHz C-Band, 100 megahertz from the 3.45 GHz band, and 70 megahertz of CBRS licenses). Even with access to Phase II C-Band spectrum from 3.8–3.98 GHz by the end of 2023, the U.S. will have a total of 450 megahertz of mid-band spectrum, meaning that these benchmark nations will have roughly 1.5 times the amount of mid-band spectrum for 5G as the United States. Those nations also continue to allocate more spectrum for future wireless use. America is playing catch-up, but with the right policies in place we can maintain our global leadership in wireless.

Key Recommendations for Future Global Wireless Competitiveness

I want to thank this Committee for its ongoing commitment to advancing U.S. wireless interests. I have four recommendations for Congress, and the U.S. wireless industry is committed to partnering with this Committee to sustain the U.S. as the global leader in wireless.

1. Re-up the FCC's Auction Authority. Reauthorizing the FCC's auction authority is critical to maintaining America's wireless leadership. 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. Auctions create a market-driven mechanism to determine the highest and best use of spectrum, assigning spectrum rights to auction winners who invest billions of dollars into next-generation network buildouts. Spectrum auctions have resulted in, to date, over \$200 billion in revenue for the U.S. taxpayers, and auction proceeds have been used to modernize systems for DoD and other agencies that have repurposed spectrum for commercial use.

Congress should expeditiously extend the FCC's auction authority. Since 1993 when Congress established the first-in-the-world spectrum auction authority, it has never allowed that authority to lapse. On five occasions, Congress has granted the FCC broad auction authority and Congress has used these opportunities to direct auctions of specific bands for commercial, licensed wireless use, with one exception (a short-term one year extension). CTIA urges Congress to do the same this year and include a requirement for auctioning specified bands coupled with an extension of the FCC's auction authority.

2. Replenish the Spectrum Pipeline. A predictable pipeline of spectrum will do much to advance U.S. 5G interests and will help us keep delivering new innovations to the American people and match the actions foreign governments are taking. We agree with FCC Chairwoman Rosenworcel: “[E]nsuring there is a pipeline of licensed and unlicensed spectrum is important for the development of 5G wireless service, next-generation services and devices, and our national economic growth and global competitiveness.”¹² It can take significant time to identify and make spectrum available for auction, so it is in our national interest to develop a spectrum pipeline that addresses today’s needs and plans for the future.

The lower 3 GHz band (3.1-3.45 GHz) is a top priority. This 350 megahertz swath neighbors existing full-power commercial spectrum, making it an ideal fit to provide large channels and flexibility to be aggregated with other bands. The Infrastructure Act provided the Department of Defense with resources to study repurposing lower 3 GHz spectrum for commercial services and extended authority for an auction. Bringing the 3.1-3.45 GHz band to market in the near term is crucial to our global 5G leadership.

Congress can take steps now to streamline access to this key band, and we support the Spectrum Innovation Act, which would enhance the process to bring that critical mid-band spectrum to auction. Congress should also take steps to identify and set clear deadlines for future access to other mid-band spectrum, as well as low- and high-band spectrum at the same time it extends auction authority. In doing so, priority should be given to those bands that are internationally harmonized for global use and those bands that can best be cleared of existing users to allow full-power 5G-friendly rules.

The 7/8 GHz band (7.125–8.4 GHz) is a prime mid-band resource that NTIA has already found to be underutilized. We also recommend mid-band spectrum in the mid- to upper-frequencies in the 4 GHz band that are used today in China and other countries.

Good spectrum policy requires a mix of spectrum bands leveraging differing capacity and coverage characteristics. With respect to low-band spectrum, in 2015 Congress directed the FCC to auction at least 30 megahertz below 3 GHz by 2024. Congress now has the opportunity to clearly define the spectrum to be auctioned and pair it for expanded capabilities. Congress should actively consider the 1.3-1.35 GHz band, the 1.124-1.164 GHz band, and 1.78-1.83 GHz band. Congress should also set a clear timetable to address commercial access to high-band spectrum, the 26 GHz, 42 GHz, and 50 GHz bands.

CTIA commends Congress' ongoing interest in repurposing and auctioning spectrum. Congressional directives to auction spectrum ensure timely access to new spectrum and have significant positive economic and societal benefits.

3. Renewing a National Spectrum Strategy. CTIA supports calls by Department of Commerce Secretary Gina Raimondo and FCC Chairwoman Rosenworcel for a national spectrum strategy. A national strategy should balance spectrum priorities in a way that enables federal agencies to meet their missions—including national defense—while ensuring sufficient spectrum is available for another national priority—empowering all Americans in the digital era and promoting a robust and innovative economy. Today, the federal government is the majority spectrum holder between 3.0-8.4 GHz, and the Department of Defense occupies 2/3 of that entire swath (totaling 3,600 of 5,400 megahertz). We should

continue to find ways to repurpose spectrum and repackage federal systems, providing them with new, more efficient state-of-the-art technology funded by auction proceeds.

On the commercial side, our wireless ecosystem thrives with licensed networks and unlicensed operations, but we also need a more balanced approach between licensed and unlicensed allocations. Today the U.S. has far more unlicensed mid-band spectrum than licensed mid-band spectrum—the U.S. has made 1,905 megahertz of mid-band spectrum available for unlicensed, eclipsing mid-band licensed allocations by more than four to one. We stand ready to assist in developing a balanced national spectrum strategy.

4. Revitalizing a Unified Government Voice on Spectrum Issues. I am pleased that two nationwide wireless providers launched C-Band 5G in January 2022, with no impact on aircraft safety, but the process to get there over the last 6 months was challenging and frustrating for all involved. While the U.S. Government's spectrum management generally works well, it broke down in the C-Band / altimeter co-existence debate. As a nation, we can and must do better.

The FCC and NTIA share responsibility for managing spectrum use in the United States, informed by a wide range of stakeholder input from affected industries, consumer groups, and other government agency interests. On the federal spectrum side, NTIA administers spectrum use for federal users—such as DOD, FAA, and NASA—and it serves as federal agencies' coordinating arm and the Executive Branch liaison to the FCC on commercial spectrum uses, including the avoidance of interference. We support NTIA and the critical role of the agency's deeply talented and committed spectrum experts, and we

welcome its leadership to speak on the Executive Branch's behalf and with a single unified voice.

I want to commend FCC Chairwoman Rosenworcel and NTIA Administrator Alan Davidson for the announcement of their agencies' new Spectrum Coordination Initiative to strengthen the processes for decision-making and information sharing and to enhance cooperative efforts to resolve spectrum policy issues.¹³ The Initiative identifies many positive reforms, and I want to highlight two that are especially important to C-Band 5G / altimeter coexistence. First, the agencies "recommit to scientific integrity and evidence-based policy," including in the area of interference protection—it is critical that this commitment extend to all federal agency involvement in spectrum. And second, they commit to "revamp technical collaboration," including technical exchange and engagement. Both steps will go a long way toward avoiding future challenges in spectrum. This Committee should empower the FCC and NTIA to speak with one voice on spectrum matters and leverage their expertise to address spectrum interference concerns.

* * *

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

¹ *CTIA Wireless Industry Indices report (July 2021)*.

² Enrique Duarte Melo et al., *5G Promises Massive Job and GDP Growth in the US*, Boston Consulting Group (Feb. 2021), <https://www.ctia.org/news/report-5g-promises-massive-job-and-gdp-growth-in-the-u-s>. Conversely,

delayed access to 5G spectrum has real impacts: every six-month delay in 5G deployment costs our nation's economy \$25 billion in economic benefits over the next decade, risks America's competitiveness, and jeopardizes our ability to ensure global 5G leadership. *Id.*

³ Monica Kuroki et al., *5G Connectivity: A Key Enabling Technology to Meet America's Climate Change Goals*, Accenture (Jan. 2022), <https://newsroom.accenture.com/news/5g-enabled-technologies-could-solve-for-one-fifth-of-us-climate-change-target-by-2025-new-study-finds.htm>.

⁴ Morgan Stanley Research, Chart of the Week: 5G Starts to Gain Traction (Jan. 31, 2022).

⁵ CTIA, 5G for Home Broadband (Nov. 2021), <https://api.ctia.org/wp-content/uploads/2021/11/State-5G-for-Home-What-is-5G-Home-Broadband-Fall-21.pdf>.

⁶ 5G Fixed Wireless Broadband: Helping close the digital divide in rural America, Accenture (Nov. 2021), <https://api.ctia.org/wp-content/uploads/2021/11/CTIA-Rural-HHs-mini-POV-V2-20211115.pdf>.

⁷ Infrastructure Investment and Jobs Act, 117 Pub. L. 58, 135 Stat. 429 (2021), Section 60102(a)(2)(I) (defining "priority broadband project") and Section 60102(h)(1)(A) (directing States to prioritize funding for such priority broadband projects).

⁸ Dr. Robert F. Roche & Sean McNicholas, *CTIA's Wireless Indices Report: A Comprehensive Report from CTIA Based on CTIA's Wireless Industry Survey Results, Year-End 2020 Results* (July 2021).

⁹ Letter from Kara R. Graves, CTIA to Marlene H. Dortch, FCC, WT Docket No. 19-348, Attachment: *5G Mid-Band Spectrum Deployment* at 3 (Feb. 16, 2021).

¹⁰ Ericsson, *Ericsson Mobility Report* (Nov. 2020), <https://www.ericsson.com/4adc87/assets/local/reports-papers/mobility-report/documents/2020/november-2020-ericsson-mobility-report.pdf>.

¹¹ Janette Stewart, Chris Nickerson, Tamlyn Lewis, *5G Mid-Band Spectrum Global Update*, ANALYSIS MASON, at 1 (Mar. 2020), <https://api.ctia.org/wp-content/uploads/2020/03/5G-mid-band-spectrum-global-update-march-2020.pdf> (Analysis Mason Report).

¹² Questions for the Record, The Honorable Jessica Rosenworcel, FCC, Response to Questions for the Record (2021), <https://www.commerce.senate.gov/services/files/E4FB6E39-28F0-4328-902A-04F5F511825C>.

¹³ See FCC, *NTIA Establish Spectrum Coordination Initiative* (Feb. 15, 2022), <https://www.fcc.gov/document/fcc-ntia-establish-spectrum-coordination-initiative>.

Mr. DOYLE. Thank you very much.
 Ms. Brown, you are recognized for 5 minutes.

STATEMENT OF MARY L. BROWN

Ms. BROWN. Thank you, Chairman Doyle, Ranking Member Latta, and members of the subcommittee. My name is Mary Brown, and I am here to provide you with Cisco Systems's views on the future of wireless. Thank you for the invitation to testify.

Cisco Systems is a \$49 billion global provider of IP-based networking equipment, solutions, and services located in San Jose, California. Our customer base spans enterprise customers, governments, and service providers. In wireless, Cisco offers Wi-Fi and private 5G solutions. Spectrum is vital to all our customers.

Thanks to the leadership from Congress, the United States finds itself in the enviable position of being a technology leader in both unlicensed and licensed technology. Not only does this mean that U.S. consumers get the best, and get it first, but companies domestic and foreign see the U.S. as a place where advanced technologies are developed and deployed. Wi-Fi is a prime example of a technology that has benefited from congressional and FCC leadership, and here are three recent statistics that prove it.

Annual U.S. revenues for the sale of unlicensed devices are approaching \$100 billion annually, while the total economic value of Wi-Fi in the United States will reach as much as 1.6 trillion by 2025.

The dollars are big, but the number of devices is even larger. Comcast reported last fall that its customers are connecting nearly one billion devices on its network alone. In the 2018 MOBILE NOW Act, Congress declared as a matter of Federal policy the FCC must provide for unlicensed spectrum. In 2020 the FCC opened 1,200 megahertz of unlicensed spectrum in the 6 gigahertz band, paving the way for a new 6 gigahertz generation of Wi-Fi.

As broadband networks increase in speed, whether 5G, fixed or mobile, cable, fiber, or satellite, so too must Wi-Fi that operates at the edge. Wi-Fi is also the most widely deployed spectrum technology in American business; 5G will soon become part of that enterprise story. And at Cisco, we are looking forward to enabling a convergence of Wi-Fi and 5G for our enterprise customers.

For 6G, the Alliance of—for Telecommunications Industry Solutions, a North American standards organization, has launched the Next G Alliance, enabling the U.S. to develop a consensus vision on what it hopes 6G will uniquely accomplish.

Turning to the question of spectrum coordination, on government agency disagreements there is probably one unfortunate issue upon which we can all agree: we have not found that happy place in spectrum policy decisionmaking, where collaboration reigns over confrontation. While my written testimony contains several suggestions, here are two points that are most important.

First, Congress should make clear to NTIA and to the executive branch, generally, that it wants NTIA to be the lead agency on spectrum matters.

Second, the recently revised FCC NTIA memorandum of understanding is an important development that we should all celebrate, underscoring the importance of agencies working together.

On auction reauthorization, Congress has maintained FCC auction authority since it was first adopted in 1993, and it should renew that authority this year, as Congress and the FCC continue to work on more spectrum for 5G and, ultimately, 6G.

Many continue to think of auctions as simply a budget reconciliation tool. It is true that over the decades auctions have amassed over \$175 billion, enabling spending on a variety of important public interest programs. However, thinking about auctions narrowly, as a vehicle that puts cash into the Federal budget ATM, misses the mark. Far more important is the economic value, measurable in hundreds of billions of dollars of contributions to the GDP created by the networks that have been built as a result of auctions.

Auctions serve other important purposes. In 2012 Congress authorized the first incentive auction. This new form of auction provided a much-needed tool to the FCC as it began its work of transitioning spectrum allocations from 20th century technologies to 21st century ones.

In conclusion, renewing auction authority remains highly relevant to 5G and 6G networks. Incentive auction authority is important to help us transition efficiently from old allocations to new ones. NTIA needs to be deemed the lead agency on spectrum within the executive branch, and spectrum policy should continue to enable the advance of both unlicensed and licensed radio technology.

Thank you for the opportunity to testify. I look forward to your questions.

[The prepared statement of Ms. Brown follows:]

"5G AND BEYOND: EXPLORING THE
NEXT WIRELESS FRONTIER"

Before the Communications and Technology Subcommittee
of the House Energy and Commerce Committee

March 16, 2022

Testimony of
Mary L. Brown
Senior Director
Cisco Systems, Inc.

Thank you, Chairman Doyle, Chairman Pallone, Ranking Member Latta, and Ranking Member McMorris-Rodgers, and members of the subcommittee. My name is Mary L. Brown and I am here to provide you with views from a leading technology vendor, Cisco Systems, Inc., on the future of wireless and the key spectrum policies and government decisions that Cisco believes will continue to advance our economy and access to universal broadband. Thank you for the invitation to testify here today.

Cisco Systems, Inc. is a global provider of IP-based networking equipment, solutions and services based in San Jose, California. As a Fortune 100 company with revenues of \$49 billion, our customer base spans enterprise customers of all sizes and types, governments, and service providers. In wireless, Cisco offers Wi-Fi and Private 5G solutions. Our service provider engineering teams build core 5G networking and transport solutions used by operators around the world. Spectrum is vital to all of our customers, and they want the technologies and services to enable them to put spectrum to work.

Summary

This testimony covers three broad areas of interest to this subcommittee. First, I discuss the importance of US leadership in spectrum policy globally, including advanced technologies such as Wi-Fi 6E and 5G, and how that benefits US interests at home and abroad. Second, I want to share with you some thoughts on spectrum coordination across government agencies and suggest ways to improve those discussions in the future. Finally, you are faced with the task of

reauthorizing spectrum auction authority that will expire at the end of the fiscal year. I hope to provide you with arguments about why this important tool must be reauthorized.

Importance of global leadership in spectrum policy

Radio systems are incredibly diverse. There are thousands of types of radio systems in use and more being invented almost every day. It is hard to think of a natural resource that can be exploited to solve so many different challenges, or one where rapid technology advancements continue to support an ever-expanding set of use cases. For commercial radio systems, two radio systems stand out as the most important to the country's economic and broadband policy goals – the unlicensed technology known as Wi-Fi and the licensed mobile technology known as 5G.

Thanks to the leadership from Congress, the United States finds itself in the enviable position of being a technology leader in both unlicensed and licensed technology. Not only does this mean that US consumers get the best and get it first, but companies domestic and foreign see the US as the place where advanced technologies are developed and deployed.

Wi-Fi is a prime example. Federal Communications Commission (FCC) decisions, beginning in the mid-1980s, created the opportunity for a new form of unlicensed radio, known as “spread spectrum,” that was increasingly being demanded by American businesses to transmit data. As the market continued to develop in the 1990s, market participants saw the value of open standards and interoperability of these systems – leading to the first Wi-Fi standard in 1997, and to the creation of Wi-Fi Alliance in 1999. And while market participants today are global – about 800 companies are members of the Wi-Fi Alliance – the industry skews to the United States in that many of the most significant players, including Cisco, are US companies.

Wi-Fi has been by any measure an enormous success. The Consumer Technology Association recently estimated that US sales of unlicensed devices (many of which are Wi-Fi) totals \$95.8 billion annually.¹ Comcast, in a 2021 report, noted that on its network alone its customers are connecting nearly 1 billion devices, and that 77% of its customers report they will be adding more smart devices this year.² Indeed, Deloitte recently noted that sales of Wi-Fi 6 devices will

¹ CTA, *Unlicensed Spectrum and the US Economy* (2022), available at: <https://shop.cta.tech/collections/research/products/unlicensed-spectrum-and-the-us-economy-quantifying-the-market-size-and-diversity-of-unlicensed-devices>

² Comcast, 2021 Wi-Fi Trends Report, available at: <https://corporate.comcast.com/press/releases/comcast-report-xfinity-households-1-billion-devices-wifi-2021>.

significantly outpace 5G devices in 2022,³ with the Wi-Fi Alliance projecting 4.4 billion Wi-Fi devices to be shipped this year.⁴ All told, the Wi-Fi Alliance estimates the economic value of Wi-Fi in the United States to be \$1.6 trillion by 2025 and globally as high as \$4.9 trillion by 2025.⁵ It has remained a truism for more than a decade that more than half of the world's Internet traffic begins or ends on Wi-Fi.

