

THE GLOBAL
RACE
TO
5G

April 2018

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Race to 5G.

Introduction

The race to lead the world in 5G is underway and China, South Korea and other nations are competing to win. They understand that wireless leadership means billions in economic growth and millions of jobs in the industries of tomorrow, such as Smart Cities and the Internet of Things.

New research shows that there are real and significant consequences to maintaining global wireless leadership and that while the U.S. has an opportunity to win the 5G race, other countries are pulling ahead right now with key policy reforms and industry investment.

America's wireless industry is ready to invest \$275 billion to deploy next-generation 5G networks — creating 3 million new jobs and adding \$500 billion to our economy, according to Accenture.

But just as winning the race to 4G required smart government policies, winning the race to 5G will require swift action on pending legislation and regulatory reforms including setting a clear schedule of future spectrum auctions and modernizing infrastructure siting rules.

We are confident with the significant industry investment ongoing and the important pending reforms before policymakers, the U.S. is positioned to lead the world again in 5G.

5G Impact in the U.S.

\$ 275 B
new investment

\$ 500 B
in economic growth

3M
new jobs

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Key Findings

In order to measure the current status of the global race to 5G and quantify the benefits associated with leading a generation of wireless, CTIA commissioned studies from leading telecommunications research firms, Analysys Mason and Recon Analytics.

Analysys Mason conducted a comparative assessment of ten nations and derived a 5G Readiness Index — an indicator of which countries are currently leading in the race to 5G. The index measures each country’s progress in moving forward with the 5G spectrum and infrastructure policies as well the industry investment necessary to win the race to 5G. Recon Analytics conducted a historical analysis of the economic benefits nations derived from leading the world in prior generations of wireless, as well as the costs associated with losing that leadership, to provide greater context of the stakes of winning or losing the 5G race.

The following represent the key findings of this research:

- China, South Korea, and the United States are currently leading the race to 5G, with China holding a narrow lead.
- America’s 4G leadership resulted in economic and job growth that would have otherwise gone to other countries.
- Losing wireless leadership in 3G and 4G had significant, long-term, negative effects on the Japanese and European telecommunications industries.
- America’s wireless industry is a global leader in making the commercial investments and preparations necessary for 5G deployment.

Policymakers have proposed forward-looking legislation and regulatory reforms that can help America win the race to 5G — but need to be addressed quickly in 2018.

Most 5G-Ready Countries



1 China



2 S. Korea



3 USA



4 Japan

Economic Impact of U.S. 4G Leadership

\$ 100 B

Wireless Leadership Matters.

The Benefits of America's 4G Leadership

Losing the race to 5G could have a significant negative effect on America's wireless industry and our broader economy. Europe led the world in 2G and Japan in 3G. In 2010, however, America won the race to 4G. Today America's wireless industry supports over 4.7 million jobs and contributes \$475 billion annually to the economy. A new report by Recon Analytics quantified the economic impact of winning and losing wireless leadership in prior generations (3G, 4G) — and highlights the stakes at play in the race to 5G.

The U.S. trailed behind other countries in deploying 2G and 3G and this resulted in economic advantage migrating to other markets. As 4G emerged, America's wireless industry seized on an opportunity to reclaim wireless leadership. Wireless carriers invested billions of dollars to deploy 4G networks, aided by smart government policies including multiple spectrum auctions and timely infrastructure siting reform.

According to Recon Analytics, this resulted a range of benefits including:

4G Leadership-Driven Economic Benefits

\$ 100 B

GDP increase

84 %

increase in
wireless-related jobs

\$ 125 B

in revenue to American
corporations

The Cost of Losing Wireless Leadership

The consequences of losing wireless leadership serve as an important warning for the U.S. as we compete to win the race to 5G.

Europe saw tangible economic benefits from having the most advanced 2G networks, leading the world in networking equipment, operating systems and handsets. That leadership translated into hundreds of thousands of jobs and billions in economic impact. Losing this leadership resulted in massive job losses and a dramatic contraction of the region's telecom hardware and software industries.

