

**REMARKS OF FCC CHAIRMAN AJIT PAI  
TO THE INFORMATION TECHNOLOGY INDUSTRY COUNCIL  
ON THE FUTURE OF AMERICAN SPECTRUM POLICY**

**JANUARY 14, 2021**

Thank you, Jason, for the kind introduction and thanks to ITI for hosting me. Since ITI's membership includes companies across the wireless ecosystem, I appreciate your affording me the opportunity to talk about Commission's work over the past four years to promote U.S. leadership in spectrum policy. In many ways—and you fans of *The Big Lebowski* will appreciate this, and the references to come—spectrum was the rug that tied the room together over the past four years. Spectrum is critical to closing the digital divide. Spectrum is critical to American leadership in 5G. Spectrum is critical to many applications, from telehealth to remote learning. I could go on, but you get the point.

For those who follow spectrum policy closely, the news of the day is the unprecedented level of bidding in Auction 107, our auction of 280 megahertz of spectrum in the C-band. While I'm proud of the work that Commission staff has done to make this auction such a success—and there is still more work to be done—the C-band is only one chapter in the story of this FCC's unprecedented work on spectrum. Today, I want to tell you that story, starting with our work on 5G.

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Let me take you back to September 2018. At a 5G Summit hosted by White House National Economic Council Director Larry Kudlow, I announced the FCC's strategy to promote U.S. leadership on 5G. We called it our 5G FAST plan—a comprehensive strategy for Facilitating America's Superiority in 5G Technology. That Plan had three planks: freeing up spectrum, promoting wireless infrastructure, and modernizing our regulations to encourage more fiber deployment, which is critical for backhauling wireless traffic into the core of the networks.

Recognizing that spectrum is the most critical input for wireless innovation, I decided early on that the Commission had to take decisive action to make more airwaves available for 5G, the next-generation of wireless technology. 5G networks will bring exponential increases in speed, responsiveness, and capacity. They'll enable advancements like smart transportation systems, the Internet of Things, and new services and applications we have yet to imagine. And they will be critical to our nation's economic competitiveness in the decade to come.

At that summit, we announced an absurdly ambitious goal: freeing up more spectrum than was then held by every mobile wireless broadband provider *combined*. So how'd we do? Well, we made it—and then some. Here are the details.

To achieve our objectives on spectrum, we knew it would take an all-of-the-above approach. That's why we've been working to free up high-, mid-, and low-band spectrum for 5G.

High-band spectrum at one point in time was considered essentially unusable for wireless services. But changes in technology have enabled this spectrum, which is typically allocated in larger chunks and can be assigned in larger channel sizes, to be used for ultra-high-speed, gigabit-plus wireless connectivity. In 2019, the FCC successfully concluded auctions in the 28 GHz and 24 GHz bands, respectively—our nation's first two auctions of millimeter-wave spectrum for 5G services. In early 2020, we concluded bidding on the upper 37 GHz, 39 GHz, and 47 GHz spectrum bands. This was the largest auction in American history in terms of the amount of spectrum offered, releasing 3,400 megahertz of spectrum into the commercial marketplace, and used an innovative incentive auction format.

All told, we've made available almost five gigahertz of high-band spectrum for commercial use through these three auctions. To put that in perspective, that was more spectrum than was used for cellular

broadband by all wireless carriers in the United States combined. So, box checked—but we were just getting warmed up.

With respect to low-band spectrum, we finished repurposing spectrum in the 600 MHz band, which was long used for broadcast television, for mobile broadband. To clear the 600 MHz band spectrum for wireless use, roughly half of our nation’s broadcast TV stations—nearly 1,000 total—had to change their transmission frequencies. This past summer, we completed this enormous undertaking—known as the “repack.” We did so on time, even though there was plenty of skepticism when we announced our transition plan in 2017 that we’d be able to hit that target. Now, all of the valuable low-band airwaves sold in the ground-breaking broadcast incentive auction are available for wireless broadband service, and this spectrum is already being used to provide 5G service to areas where over 250 million Americans live.

But since we first rolled out the 5G FAST plan, we’ve made the most headway on mid-band spectrum. Mid-band spectrum is appealing for 5G because its propagation characteristics allow for good geographic coverage while the amounts of spectrum typically available for use afford good capacity.