Congress' delegated to the FCC the impetus to build on Wi-Fi's runaway success story, when in the 2018 Mobile NOW Act it declared, as matter of federal policy, that for unlicensed spectrum the FCC must

“...maximize the benefit to the people of the United States of the [unlicensed] spectrum resources of the United States; ... advance innovation and investment in wireless broadband services; and ... promote spectrum policy that makes available on an unlicensed basis radio frequency bands sufficient to meet consumer demand for unlicensed wireless broadband operations.”⁶

When efforts to make unlicensed 5 GHz spectrum contiguous largely came up dry, the FCC in 2018 opened a Notice of Proposed Rulemaking on 6 GHz, culminating in a ground-breaking decision to open the band in 2020. Opening 1200 MHz of spectrum in the 6 GHz band alleviates the congestion increasingly becoming an issue for a technology that had not had any new spectrum since the mid-2000s, over 15 years ago, and before the introduction of the first smartphone. The 6 GHz band enables an entirely new generation of advanced Wi-Fi technologies – today, Wi-Fi 6E and tomorrow, Wi-Fi 7. It is essential for Wi-Fi to stay abreast of evolving broadband capabilities whether that broadband connection is 5G (fixed or mobile), cable, fiber or satellite. Wi-Fi 6E represents a 3-4X improvement in data speeds over Wi-Fi limited to the 2.4 and 5 GHz bands, and equipment now being certified is being advertised with peak data rates of as much as 10 or more gigabits per second. As the broadband connections to which Wi-Fi is attached speed up, as devices themselves consume and use more data, Wi-Fi networks must keep

³ Deloitte, TMT Predictions, 2022 at 57, available at: <https://www2.deloitte.com/us/en/insights/industry/technology/technology-media-and-telecom-predictions.html>

⁴ Wi-Fi Alliance, 2022 Wi-Fi Trends, available at: <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-2022-wi-fi-trends>.

⁵ Wi-Fi Alliance, Global Economic Value of Wi-Fi (2021-2025), available at: https://www.wi-fi.org/download.php?file=/sites/default/files/private/Global_Economic_Value_of_Wi-Fi_2021-2025_202109.pdf

⁶ Mobile NOW Act, Section 17 (2018) adopted as part of the Consolidated Appropriations Act of 2018.

up if Wi-Fi is to continue to play its important role in delivering broadband to American consumers. US innovation – such as innovation in virtual and augmented reality devices – depends upon it.

Enterprises, too, reap the benefit. Wi-Fi is the most widely deployed spectrum technology in American business. It is important to understand that for many companies, the bulk of enterprise data traffic may be inside the enterprise only, and may never see the Internet. Nevertheless, that data is critical to enabling American industry to deeply digitize its operations using wireless, providing platforms for business innovation and competitiveness. 5G will soon become part of the enterprise story, and at Cisco, we are looking forward to enabling a convergence of Wi-Fi and 5G for our enterprise customers within their networks.⁷

To add to the innovation curve, the FCC's 2020 decision is enabling for the first time ever, automated spectrum sharing through a mechanism known as Automated Frequency Control (AFC). These database services, informed by the FCC's licensing records, will steer Wi-Fi operations away from frequencies in use by nearby microwave links, and in the process enable Wi-Fi signals to match the strength of Wi-Fi transmitters in the 5 GHz band without causing harmful interference. It is a measure of the enthusiasm for the future of Wi-Fi that 14 applicants filed to become AFC system administrators. Industry is very much looking forward to the FCC moving these applications through a review process this year, so that we can show the world the practical value of spectrum sharing.

Finally, the FCC was the first to open the door to Wi-Fi 6E, but its decision has now been magnified many times over, with regulators around the world moving to open 6 GHz to Wi-Fi and similar radio systems. That is a huge benefit to the US-based Wi-Fi manufacturing sector, and we hope to obtain universal availability of the 6 GHz band.

For 5G, while we are right to be concerned about falling behind, our 5G infrastructure is strong and growing. Key to this endeavor has been the FCC, the National Telecommunications and Information Administration (NTIA) and Department of Defense collective (DoD) willingness to do the hard work of making mid-band spectrum available. Mid-band spectrum is composed of frequencies in the 3 GHz and the 2.5 GHz bands, and is proving to be an essential ingredient for 5G. In fact, the most widely deployed spectrum for 5G in the world is in the 3 GHz band. This enables global economies of scale for the devices that use 3 GHz. As we have seen last year's record-breaking \$81 billion auction of 3.7 GHz spectrum, "mid-band" spectrum is highly desirable for 5G networks, and some of the mid-band "have-nots" used that auction to flesh out their spectrum portfolios. In our country, competition for 5G offerings will be robust.

⁷ Cisco recently launched a Private 5G solution that can be used by mobile operators to meet the needs of their enterprise customers or by enterprises themselves, using spectrum available to them such as in the Citizens Band Radio Service (CBRS).

With mid-band spectrum, operators can immediately use it to supplement capacity for downlink traffic. Traffic that was carried on low-band frequencies to customers' devices can now be placed on mid-band spectrum if the customer's device is within range. The early deployment pattern is straightforward. To utilize the spectrum for supplemental downlink, 3 GHz transmitters are mounted on existing towers. While the 3 GHz radio waves do not travel as far as radio waves in low band spectrum, they can carry a significant amount of downlink traffic to nearby devices. The more difficult 3 GHz deployment path is network densification – namely, mounting network radios much more closely together. Naturally, this may require many more towers. Network densification does enable more ubiquitous mid-band coverage, at least in dense urban areas. To date, what has been observed among US carriers are different approaches and priorities to network densification.

The question of how much mid-band spectrum is required is an interesting one. The global mobile community called on regulators to provide one gigahertz of mid-band spectrum in 2019. The Global Mobile Operators Association has divided mid-band into “lower” and “upper” segments, with lower segments extending to 1.5 GHz. In the US, the FCC has delivered, or is on track to deliver, about 750 MHz of mid-band spectrum, while discussions continue about possible commercial use in the 3.1 – 3.45 GHz range. We should remind ourselves that as an advanced economy, most of this mid-band spectrum was already in use, and it has been through the substantial and dedicated efforts of those at the FCC, NTIA, and DoD that the US has been able to vault into a global leadership position in mid-band spectrum availability.

Even as the unlicensed community, led by US companies, works to bring Wi-Fi 7 to market in the 2024 timeframe, so too are US interests focused on 6G. The Alliance for Telecommunications Industry Solutions (ATIS), a North American standards organization, has launched the Next G Alliance to focus on 6G. Cisco participates in the Alliance. While 6G will be the product of the global standards community, it is extremely important that the United States develop a consensus vision of what it hopes 6G will uniquely accomplish that is different from 5G. In 2021, the Alliance defined six broad goals for 6G technology, which is the very first and necessary step toward deciding what to standardize. Those goals are (1) trust, security and resilience (2) cost efficiency (3) enhanced digital capabilities for multi-sensory experiences, including human to machine interaction (4) use of artificial intelligence in the network fabric (5) advancements in cloud and network virtualization, and (6) design that addresses energy efficiency.⁸ Various working groups operating under the Next G initiative are now discussing the next level of detail in technology, spectrum, applications and more.

⁸ NextG Alliance, “Roadmap to 6G,” is available here: https://nextgalliance.org/white_papers/roadmap-to-6g/

Cisco has also called upon Congress to support OpenRAN initiatives that would enable 5G (and future “G”) operators to pick and choose from among vendors. Cisco is a strong proponent of open standards, and we believe that the mobile industry would benefit from an OpenRAN approach. Technology improves in environments where there is competitive supply. We also believe that opportunities created by OpenRAN could contribute to building US domestic 5G technology supply.

Issues in Spectrum Coordination Across Government Agencies

There is one unfortunate issue upon which we can all agree – we have not found that happy place in spectrum policy decision-making where collaboration reigns over confrontation. The issues cut across several FCC dockets, but I will focus on two. The first involves repurposing federal spectrum to commercial use or sharing federal use with commercial use. The second involves Executive Branch agency constituents, using commercial spectrum, who are unhappy with FCC proposed or decided policies that introduce new sharing requirements or adjacencies.

Trying to make sense of these complex debates is fraught with peril. Government’s attention should first be placed on two fundamental truths. One, advanced spectrum sharing technologies and layering different systems into the same spectrum bands are going to be increasingly used tools going forward as demand for spectrum continues to build. Two, regulators will continue to be faced with the prospect of packing more radio systems more tightly together, creating new adjacencies that require careful evaluation of impacts to adjacent incumbent systems, especially receivers. There is no place any longer for wide guard bands between radio systems where spectrum lies fallow.

Fostering a climate of collaboration instead of contention will require some new approaches.

Most fundamentally, Congress should make clear to NTIA and to the Executive Branch generally, that it wants NTIA to be the lead agency on spectrum matters. That includes NTIA being responsive to its sister agencies, and includes those agencies working through NTIA to advance their concerns during the time when the FCC is building its record.

Second, the recently revised FCC/NTIA Memorandum of Understanding (MOU) is an important development that we all should celebrate. The agencies’ commitments to following through on regular dialogue and problem solving can be an important mechanism that can help bring certainty to spectrum policy decisions. As part of the NTIA’s Commercial Spectrum Management Advisory Committee in its last term, I co-chaired the committee that initially made the proposal for the MOU to be dusted off and modernized. I am delighted that the agencies have now done so.

Government's work should not stop there. One observation from these recent debates, particularly where the dispute involves agency constituents, is that these constituencies are mainly user communities. In other words, they operate systems, and they know a lot about the systems they operate. But they are not researchers or developers, or, for the most part, PhDs in electrical engineering. In the disputes involving user communities, the common refrain is that they do not perceive there is an authoritative neutral voice evaluating the engineering of whatever is being proposed from their perspective. And while they may not be deeply schooled in radio theory, or advanced sharing technology, the absence of a champion within the decision-making process tends to cause these communities to strike a more confrontational pose, and sometimes we see agencies doing so on their behalf.

One policy innovation for Congress to consider is to create that neutral and authoritative voice to enable collaboration. Our country is fortunate to have the NTIA Boulder lab. That is the place that shouldered the work of reviewing advanced sharing technology for the Citizens Band Radio Service. Due to that work, once CBRS finally launched, the Department of Defense did not seek to overturn the FCC rules, and in fact was more in the mode of a collaborator with industry. When tapped to do what it does best, the Boulder lab is one place we can go for ground truth and building engineering consensus. However, Congress must be mindful that the lab needs to be funded to do whatever it is asked to do, and its evaluations should not be used for delay. Many in industry have pointed to the lengthy evaluation of sharing technology in CBRS that contributed to years-long delays in opening that band to commercial service.

Another policy innovation this body could consider is to fund the FCC to hire third party consulting research in the engineering field. The FCC today resolves issues in a quasi-adjudicative mode. Parties bring evidence to them, and the FCC's expert staff work to understand and evaluate that evidence, ultimately providing a recommendation to the Commission on the best resolution for rulemaking or licensing. What the FCC does not do – but other regulators in other countries do – is fund independent engineering research to more fully and impartially develop a record for decision-making. In the US, we have never funded the FCC to do this. In the UK, Ofcom maintains a broad research program in support of its regulatory agenda. This is yet another option to create a more collaborative approach to spectrum problem-solving, as it avoids the FCC having to choose between evidence brought forward by competing and often contentious camps. One pathway toward this idea is simply to ask the FCC what engineering research it would undertake if funded to do so, and why it believes that research would be important.

Some additional, but more technical, matters might benefit from a Congressional nudge, but could potentially decrease contention and enable our country to use spectrum more efficiently. Propagation models predict how radio waves lose energy as they travel through the air, buildings or terrain. The state of our propagation modeling today is an informed best guess usually

derived from International Telecommunications Union group decision-making, with all the attendant compromises that you can imagine would happen in such a setting.⁹ This is an area where government could really help industry advance our understanding of when radio wave transmissions will create issues and when they will not. Better modeling will mean government can make better spectrum decisions both for questions around sharing but also around adjacencies. It is not a problem that private sector members can resolve by themselves. Expertise exists at NTIA, the National Institute of Standards and Technology (NIST) and the FCC. Congress should ask these experts what problems should be solved first, and give them the means to move forward.

Finally, there are important sharing scenarios that simply cannot be solved without use of Monte Carlo analysis and modeling. Opening the 6 GHz band to unlicensed use was the most recent example. In that case, Monte Carlo analysis hypothesized “new” transmitters operating in geographic proximity to existing radio systems, and asked if harmful interference from the new transmitters to the old receivers would result. That analysis then informed the creation of mitigation techniques (conditions on operations such as power levels) for the “new” transmitters – enabling more use of spectrum than would otherwise be possible. The FCC needs to build confidence in the use of Monte Carlo analysis – for spectrum stakeholders and for its own decision-making. The Europeans have built a public Monte Carlo tool, and while it may not be perfect, they are refining it. In the US, when Monte Carlo analysis is used, it is based on proprietary models. Naturally, the builders of those models do not warm to the idea of sharing their intellectual property with the world. But these tools – while not necessarily decisional in any particular case – are ones that should be available to the FCC and to the broader community to help inform their understanding and build confidence in decision-making.

Auction authority

In 1993, Congress took a leap of faith, providing for five years of FCC auction authority in the Budget Reconciliation Act of 1993. At the time, the problems of choosing between competing applicants for spectrum licenses had demonstrated that beauty contests and lotteries yielded arbitrary results and resulted in lengthy delays as the private market then reconstructed a semblance of a rationalized spectrum footprint that made economic sense. At the time, no one thought that the FCC’s auctions would amount to much – the goal was simply to put spectrum in the hands of those who wanted it most with the hope that networks could be deployed quickly.¹⁰

⁹ The ITU-Radio sector is composed of nearly 200 governments (one country, one vote), and has been estimated to have another 800-900 representatives from the private sector and academia participating in its work programs.

¹⁰ Peter Crampton, “Money Out of Thin Air; the Nationwide Narrowband PCS Auction” *Journal of Economics and Management Strategy* (1995).

Heads turned when the first auction – for 10 nationwide paging licenses – cleared \$617 million. In the nearly 30 years since, Congress has maintained FCC auction authority and has itself been a source of policy innovation. In 2012, for example, Congress authorized the first “incentive” auction – a groundbreaking new form of auction that enabled broadcasters, on a voluntary basis, to be paid to exit needed 700 MHz spectrum, enabled mobile licenses to be created for first-in-the-world 4G networks, and provided an significant down payment on an interoperable new 4G network for First Responders, now known as “FirstNet.”¹¹ This was the first time auctions had been used to incent the exit of incumbents, and provided a much-needed tool to the FCC as it began the tremendously important work of transitioning spectrum allocations from 20th Century technologies to 21st Century technologies. Since then, incentive auctions have successfully been used for millimeter wave spectrum (Auction 103) and most recently, for C-band downlink spectrum at 3.7 – 3.9 GHz (Auction 107). It has been said by others, but is worth repeating – by authorizing incentive auctions, Congress creates a market where none existed before, and where market dynamics can better align spectrum use to meet our national needs.

Many continue to think of auctions as simply a budget reconciliation tool. It is true that over the decades, auctions have amassed over \$175 billion, enabling spending on a variety of important public interest programs. However, thinking about auctions narrowly, as the vehicle that puts the cash into the federal budget ATM, misses the mark. Far more important is the economic value and innovation created by the networks that have been built as a result of auctions. Economic value includes not just mobile operator capital investment and job creation – although that amounts to hundreds of billions of dollars and millions of new jobs – but also the spillover effects to GDP growth measuring in the hundreds of billions of dollars.¹² To governments at all levels, that means revenue that over time swamps the dollar amounts received for the sale of the spectrum. Moreover, US innovation is also fueled by efficient spectrum allocation from auctions. Spectrum availability acts like a magnet for network research and development, and translates into a strong hand for US intellectual property.

¹¹ In Auction 101, the forward auction generated about \$20 billion and the reverse auction paid out \$10 billion.

¹² Analysis Group, “The Economic Impact of Allocating Mid-Band Spectrum to 5G in the United States,” available at: https://www.analysisgroup.com/globalassets/uploadedfiles/content/news_and_events/news/sosa-rafert-economic-impacts-of-reallocating-mid-band-spectrum-to-5g-1.pdf (400 MHz of 3 GHz mid-band spectrum will yield \$154b in capex, \$274 billion in additional GDP and 1.3 million new jobs).

Recognizing these links, the FCC on a bipartisan basis and pursuant to Congress' direction has been working fast and furiously on making sure there is spectrum available for 5G networks – allowing carriers to repurpose spectrum holdings for new generations of technology, securing critical 3 GHz “mid-band” spectrum, and opening up “high band” millimeter wave spectrum for innovative new services. These efforts would not have been as swift or as successful without auction authority. The effort continues even today as the FCC works to get a 2.5 GHz auction over the finish line,¹³ and in its consideration of other bands such as 3.1-3.45 and 12 GHz.