As the European Commission's spokesman for digital economy and society said, in the "mobile equipment industry, we had 80 percent of the market in 2008 and because we were not ready for 4G mass deployment, the EU industry lost almost its entire market share for mobile phones."

The consequences of losing wireless leadership are long-lasting and hard to overcome. Despite early efforts to invest in 5G, European countries are far outside the first tier of competitors in the race to 5G.

The European experience was seen in Japan as well. Japan's loss of wireless leadership in the transition from 3G to 4G networks had a similar impact. Most Japanese corporations exited the handset business and their early lead in mobile internet services faltered.

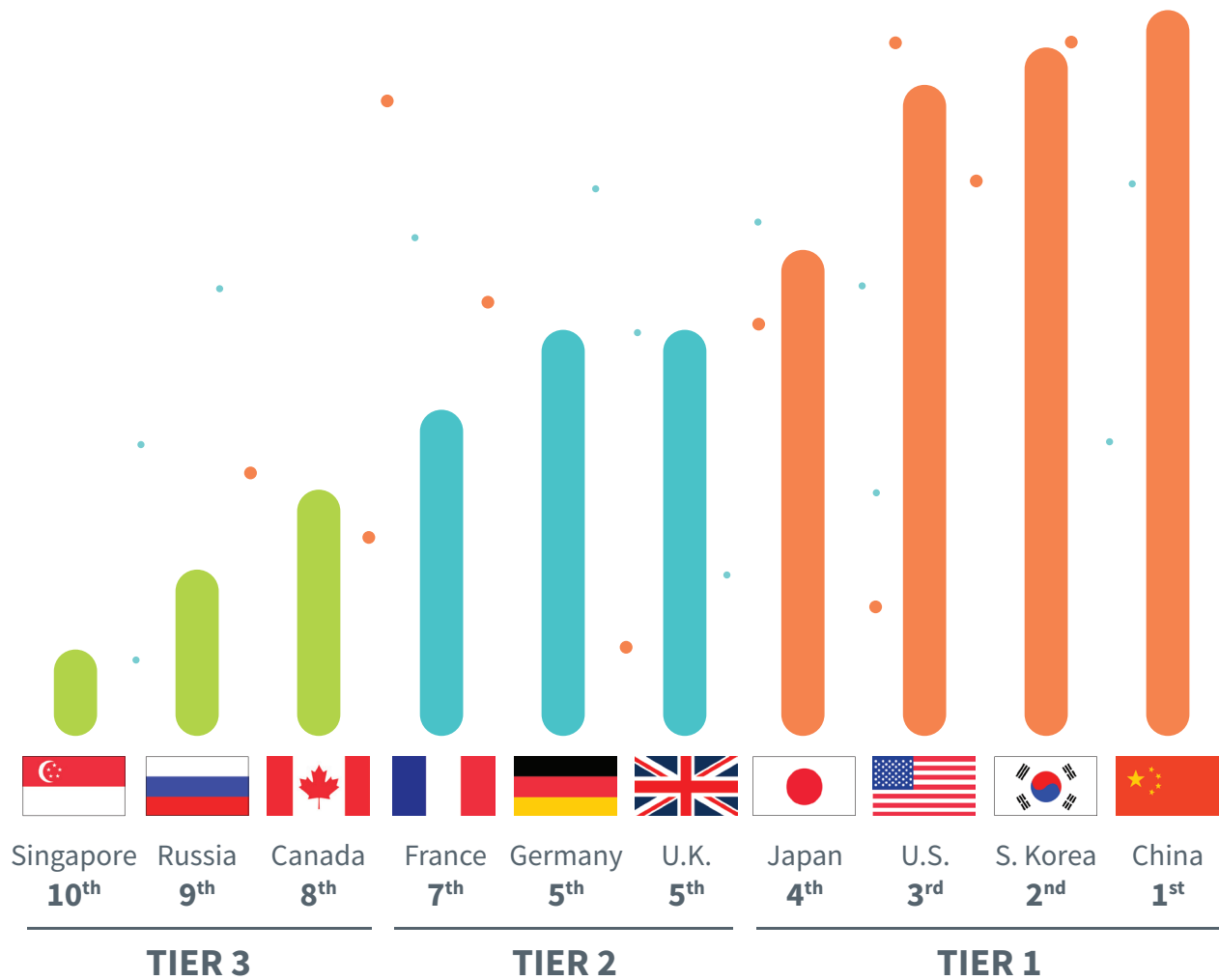
“[In the] mobile equipment industry, we had 80 percent of the market in 2008 and because we were not ready for 4G mass deployment, the EU industry lost almost its entire market share for mobile phones.”