When I came into office in 2017, the cupboard was almost empty. The only mid-band spectrum in the pipeline was the 3.5 GHz band, which was saddled with misguided restrictions that weren’t going to encourage 5G deployment. So not quite “mark it zero,” but close. Despite starting from behind the eight ball, we turned things around, and in a big way. Under my direction, the FCC systematically identified mid-band airwaves that were being underused. This was a very complicated case, you know, a lot of ins, lot of outs, a lot of what have yous. But we figured it out and set plans in place to put these airwaves to work for the American people.

For instance, in July 2019, the Commission adopted flexible new rules for the 2.5 GHz band. This is our nation’s single largest band of contiguous spectrum below 3 GHz, and it’s well-suited for 5G deployment. We approved a Rural Tribal Priority Window so that Tribal Nations would have early access to unassigned 2.5 GHz spectrum over rural Tribal lands. This window closed last September, and we received over 400 applications. Commission staff have already conducted initial review of, and accepted for filing, 214 of these applications. We intend to auction any remaining spectrum shortly after we finish processing the applications filed during the window. Indeed, earlier this week, we adopted a public notice seeking comment on the procedures to be used to auction overlay licenses for the remaining available spectrum. To keep our nation’s mid-band spectrum efforts on track, it will be critical for the FCC to conduct the 2.5 GHz auction in 2021.

With former Commissioner O’Rielly’s leadership, and to incentivize 5G deployment, we adopted significant rule changes for the 3.5 GHz band. That band had been a bit of a mess, but we were inspired by the credo of Walter Sobchak—“This is not Nam, Smokey, this is bowling. There are rules.” This past August, the FCC successfully completed an auction of 70 megahertz of licensed spectrum in the 3.5 GHz band—the first-ever U.S. auction of mid-band spectrum for 5G. The auction garnered unprecedented interest, with 228 entities winning a total of 20,625 licenses in the auction. And we’ve completed the necessary technical work so that the band’s entire 150 megahertz is now available for commercial use. It’s already being used for innovative use cases, including private LTE networks.

In September 2020, the Commission proposed to make the 3.45-3.55 GHz band available for innovative commercial operations while accommodating limited remaining operations by federal incumbents. This followed on the White House and the Defense Department’s August 2020 announcement that this 100 megahertz of contiguous mid-band spectrum should be made available for 5G as quickly as possible. The Commission is working hard to lay the groundwork for auctioning the 3.45 GHz band later this year, as Congress directed in the omnibus spending legislation passed last month.

But this Commission’s biggest move to free up mid-band spectrum for 5G has been in the C-band, or the swath of spectrum from 3.7 GHz to 4.2 GHz. This spectrum is mostly used by fixed-satellite

companies to beam content to video and audio broadcasters, cable systems, and other content distributors. However, with advances in technology, these companies can now provide the same services using alternative technologies or considerably less spectrum.

That's why, this past February, the FCC voted to clear the lower 300 megahertz of the C-band and make 280 megahertz of it available for 5G through a public auction. All eligible space station operators currently using this spectrum committed to an accelerated relocation to the upper 200 megahertz of the C-band—meaning that the lower 280 megahertz will become available for 5G two to four years earlier than otherwise would have been the case. And the courts rejected legal challenges to our decisions, just as the Supreme Court has roundly rejected prior restraint.

We kicked off our auction of the lower 280 megahertz of the C-band a little over a month ago, and as I noted at the outset, the response has been unlike anything we have ever seen. Before the C-band auction began, the most lucrative auction in FCC history netted about \$45 billion in gross bidding. Bidding in the C-band auction has already eclipsed \$80 billion. The bidding we have seen, in my view, represents a strong endorsement by the private sector of the rules that the FCC has put in place to transition this spectrum to 5G. Industry clearly has confidence that this spectrum will become available quickly and will be critical to 5G deployment.

Put all these together—the C-band and the 3.5 GHz band, together with a future auction of the 3.45 GHz band—and we are on a path to have a contiguous 530-megahertz swath, from 3.45 to 3.98 GHz, of mid-band spectrum available for 5G. Not bad, considering where we started. That's 5G FAST.

Now, a record-shattering auction is great news. But it's not even the main takeaway on the spectrum front. The main headline is that, by any measure, this has been the most aggressive FCC in history in putting the public airwaves to work for the public. And that's not just, like, my opinion, man. The credit for this accomplishment goes to our amazing staff across the agency. They worked painstakingly and for years on the technical, economic, legal, and other aspects of all of these bands. They succeeded in advancing U.S. leadership in 5G.