Moreover, the FCC's auction authority has been put to work to solve other critical problems. While smaller in dollar value, auctions are heavily relied upon to administer broadcaster licenses and provide an efficient mechanism to resolve competing interests. In fact, smaller auctions have been used to distribute license awards in a variety of radio services, from VHF Public Coast stations to Multichannel Video Distribution & Data Services licenses. More significantly, reverse auctions for rural high-cost support mean that the discipline of the auction reveals the least amount of subsidies the FCC needs to dedicate to achieve its universal services objectives. That expertise and capability would not exist but for the auction authority Congress grants to the FCC.

At the level of international leadership, the FCC auctions program has spread around the world as other countries recognized the compelling benefits of assigning spectrum resources via auction. This recognition has sped assignment of spectrum to carriers globally, enabling faster deployments. As a result, not only are the countries of the world and their populations far more connected than at any time in human history, but availability of these technologies globally means US businesses of all types can conduct business at a global scale, whether selling into foreign markets or managing supply chains.

Finally, this topic would not be complete without mentioning that the auction activity Congress enabled provided the trajectory for US economists Paul Milgrom and Robert Wilson to win the Nobel Prize in Economics in 2020 on the strength of their work in spectrum auctions.

And some thought you were simply balancing the federal budget.

The evidence is clear - auction authority has become a key tool in how the FCC conducts its work in a variety of contexts, and pays dividends many times over. Auction authority renewal deserves your consideration this year to provide a predictable path forward for its use.

¹³ Auction of Flexible-Use Licenses in the 2.5 GHz Band for Next-Generation Wireless Services, Further Notice of Proposed Rulemaking, AU Docket No. 20-249 (released February 9, 2022). As of today's hearing date, the FCC is considering comments received on February 23, 2022 on its proposed revised bidding rules.

Mr. DOYLE. Thank you very much. We have concluded opening statements. We are now going to move to member questions.

Each member will have 5 minutes to ask questions of our witnesses, and I would ask all my colleagues, who I love dearly, to adhere to the 5-minute rule, lest you hear my gavel. I will start by recognizing myself for 5 minutes, and try to set a good example.

So, as we have heard from our witnesses today, and as demonstrated by the strong demand in recent auctions for wireless licenses, mid-band spectrum is vitally important for wireless connectivity. Our bill, the Spectrum Innovation Act, seeks to maximize the amount of spectrum available for consumer use in the 3.1 to 3.45 mid—prime mid-band spectrum.

Mr. Guice, as an advocate for innovative and competitive spectrum usage, can you discuss how you see the Spectrum Innovation Act producing greater utilization of the band?

Mr. GUICE. Yes. Look, I think it is a great question, and the Act itself sort of sets out, like, there are opportunities for licensing in this band, and there are opportunities for sharing.

I think, as we learned in the CBRs process, if we engage with DoD, we engage with NTIA and the FCC, we can structure a path forward that will result in more spectrum coming online for utilization than if we sort of lock ourselves into a camp on this spectrum.

Mr. DOYLE. Thank you.

Mr. Bergmann, do you believe this legislation can help provide consumers with greater access to 5G and other next generation wireless technologies?

Mr. BERGMANN. Mr. Chairman, thank you for the question. Thank you for your focus on this legislation. Absolutely, for 5G it is all about mid-band, and the lower 3 gigahertz band is an absolutely critical band.

So we appreciate your leadership with the Spectrum Innovation Act, which would speed access to this band. Its focus on having NTIA and the FCC in the room, its focus on licensed spectrum, its focus on a timeline for auction are all critical to moving this internationally harmonized key band to market.

Mr. DOYLE. Thank you. So as spectrum usage increases and our airwaves become more crowded, we are increasingly seeing confrontations between incumbents and new users, including even new users in the neighboring spectrum bands. So I am glad to hear the witnesses reinforce the importance of having Federal Government engage in a coordinated spectrum management process.

Ms. Brown, you discuss in your testimony how we manage the impact of new spectrum users on adjacent incumbent systems. Could you expound on that, and how that would shape the end user and consumer experience?

Ms. BROWN. Yes, thank you for the question.

I think the way in which we have equipped our agencies to resolve new band adjacencies is not lending itself to a successful resolution of issues at this point.

My observation around these issues—and it goes to C-Band, but also to transportation spectrum and elsewhere—is that the decisions are often challenged by user communities who fear interference, and who do not perceive that there is a voice in the deci-

sionmaking process that addresses their concerns from their perspective.

So to be clear, the user communities know a lot about their systems, but they don't know a lot about spectrum sharing or adjacencies. And so we have seen them striking a confrontational pose——

Mr. DOYLE. Right.

Ms. BROWN [continuing]. Instead of a collaborative one.

So we need to think about new ways to put new dynamics into the process that helps build consensus. In my testimony I suggested a couple of things to explore: one is to put the NTIA's Boulder lab more front and center in the middle of these issues to help build engineering consensus around what the right answers are; another might be to give the FCC the authority to conduct independent engineering research, which it does not really do today, but which other regulators in other parts of the world do.

The payout, of course, is enormous because, by sharpening the tools that the regulators have and building consensus, we can reduce the friction, and we can get better use out of our airwaves, which is a matter of interest to consumers, but it is also a matter of national competitiveness.

Mr. DOYLE. Thank you. You know, much of today's discussion has been about domestic spectrum policies, but what happens at the international level certainly can have a direct impact on what happens here at home. So for this reason, I would like to take the opportunity to mention the upcoming leadership elections at the U.N. International Telecommunications Union.

I want to second what Ranking Member Rodgers said. The U.S. has nominated a very well qualified candidate, Doreen Bogdan-Martin, and it is important that Congress and the Administration continue to advocate for her to be the next Secretary-General of that body.

With these important considerations in mind, and recognizing your experience within the international forums, Ms. Stancavage, I was hoping to hear from you how spectrum decisions here in the United States shape international conversations and global policies, and how that ultimately impacts American consumers and companies. So could you please share your thoughts with us in ten seconds?

[Laughter.]

Mr. DOYLE. Or I am in big trouble with my colleagues.

[Laughter.]

Ms. STANCAVAGE. It is absolutely crucial, Mr. Chairman.

Mr. DOYLE. That is a——

Ms. STANCAVAGE. Absolutely——

Mr. DOYLE. That is a great answer.

[Laughter.]

Mr. DOYLE. And with that I yield back my time and recognize my good friend, Mr. Latta, for 5 minutes.

Mr. LATTA. Well, I was waiting to see if your chair disappeared.

[Laughter.]

Mr. LATTA. But thank you, Mr. Chairman.

Mr. Bergmann, you point out in your testimony the FCC's general authority to grant new permits or licenses for the use of spec-

trum expires on September 30th of this year. However, the FCC retained authority to auction spectrum for the lower 3 gigahertz band that was provided in the Infrastructure Investment and Jobs Act.

As Congress considers whether or how to reauthorize spectrum auction authority, what spectrum bands are in the pipeline?

And how should Congress be thinking about extending the FCC's authority to continue to make spectrum available for commercial use?

Mr. BERGMANN. Thank you, Ranking Member, for that question. It hits on two of the most important things for us, which is auction authority and having a spectrum pipeline.

In our 30 years with auction authority, it has never expired before. So this is new ground. It is really important that that be moved forward. And when Congress does that, we urge you to consider a spectrum pipeline.

There are some really important candidates. For us, it is all about mid-band spectrum. The lower 3 gigahertz band, which you mentioned, is absolutely critical. There is work that is started on that now, but Congress can work to advance that and speed access to that band. It is internationally harmonized, it has large channels.

There are also other mid-bands that are really important, as well, too. The 7 gigahertz band is subject to focus. It is something that NTIA has looked at, we would urge this committee to look at. The 4 gigahertz band is a band that is being used internationally. We would urge this committee to look there, as well, too.

I am delighted to talk to you all about low and high bands, as well, too. But the focus really is on mid-band spectrum right now.

Mr. LATTA. Well, thank you.

Ms. Brown, as you may know, I am co-chair of the Wi-Fi Caucus, which is focused on the benefits that unlicensed spectrum can provide for our economy and new, emerging technologies. Recently, the FCC made a significant amount of unlicensed spectrum available for Wi-Fi use. Would you speak to how Americans use both licensed and unlicensed spectrum?

And what do you expect to see, in terms of demand for both licensed and unlicensed spectrum, in the next 5 to 10 years?

Ms. BROWN. Yes. Thank you for the question. Thank you for the question.

The demand for any wireless technology, whether it is Wi-Fi or 5G, can—just continues to rise. Wi-Fi today and unlicensed spectrum represents more than half of all internet traffic because we are consuming most wireless traffic when we are indoors, whether at work or at home. That is not to say that 5G is unimportant. It is vitally important, and we are going to be using a lot more of it in the future.

I—from a consumer perspective, what we are going to see, I think, is more of a convergence of the two ecosystems as we go forward. And one example of that would be the fixed 5G offerings that are already in the marketplace, where the traffic is hauled via 5G back to a base station, but in the home the connections to the actual devices are Wi-Fi. So more examples like that coming, and more convergence, and it is going to be to the benefit of the American consumer.

Mr. LATTA. Well, thank you very much.

Mr. Todd, HTC Communications serves both rural and urban environments with a mix of licensed and unlicensed spectrum. Would you want to speak about how you identify your spectrum needs, and what the 2.5 gigahertz spectrum auction would mean for a rural provider like HTC?

Mr. TODD. Thank you for the question. So, for HTC, mid-band spectrum means choice. It is critical for us for propagation and speed. It is important for scalability and markets that you mentioned, both rural and urban areas. So consumers would lose out without access to this technology, as the increase for broadband continues to grow, and those needs occur across our service area.

Mr. LATTA. Thank you.

Ms. Stancavage, if I could ask you a question, something you said if I heard you correctly, you know, the U.S. might not be in the lead in 6G, how do we wake people up around this place to make sure we stay in the top?

And what would happen if we were not in the lead in 6G?

Ms. STANCAVAGE. Thank you for the question. And before I start I would like to say I have been with Intel for 20 years, and we expected a good reception in Ohio, but it has far exceeded that. So many thanks for that on behalf of my colleagues.

Mr. LATTA. We appreciate it.

Ms. STANCAVAGE. So in terms of 6G, it is really important.

I described, you know, the 5-year gap, basically, where we had to intercept that with product development plans. And so, when we look out to the 6G horizon, trying to complete that process internationally by 2030, I don't see the urgency that I think we need to have to make sure that we are in a position.

So anything we can do to initiate those discussions and make sure they happen in a timely manner would make the U.S. really well placed to make sure that, when those discussions happen globally, the U.S. positions are taken into account, and we can coalesce countries around our position.

Mr. LATTA. Well, thank you very much.

Mr. Chairman, I yield back.

Mr. DOYLE. I thank the gentleman. The Chair now recognizes the chairman of the full committee, Mr. Pallone, for 5 minutes.

Mr. PALLONE. Thank you, Chairman Doyle.

Our airwaves should be used to advance fundamental ideals like free speech association and democracy. Authoritarian regimes like those in Russia and China, however, are using this resource instead to watch and track their people, spread disinformation, and shut down free speech. And that is why it is as important as ever that the U.S. and like-minded countries lead in the development and deployment of these technologies, so that our public interest principles are at the center of any technological progress.

So I wanted to ask Mr. Guice, can you expand how we keep the public interest at the forefront of our spectrum policy?

Mr. GUICE. Thank you, Chairman Pallone, for the question. It is a critical aspect that we need to pursue.

The public interest has been the driving—the driver underneath our spectrum policy for decades, focusing on ensuring that communities, low-income communities, communities of color, and other—

have that opportunity to get connected is important. And ensuring that that technology is open is important, so that we all have a right and an ability to speak on these networks.

I think, as we look forward to how we do that, making certain that we address digital equity concerns, as you raised in your opening statement, is an important step. Using auction revenues to advance that is important, and that doesn't have to compete with some of the other public interest needs that I know a number of members on this committee are looking at.

Mr. PALLONE. Well, thank you. And then I wanted to ask Ms. Stancavage—I don't know if I am pronouncing it right.

When it comes to getting the—most of our airwaves to promote the public interest, coordination is the key. And so NTIA and FCC's recent Spectrum Coordination Initiative certainly helps improve things. And we also reported legislation out of the committee requiring something similar last year.

So my question to you is, why is spectrum coordination important, globally?

How can we, as the leading democracy in the world, aid in this effort?

And would having a national spectrum strategy in place help?

Ms. STANCAVAGE. Thank you for the question.

So in terms of making sure that we are available and participating in those discussions, when you move into new spectrum bands, the components that you need to do that are not readily available. So you need radios, you need filters, et cetera. And when you need those components, if the U.S. doesn't have bands to put forward, and the manufacturers are not aware of those, what ends up happening is other countries can then go into the void and then put other bands in higher priority.

So if the U.S. does want to be a leader here, early action allows us—even signaling ideas of which bands are under consideration and starting that process really is helpful for us to be able to identify those, and make sure that that is happening at the international level, as well.

Mr. PALLONE. Well, thank you.

And then, Ms. Brown, unlicensed use of our airwaves offers enormous social and economic benefits, and unlicensed airwaves help kids compete—or complete, I should say, their homework, as well as enable the advancements in health care and other things.

In addition, a recent report found that unlicensed spectrum contributes over \$79 billion per year in economic value.

So with these benefits in mind, what is the impact to consumers and innovators if the U.S. fails to free up additional airwaves for unlicensed use?

Ms. BROWN. Great question. Thank you for the question. Let me elaborate a little bit on what my colleague, Ms. Stancavage, said.

Consumers benefit when we can lead in spectrum allocation, and then we can lead in product development. So for example, in the recent 6 gigahertz band, we were the first country to adopt that unlicensed band. We now have over 200 pieces of equipment that have been through the certification process, ranging from television sets, access points, laptops, smartphones, et cetera. And all of that is happening here first.

So we get the access to equipment and the innovation and the innovative new uses of unlicensed, and as we move forward we are expecting to see a lot more deployment of augmented reality and virtual reality types of devices in that band, because we now have the room to spectrally support those sorts of technologies. So tremendously important. Thank you.

Mr. PALLONE. Thank you.

I yield back, Mr. Chairman.

Mr. DOYLE. The gentleman yields back. The Chair now recognizes the ranking member, Mrs. Rodgers, for 5 minutes.

Mrs. RODGERS. Thank you, Mr. Chairman. At our last—this is beginning with Mr. Bergmann.

At our last hearing with NTIA Administrator Davidson, I voiced my concerns with the FAA circumventing the established spectrum management process, and pressuring wireless carriers into accepting more conditions on their spectrum licenses after the auction had concluded.

Congress designated the FCC as a technical expert agency to make spectrum management decisions that are in the public interest, and with the necessary authority to work through these types of concerns. Mr. Bergmann, how can we move forward from this incident, and rebuild trust in the spectrum decisionmaking process?

Mr. BERGMANN. Thank you so much for the question and your focus on this issue. It is absolutely critical.

I think, from a nearly universal set of perspectives, we can agree that the process broke down with the C-Band altimeter debate. And, you know, that is really unfortunate, because we had the FCC and NTIA, who are our spectrum experts, you know, look at this issue, plan for an auction. You had wireless carriers invest tens of billions of dollars, over \$80 billion, to purchase the rights to use this spectrum, and then had eleventh or thirteenth-hour objections to that. And that is a tremendous challenge, and it undermines that auction authority and our spectrum framework for making that spectrum available.

So I think that, you know, some of the things that we think about are improving coordination. I would applaud Mr. Davidson, Chairwoman Rosenworcel for their Spectrum Coordination Initiative. We think that is a very, very positive step.

We are encouraged that the coordination has improved and gotten much more engineering to—engineering-focused. It is really important that these be science-based decisions. We need to make sure that concerns are raised early, and that we plan for those concerns.

One of the things that, you know, we think about is a whole-of-government approach is so key, so that we don't just identify concerns, but we can plan for priorities. We know that 5G is a priority. We want to plan for that. Because, of course, this is all about making sure that we achieve the benefits of 5G. It is about the \$1.5 trillion to the economy, the 4.5 million new jobs that 5G stands to bring.

So we really thank you, and appreciate your focus on this issue.

Mrs. RODGERS. Thank you.

Ms. Brown, over the last several years the committee has taken action to ensure our communications networks are secure, and to

continue American leadership in the wireless industry. International harmonization of spectrum policy can play an important role in encouraging trusted vendors to align with our economic and security interests. And the United States has historically been a leader in identifying what spectrum is coming down the pipeline. However, other countries like China seek to disrupt that leadership and offer a different vision with their spectrum interests in mind.

What can we do to ensure continued U.S. wireless leadership internationally, as well as continued economic growth and innovation by our trusted allies and partners?

Ms. BROWN. Thank you for the question. I think we are already doing it and we need to just keep doing more of it. This hearing is a great example.

We need, as my colleagues have said, to identify spectrum pipeline, to continue to advance our spectrum allocations in support of our largest technology ecosystems—namely, Wi-Fi and 5G, and then leading into 6G. And, as a result of that, by taking action and building consensus here, we have enormous weight when we turn to face the international community. We have seen that in the unlicensed space, with the 6 gigahertz decision that the FCC made in 2020, where we have dozens and dozens of countries that are following the FCC's lead.

So moving quickly, being—paying attention to it, getting the work done, very important. And we need to keep doing more of it. Thank you.

Mrs. RODGERS. Thank you.

