

**REMARKS OF
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Good Morning. It's wonderful to be here at Mobile World Congress and help kick off this discussion of the future of mobile spectrum. And let me also add that it is terrific to be in Spain—and in beautiful Barcelona.

I want to start this morning by taking you far away from Barcelona for a moment—and talking about Chicago. I was in Chicago last week. It's a great American city, right in the middle of the country, on the banks of Lake Michigan. And it's windy. Really windy. None of these faint Mediterranean breezes we have here. And if in Barcelona it's all about fizzy cava and delicate ham, Chicago is a place for a stiff drink and a thick steak. It's a city that is proud of its history with stockyards and steel mills—but it is also firmly looking towards the future.

That future involves a project called the Array of Things.

The Array of Things is an ambitious plan Chicago has to place 500 wireless nodes all across the city.

These nodes will measure pressure, light, air quality, temperature, foot traffic—and an array of other things. The data produced will be available to the city—and the public—at no charge. From this data, the city hopes to reveal patterns—patterns that will allow it to better plan urban activity and learn to prevent problems—like childhood asthma, flash flooding, and street congestion—before they occur. Think of it like a fitness tracker—not for the wrist—but for the city itself. It's pretty cool.

Now this is possible today with 4G technology. But it provides a great glimpse of the future—and helps illustrate the possibilities of 5G.

5G services are poised to provide speeds more than 10 times faster than today's 4G networks, with lower latency—and as a result, a whole new world of wireless opportunities.

But more than that, they will take initiatives like the Array of Things and up the ante. Because while 4G technology has brought smart phones to our palms, pockets, and purses . . . the benefits of 5G technology are bigger, bolder—and more diffuse. They will be felt throughout the economy.

So imagine, for a moment, that cities worldwide can significantly reduce commute times and traffic. It will take sensors in streetlights, roadside architecture, and cars to see where traffic patterns could be more efficient and public transportation more effective. 5G technology can make it happen.

Imagine tiny cameras in the helmets of public safety officials fighting a fire. They could relay video back to colleagues just outside the affected area who could direct a team of firefighters in real time, enhancing safety for first responders and those they rescue. 5G technology can make it happen.

Imagine monitoring trees with sensors to identify drought before it occurs and when preventative measures are still effective. Think of it as the Internet of Trees—and 5G technology can make it happen.

Now to get from here to there will take, you guessed it, spectrum. More than that, it will take new, creative ideas about spectrum policy that have not always been front-and-center in the 4G past. So now let me offer you three ideas for the road to 5G.

First: To find spectrum for next generation networks we need to look high.

Today, the bulk of our 4G networks are built on spectrum frequencies from 600 MHz to 3 GHz.

But the 5G future will look different—very different. We will need to bust through this old 3 GHz ceiling and create new possibilities for millimeter wave spectrum in the airwaves at 24 GHz and above. This is spectrum that is way, way up there. I think of this as the airwaves that will take us to infinity and beyond.

But with these stratospheric frequencies, of course, there are propagation challenges. While these super-high signals carry a significant amount of data, they do not go far. But we can turn this limitation into a strength by combining these frequencies with small cells packed close together, densifying networks at lower cost. All of this, in turn can mean service that reaches further into buildings at faster speeds than ever before. This is especially useful in urban corridors and fast-growing areas with the greatest traffic demands.

It won't be simple to put these bands to use. But last year, at the World Radio Conference in Geneva, a number of these bands were put on the table for study at the next gathering in 2019. This is terrific—because a lot can be done here with global scale.

But let me make a prediction. In the United States, the Federal Communications Commission will not wait. We are moving forward now. We already have a rulemaking on millimeter wave spectrum and are already considering a variety of bands in these spectrum frontiers. And among others we will proceed this year with a framework for the 28 GHz band, despite the fact this band was excluded from the list for 5G study at the World Radio Conference.

Second, let us not forget unlicensed.

Good spectrum policy involves a mix of licensed and unlicensed airwaves. This is true today with 4G services—and it will continue to be true with 5G as well.

Today, unlicensed spectrum supports Wi-Fi—and Wi-Fi has helped democratize Internet access.

Unlicensed spectrum also helps our wireless operators manage their networks. Today, more than half of all wireless data connections are offloaded at some point onto unlicensed airwaves.

Unlicensed spectrum is also how we foster wide-scale wireless innovation. That's because the low barriers for entry make them perfect sandboxes for experimentation. And that experimentation has a bottom line. In the United States, unlicensed spectrum contributes more than \$140 billion to the economy annually.

Today, of course, we have extensive unlicensed activity in the 2.4 and 5 GHz bands. But we need to do more than treat unlicensed as an afterthought—because we need a cut for unlicensed spectrum going forward.

This is true for low-band spectrum—and high-band spectrum, too.

Right now, for instance, the United States is exploring opportunities for unlicensed use in the guard bands in 600 MHz, as we reorganize this UHF band to combine mobile and broadcasting use.

We are looking to expand unlicensed operations in millimeter wave spectrum, namely in the 64 GHz–71 GHz band. Note that the upper portion of this band was identified for 5G study at the World Radio Conference last year. But we are already looking at making the band we have identified available sooner—and making it unlicensed.

Third—and finally—it's time for creative licensing policy.

There was a time, not that long ago, when bands for mobile use were strictly licensed or unlicensed. One or the other. Pick one. No in-between.

But now—and going forward with 5G—we can be more creative.

To get a feel for how, take a look at the 3.5 GHz band.

In the United States we are using this band to chart a new course for spectrum policy. Instead of the same-old, same-old binary choice between licensed and unlicensed, we adopted a creative three-tiered model for spectrum sharing and management.

Under this three-tiered system, incumbent government users have a primary and preemptive right. But we know they do not need access all the time, everywhere, so we created a secondary license opportunity, custom-built for smaller cells. Then, to the extent demand for small cells is limited, opportunistic unlicensed use is permitted by rule.

To make this work, all three groups of users will be managed by a dynamic spectrum access system.

This effort is complex—but it's important. Because as demand for our airwaves grow—and continue to grow with 5G—we will need to get creative. And the approach we've put in place in the 3.5 GHz band is both creative—and efficient. It's one to watch for the future.

The future is where I started, so let me end there, too.

I think the Array of Things project I began with is an instructive example of the future. It gives us insight into the extraordinary things coming our way with the next generation of wireless service. That's important—because worldwide we have problems to solve, resources that are constrained, and communities that need help navigating what is possible in the digital age.

We have no shortage of challenges ahead.

But remember we are on the cusp of cars that can drive themselves, streets that can be safer, emergency services that are more effective, health care that is more personalized, and more capability across the board—because we are more connected.

So get excited. Because 5G technology can help us get there. That is, if we get our spectrum policies right. And that strikes me as worth the effort.

Thank you.