I want to keep my remarks today focused on spectrum, but I'd be remiss if I moved on from the 5G FAST plan without a quick nod to the non-spectrum elements. I'll spare you the details of our work to promote wireless infrastructure and modernize our regulations to encourage more fiber deployment. The most important thing to know about them is that all the evidence suggests they are working. In 2018 and then again in 2019, the United States set records for annual fiber deployment. And the number of new cell sites in the United States has skyrocketed. We added fewer than 7,000 cell sites from 2013 to 2016, but added over 87,000—over 12 times as many—from 2016 to 2019. Nice marmots, indeed. Commissioner Carr led the Commission's efforts on wireless infrastructure policy, and he deserves much of the credit for this success. So more spectrum. More small-cell deployment. And more fiber. That too is 5G FAST.

While our 5G FAST plan may have been the key driver of the Commission's work to free up licensed spectrum, it's not the entirety of our work. We've studied the entire spectrum chart closely, and where we've seen airwaves that clearly aren't being put to their highest-value use, we've acted.

For example, we reconfigured the 900 MHz band for the deployment of broadband services and technologies. For decades, this band had been allocated for narrowband communications like two-way dispatch radios used by business, industrial, and land-transportation licensees. Our new rules made available six of the band's ten megahertz for the deployment of broadband services by utilities and other industries. This will enable private LTE networks to deliver critical infrastructure services that can improve electric grid monitoring, cybersecurity, and detection of public safety threats, and can otherwise help power customers avoid entering a world of pain.

Also, way up in the 76 to 81 GHz band, we tripled the amount of spectrum available for vehicular radars, which are used for safety applications like collision avoidance and adaptive cruise control, among

other things. These applications will help keep drivers, pedestrians, and others safe on and around our roadways.

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So far, I've described the Commission's model for making spectrum available for licensed use, where, essentially like Lenin said, the FCC looks for the consumers who will benefit, and, uh . . . . But we also have embraced a completely different model at the same time: allowing entrepreneurs and innovators to use spectrum without the FCC prescribing the what, when, and how. Indeed, our work to make airwaves available for unlicensed use has also put us in the history books.

When most people think unlicensed spectrum, they think Wi-Fi, and for good reason. With our growing reliance on Wi-Fi, for everything from in-home device connections to cellular offload, we are going to need faster, stronger Wi-Fi networks. The good news is that Wi-Fi 6, the next generation of Wi-Fi, has already started rolling out. Wi-Fi 6 will be over two-and-a-half times faster than the current standard, and it will offer better performance for connected devices. But in order to fully take advantage of the benefits of Wi-Fi 6, we need to make more mid-band spectrum available for unlicensed use.

And that's exactly what the FCC did. Last April, the Commission unanimously approved my proposal to make the entire 6 GHz band available for unlicensed use. For years, the FCC heard concerns that existing Wi-Fi channels were getting congested and this agency responded, "you want Wi-Fi? We can get you Wi-Fi. Believe me. There are ways, Dude." By opening the whole 6 GHz band for unlicensed, we are creating a massive 1,200 megahertz testbed for innovators and innovation. To put this in context, we effectively increased the amount of mid-band spectrum available for Wi-Fi by almost a factor of *five*.

Ultimately, I expect that 6 GHz unlicensed devices will become a part of consumers' everyday lives. And I predict our decision will play a major role in the growth of the Internet of Things, connecting appliances, machines, meters, wearables, smart televisions, and other consumer electronics, as well as industrial sensors for manufacturing. It'll also mean big improvements for gaming, augmented and virtual reality, fixed wireless broadband services, and more.

In addition to the 6 GHz band, the Commission also took a fresh look at the 5.9 GHz band for unlicensed use. Back in 1999, the FCC allocated 75 megahertz of spectrum in this band for a service called Dedicated Short-Range Communications. Commonly known as DSRC, this technology was intended to help meet the nation's transportation needs into the next century and improve the safety of our nation's highways. Unfortunately, after two decades, DSRC had barely been deployed, meaning this spectrum was largely unused.

This past November, the Commission unanimously voted to make the lower 45 megahertz of the 5.9 GHz band available for unlicensed uses like Wi-Fi. Our new rules also transition the upper 30 megahertz of this band away from DSRC to enable a different automotive communications technology called Cellular Vehicle-to-Everything, or C-V2X. This was a challenging issue; at times, the prospects for success looked darker than a black steer's tuchus on a moonless prairie night. But we persisted, and a unanimous FCC scored a win for American consumers and a win for automotive safety.