Ms. Stancavage, one of the major successes under the Trump Administration was bringing together NTIA, FCC, and DoD to establish America's Mid-Band Initiative Teams, AMBIT, to identify and make 100 megahertz of mid-band spectrum for 5G. How does the U.S. compare to its international counterparts in the—in terms of spectrum availability?

And what areas of spectrum policy should we be thinking about, domestically, to better position the United States at the international level?

Ms. STANCAVAGE. Thank you for the question.

I would characterize it as there is different amounts and different use cases, and that is happening—you know, it has sort of started in some of the leading markets in countries that wanted to make sure they were playing leadership roles moving forward. And the U.S. was the very first, in terms of the high-band spectrum that we made available.

We then saw the international community at the World Radio Conference come together on which bands were going to be targeted globally and used, and they are following the U.S. lead. And so we are expecting to see a lot more 5G deployments in countries that have not made them to date.

When we look at the bigger picture, we have to also see what continues. Like, 5G is not a point in time. So the standard was created in 3GPP. That will continue to evolve as we move toward 6G. And as that happens, we want to make sure that we have spectrum available in the near term.

So domestically, we should be thinking what can we put into the spectrum pipeline for the near term, and also be looking at that

over the longer term for 6G. How are we going to make sure that we have identified which pieces of spectrum may be viable in the U.S., and which ones we want the international market—so I would say, near term, making sure we have the pipeline, and longer term. Thank you.

Mrs. RODGERS. Thank you.

I have gone over. I yield back. Thank you, Mr. Chairman.

Mr. DOYLE. The gentlelady yields back. The chair recognizes Mr. McNerney for 5 minutes.

Mr. MCNERNEY. Well, I thank the chairman. This is a really important subject to me, personally, and I am really glad you held it. I thank the witnesses.

Ranking Member Latta and I co-chair the congressional Wi-Fi Caucus, and I have long advocated expanding unlicensed spectrum in our national spectrum strategy. Mr. Guice, how do we ensure that the unlicensed spectrum does not overlook

[inaudible] commercial interests' push for more—

VOICE. [Inaudible] Guthrie.

Mr. MCNERNEY [continuing]. Spectrum availability?

Mr. GUICE. Thank you, Mr. McNerney, for the question. The main way to do it is to recognize that the successful way to effectuate our spectrum policy is to make a variety of access regimes available as we look at spectrum bands.

As has been noted here, you know, the seven gigahertz band, that is a great opportunity to expand on our unlicensed work. And so opening that band up, with particularly the lower 125 megahertz, could present real opportunities to advance not only Wi-Fi 6, but help us evolve into Wi-Fi 7. But really, keeping that mix of access regimes available is what will be critical.

Mr. MCNERNEY. Well, thank you.

You observed that using artificial intelligence in network—in the network fabric was identified by the Alliance for Telecommunications Industry Solutions—and this question goes to Ms. Brown, I am sorry—that using AI has been identified by the Alliance for Telecommunication Industry Solution as the goal for 6G technology. How does that availability of licensed and unlicensed spectrum affect the United States' ability to compete with other nations in AI?

Ms. BROWN. Thank you for the question. The—it is widely expected that AI will be used in 6G networks to a far greater extent than it is today. It is already in use in networks today, but to a far greater extent. And I think, by leading in 6G, both in terms of what the vision and the use cases are, and understanding how that impacts spectrum allocations, paying attention to those spectrum allocations, and getting that work done in the—in a prompt way is going to ensure that U.S. innovation will be first in these in these new 6g networks to come.

So this is another sort of benefit of paying attention to the spectrum allocation process, and getting that work done as quickly as possible. Thank you.

Mr. MCNERNEY. Well, thank you.

Ms. Stancavage, can AI be used to enhance spectrum utilization, spectrum efficiency?

Ms. STANCAVAGE. Thank you for the question. I think most of the AI that we see right now is actually—in terms of network—is to increase network performance, to make sure that the network is operating as well as it can be, and to continue to improve it.

I think, as you move forward toward edge computing and more pushing the compute aspects closer to the end user, we will see increased AI applications and allowing the benefits of the connectivity with the compute and AI to really maximize the overall benefits.

Mr. MCNERNEY. Well, what are some of the real-world problems in building the next generation of wireless networks that AI can help address?

Ms. STANCAVAGE. I think mostly it is going to be on the network performance in the near term, but I would not underscore what the applications will enable. When you can look at AI being able to, for instance, look at machine welds on a factory floor to make sure that the weld has been done correctly in a way that no person could see the images—so it is the end user applications that AI will encourage, when you combine with the connectivity. But for the near term, I think it is mostly in terms of the network performance and really enhancing that overall performance.

Mr. MCNERNEY. Well, thank you. That is a viewpoint I hadn't thought of, was looking at well—in parts on the factory floor.

Mr. Bergmann, you discussed how the United States should replenish the spectrum pipeline, and how China has implemented mid-band spectrum in the mid to upper frequencies of the 4 gigahertz band. How will American consumers and businesses be affected if other countries continue to innovate their spectrum offerings while the U.S. lags?

Mr. BERGMANN. Thank you so much for the question. Mid-band spectrum is key to 5G, because it provides the capacity that we need for new expanded capabilities, higher capacity, lower latency.

And what that enables is a variety of benefits. It enables us to address concerns about the digital divide with new services like 5G for home. It enables us to address our Nation's climate change goals as we start to integrate 5G into some of the highest-emitting sectors in our economy. It enables us to be the home for innovation by bringing the topics like the one you were raising, AI or virtual reality, and innovation in those industries here to the U.S.

And so that is why it is so critical that we have mid-band spectrum to enable that continued growth.

Mr. MCNERNEY. Thank you—

Mr. DOYLE. The gentleman's time has expired.

Mr. MCNERNEY [continuing]. And I yield back.

Mr. DOYLE. The Chair now recognizes Mr. Guthrie for 5 minutes.

Mr. GUTHRIE. Thank you, Mr. Chair. I appreciate the recognition, and I appreciate everybody being here today.

And as you know, we are pushing against the September 30th deadline. And I am the co-chair, with Ms. Matsui, of the Spectrum Caucus. And I believe that making more spectrum available to non-Federal users is critical, especially as 5G and other wireless technologies are being deployed in the United States.

So my first question, Mr. Todd, how has making more spectrum available for commercial use bolstered our efforts to close the digital divide?

Mr. TODD. Thank you for the question. So, as a cooperative, HTC is focused on serving all of our members equally, and providing equal access to service. Broadband expansion has allowed us to be able to expand into markets where larger carriers may not have made broadband available.

So we have been able to see firsthand how bridging the digital divide can really affect and improve opportunities in rural communities. We have seen examples of hotspot deployments at community centers at the peak of COVID to be able to allow households without access, access to broadband, to come together at those locations to be able to connect.

For us, it is all about the availability and usability of the spectrum to be able to make sure that, as we continue to expand out, that folks have access as soon as they can to broadband.

Mr. GUTHRIE. We—some co-ops in our area are trying to expand broadband to areas that are under-served, as well. Is that—is your focus mostly on areas that are under-served by—well, population areas are going to be served by people who have the ability to go in and recover their investment. And are you focused on areas that aren't necessarily being able to recover investment?

Mr. TODD. Yes, sir. Our expansion has been in the areas where we have been unable to recover investment through traditional mechanisms. We have participated in different programs, whether it be state-Federal funding programs, to have access to grants to expand into those areas. And those vehicles have been very beneficial for us.

Mr. GUTHRIE. OK, thanks. That is good to know, thank you.

And then, Ms. Brown, Representative Matsui and I have been working on legislation to reauthorize the FCC's spectrum auction authority. And beyond the 3 gigahertz band and the 2.5 gigahertz band, we are continuing to do our due diligence to determine what additional bands may be ripe for auction. And so my questions, Ms. Brown, are what are the benefits for Congress preserving its authority to direct the FCC to conduct certain auctions?

Ms. BROWN. The Congress has played a leadership role for 30 years in identifying spectrum bands and providing direction to the FCC about what should happen next. And that is an invaluable policy direction that really helps drive consensus across the FCC, NTIA, and other agencies.

I can't stress enough how important it is for you all to help the spectrum community direct the FCC on this important auction program. We have not had for a long time auction authority without some direction in terms of what spectrum should be up next. And I encourage you to do that again this year.

Mr. GUTHRIE. OK, thank you. Thank you, I appreciate that.

Mr. Bergmann, I agree with you about the importance of making spectrum available for exclusive use, particularly the mid-band spectrum. One of the earlier mid-band auctions was the CBRS auction, which, as you know, granted priority access licenses to commercial users with coordination around the Department of Defense.

We have also seen the 3.45 gigahertz auction that granted flexible use licenses.

Spectrum coordination is key for successful operation sharing regimes. I have introduced the Smart Spectrum Act, which would require NTIA to establish an incumbent informing capability system for sharing spectrum between Federal and non-Federal users.

So I will get to my questions in an efficient manner. So what are some lessons learned from the previous auctions like CBRS and the 3.45 gigahertz that can—we need to take into effect as we look at the next spectrum?

Mr. BERGMANN. Thank you, Congressman Guthrie. It is important that we be thinking about all tools that we have available to us to make more spectrum available. And so we appreciate the focus there.

I think, for us, when we think about spectrum access, it is about certainty. You know, our companies have made investments of about \$30 billion per year in licensed access spectrum, and having that certainty is absolutely critical.

So you know, when we look at, you know, different spectrum sharing arrangements, you know, one of the challenges of the CBRS framework is the complexity. You know, it is more complex than any other country has deployed in that, you know, sort of critical area. And we think about things like the power levels that can be used.

And so, you know, for us, I think the market tells the story. If you look at the CBRS auction and compare—in comparison to the C-Band auction right above it, or the 3.45 band right below it, you see that the market valued that greater certainty that you had with exclusive use spectrum. And you know, to a value of about 4 to 1, you know, when you adjust for the amount of spectrum. And the reason is—

Mr. GUTHRIE. Yes, I think my time has sort of expired, so I will yield back. He was about to gavel me, so I will go.

[Laughter.]

Mr. GUTHRIE. I will go. I heard him.

Mr. DOYLE. Thank you, Mr. Guthrie.

Before we go to the next question, I want to recognize the former chairman that has just walked into the room, Joe Barton from the great State of Texas and, more importantly, the Republican manager of the congressional baseball team.

Joe, good to see you.

Mr. BARTON. [Inaudible.]

Mr. DOYLE. That is why I love you so much, Joe.

[Laughter.]

Mr. DOYLE. Glad to have you here, Mr. Chairman. Thank you.

Ms. Clarke, you are recognized for 5 minutes.

Ms. CLARKE. Oh, thank you, Mr. Chairman. And I thank our ranking member for convening this important hearing. Thank you to our witnesses for their testimony, and for joining us today. Greetings to everyone.

As the COVID-19 pandemic has laid bare, the need for accessible broadband connectivity in both urban and rural areas is critical for under-served and marginalized populations to stay connected to essential online resources like education, remote learning, employ-

ment, remote work, health care services, telehealth, and—as well as narrowing the digital divide. Many in these communities use mobile devices to participate in online activities such as virtual learning, which often requires high speed network connections that aren't always accessible and/or available.

My first question is for Ms. Guice—excuse me, Mr. Guice.

Mr. Guice, you have noted that a primary focus on public interest needs is necessary to fulfill the growing demand for spectrum resources. When competing ideas for public interest are at play, how can we ensure that spectrum policy decisions made in the public interest do not further entrench inequitable spectrum access for historically under-served communities?

Mr. GUICE. Representative Clarke, that is a great question, and thank you for your leadership in this area. I know that we have worked together on a number of efforts to ensure that these communities get served.

It is critical. It is critical that we focus our policies on ensuring that we don't leave folks behind that we know traditionally get left behind. And so, to advance those initiatives, you know, we have suggested digital literacy as one way to reach those communities, making certain that they have the skills and the tools necessary to get that access.

We are, obviously, looking at all the money that Congress has put forward on a bipartisan basis to drive investment into these lower-income communities in our rural and urban areas as a way to address that.

And we are also looking at the authority that the FCC gave—the Congress gave the FCC on a bipartisan basis to look at past digital discrimination to make certain that we bridge these gaps.

Ms. CLARKE. A quick question: How do we create a maintenance of effort?

Because often times we do these one-shot deals and, you know, it wanes over time. And these communities have been systemically discriminated against.

Mr. GUICE. Yes.

Ms. CLARKE. How do we create within the dynamics before us a maintenance of effort?

Mr. GUICE. That is a great, great question, as well. You know, we have—in one context we have a universal service program that provides continued funding. In this context, you know, we should look at auction revenues. This is a source of funding that is pretty substantial, where we could endow a foundation with some of these revenues, a portion of it, and say to them, “Here is your mission. Make certain that these community's needs are addressed. Make certain that we focus those efforts.” So we would love to work with your office on trying to bridge that.

Ms. CLARKE. Absolutely. And as a followup in your testimony, you explained that revenue generated from spectrum auctions could support public interest needs. That being said, should we also be looking at how we might—spectrum re-allocations and auctions themselves be constructed to promote digital inclusion, and increase access to the affordability of 5G connectivity for unserved and under-served communities?

Mr. GUICE. Yes, absolutely. I mean, that is the game here, right?

We need to make certain that we are getting everybody, all Americans, connected. And figuring out the tools to help them is critical.

Ms. CLARKE. Wonderful, I thank you.

As the world goes wireless, the uses and demand for wireless connectivity and spectrum continue to increase rapidly. In recent years, the U.S. has made enormous progress in unleashing spectrum, which has been allocated for both licensed and unlicensed use.

Ms. Brown, in your testimony you stated that the United States finds itself in the inevitable—excuse me, unenviable position of being a technology leader in both unlicensed and licensed technology. As we replenish spectrum pipeline, is it critical that we use available spectrum bands as efficiently as possible?

Recognizing that, what considerations should policy—recognizing this, what considerations should policymakers take into account when evaluating the best methods for allowing new uses in the spectrum bands?

Ms. BROWN. Well, the short answer to that question is yes, we should.

And I would point, by way of example, to the FCC's flexible spectrum licensing program, which allows operators to continually upgrade and change out the technology that they are using in the license spectrum that they have. That is a huge advantage that the United States has globally. Not all regulators do it, and we should encourage it.

Mr. DOYLE. The gentlelady's time—

Ms. CLARKE. Thank you.

Mr. DOYLE [continuing]. Has expired.

Ms. CLARKE. I yield back, Mr. Chairman.

Mr. DOYLE. The Chair now recognizes Mr. Kinzinger for 5 minutes.

Mr. KINZINGER. Well, thank you, Mr. Chairman, and I wish I could be there with you all soon. And I appreciate all the witnesses for being here.

We can all agree and, as most of us have publicly stated, that the United States has a vested interest in being the world leader in 5G tech and service. But I think it is also safe to say that the coordination of spectrum policy, which is absolutely vital to the effort to lead in 5G and beyond, has been subpar.

Don't get me wrong, the FCC's auctions have been a major success, bringing in tens of billions in revenue to the Federal Government and allowing for efficient uses of commercial spectrum. But in the past five or 6 years alone, we have seen numerous disputes, inter-governmental, inter-industrial, and government-to-industry disputes which hamper overall effort. And they have been embarrassing, frankly.

What can the—how can the U.S. be expected to lead, when it has to grapple with turf wars in government, and scaremongering from certain industries? It is my hope that we can all work together to overcome these challenges, reauthorize spectrum auction authorities, and remove unnecessary obstacles to spectrum organization and efficiency.

First question, Mr. Bergmann, with the demand for spectrum reaching all-time highs, what does Congress need to do to help direct more spectrum toward 5G and 6G?

And what are the spectrum needs of the industry going to look like for 6G?

Mr. BERGMANN. Thank you so much for the question, Congressman. I think I can answer both of your questions with one answer, which is to say the key is for this committee to focus on extending the FTC's auction authority with a defined set of spectrum bands, because that is what is critical for advancing 5G, and it is also critical for addressing the coordination issues that you referenced.

I mentioned earlier that the FCC and NTIA are our spectrum regulator experts. This committee is our Nation's spectrum expert, as well, too. And we really look for this committee to lead in terms of defining those auctions. That plays a tremendous advantage in terms of moving quickly. And it also helps reduce some of those back-end problems of coordination that we have seen more recently.

[Pause.]

Mr. DOYLE. Adam, are you still with us?

There he is.

[Pause.]

Mr. DOYLE. Well, Adam, are you able to hear us?

Well, the wonders of modern technology, huh?

[Pause.]

Mr. DOYLE. You want me to go to the next witness, or just wait? Who is next, Mr. Veasey?

You know what? I am going to——

Mr. KINZINGER. Yes, Mr. Chairman, I am having some connection issues.

Mr. DOYLE [continuing]. Recognize Mr. Veasey, and then we will let——

Mr. KINZINGER. Let me yield back.

Mr. DOYLE [continuing]. Adam back on, if——

Mr. KINZINGER. I will yield back.

Mr. DOYLE [continuing]. He needs it. Adam, are you there?

Mr. KINZINGER. Yes. If you can hear me, I will yield back.

Mr. DOYLE. Oh, OK, the gentleman yields back. The Chair recognizes Mr. Veasey for 5 minutes.

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

And as many of you know, just like the rest of the country, the Dallas-Fort Worth area is experiencing huge growth in technology companies. And we want to make sure that we are collectively working together to ensure that low-income communities and communities of color across the Metroplex, as we like to call it, can benefit from some of the economic opportunities made possible as we explore the next wireless frontier. And that brings me to my next question for Mr. Guice.

Can you elaborate how using a mix of access regimes—approach and exploring spectrum opportunities benefits low-income communities and communities of color as new technologies and services emerge?