European Commission Spokesman

5G Readiness Country Comparison.

Introduction

Analysys Mason ranked ten countries with developed wireless markets across key factors to compare current 5G readiness efforts. Countries were evaluated based on spectrum and infrastructure policies, industry investment, and overall government support.



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Country Snapshots.

Tier One: China, South Korea, United States, Japan



Top Carriers:

- China Mobile
- China Unicom
- China Telecom

China

China holds a narrow lead in the race to 5G thanks to a combination of industry momentum and government support — the country’s latest Five-Year plan aims for broad commercial launch of 5G by 2020 and each of China’s providers have committed to this timeline. All major wireless providers have conducted extensive 5G trials and committed to 5G commercial launches while the government has opened up significant amounts of both mid- and high-band spectrum.

Specifically, China’s regulatory authority has committed to release at least 100 MHz of mid-band spectrum, with a focus on 3.4-3.6 GHz, and 2 GHz of high-band spectrum for each wireless provider.



Top Carriers:

- SKT
- KT Corp
- LG Uplus

South Korea

South Korea is very well positioned thanks to strong wireless provider commitment, with the Winter Olympics earlier this year providing a focal point for early investment, research, and trials.

Imminent government action is expected to free up both mid-band (3.5 GHz) and high-band (28 GHz) spectrum for 5G this year, for a total of 1300 MHz, with an additional 2 GHz of high-band spectrum possible.





United States

The U.S. ranks near the top thanks to across-the-board industry efforts, including extensive commercial trials and aggressive deployment timelines. Analysys Mason found that U.S. is a global leader in commercial 5G efforts today. All major wireless providers are trialing 5G technologies and equipment, with many committing to 5G launches by the end of 2018.

Top Carriers:

- Verizon
- AT&T
- Sprint
- T-Mobile
- U.S. Cellular

Policymakers have made important efforts to identify high-band spectrum for 5G, including 11 GHz of mm-wave spectrum in 2016 and an additional 1700 MHz in 2017, with the first high-band auction set for November of this year. The U.S. can further improve its position by bringing mid-band spectrum to market and by establishing a clear spectrum pipeline as seen in China and South Korea. These are the primary spectrum-related impediments to U.S. 5G efforts identified by Analysys Mason.

From an infrastructure perspective, recent modernization of federal siting rules will help accelerate deployment and 16 states have enacted small cell legislation. Additional pending reforms focused on local modernization need to be enacted quickly to help expedite deployment.



Japan

Japan rounds out the top tier, with the government and wireless carriers focusing on widespread deployment in advance of the 2020 Olympics.

Wireless providers are investing in 5G testing, and Japan’s regulatory authorities have committed to releasing mid- and high-band spectrum by early 2019 — aided by a national 5G roadmap policy adopted in 2016.

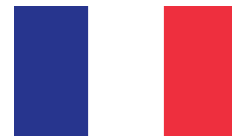
Top Carriers:

- NTT DOCOMO
- KDDI
- Softbank



Tier Two: The United Kingdom, Germany, France

These countries have not made substantive progress in preparing for 5G leadership. For instance, only one wireless provider in France and no providers in Germany have committed to rolling out 5G by 2020 and — while some low- and mid-band spectrum has been awarded — no high-band spectrum has been identified for 5G. The UK has conducted the first stage of its auction of 2.3 and 3.4 GHz spectrum for 5G in March 2018, and Germany plans to conduct its own 5G auction later this year. France’s regulator is also beginning to issue licenses for commercial 5G trials in cities across France.