These two initiatives, on 6 GHz and 5.9 GHz, will open up 1,200 and 45 megahertz of spectrum for unlicensed use, respectively. Now let's talk about gigahertz—1,000 times as large. Through our 2019 Spectrum Horizons Order, the Commission made a massive 21.2 gigahertz of spectrum above 95 GHz available for unlicensed use across four frequency bands. Instead of a lane or two, which is often filled with traffic, innovators now have massive open roads to work with. These airwaves were once considered to be beyond the outer limits of usable spectrum. But that's what some once thought about the original Wi-Fi band in 2.4 GHz, too. I can't wait to see what innovation lies over these horizons.

One more area where we've opened up new opportunities for unlicensed use is with TV white spaces, which include unoccupied channels in the broadcast television bands. White space signals propagate well over long distances, varying terrain, and even into and within buildings, making this unlicensed spectrum attractive for delivering wireless broadband service to rural areas. We modified our antenna height rules and power limits to allow for improved broadband coverage in rural areas using white spaces, which expanded their ability to deliver wireless services in many rural and underserved areas while still protecting from harmful interference broadcast television stations. Our work in this area was inspired in part by a young man I met in rural Virginia in July 2017. Dylan Harris had started using TV white space-enabled broadband to do his homework. He told me that the biggest change was that he now didn't need to check the weather beforehand. Why? Well, previously, if it rained, his family's satellite connection wouldn't work, and he couldn't get online.

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As I've discussed, this FCC accomplished a lot on spectrum. Four years of beautiful tradition, from 600 MHz to 47 GHz, you're damn right I'm living in the past. But we also learned some lessons along the way—lessons that'll be useful for the future.

One of the most valuable lessons I learned from our work on spectrum is to listen to the experts at the agency and use solid engineering analysis as our guide. When it comes to freeing up airwaves, there is virtually no more greenfield spectrum available. That means there are no easy solutions. Whenever you explore new uses for spectrum, you're going to draw battles with incumbents or others worried about harmful interference. To help make the right call, you must rely on sound engineering. The only alternative, essentially, is arbitrary politics. And say what you will about the tenets of the FCC's approach—at least it's an ethos.

That's especially true when the engineers tell you what you would rather not hear. For example, as we neared the finish line of my tenure, one thing I very much hoped to get done was to authorize the use of very-low-power devices in the 6 GHz band. We worked the problem as hard as we could. But the advice I got from the engineering experts on our career staff was that we just did not yet have a sufficient foundation in the record in order to safely move forward. That's disappointing to some—me included—but it was the right decision. I hope further study enables the FCC to move ahead in the future.

Another lesson I learned is that arguably the biggest thing hampering efforts to use spectrum more efficiently is—our own government. On proceeding after proceeding, we saw that other federal agencies tried to throw up roadblocks. Rather than look out for the public interest, many agencies were looking out for their narrow parochial interest. And since most don't have in-house spectrum expertise, they ended up simply parroting the exaggerated, hysterical, and often outright false claims being made by the industries they regulate. To achieve their aims, they ended up bypassing normal channels and complaining to Congress or the media in an effort to block or delay efforts to free up spectrum for commercial use.

Anyone who thinks the change in Administration will change these incentives is obviously not a golfer. And I'm not the only one who thinks so. Congresswoman Doris Matsui, who is co-Chair of the Congressional Spectrum Caucus, recently wrote to President-elect Biden to express her concern about freelancing federal agencies. She put it succinctly and well: "This spectrum management approach is broken." It needs to be fixed.

In the near-term, the FCC must hold its ground. As the Dude famously said, "This aggression will not stand, man." Interested parties will likely use the change in Administrations as an opportunity to re-litigate settled disputes like the 5.9 GHz and 6 GHz rules, the L-band, and perhaps even the C-band. If we are to preserve the value this FCC delivered to American consumers, the agency's new leadership will have to be willing to withstand the pressure from the voices who are always going to say, "No." Or, more

diplomatically, “We strongly favor of American leadership in 5G or next-generation Wi-Fi—just not in this band (which we just happen to have an interest in).” Pacifism is not something to stand behind.

Let me put a finer point on this. To meet our nation’s spectrum needs, I ended up angering congressional committee chairs of my own political party. Believe me, it gave me no pleasure to do so. I wish it could have been avoided. But my successor is going to have to be willing to do the same thing, to have the courage to stand up to congressional committee chairs of his or her political party. Otherwise, our nation’s spectrum efforts will suffer significantly.

Also in the near-term, the next Administration needs to install strong leadership at NTIA and empower NTIA to be the Executive Branch’s one voice on spectrum policy. We must bring an end to the practice of each agency having its own spectrum policy.