Mr. GUICE. Yes, thank you very much for the question, Congressman Veasey.

A mix of access regime. What it does is it ensures that entrepreneurs at minority businesses have the opportunity to explore getting access to spectrum and spectrum technologies on unlicensed networks without a huge upfront payment on spectrum acquisition. So it creates those kind of opportunities.

In addition, you know, the FCC actually has a policy given to it by this Congress under section 309 that it should structure its auctions in a way that encourages minority and women-owned businesses to participate.

And as the FCC looks at structuring auctions, we encourage them to think about how design of that auction, particularly in terms of spectrum service areas, may hinder that capability or that opportunity for women and minority-owned businesses. So we kind of push them, and we hope you will push them.

But it is that mix of access that entrepreneurs and innovators in the unlicensed space can obtain market without having to go through the spectrum acquisition cost, and then those minority and women-owned businesses that can pursue opportunities in spectrum, the FCC should structure its auction to encourage that participation.

Mr. VEASEY. What can Congress do to help prioritize that to make sure everyone who wants and needs to be connected has equal access to the next generation of technology?

Mr. GUICE. Well, you know, Congress took a substantial step in the IIJA in bringing connectivity to these communities. The NTIA, as it rolls that program out, needs to be rigorous in ensuring that the states are pursuing those opportunities where there are, you know, urban and rural divides that need to be bridged. This is a once-in-a-generation investment, and we certainly are encouraging them to make certain that, you know, through the mapping and other efforts, they are targeting these communities with those investments.

Mr. VEASEY. Ms. Stancavage, I wanted to ask you a question. You know, as government and industries work together in the U.S. to secure the next generation and deployment, we should be very intentional about advocating in the public, and recreating a robust workforce pipeline.

I wanted to ask you about Intel, and what initiatives has Intel taken to not only educate communities about the benefits of 5G and other cutting-edge technology, but also to recruit high school students and college students of diverse backgrounds to join the technology workforce.

Ms. STANCAVAGE. Thank you very much for the question, Congressman Veasey.

So Intel takes workforce development very seriously. We have a variety of programs. In Ohio, for instance, we are, as part of our initiative there, making sure that we are doing workforce development as part of our Ohio rollout.

But in addition, one of my colleagues is very active in a program with AI, where we are making sure that AI for Youth is really explaining the technology and helping.

We also have programs at the community college level that we use, and I believe the First Lady Biden was just at one of the sites

to look at that, as well, in Arizona to see what we are doing in that respect, as well.

So we do have, you know, for college students, for younger students, and what we are doing with workforce, because we see it as absolutely critical to make sure we are prepared now and over the longer term.

Mr. VEASEY. Thank you very much.

And with that, Mr. Chairman, I yield back.

Mr. DOYLE. The gentleman yields back. I will now yield 5 minutes to my fellow suffering Pittsburgh Pirate fan and friend, Gus Bilirakis.

Mr. BILIRAKIS. Thank you. And let me just tell you, we have the number-three farm system in baseball. There is no question. And it is a bright future. I guarantee it, Mr. Chairman.

OK, in 2019 CTIA unveiled the idea of a national 5-year spectrum plan. At that time I said that this was a good idea to ensure a unified strategy among all agencies and Federal partners to understand and achieve a defined goal. Since then, there have been well-publicized instances that prove Federal agencies are not on the same page when it comes to spectrum strategy, unfortunately. And in some ways, this disharmony is an embarrassment for a functioning government.

In my research I found that the country of Australia has maintained a 5-year spectrum plan since at least 2017. Their plan is publicly updated by annually—biannually with their successes, failures, and status reports, which are then rolled into an updated 5-year plan.

The question is for Mr. Bergmann.

What would you say is the status of a unified American spectrum strategy?

What a minimum—at minimum, should be included in a U.S. strategy on spectrum?

And should we use Australia's spectrum plan as a model?

Mr. BERGMANN. Thank you. Thank you, Congressman.

Mr. BILIRAKIS. Sure.

Mr. BERGMANN. You know, your description of the focus on spectrum auctions and spectrum planning is really critical. And I think that is definitely something that we can benefit from, and incorporate here. A national spectrum strategy is a key way to do that. We can plan for auctions to have that pipeline of spectrum bands. You can make sure that you are taking your most highly valued assets.

You know, I have talked a lot about mid-band spectrum. When we look at the portfolio of mid-band spectrum, we see that government is overweighted, DoD has access to two-thirds of the key mid-band spectrum.

We also look at the allocations between licensed and unlicensed, and you have today about 1,900 megahertz of that mid-band spectrum for unlicensed. You are at anywhere between 270 or 450 today for licensed spectrum in that mid-band range.

So we think it is really important that you make those kind of strategic decisions so that we have enough of the right assets coming to market.

I would also again encourage this committee, as our spectrum experts, you all can help with that spectrum pipeline when you guys consider the FCC's auction authority, and provide some of that direction, as well, too.

Mr. BILIRAKIS. Thank you very much.

One issue I have been pounding the desk on—and I am not going to pound the desk, Mr. Chairman—on getting the NTIA and the FCC to update their memorandum of understanding on spectrum coordination. And this committee unanimously passed my bill, the Spectrum Coordination Act, which would do just that.

And I appreciate it, Mr. Chairman, you putting that on the agenda. I would love to see it get on the floor of the House of Representatives as soon as possible.

Prior to our last hearing, these two agencies put out a press release that they would be working to update the MOU on their own.

Mr. Bergmann again, have we heard anything beyond the press release on the status of this update?

For instance, do we have a timeline for an updated agreement?

Do we know what they are seeking to address to make this process better?

And as a followup, again, we all know intimately the problem surrounding Federal agencies with the last spectrum auction and licenses.

So let's go ahead and get that response from you first, please.

Mr. BERGMANN. Thank you so much. You are absolutely right to focus on coordination between agencies. We want NTIA and the FCC to be at the lead of that, so we certainly support your legislation and efforts to move that MOU forward.

We do think it is critical that all agencies appreciate and recognize the goals that you talked about with the National Spectrum Strategy, so that we have both NTIA and the FCC leading, and the other agencies thinking about how do we support those goals, so that we identify concerns early and we can plan for them.

Mr. BILIRAKIS. Thank you. So is there a better way to incorporate any Federal agencies with shared spectrum or adjacent spectrum in the pre-auction process to avoid these blunders without being too burdensome? Because that is important, as well. What do you think?

Mr. BERGMANN. I think we do have existing processes through sort of the inter-governmental coordination, and the key is that those processes broke down in the instance of the C-Band. We need to have a recommitment to those coordination policies so that those concerns are addressed early.

What is at stake, right, is how quickly can we bring 5G to market, and how quickly can we bring 5G home to bear for the digital divide or connecting rural areas? How do we push innovation faster here in the U.S.?

So I think it is really critical that we get that C-Band spectrum online in July, and I would definitely encourage this committee, through your oversight role, to make sure that those agencies are getting that feedback in as quickly as possible.

Mr. DOYLE. The gentleman's time has—

Mr. BILIRAKIS. Very good. I yield back.

Mr. DOYLE [continuing]. Expired. The Chair now recognizes Mr. McEachin for 5 minutes.

Mr. MCEACHIN. Thank you, Mr. Chairman. And to you and to Chairman Pallone I thank you for convening today's hearing.

Mr. Guice, I would like to start off with you, and just note that when we did the development of wired broadband services in rural communities, we found that it was critical to ensure that we knew what areas are served and what areas are not. And that is why I was privileged to help with the passage of the Broadband Data Act last Congress, which attempted to help improve how we collect data for wireless—wireline providers for our broadband maps.

But as you know, it is a little trickier with wireless providers. How do we make sure that we have accurate maps of which wireless providers serve which areas, and why is it important to get it right?

Mr. GUICE. Thank you, Congressman McEachin, for the question, and thank you for your leadership on trying to secure support for devices so that we can get folks in our low-income communities connected. We will continue that work.

The mapping question is a really good question. When we talk about wireless mapping, it is different and more difficult than a wireline map. Unfortunately, too often our maps have relied on sort of the theoretical propagation characteristics, which leaves a lot of communities unserved, but reported as served.

As we look at the rollout of 5G and the small cell technology that that technology relies on, it is going to be critical that we get that information right, because the opportunities to miss communities in our urban sectors as well as communities in our rural sector are just vastly increased.

So, you know, let's take a look at the actual technical opportunities, but also let's make certain that the crowdsourcing of data that we present as an opportunity to challenge those maps is available to consumers, as well. So it can't be just a state-led effort. It can't be just a professional effort. We need true crowdsourcing, because the opportunity for these technologies to miss communities are pretty great.

Mr. MCEACHIN. Thank you for that.

Mr. Bergmann, I would like to talk to you about the so-called last mile, if we can. Where do things stand currently, in terms of the effectiveness of fixed wireless as a last-mile option for our rural communities?

And how do we ensure the spectrum remains available as we move forward with auctions?

Mr. BERGMANN. Thank you so much, Congressman, for the question.

As we think about trying to meet our biggest challenges, like connecting 100 percent of the population, which is the absolute right goal for this committee, I think mobile wireless is particularly well suited to make those connections, and so I would applaud this committee for its focus on technological neutrality in the programs that you all have adopted. And we have seen, with the success of programs like the Emergency Broadband Benefit, the Affordable Connectivity Program, two out of every three consumers choosing wireless.

And we are really excited as we think about now fixed wireless for home broadband. We see already our nationwide providers, regional providers investing in fixed wireless, connecting tens of millions of homes already. And with the right spectrum, they have plans to connect together over 200 million homes. So we know that this can be a critical part of the equation because it can be deployed quickly, in many cases can be deployed more affordably, and it is going to bring choice to the home broadband market. So we are very, very excited about 5G home for wireless, and appreciate this committee's focus on making sure that we have got the right spectrum to do that.

Mr. McEACHIN. All right, thank you, sir. I thank all the witnesses.

Mr. Chairman, I am going to give you a whole minute back. I yield back.

Mr. DOYLE. Thank you, Mr. McEachin. The Chair now recognizes my good friend, Bill Johnson, for 5 minutes.

Mr. JOHNSON. Thank you, Mr. Chairman.

Mr. Todd, as co-chair of the 5G Caucus, I am focused on finding additional spectrum opportunities so that our Nation's 5G network can be swiftly deployed. I am pleased that FCC Chair Rosenworcel recently announced that the FCC plans to start an auction for the 2.5 gigahertz band this July. This auction will make more spectrum available for 5G expansion, especially in rural parts of the country.

But unfortunately, the FCC's auction authority is set to expire on September 30th. Something has—like that has never happened since the FCC's auction authority was first enacted in the mid-1990's. Please walk us through how this looming expiration might impact the preparation of smaller carriers.

Mr. TODD. Thank you for the question. From a small carrier perspective, not continuing auction authority would hinder our participation because we don't have the resources that larger, regional—national providers have.

Mr. JOHNSON. OK, Mr. Bergmann, recently a technical disagreement in the C-Band spectrum made national news. We all heard about it. As spectrum repurposing is becoming more difficult, we need to ensure our spectrum licensing system provides certainty to encourage investment in wireless technology, and we need to ensure that Federal agencies are communicating, collaborating, and fully cooperating to ensure safety issues are addressed without disrupting the auction process.

The C-Band spectrum that was auctioned is a non-Federal band. Can you explain how the FAA inserted itself into the process, and whether they had a formal role in the re-allocation process?

Mr. BERGMANN. Yes, thank you very much for the question and the focus on the issue.

You know, I think we can all agree that the process broke down in the C-Band altimeter discussions and caused unnecessary friction. You know, we saw that when we look at how the rest of the world uses that band safely, and has both 5G and safe flights.

And so I think, you know, it is absolutely critical that we learn from this lesson when we have companies that are willing to invest

tens of billions of dollars to solve the digital divide, to bring jobs. It is absolutely critical that that process happen smoothly.

And I think, you know, the keys are, as you say, making sure that there is early agency input. The FCC and NTIA do have a process where they share proposed decisions and circulate those.

I think the challenge here is that some of those aviation—some of that aviation equipment listens outside of its band. In the 5G world we stay in our lane. We are very focused on providing service in our lane, but that aviation equipment listens outside of its band.

And so, you know, when I think about early planning, I think about not just raising concerns, but how do we plan for the future, so that there are technology upgrades, so that we can——

Mr. JOHNSON. Yes.

Mr. BERGMANN [continuing]. Be more efficient with that spectrum.

Mr. JOHNSON. Back to those operative words, cooperate, communicate, and collaborate across agencies to make sure we address these questions up front.

Mr. Bergmann, continuing with you, the FCC was established by Congress to be the authoritative technical expert on spectrum matters. While the FAA's stakeholders did not like the outcome of that proceeding, what is the long-term impact to the public's trust when Americans see Federal agencies raising last-minute concerns after the auction, once concerns were already addressed by the so-called expert agencies?

I mean, how can the American people trust what we are doing, if we miss something this big?

Mr. BERGMANN. I would absolutely agree with you. I think we saw unnecessary friction in the aviation industry for consumers, and certainly in the wireless world, as well, too. And we know that every 6-month delay in 5G costs us \$25 billion in the benefits that we hope to achieve from it. So it is absolutely critical that we solve these issues, going forward.

Mr. JOHNSON. You bet. One last question for you, Mr. Bergmann, and I will ask it quickly.

One of the biggest auctions the FCC has ever conducted is the auction of the C-Band spectrum. While the first 100 megahertz of the full 280 megahertz has been made available, the remaining 180 megahertz of the spectrum will be made available in phase 2 of the transition. As Congress examines whether and how to extend FCC authority to issue permits and licenses, what would be the impact to your industry if the FCC is unable to complete processing the phase 2 licenses?

Mr. BERGMANN. Absolutely. Well, it is absolutely critical that we bring spectrum—that first phase available in July, and it is critical that we move forward with phase 2, as well, too. We know that is key to all those benefits that 5G will bring to us.

Mr. JOHNSON. OK. So you are aware of it.

Thank you, Mr. Chairman——

Mr. DOYLE. The gentleman's time——

Mr. JOHNSON [continuing]. I yield back.

Mr. DOYLE [continuing]. Has expired, and the Chair now recognizes Mr. Soto for 5 minutes.

Mr. SOTO. Thank you, Mr. Chairman. In central Florida and throughout the Nation, Americans rely on spectrum for cell service, internet, social media, GPS, various apps from health to music. And that is why I was so excited about the 5G rollout. This was a tremendous accomplishment.

We know there was balancing that had to happen between both cellular and aviation, and those issues will continue to be resolved. And it is key that we work together, both through cellular and aviation and other areas, as we go forward on C-Band concerns that have been around for about 4 years.

Especially representing central Florida, a tourism capital with so much air traffic, we happen to be able to do this because we work together, right, in public-private partnerships, government, as well as private industries. And that is why it is so key for us to do the same thing as we open up new spectrum for auction, which is why we are here today, to make sure we educate the American people on why it is key to extend the FCC's auction authority currently set to expire on September 30th of this year.

And what is at stake, particularly mid-band spectrum, which is good signal, has a good signal range, and is better indoors. It helps with increased capacity, faster speeds, latency, so many things that are key to make sure we have that crisp cell phone connection. And so we have to continue this work together as we march toward 6G—you heard it, 6G next, to those of you at home who are just catching up with 5G. Artificial intelligence, virtual reality, machine learning, and other technological advances, 6G will be critical to these for our economy, healthcare, national security, finance, entertainment, so many other issues.

I am glad it was brought up before about the American COMPETES Act and the CHIPS Act that is included in there, because all of this is together. Without the supplies for cell phones and so many other technological advances, we won't be able to let this happen. So I am hopeful, like with the infrastructure law and, particularly with the recent budget, that this committee and this Congress will come together to pass the America COMPETES Act with CHIPS funding. We are excited to make microchips in central Florida in NeoCity, and we are going to keep going forward on that.

I am also concerned about commercial space flight and streamlining telecommunications with regard to our rockets that go up, literally, every week, multiple times a week, by SpaceX, Blue Origin, ULA, and, of course, by NASA. So our LAUNCHES Act is something that we look forward to longer discussion on in the future.

But for now, we know it is critical for FCC and NTIA to work together to develop positions on international spectrum issues: one, to help achieve global harmonization; two, to make sure we are in the best position to capitalize on what the next generation of wireless technology has to offer; and three, to ensure timely commercialization of products for the U.S. market.

Ms. Stancavage, why is it important to U.S.'s economic and security interests to play a leadership role in engaging the international community in spectrum policy?

Ms. STANCAVAGE. Thank you for the question, Congressman Soto. It is absolutely critical.

As I described, it is—we have to be early in the process to make sure that we have the components around it so that we are able to intercept the product and investment cycle to make sure that there is timely access. And that is true for licensed and unlicensed technologies. And when the U.S. does act quickly, what you see is the bands that the U.S. selects, we do have the equipment to support those, and then we are able to provide that equipment, and we are then able to capitalize on the economies of scale when other countries do, as well.

So rather—waiting at the back of the queue, we are at the front of the queue, and then we are able to make sure we have the equipment, and we have it at a—in a more cost-effective manner.

Mr. SOTO. Like in so many issues, it is critical for America to lead, and I appreciate that.

Mr. Bergen (sic), much of the mid-spectrum is occupied by Federal Government agencies. Obviously, this is a sensitive area, where we have to have careful balance. Do you have any recommendations on how we can determine what spectrum the government needs, and what can be reallocated?

Mr. BERGMANN. Absolutely. Thank you for the question and the focus on mid-band spectrum.

You are absolutely right. The Federal Government is overweighted in our mid-band spectrum portfolio. There are absolutely important missions there. The key is to find ways to be more efficient with the spectrum that we use.

In the commercial wireless industry we have strong incentives to constantly have new generations of technology that are more efficient. With spectrum, we have increased our spectrum efficiency by 42 times in the last ten years. The same incentives don't always exist for the Federal Government. So we need to find a way to make them more efficient, so that they can do their important missions, and we can reallocate spectrum for commercial use.

Mr. SOTO. And that is why we are here today—

Mr. DOYLE. The gentleman's time has expired.

Mr. SOTO. Thanks.

Mr. DOYLE. The Chair now recognizes Mr. Long for 5 minutes.

Mr. LONG. All right, folks, everybody gather round here, about to begin the auction. Hey, hey. Beautiful day for an auction, and as you all know, it never rains on a Billy Long auction, there is always a cool breeze at about 40 degrees. But I am very happy today to be here today selling the 2.5 gigahertz band. And you are all—we have had your credit pre-approved and everything, so everyone is free to bid at will.

All right, who got 25 million? Here? Twenty-five, twenty-five? We get 20, somebody say 25? What are you—15, 10, \$10 billion, 2.5 gigahertz? Come on, now. All right. Six million, eight, eight, nine, now we got a nine, ten, ten, 11 here, eleven. Ten million dollars? Eleven, 11 now, eleven, twelve. Yes, 13 million, 14, 14-and-a-half, 13, 14-and-a-half. Sold at \$13 billion to Chairman Doyle there, 13 billion.

[Laughter.]

Mr. LONG. Sir, if you will pay your bill at the door out there before you leave, that would be greatly appreciated.

And folks, I have a 31-year career as an auctioneer before coming to Congress. And so I know a little bit about auctions, and that is the place that things happen, and it is transparent, fair, and all equal to everyone. Everyone is free to bid.

Auctioneering spectrum benefits the American taxpayer and the Federal Government. In fact, it has the potential to raise significant funds, as you just witnessed here, with him paying 13 billion for that band, to the U.S. Treasury and for the congressional priorities such as rural broadband deployment in places like my district in southwest Missouri.

It is important for the FCC auction authority to be extended with language requiring some FCC auctions, even for a short term.

Now, switching gears, Ms. Brown, I would like to ask you, upon identification by Federal agencies the FCC is required to auction spectrum in the lower 3 gigahertz band within the next 7 years, as NTIA looks to potentially relocate incumbent Federal systems or to find a technical solution to sharing. What is the viability and the—or visibility into broadband range for spectrum assignments and their use?

And how important is it that NTIA gets this information?

Ms. BROWN. Thank you for the question. It is critically important that NTIA get the information about Federal use in that band because 3 gigahertz is the most important 5G band, not just in the United States, but in the world, because it can get put to work immediately to deliver 5G services.

So I think one of the things that the Spectrum Innovation Act does well is it does give a timeline to NTIA and FCC to make up their minds, but it also gives them flexibility in the decision-making, depending on what they find in the band, and whether it can be moved, or changed, modified, or whether it needs to stay put. So I think Congress is on the right track there.

Mr. LONG. Thank you. And I will go to Ms. Stancavage next.

Under Chairman Pai's tenure, the FCC started the Spectrum Horizons proceeding to seek comment on how to unleash innovation in new technologies in spectrum above 95 gigahertz. How do you envision the future of these terahertz frequencies being used, and how is the rest of the world looking at possible uses for this spectrum?

Ms. STANCAVAGE. Thank you for the question, Congressman Long.

So basically, when we look at this, it is about the capabilities that are enabled. So when you look at 4G, it was very humancentric, what you did on your phone. With 5G, we added ultra-reliable low-latency computing, and also for machine massive machine-type communication, or IoT. Those extra capabilities are enabling businesses to get those same types of benefits.

And now, as we move into 6G, there is research and development going on for some of those that would require very, very large bandwidths, but very short range, which would be consistent with those bands, for things like positioning, very high accuracy positioning, and sensor uses. So you want to take advantage of the capabilities that the technology brings and what is able to be deployed there.

So there is definite interest in a lot of different research areas to look at those high bands.

Mr. LONG. OK, thank you. And I just want to make a note that, if this 5.2 ends up bringing less than 13 billion, that they should hire me as their auctioneer next time.

And being an auctioneer, I did my 5 minutes in two-and-a-half minutes. So, Mr. Chairman, I yield back.

Mr. DOYLE. I thank the gentleman. I am going to need an installment plan, Billy.

[Laughter.]

Mr. DOYLE. The Chair now recognizes Mr. O'Halleran for 5 minutes.

Mr. O'HALLERAN. Thank you, Mr. Chairman. I appreciate that. As we consider the future of the Nation's spectrum allocation and American leadership in this frontier, I want to recognize that, while making more mid-band spectrum available is important for American leadership on 5G deployment, it is also critical for closing the digital divide in rural America.

The spectrum decisions made—and I hope we get this done by September, end of December, September—made here in D.C. have the potential to vastly improve connectivity in Arizona and across rural America. Access to spectrum is a key part of unlocking the potential of wireless broadband in rural America and Indian country.

Broadband is the lifeblood of the 21st century economy. It is critical to economic development, telehealth, and education in rural areas. Ensuring our rural and tribal communities and the providers that serve them have access to the spectrum resources necessary is essential to closing the digital divide and making sure our rural schools, hospitals, and businesses are not left behind.

In the past spectrum auctions, like the most recent 2.5 gigahertz, the FCC created a tribal priority window so that spectrum could be allocated to ensure eligible federally recognized tribal governments, as well as tribal communications providers were able to connect their communities. This presented a landmark opportunity for tribal nations to gain access to spectrum to better serve their communities.

Mr. Guice, I know you are working with tribal nations before, and including the Gila River Indian community in the southern part of my district. Can you discuss what else Congress should be considering to make sure that tribal communities can get the best wireless services possible?

Mr. GUICE. Thank you, Congressman O'Halleran, for the question. And it was an honor to serve Gila River for the years in which I did that. What it did give me an awareness of was just how difficult the challenge is of bridging the divide in our tribal communities.

What Congress can do is—what you did, you know—promote the opportunity for tribal windows when spectrum becomes available, make certain that there is sufficient time for those tribal communities to apply for that window. So we appreciate your leadership on that that work.

But as Congress looks at spectrum opportunities, it needs to recognize the sovereignty of our tribal nations, and that sovereignty

means that they should have some input into the destiny of the wireless spectrum that runs over their lands. So that is sort of what the tribal window created. And as we move forward on all spectrum bands, we think that is a good policy for the FCC to look through.

In addition, the FCC can look at tribal bidding credits, and how to reform those to better utilize them, as well as disaggregation of spectrum license areas so that tribal communities can build the networks on their lands where a provider has the area, but not the will to build.

So I look forward to working with your office on these issues. Public Knowledge is an advocate for our tribal communities, to make certain that they have affordable access because, as you know, they are some of the least served communities in the country.

Mr. O'HALLERAN. Well, thank you very much. In the FCC's auction for Citizens Broadband Radio Service, more than 200 bidders won over 20,000 licenses, including many entities like wireless internet service providers and tribes.

Mr. Todd, why so many bidders—or why so many bidders were able to win the spectrum in the auction (sic)?

What lessons can we learn from it?

How—and how can we ensure rural providers are able to meaningfully produce and participate in the future auctions?

Mr. TODD. Thank you for the question. So as a small provider, having access to smaller license areas is critical for small providers to be able to participate in auctions.

As I mentioned earlier, as a small provider, we have limited resources. I would expect this to be a similar situation for other providers, as well, where we don't have the resources that larger providers have to participate in auctions on a larger scale, as well as larger sizes of spectrum.

So for us, having usable spectrum that is available, that has OEM equipment that we can roll out, that definitely supports consumer choice and competition in those areas.

Mr. O'HALLERAN. Thank you very much—

Mr. DOYLE. The gentleman's time has expired. The Chair now recognizes Mr. Carter for 5 minutes.

Mr. CARTER. Thank you, Mr. Chairman, and thank all of the witnesses for being here today.

Ms. Brown, I want to start with you, if you will. During the pandemic, as we all know, Americans relied on Wi-Fi for work, school, and so many other things. In fact, I was reading a book the other day that said that the average teenager was on the internet five hours a day more during the pandemic than they were before. It is just unbelievable to me that it is—that that is true. It—and it—that we are on the internet so much.

But what I wanted to ask you is, unlicensed spectrum plays a crucial role, as we all know, in enabling Wi-Fi technologies. And under the last Administration, the FCC made an unprecedented amount of unlicensed spectrum available for commercial use. Do you think that is going to be enough to keep up with all the new data-rich applications that Americans use today?

I mean, all of us are on the internet. I am hunkered down now, and using it virtually. And do you think that is going to be enough to accommodate all of us?

Ms. BROWN. Well, thank you for the question. Over the long term, it probably won't be enough. But I think, for the immediate term, industry is already rolling out innovative new technology on the 6 gigahertz band. And we are looking forward in a couple of years to a second generation of technology coming into the 6 gigahertz band. A technology known as Wi-Fi 7 will be coming our way in about two years' time.

But that said, the—if demand continues to go up, and we expect it will with AR and VR and other sorts of technologies, over time we do need to look for other opportunities, including perhaps spectrum at the very low end of the 7 gigahertz range, or other places where we could expand Wi-Fi technology.

Mr. CARTER. OK, let me ask you something else. There is a little known research and engineering arm of the NTIA that is in Boulder, Colorado. And I believe that this expert facility is being underutilized, given the level of expertise it has.

So I recently introduced a bill, the Institute for Telecommunication Scientists Codification Act. This bill would give the ITS statutory authority to continue its work with a focus on establishing an initiative to support the development of emergency communication and tracking technologies where conventional radio communication is limited.

Ms. Brown, would you elaborate on what makes the people in Boulder so uniquely positioned to enable collaboration on next generation spectrum technologies?

Ms. BROWN. Yes, thank you, yes. The Boulder Lab is national treasure. It is the place where radar was invented in World War II, and it has a long and distinguished career in spectrum sciences. I think innovations like your bill that would enable that lab to work on commercial issues around sharing and adjacencies would be welcome.

It struck me as very astonishing that we got so far down the road in the C-Band debate without actually having facts on the ground about what the altimeters could or couldn't do, and the degree to which interference might arise. It wasn't actually until this fall that we started seeing facts pop out on that. And I noted this week there was an article in the—one of the national newspapers about Boulder getting involved in actual measurements using DoD funding.

So, yes, more flexibility and more funding for that lab would, I think, really help us with mitigating the kinds of issues we have seen in spectrum allocation.

Mr. CARTER. Thank you, Ms. Brown, I appreciate that.

Mr. Bergmann, I want to ask you real quickly. I have the honor and privilege of representing the 1st district of Georgia, and we—whereas it includes the entire coast of Georgia, it also includes a lot of rural areas, and getting broadband to those parts of the State is really important to my constituents for a number of reasons: work, learning, entertainment, whatever.

I understand that the future of 5G is more than just mobile, but there will be a fixed component to it, and that your members will

offer home broadband services with 5G. Would you tell me what it would mean for rural Americans? Will they have access to these 5G home broadband services?

Mr. BERGMANN. Yes, thank you for the focus on fixed wireless for 5G home. It is an absolutely key growth area. And our companies national and regional are all investing in it. We see them covering tens of millions of homes today. Together, they will cover over 200 million homes over just the next couple of years.

The key, I think, for this committee is you all have just made an enormous investment in making sure that everyone is connected with the \$40 billion through the infrastructure legislation. Fixed wireless can play a key role there by going faster, and providing the full complement of services that this committee is looking for. These services can provide 100 megabits down, 20 megabits up, and are really key for connecting everyone faster, more cheaply, and bringing competitive choice to the home broadband market.

Mr. CARTER. Thank you, Mr. Bergmann.

And thank you, Mr. Chair, and I yield back.

Mr. DOYLE. The gentleman yields back. The Chair recognizes Congresswoman Rice for 5 minutes.

Miss RICE. Thank you, Mr. Chairman. I just want to thank our colleague, Mr. Bilirakis, for raising the issue of the importance of the MOU between the NTIA and the FCC. And I think it is really, really important that it be fixed. Everyone has acknowledged that maybe it is not where it needs to be, and I think that is really important.

Government and industry working together has allowed the U.S. to be the global leader in new and emerging wireless technology. We were the first nation with widespread 4G coverage, leading to countless innovations here in the U.S., including the development of the app economy. Now, with the emergence of 5G and next generation Wi-Fi capabilities, the U.S. can build on this leadership record, grow our economy, and be on the forefront of technological innovation for the good of communities everywhere.

Mr. Guice, you mentioned the importance of coordinated spectrum management. It seems that recent spectrum disputes involved parties that questioned the finality of the FCC's decisions. How can Congress ensure that parties with interests in a spectrum band are able to have their voices heard early in the process and, at the same time, allow FCC to reach a final decision that everyone can count on in making investment and development decisions?

Mr. GUICE. Thank you so much, Congresswoman. It is a great question.

And, you know, as this committee and as the chairman and ranking member have highlighted, reinforcing that interagency process and insisting on it being followed is the best step. And the oversight of this committee on that process is extremely helpful in producing that finality. So I encourage this committee to stay very active on that with members around the—around Congress that are quite often approached by private entities and on behalf of some of the Federal agencies that they regulate to get involved in this process. So it is a difficult one to fix.

That said, you know, there is a public process that is run, and these entities—these private entities, the government agencies—

should all participate fully in bringing those—that information to the record, so that we can make an evidence-based decision. I think, as Ms. Brown testified, you know, it is a sad fact that, at the end of the process—in fact, after the process was done—that we learned that there were these concerns with the altimeters and the C-Band. That is just inexcusable. There was an opportunity for a public record and for data to be submitted to take into account those concerns.

And so that is sort of how we fix it. We have to insist on not only that public participation, but, at the end, when the decision has been made in coordination with NTIA and the FCC to go forward with these spectrum auctions, that that finality is insisted upon, and that there is given no quarter for those voices that come in after the fact to try to disrupt it.

Miss RICE. Ms. Brown, can you explain how disputes over spectrum delay deployment of new technologies?

Ms. BROWN. Yes. Probably the principal case of delay involves the transportation spectrum at the top end of the 5 gigahertz band, which has lingered now for some years.

The FCC, a few years ago, a couple of years ago, had decided that some of that spectrum should be made available for Wi-Fi, and cut back the amount of transportation spectrum. That continues to be disputed by the transportation industry, which would like more spectrum available for communications, networking of vehicles on the road for safety purposes, et cetera. But that is a prime case where the user community and the transportation sector and the FCC had different visions for the same spectrum.

So now we are waiting around for a court case that will be resolved soon that will tell us what the future of that band is. And I certainly hope that, once that is resolved, and if it is resolved in the FCC's favor, that the FCC can promptly go forward and DoT can promptly go forward with implementing transportation solutions in the spectrum that is that is left for ITS.

Miss RICE. Thank you. Thank you to all the witnesses.

And I yield back, Mr. Chairman.

Mr. DOYLE. The gentlewoman yields back. The Chair recognizes Congresswoman Eshoo for 5 minutes.

Ms. ESHOO. Thank you, Mr. Chairman, for holding this hearing. Let me begin by addressing something to Mr. Bergmann.

I thought that Mr. Carter asked you a very good question, and I was very anxious to hear your answer, but I didn't hear it.

The most recent annual speed tests by PC Mag found that Verizon and AT&T's 5G speeds in several cities are comparable or sometimes even slower than their 4G speeds. To make matters worse, consumers sometimes have to pay more for 5G by upgrading their device or their plan.

Now, I do understand that there are reasons that speeds aren't optimal yet relative to 5G, but this practice of advertising faster speeds—and yes, I did watch the Super Bowl, along with millions of others, and one ad after another about complete 5G across the country. You know, all that advertising, and charging for it while delivering lower speeds, it seems to me like a highly misleading practice to me.

So my question is simple: Why are Americans

[inaudible] more for slower wireless speeds?

And if you could just be—you know, condense your answer.

Mr. BERGMANN. Absolutely. Well, thank you for the question, Congresswoman, I am glad to have a chance to answer it——

Ms. ESHOO. Really, thank you. I know it is a tough one. So thank you for saying thank you to a tough question.

Mr. BERGMANN. Well, so I would highlight a couple of things.

One, we continue to see wireless speeds go up, year after year. They are up 85 times since 2010, up 360 percent since 2000——

Ms. ESHOO. I mean, 2010 was 12 years ago, so I don't know—did you—let me ask this. Did you read this article? Are you aware——

Mr. BERGMANN. Congresswoman, I——

Ms. ESHOO. I mean, it was——

Mr. BERGMANN. I have not seen that article, but I know that speeds continue to go up year over year, and prices continue to go down year after year in the wireless market.

And so we think it is critical that consumers have accurate information about what they are purchasing. So I would absolutely agree with you about that. But we are incredibly excited about the advancements in speed that we see from competition, and the increasing value that we see for consumers.

Ms. ESHOO. Yes, well, I appreciate your words, but they are—they really don't—you are not answering the question that I posed.

There is heavy advertising, but what is being advertised is not so. It just isn't so. And it can be documented that it is not so. And consumers are, you know, are being told that they—well, the advertising simply is misleading. But I understand why you don't want to acknowledge it, because it is uncomfortable to. But I think the problem remains.