But longer term, we need to have a conversation about whether our current bifurcated framework for spectrum management makes sense. Currently, our division of responsibility for managing spectrum has NTIA governing federal spectrum and the FCC governing non-federal commercial spectrum. Globally, this makes us an outlier. Should we think about having unified regulatory authority over spectrum entrusted to the FCC to minimize the need for coordination? To be clear, I know this change would not solve all of the discord we’ve seen over the past few years. And I understand that there needs to be a mechanism for the Executive Branch to weigh in on spectrum issues. And of course, this would require a legislative fix; as the Big Lebowski himself said, “I cannot solve your problem, sir.” Only Congress can. But I also know that the current structure doesn’t work. If the FCC ultimately holds the pen on all spectrum matters, perhaps agencies will stop throwing up roadblocks by default and will recognize that the best way to preserve their interests is to persuade the Commission with sound engineering and facts. Again, we’re one of the only countries in the world with a bifurcated spectrum management system. The progress we’ve made since 2017 is despite this dual-track system, not because of it; indeed, the process has become an unruly mess. It may well be time to take a different approach.

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I know that offering advice on your way out the door is not necessarily a parting gift that everybody will be interested in. But there is one thing I’m leaving behind that I think everybody will appreciate, and that’s more spectrum in the pipeline.

We’ve been working with NTIA to prepare to auction 50 megahertz in the 1300 MHz band for commercial, flexible use in the next few years. We’ve also started looking at the 4.8 GHz band, which is getting interest in East Asia for 5G and is currently held by federal incumbents. Then there’s the 3.1 to 3.45 GHz band, where we’ve started the process of clearing out non-federal users so that it can be made available for 5G. NTIA has asked executive branch departments and agencies to review their current spectrum assignments in the 3.1 to 3.55 GHz band, as well as the 7.125 to 8.4 GHz band, as directed in an October 2018 Presidential Memorandum directing agencies to “thoughtfully consider whether and how their spectrum-dependent mission needs might be met more efficiently and effectively, including through new technology and ingenuity.” And just yesterday, the Commission launched a proceeding seeking comment on how to maximize efficient use of the 500 megahertz of mid-band spectrum in the 12 GHz band. There’s also high-band spectrum that we have teed up, such as 42 GHz. And of course, the FCC is on track to auction two bands, the 3.45 and 2.5 GHz bands, this year.

With all the talk in the present about 5G, it’s sometimes hard to remember that the future—6G—is already in view. In that regard, we’ve put the U.S. on a path to lead the world in wireless innovation for many years to come. When I started at the Commission 8 years ago, 4G LTE was still the big new thing. Then I remember meeting with NYU Professor Ted Rappaport, who showed us how ultra-high-band millimeter wave spectrum was valuable and could create “wireless fiber,” opening doors for 5G and beyond. Well, earlier I spoke about our Spectrum Horizons proceeding and how we made these huge swaths of spectrum above 95 GHz available for unlicensed use. We also added a new experimental

license type that permits experimental use on any frequency from 95 GHz to 3 THz, with no limits on geography or technology. Professor Rappaport testified to the Commission before we adopted the *Spectrum Horizons Order*, and he said that “with . . . this historic vote, the FCC has launched the race to 6G, helping to ensure the U.S. will play a leading role in future generations of wireless.”

We currently don’t know precisely what types of applications and wireless services the laws of physics will permit in these bands. And that’s sort of the point. The history of wireless innovation is one of government creating space for broad thinking and entrepreneurs using that space to take us in unexpected directions.

But here’s what I do know. We wouldn’t have come so far, so fast on wireless innovation, and we wouldn’t be so well-positioned to lead in the future without the outstanding work of the FCC staff. I will forever be grateful to Julie Knapp, Ron Repasi, and everybody in the Commission’s Office of Engineering and Technology, which is full of the best and brightest engineers an agency could ask for. Thanks as well to Don Stockdale and his team in our Wireless Telecommunications Bureau. And thanks to my spectacular wireless advisors in the Chairman’s Office—Rachael Bender, Aaron Goldberger, and Sean Spivey.

Over the past four years, the FCC has taken unprecedented steps on spectrum to give big thinkers a big sandbox to work with in order to unleash big waves of wireless innovation. Along the way, there were some strikes and gutters, ups and downs. But we put our faith in American ingenuity. We vaulted the United States into a leadership position. And we delivered for the American people. And now, as the mobile future unfolds, we can all abide. I don’t know about you, but I take comfort in that.