Going to Mr. Guice, I appreciate your view that Congress, you know, should ensure that spectrum proceeds are obviously used in the public interest. One of the issues that I have been on for, oh, my goodness, a decade and a half, is NextGen 911.

Is there anyone on the panel that thinks that 911, NextGen 911, should not be a part of the proceeds of future auctions? Is there anyone that doesn't think that? You could raise your hand.

And just to remind everyone, these are our—this is our public safety system. And I think that, once and for all, we really need to address this, and make sure that every community, whether they are rural, suburban, urban, that we have a solid system for law enforcement, for firefighters. We owe that to the American people. They dial 911, they need someone to answer. So I really look forward to making sure that spectrum funds, or part of those funds actually go to 911.

It is music to my ears to hear so many members and witnesses talking about unlicensed. They have been on that for a long, long time. So I am not going to spend any time on it, or ask questions because I just want to highlight that it is a delight that everyone knows, especially Members, of the high value of unlicensed, because it is the innovation platform.

So with that, Mr. Chairman——

Mr. DOYLE. The gentlelady's time has expired.

Ms. ESHOO [continuing]. I will yield back my two seconds.

Mr. DOYLE. I thank the gentlelady. Mr. Curtis, welcome. You have 5 minutes.

Mr. CURTIS. Thank you, Mr. Chairman and Mr. Ranking Member and our committee members. I am just going to climb up on a soapbox for a half a second, and then I will ask some questions. And it is really dealing with the rollout of C-Band and this—the concerns that we saw with that.

I think we all understand that the stakeholders need to be involved, but doing that up on the front end—and it just feels like, if we are really going to beat our competitors, primarily China, at this game, that we have got to be better on our game than that.

Now, let me climb off the soapbox and talk about my district just a little bit. I have a very rural district. I like to laugh at my colleagues back East that say they have rural, and would invite them out to Utah to see real rural. And my definition of rural is you have to drive three hours without seeing a structure. And that is how my district is. I have got vast amounts of rural parts of Utah. I have got the Navajo Indian Reservation, and I wanted to just touch on that, Mr. Bergmann, for a second.

Currently, the Indian tribes have been given priority in the 2.5 gigahertz spectrum rollout. And yes, I am glad, I mean, right? We have got to help these good people. Imagine, I have got some people without running water, electricity, let alone broadband in parts of this—part of my district.

And we all know—and then I think the intention is to eventually have the rest of the auction. And we all know how—we have talked about it in this hearing, how important these auctions are. But I am a little concerned that supply chain issues—there could be a delay out—of the rollout to the tribal nations, and then separately a delay in the auction.

So, Mr. Bergmann, given the supply chain issues, do we expect any delays to buildout in the tribal lands, and what challenges do you see?

Mr. BERGMANN. So thank you, Congressman. And you are absolutely right, the challenges that tribes face, I think, are unique and incredibly difficult. I think that 2.5 auction is sort of key part of that. And so I would encourage the committee to move forward with extending auction authority.

Particularly when you think about deployment challenges, certainly supply chain challenges, I think, are something that is felt broadly across the economy, and I encourage the committee to think about things that we can do there.

And we need to be creative. The funding that this committee made available through the Infrastructure Act will play a key role focused on tribal areas, and we need to think about things like siting. How do we make sure that we go faster on Federal lands? How do we help tribes move more quickly?

So it really is an all-of-the-above approach for tribal areas.

Mr. CURTIS. Yes, so could you comment about this issue of delaying the auction? And if that happens, will it expire? And what would that do to the whole 5G rollout?

Mr. BERGMANN. So in our 30 years of FCC auction authority, we have never had it expire. It is really critical that we have auction authority as we are heading into a set of auctions, because we want

bidders to have certainty so that they know that they will be able to use those licenses that they are stepping up to invest in.

Mr. CURTIS. So you are telling me don't worry?

Mr. BERGMANN. We definitely need to make sure that auction authority—

Mr. CURTIS. OK, good.

Mr. BERGMANN [continuing]. Is extended.

Mr. CURTIS. Good, I am with you on that. Well, and on—let me ask you about national spectrum strategy. Is it a good option? If so, how do we—which—you know, which agencies and things like that—help us, walk us through how we do that successfully.

Mr. BERGMANN. Absolutely. I think it will play a key role. And I think you have heard a little bit today about the challenges of spectrum coordination recently.

We need to have agencies coordinating, we need to have agencies sharing data, and we need the FCC and NTIA at the front of that, and would encourage this committee to take an important role, as well, too, because you all recognize the importance of spectrum, and can help make sure that our spectrum policies reflect our national priorities.

Mr. CURTIS. Can you just touch on balancing commercial and government interest?

Mr. BERGMANN. Absolutely. It is—you know, particularly when we think about mid-band spectrum, which is this key ingredient for 5G, our portfolio of mid-band spectrum is overweighted toward government today. We know that the U.S. Government is the primary user of mid-band spectrum. DoD has access to nearly two-thirds of those critical mid-band frequencies. We need to find ways to be more efficient, and get those Federal Government missions done, and make more spectrum available for 5G.

Mr. CURTIS. Yes, it has actually been pretty incredible, the innovation, right, that has come about in how we use spectrum, and I think—

Mr. BERGMANN. In the wireless industry we invest tens of billions of dollars every year to have new generations of technology to be more efficient. We need to make sure we are doing the same thing on the government side, too.

Mr. CURTIS. Thank you.

Ms. Stancavage, the U.S. prepares—as the U.S. prepares for the next World Radio Communication Conference, how can Congress be supportive, right?

And how do we continue to show American leadership?

Ms. STANCAVAGE. Thank you for the question, Mr. Congressman.

I think the most important thing is to make sure that the U.S. is an early actor, that we are identifying early which bands are potentially available, and then following through into the commercialization process, so that it is very clear where we are going with this. And anything Congress can do to support in terms of identifying spectrum early, opportunities, and that making sure that it follows through would be really welcome.

Mr. CURTIS. Good.

Mr. DOYLE. The gentleman's time has expired.

Mr. CURTIS. Thank you. I yield, Mr. Chairman.

Mr. DOYLE. The Chair now recognizes Ms. Matsui for 5 minutes.

Ms. MATSUI. Thank you very much, Mr. Chairman. And as co-chair of the congressional Spectrum Caucus, along with Mr. Guthrie, I want to thank you for holding this important hearing.

Spectrum governance is a fundamental part of sustaining America's competitive edge in the 21st century, from 5 and 6, Wi-Fi 6, and the satellite broadband, it is important that the Federal Government is speaking with one voice to move us forward.

I have a question regarding spectrum pipeline. To ensure that the United States remains a global pacesetter in wireless communications technology, a reliable pipeline for spectrum is needed. We have exciting opportunities coming up in the 2.5 and 3 gigahertz bands. Beyond that, the picture becomes less clear.

I believe the 7 gigahertz band presents a meaningful opportunity to keep our pipelines strong. However, given the amount of Federal users in that band, we need to proceed carefully with a whole-of-government approach. And that is why I sent a letter to NTI Administrator Davidson yesterday, urging him to commit to finishing the 2019 study on 7 gigahertz.

Mr. Guice and Mr. Bergmann, can you describe the characteristics of the 7 gigahertz band, and how they might be put to use to support commercial operations?

Mr. GUICE. Thank you, Congresswoman Matsui, and thank you for your leadership on spectrum issues. You have really been a great asset for everybody to have on these issues.

What I would say is that this is another example where mixed access regimes will be beneficial to the outcome. You know, what we learned in CBRN was that, based on spectrum coordination over a period of years, four to five years of coordination, hearing the agencies out, and working through the NTIA and FCC interagency process, only after that period of hearing folks and really taking in their perspective did we get to a situation where we could utilize the most of that band in 7 gigahertz, where there are very sensitive military systems, and a real need for DoD to have its voice heard through the NTIA process. Only by doing that can we really utilize this band to its fullest potential.

Ms. MATSUI. OK.

Mr. GUICE. Like I indicated, I think the lower 7 gigahertz is a real opportunity for unlicensed. But we do see that there might be licensed opportunities.

But I think only by going in with that sort of open mind for a variety of access regimes can we get the Federal agencies to really focus on what the realm of the possible is for—

Ms. MATSUI. [Inaudible]—

Mr. GUICE [continuing]. That band.

Ms. MATSUI. And Mr. Bergmann, do you have any more comments on that?

Mr. BERGMANN. Thank you, Congresswoman. We certainly appreciate your leadership on spectrum issues. Thank you for your letter today on—focused on the 7 gigahertz band.

We have talked a lot about the importance of mid-band, and the 7 gigahertz band is a huge band. It is 1,300 megahertz. As you have heard, there are important Federal systems there, but there are also opportunities to be more efficient with how we use that spectrum. So we would certainly encourage and follow your lead in

terms of, you know, asking our Federal Government policymakers to look at how we can make some of that spectrum available.

We know that that spectrum has been under study since 2019, and there are real opportunities there for licensed spectrum. So thank you for your leadership on that. We would love to continue working with you to see that included in a spectrum pipeline bill.

Ms. MATSUI. Certainly, thank you.

And in September of this year, the FCC's auction authority is set to expire. This authority underpins America's ability to really bring new spectrum to market, and stay ahead of the other countries in the race to 5G and beyond. Extending this authority can and should be bipartisan. And with implications for the next 2.5 gigahertz auction, it should happen as soon as possible.

Mr. Guice, do you believe—and I think this question was asked somewhat before—do you believe tying auction revenue to investments in things like NextGen 911 would be—9-1-1—would be a useful way to help modernize America's communications infrastructure?

Mr. GUICE. Yes. Over the last decades, what we have seen is that auction revenues can be substantial, and they should be put to use to advance our public interest needs. NG911 is a critical need. Congress had looked at providing some of that funding as part of the IIJA. Unfortunately, that didn't get there. So if we need to use auction revenues to do that, let's do that, and let's also think about digital equity.

Ms. MATSUI. OK, fine. And Mr. Bergmann, how can extending auction authority quickly increase the likelihood of a successful 2.5 auction?

And I think I have run out of time, but maybe you can make a couple of comments——

Mr. BERGMANN. I would just say——

Ms. MATSUI. A 5-second comment.

Mr. BERGMANN. I would say quickly, you know, auctions are the bedrock of our mobile wireless networks, including 5G. And bidders in auctions need to have certainty about getting access to spectrum. So getting that auction authority extended is really critical.

Ms. MATSUI. OK. Thank you very much, Mr. Chairman, I——

Mr. DOYLE. The gentlelady's time has expired.

Ms. MATSUI [continuing]. Yield back.

Mr. DOYLE. The gentleman—the Chair recognizes Congressman Welch for 5 minutes.

Peter, can you hear us?

I can see his video, but I don't think he can hear us.

Mr. WELCH. Hi.

Mr. DOYLE. OK, Peter, you have 5 minutes.

Mr. WELCH. Thank you. I am having sketchy in-and-out internet. So if I go off, Mr. Chairman, you know what to do.

Mr. DOYLE. Do you have 5G, Peter?

Mr. WELCH [continuing]. Questions similar to Congresswoman Matsui, but I want to ask Mr. Guice.

Do you agree with Chairwoman Rosenworcel's proposal to use auction proceeds to fund NG911 deployment?

Is there much precedent for allocating auction proceeds to fund public interest projects like that?

Mr. GUICE. Thank you, Congressman Welch. Yes, we do support it. We think it could be a nice complement to our drive to make certain that auction revenues are being used for public interest needs, as opposed to flowing into the general treasury and leaving the sector.

So, yes, the NG911 for sure, and there is precedent under FirstNet. Back in 2012, Congress designated auction revenues to fund that network.

[Pause.]

Mr. DOYLE. Can you hear us, Peter?

Mr. WELCH. Yes, Mr. Chairman, it is sketchy in and out, so I am going to spare you and yield back, and have confidence that you will handle this on my behalf.

Mr. DOYLE. OK, the gentleman yields back. The Chair recognizes Congressman Cárdenas for 5 minutes.

Mr. CÁRDENAS. Thank you very much, Mr. Chairman and Ranking Member Latta, for holding this very, very important hearing. I think it is really important for people to understand that what we are talking about is quite invisible to the American people. But at the same time, as you have heard from all these experts today, it is incredibly critical for not only the livelihood, but the education and the health of people across America.

So with that, I would like to ask, Mr. Guice, Wi-Fi is the most heavily used wireless technology in the world and was born in the U.S. Consumers, schools, and businesses rely on it for—more now than ever before. What actions can Congress and the Administration take to continue advancing the development of Wi-Fi here in the United States?

Mr. GUICE. Thank you, Congressman Cárdenas. Yes, it is important that we continue to provide spectrum access opportunities for Wi-Fi. It is a key connection point, as Ms. Brown recognized.

You know, whether you are on a 5G network or a fixed network, if you are in your home you are likely going through a Wi-Fi network. And so making certain that there is sufficient spectrum to make that a meaningful connection is important.

As I mentioned earlier, I think the 7 gigahertz spectrum offers a real opportunity to build on what we did in 6 gigahertz. And so we look forward to working with you and this committee to make sure that advances.

Mr. CÁRDENAS. Speaking of 6 gigahertz, in your testimony you support the FCC's recent decision to open up the 5.9 and 6 gigahertz bands for unlicensed use. What is the next spectrum bands that the FCC should consider for unlicensed use?

Mr. GUICE. Thank you. I think that opportunity really is in—likely in the 7 gigahertz band. It is adjacent to what is going on in six. It would give us an opportunity to take the 180 megahertz channel, and increase it to 360 megahertz, which is going to be critical for Wi-Fi 7. So we look forward to that as a real opportunity.

Mr. CÁRDENAS. And what should we expect to do? What should we call on ourselves to do to make sure that rural communities and communities of color, tribal lands, et cetera don't fall behind on current and future Wi-Fi technologies as they become available?

Mr. GUICE. Yes, it is a great opportunity for this committee to look at a mix of policies to promote.

You know, we can talk about digital literacy to make certain that our low-income and communities of color have the skills necessary and the tools to make the connection to broadband, be it wireless or wireline.

I think, for our tribal communities, pursuing the tribal priority windows when we look at spectrum auctions is a critical step, and in recognition of their sovereignty.

And I think just making certain that we understand where service is and is not available is critical.

And, like I mentioned, in the 5G space, making certain that we have crowdsourced data to ensure that these small cells that are operating in our 5G, are delivering 5G technologies are being delivered to our rural and urban corridors so that those communities that live in those have opportunities to get that access.

Mr. CÁRDENAS. So Mr. Guice, it is going to take a true public-private partnership to make sure that we don't leave people behind.

Mr. GUICE. Absolutely. That is going to be critical. These are, quite often, communities that are vulnerable, and they are highly dependent on government making certain that their needs are represented in policy. They don't quite have the lobbying capabilities of some of our larger companies, and so it is incumbent upon members like you to represent those needs.

Mr. CÁRDENAS. Is there a battle of the bands going out there, Mr. Guice, when it comes to public safety, et cetera?

I know that it was mentioned more than once about the Department of Defense having a large segment of spectrum within their purview.

Mr. GUICE. So look, the government needs the spectrum that it needs, and we want to be respectful of that. But we do believe, with others on this panel, that there can be more efficient use of that spectrum.

The key is going to be working through a collaborative process with those agencies and the direction of this committee, that there are certain bands of spectrum that need to be thought of as coming online for commercialization to further those opportunities. But if we approach it in a collaborative and cooperative spirit, and really listen to their concerns, I think we have a real opportunity to open up more of this spectrum and to accommodate their needs, be it licensed or where a government agency needs to stay through sharing, open access spectrum opportunities. All of that needs to be on the table, and they need to feel comfortable with coming forward in an environment where those interests will be respected.

Mr. DOYLE. The gentleman's time has expired.

Mr. CÁRDENAS. Thank you, Mr. Chairman, I yield back. Thank you.

Mr. DOYLE. So I think we have gone through our committee members, and I see my good friend and fellow Pennsylvanian, Mr. Joyce, who is waiving on.

And I yield you 5 minutes, sir.

Mr. JOYCE. Thank you, Chairman Doyle, another Pennsylvanian, and Ranking Member Latta, for allowing me to waive onto this im-

portant communication and technology subcommittee hearing. And thanks to all of the witnesses for appearing with us here today.

Spectrum is vital in ensuring the connectivity for all Americans, especially the constituents in my district in Pennsylvania. Mr. Todd, how would you have a national spectrum strategy or certainty about what spectrum bands the FCC intends to auction help increase participation by regional providers like HTC (sic)?

Mr. TODD. Thank you for the question. So for HTC, having a plan allows us to better prepare and plan and have an understanding of what spectrum would be allowed to be able to support in the areas that we serve. So for us, it means faster expansion of access to areas that need service.

Mr. JOYCE. And that expansion to access is so important within my district in Pennsylvania. My constituents are looking forward to this being present.

Mr. Bergmann, wireless carriers utilize low, mid, and high-band spectrum in different ways. But recent focus has been placed on making mid-band spectrum available. How should Congress be thinking about these various spectrum bands as we consider how best to keep the pipeline full?

Mr. BERGMANN. Thank you, Congressman. That is exactly right. The focus for 5G right now is on mid-band spectrum, and, you know, we would urge this committee to move forward with a series of directed auctions to create a pipeline of mid-band spectrum for 5G, and then for 6G.

There are candidate bands that we have talked about a little bit, the lower 3 gigahertz band, the 7 gigahertz band, the 4 gigahertz band. All of these provide the capacity and the coverage that we need to make sure that we can connect everyone, and that we can continue to lead in innovation.

Mr. JOYCE. Mr. Todd, how does HTC utilize its spectrum across various bands to serve constituents like mine in rural America, in Adams County, outside of Gettysburg, in Bedford, in Fulton, in Huntington County? How does HTC look to achieve that?

Mr. TODD. Thank you. For HTC—I definitely can't speak to the areas in Pennsylvania that you serve, but in rural communities that are adjacent to our service area, we look at additional spectrum as that needed tool for us to be able to expand access.

Specifically for us, hotspots and mobility are essential. We have areas today where technicians are unable to connect wirelessly in certain areas. We are using wired fiber facilities to complete orders, but we need mobility to be able to access and to communicate back with our offices to ensure efficient operations. So moving forward there, it allows us to be able to provide access quicker, more reliable access, and to serve more areas. Thank you.

Mr. JOYCE. FCC Chair Rosenworcel recently announced that the FCC will begin an auction of additional bands this summer. What benefits, Mr. Todd, specifically for rural Americans would these additional auctions make available?

Mr. TODD. Thank you again. For us, it is consumer choice and competition are essential for additional bands of spectrum to be rolled out. In our opinion, having the availability and capacity for additional bandwidth is essential to achieve what your objectives are.

Mr. JOYCE. Again, I would like to thank all the witnesses for your participation here today. I would like to thank Chair Doyle for allowing me to waive on to this important hearing. Thank you, and I yield.

Mr. DOYLE. Thank you. The gentleman yields back. I see we do have one more committee member who has come on. So we will yield 5 minutes to Congresswoman Kelly.

Ms. KELLY. Thank you, Chairman Doyle, for holding this hearing today. Spectrum issues don't often grab headlines. When they do, as we have seen recently, they suddenly are top of mind in national news. It is my hope that the renewed commitment of cooperation, including a forthcoming updated MOU between NTIA and the FCC will help ensure we don't have public spats around spectrum usage in the future.

As 5G continues to roll out, and the planning for 6G and beyond begins, it is important that the U.S. maintain its leadership position in deploying advanced wireless technologies. The government and the private sector must work closely to align technical specifications and investments to allow for quick, robust adoption nationwide.

Ms. Stancavage, in your testimony you spoke about how developers need to know which spectrum bands might be available to foster U.S. technology leadership. Can you walk us through the decisions that need to be made at both the international and national levels so a company like Intel can begin investing in chips to support future generations of Wi-Fi, 5G, and successive wireless technologies?

Ms. STANCAVAGE. Thank you for the question, Congresswoman Kelly.

So when we look through the process, what we look at is to determine a new spectrum—when a new spectrum band comes online, you need to have the relevant components available, as well. So you need to have radios, you need to have filters, et cetera. So what we try to do is make sure that we understand the international environment where markets are. Typically, the U.S. has been in the front of that, in terms of identifying spectrum bands. And then we are able to take that and determine sort of when we would need to intercept in the product development timeline.

When we look back at 5G, we actually completed our analysis, and we are starting to intercept product timelines in September 2015 for a decision that the international community did not make until November 2019. That gives you a sense of how long it takes to make sure that you have everything in place to support what is going to be needed at—for global economies of scale. And we look forward to making sure that the U.S. is able to be in a place to do something similar with respect to 6G.

Ms. KELLY. Thank you.

Ms. Brown, do you have anything to add on to the importance of strong, consistent U.S. leadership on spectrum issues to a company like Cisco?

Ms. BROWN. Yes, thank you very much. Ms. Stancavage spoke about the importance of identifying spectrum bands early so that industry can plan and have equipment available.

Outside of the ITU process—for example, in unlicensed spectrum—U.S. leadership plays a crucial role, and we have seen in the last two years since the FCC opened up the 6 gigahertz band—again, at Congress’s direction from the MOBILE NOW Act—that an enormous number of countries are following suit. So this is all due to the fact that the FCC was the first mover, and people are paying attention and wanting the same kinds of innovation in their economies that we are getting here.

So a very important issue to pay attention to, and I thank you for the question.

Ms. KELLY. It is safe to assume—thank you—that consumers and business will only connect more devices, and use more data in the future. So we need to prepare now, so that our networks can support this dramatic increase in demand.

Ms. Brown, I understand we will need to make more spectrum available for licensed and unlicensed use to meet these anticipated network demands. What do you believe are the spectrum bands that we will need to free up first to allow for the rapid deployment of advanced wireless technologies?

Ms. BROWN. Thank you for the question.

The first issue, of course, is getting the 2.5 auction across the finish line. So we need auction reauthorization to get that done.

I think the panel here is in agreement that the lower 3 gigahertz band needs to be carefully examined by NTIA, the constituent Federal agencies, and the FCC to determine what can be done in the lower 3 gigahertz band. I cannot emphasize enough how important 3 gigahertz spectrum is in the 5G networks, globally. So anything we can do there is good.

There are other bands in play for—potentially, for the future. Mr. Bergmann brought up the 4 gigahertz band. That is a band that is being used by 5G in the Asia region. That might—we might want to look at that. And 7 gigahertz, depending on what is in there, could be a band of interest, as well, either for unlicensed, licensed, or both.

Ms. KELLY. Thank you so much, and my time is up.

I yield back. Thank you, Mr. Chair.

Mr. DOYLE. The gentlewoman yields back.

Mr. Walberg, I can’t tell you how happy we are that you were able to join us here at the last minute.

[Laughter.]

Mr. DOYLE. And it is my great pleasure to yield 5 minutes to you.

Mr. WALBERG. Mr. Chairman, you are so kind, and that is exactly why I came back, to join you, to bring that joy.

[Laughter.]

Mr. WALBERG. I didn’t think my amendments in the other committee would take so long and cause so much disruption, but we will try not to do that here.

Today’s hearing is appropriately named the “5G and Beyond.” As co-chair of the 5G Caucus, I think we should be doing more to educate Members of Congress and staff about the opportunities of future generations of wireless networks. The promises of 5G and its successors are not just blazing fast download speeds for urban centers. They will be key players in connecting rural communities like

mine, deploying precision agriculture, spurring better telehealth services, and more.

This is why I have directed my staff to begin reaching out to stakeholders to ensure that we, as a caucus and a Congress, are continuing to march toward 5G and beyond. It is imperative that we stay on top of these issues, both at home and abroad and, honestly and personally, whether we understand it or not. It is something that is coming, and we need it.

Mr. Bergmann, at home a major factor of wireless leadership is ensuring that our spectrum pipeline does not run dry after the upcoming 2.5 gigahertz auction. And I am sorry I missed Billy's auction that went on here. Have you identified spectrum bands that would be good candidates for future 5G use?

And second, what can Congress do to help identify these additional bands?

Mr. BERGMANN. Thank you for your focus on mid-band spectrum. It is absolutely critical.

You know, I would highlight the lower 3 gigahertz band is absolutely critical for 5G. This is a place where dozens of countries around the world are already using the spectrum. So it is really key that we put this to play, and I would certainly commend this committee to look at that.

There are a couple of other bands that I would encourage you all to look at, as well, too. The 7 gigahertz band is an enormous band that has Federal users in it today with important missions, but we think there are opportunities to be more efficient with the use of that band, and to make some of that band available for commercial license use.

And then we ought to look at what other countries are doing, internationally. The 4 gigahertz band is also being used in Asia for mid—for 5G services, as well, too.

So we ought to be looking at each of these different candidates, looking at what the rest of the world is doing, and then also leading, as well, too. Just as we did with 600 megahertz, we can lead on mid-band here in the U.S., and so that is critical.

I would encourage you all, as you think about extending auction authority, to make sure that you all do what Congress has done each time it has extended authority before, which is to set a defined set of auctions.

Mr. WALBERG. Yes, we do need to lead. We can't just get out of the way. We need to lead.

And thank you for looking beyond our borders. Leadership in the national standard-setting will allow the U.S. to shape 5G policies that benefit American companies and consumers, and not bolster the deployment efforts of our adversaries.

Ms. Stancavage and Ms. Brown, both of your organizations have been very active in standard-setting bodies around the world. Can—how can U.S. participation in international regulatory processes be improved to help us take the lead in expanding spectrum for 5G, and going into 6G?

Ms. STANCAVAGE. Thank you for the question, Congressman Walberg.

So I want to first differentiate between two types of standards bodies. For instance, 3GPP is industry-led. The Intel representa-

tives there, we are very active there and in others: Wi-Fi Alliance, IEEE, et cetera. Those are industry-led. And when you look at those, we send our technical experts, the ones who are doing the technical innovation and the ones who have the expertise in wireless networks and sort of how to best increase the technical capabilities of those going forward.

In the regulatory arena, we have the International Telecommunications Union, and that is a place that I have gone as a spectrum policy expert. And so that is the group that is looking more at, you know, sort of which spectrum bands are most applicable, et cetera. And there it is really important that we, as the U.S., understand where we are going, what we have in the pipeline in the near term, but also over the longer term, so we are able to make those priorities apparent, and try to get other countries to coalesce around those.

So I did want to differentiate between the two different types of standards bodies.

Mr. WALBERG. Thank you.

Ms. Brown?

Ms. BROWN. I don't have much to add to Ms. Stancavage's excellent summation.

I will say that standards internationally play out in a number of venues, and U.S. leadership is critical. For example, in the Wi-Fi world we have an industry-led standards group, IEEE, that does most of the standardization work. But it turns out one of the key entities that does standards for Wi-Fi is also the European telecommunication standard agency, ETSI, and they are important because a significant part of the world follows their standards.

So by leading here, by leading in IEEE, we have also been able to lead in ETSI. So again, being a first mover is very important.

Mr. WALBERG. Thank you.

Mr. DOYLE. The gentleman's time—

Mr. WALBERG. I yield back.

Mr. DOYLE [continuing]. Has expired.

Seeing no more members, the Chair requests unanimous consent to enter the following records and other information into the record: a letter from a broad range of 20 carriers and members of the wireless ecosystem urging Congress to extend the FCC spectrum auction authority; a letter from Digital Liberty to the House Subcommittee on Communications and Technology.

Without objection, that is so ordered.

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

Mr. DOYLE. I want to thank our witnesses for their participation in today's hearing.

I would remind members that, pursuant to committee rules, they have ten business days to submit additional questions for the record to be answered by the witnesses who have appeared. And I would ask the witnesses to please respond promptly to any such questions that you may receive.

At this time, the committee is adjourned.

[Whereupon, at 1:30 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

Conclusion

As we look toward the future, some wonder if the auction “engine” that has served the country so well over the last 30 years will lose its efficacy as fewer spectrum bands become available or as technology changes. These are good questions, and here are a few answers.

First, the 5G and 6G technologies being deployed or that are under development continue to work best in exclusive use spectrum, where one licensee can manage its own network using its own licensed spectrum frequencies. The hunt for spectrum supporting exclusive use is not over, and therefore auctions remain relevant, even if to some degree, spectrum must be shared in some cases.

Second, incentive auctions are a tool to transition from decisions of the past to the needs of the future. Incentive auctions will remain an important tool for some time as older uses wane and new ones are introduced.

Finally, over the 7+ decades left in this century, it might be that wireless technology could evolve to diminish the need for spectrum licenses as we know them today. Future networks might be supplied with spectrum from an intelligent sharing mechanism, eliminating the need for individual licensees to be assigned specific frequencies. At a practical level back here in 2022, what we can say about that future is that if this happens, technology barriers are likely to be less of an issue, while business and economic barriers are going to be more significant. None of it will be easy or quick. It is nevertheless an enticing thought, as such a future state could well represent the pinnacle of efficient spectrum use with attendant benefits that we cannot clearly see today.

For now, continuing governmental policy focus on developing and learning about spectrum sharing technologies, continuing our efforts to better understand issues around band adjacencies, emphasizing collaboration over confrontation, and advancing both unlicensed and licensed radio technology to meet the needs of consumers are the most practical steps we can take toward the future.



March 16, 2022

The Honorable Frank Pallone, Jr.
Chairman
Committee on Energy & Commerce
U.S. House of Representatives
107 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Mike Doyle
Chairman
Subcommittee on Communications &
Technology
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20515

The Honorable Cathy McMorris Rodgers
Republican Leader
Committee on Energy & Commerce
U.S. House of Representatives
1035 Longworth House Office Building
Washington, D.C. 20515

The Honorable Bob Latta
Republican Leader
Subcommittee on Communications &
Technology
U.S. House of Representatives
2467 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Pallone, Chairman Doyle, and Republican Leader McMorris Rodgers and Republican Leader Latta:

As carriers and members of the wireless ecosystem that depend on access to finite spectrum resources to preserve and expand broadband and communications services, we strongly urge Congress to extend the Federal Communications Commission's ("FCC" or "Commission") spectrum auction authority.

Since Congress first authorized the FCC to establish "a system of competitive bidding" for spectrum for commercial use in the Omnibus Budget Reconciliation Act of 1993, the Commission has conducted over

one hundred spectrum auctions, supporting wireless technologies and services that depend on licensed spectrum while generating hundreds of billions of dollars in revenue for the Treasury. Congress has since extended auction authority four times to support FCC efforts, in coordination with the National Telecommunications and Information Administration, to identify spectrum bands that can be reallocated for commercial wireless use and bring that spectrum to market. Absent further Congressional action however, the FCC's current general spectrum auction authority will expire on September 30, 2022.

While our industry works to expand next generation 5G services and looks ahead to successor technologies, continued expansion of wireless connectivity depends on sustainable and predictable access to spectrum. Indeed, the extension of auction authority is critical to ensure the success of work already underway to make spectrum currently in the pipeline available for commercial use. For example, success of the upcoming 2.5 GHz band auction could depend on extension of the FCC's auction authority. Smaller carriers in particular cannot meaningfully prepare to participate in potential upcoming auctions without the confidence that the auction can close and that spectrum will be available for use.

Particularly as Congress considers ways to support spectrum coordination efforts between the FCC and other government users, allowing FCC auction authority to lapse hampers the FCC's ability to participate in the intergovernmental process. This could create new barriers to improved spectrum management policies that benefit federal users and consumers alike at a time when strong FCC leadership is needed to ensure the United States continues to lead the world in the development of next generation wireless networks and applications.

Smaller carriers and carriers serving rural America are at greatest risk of harm if FCC spectrum auction authority were to lapse. Meeting the Congressional mandate, the FCC has successfully used spectrum auctions to support competition and widely disseminate licenses through a variety of means, including appropriately tailored geographic license sizes, small business and rural bidding credits, and interoperability requirements. Particularly for carriers that may have challenges securing spectrum on the secondary market, FCC-led spectrum auctions are the primary way to have a meaningful opportunity to access this critical resource and in turn provide the latest wireless services in small towns and rural communities that may otherwise be left behind.

Continued wireless leadership and growth depends on access to additional spectrum resources, and we strongly support the extension and continued success of FCC spectrum auction authority to advance wireless connectivity. Thank you for your focus on this critical issue.

Sincerely,

ATN International
C Spire
Cellcom
Chat Mobility
Ericsson
GCI
HTC
IDI
Inland Cellular
Interop Technologies

MTPCS d/b/a Cellular One
Nex-Tech Wireless
Nokia
Pioneer Cellular
PTCI
Thumb Cellular
T-Mobile
Union Wireless
US Cellular
Viaero Wireless



March 16, 2022

Dear Members of the House Subcommittee on Communications and Technology,

During your hearing entitled **5G and Beyond: Exploring the Next Wireless Frontier**, Digital Liberty would like to recommend extending FCC auction authority, adherence to the interagency process for spectrum allocations, and avoidance of instituting a minimum book tax.

FCC auction authority should be extended before it expires to ensure current and future auctions can continue without issue. Congress must continue to identify bands for auction to keep the spectrum pipeline open and flowing. This continued process is vital for innovation, investment and international competition.

Deployed spectrum brings billions of dollars in investment and connectivity for innovation and to close the digital divide. The associated auctions have also brought billions of dollars to the U.S. Treasury. While extending auction authority, Congress must keep in mind that CBO scores for spectrum, historically, are grossly underestimated often by tens of billions of dollars.

As Congress looks to maximize the value of bands available for auction, we must also avoid policies and practices that would depress auction revenues or otherwise limit future deployments. **It is important that the NTIA-FCC interagency process is utilized and respected without debates falling into the public sphere, and Congress should avoid counterproductive taxes, such as the minimum book tax the was included in Build Back Better.**

The FCC is the agency tasked with determining commercial spectrum allocations. They have the experience and engineering expertise to make these determinations and have a very long track record of success with spectrum auctions and reallocating spectrum to best uses. Stakeholders must respect the process which is designed to reveal and resolve interference issues well in advance of licensing and deployment. In recent years, we have seen agencies look to derail deployments after years of proceedings, technical analysis and review. Without being able to trust this process, companies may be hesitant to participate in the auction process or we will see a decrease in valuation and revenues.

If instituted or even considered, the minimum book tax is wholly counterproductive to the stated goal of bridging the digital divide, universal service, and winning the race to 5G. While Digital Liberty supports no version of a 15% book tax or 15% corporate minimum tax, these taxes are particularly harmful for ISPs and spectrum licensees. The book minimum tax as applied to spectrum would be a retroactive tax on licenses purchased from the government that are not freely transferrable and have associated FCC buildout requirements. A tax of this nature would stymie policy goals, reduce auction revenues, reduce investment and delay deployments.

FCC auctions have proven vastly beneficial to taxpayers, who are after all the beneficiaries of efficient allocations of this valuable, finite resource. We appreciate your continued focus on American competitiveness in all areas associated with connectivity and are happy to assist in achieving these goals.

Regards,

Katie McAuliffe
Executive Director
Digital Liberty