Tier Three: Canada, Russia, Singapore

These countries are in the lower tier because wireless providers have not shown a commitment to date to 5G deployment and policymakers have not made progress in developing a 5G strategy or identifying the spectrum bands necessary for 5G services. For instance, Russia’s 5G roadmap does not contain plans to license spectrum and only one provider has committed to 5G deployment in 2020.



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How We Win.

The U.S. wireless industry has invested around \$300 billion in deploying next generation networks over the past ten years, and paid more than \$62 billion to the U.S. Treasury for spectrum just in the past five years. This has supported a 35x increase in mobile data usage since 2010, and boosted the wireless industry's annual contribution to GDP to \$475 billion. It is projected that the wireless industry will invest another \$275 billion in building out 5G networks across the U.S., driving an additional \$500 billion in GDP.

America's wireless industry leads the world in its pursuit of 5G leadership but winning the race to 5G will also require timely government action. Specifically, the federal government needs to move forward on releasing hundreds of MHz of new spectrum, and every level of government needs to act to modernize infrastructure rules.

America's wireless providers and equipment vendors have conducted dozens of 5G trials across the country. Thanks to those trials and industry investment in the technology and people that will enable 5G, the U.S. will see these next-generation networks soon — as early as this year.

Driven by the intense competition in the wireless market, all national providers have announced 5G deployment plans with new announcements happening all the time. Communities like Dallas, Atlanta, Chicago, Houston, Los Angeles, Washington, DC, Sacramento, and Las Vegas will soon see the beginning of 5G networks.

With government help, more communities can experience 5G more quickly and position the U.S. to reclaim our wireless leadership. Swift action in 2018 can help drive the U.S. back into the lead for 5G ahead of China and South Korea.

Verizon on track to launch 5G broadband offering in 2018

AT&T names first three cities to get its ultra-fast 5G network

T-Mobile to launch 5G in 30 cities this year, including New York and LA

Sprint to Launch 5G Network in 2019

Spectrum

Progress to Date

Unlocking a mix of new low-, mid-, and high-band spectrum for wireless use will position the U.S. to win the 5G race. U.S. policymakers have recognized the importance of spectrum to our continued wireless leadership and identified key future opportunities. Policymakers need to finalize plans and execute on pending proposals for additional spectrum auctions and continue efforts to identify other spectrum to bring to market.

High-Band. In 2016, the FCC took the first step to unlock high-band spectrum at 28 GHz, 37 GHz, and 39 GHz for wireless use. In late 2017, the FCC made an additional 1700 MHz of high-band spectrum available in the 24 GHz and 47 GHz bands for 5G. Earlier this year, the FCC announced that the first high-band auction would begin in November 2018.

Mid-Band. In 2015, the FCC established an experimental spectrum sharing system for spectrum at 3.5 GHz. In 2017, the FCC began exploring how three bands, including 3.7 – 4.2 GHz, could be used for commercial wireless. Earlier this year, the Administration identified spectrum at 3.4 GHz as a government band for potential reallocation for mobile broadband.

Low-Band. Congress is already considering spectrum at 1.3 GHz and 1.7 GHz, and NTIA has identified both as candidate bands for reallocation. Reallocating these two spectrum bands is expected to raise up to \$62.6 billion at auction.

Mid-Band Spectrum Availability



1 China



2 UK



3 S. Korea



4 Japan



5 Germany



6 U.S.

The U.S. is lagging behind our international peers on mid-band spectrum. By the end of 2018, the U.S. is expected rank sixth out of ten countries in terms of mid-band availability.

What Policymakers Can Do

Congress. The bipartisan AIRWAVES Act sets a timeline for auctioning a series of critical low-, mid- and high-bands over the next five years, and should be a high priority for Congress this year.

Knowing when and what spectrum will be auctioned facilitates investment, and allows wireless carriers to plan and build their 5G networks. A clear pipeline of spectrum auctions can also fund much-needed upgrades to agency systems, support government priorities, and reduce the deficit.

The FCC. The agency has properly identified the core challenges and future bands. The FCC should promptly auction the five identified high bands and follow through on identifying and making available additional future bands. The agency should also act quickly to provide access to critical mid-band spectrum. Specifically, the FCC should finalize key investment-friendly changes — longer license terms and larger geographic areas — to the 3.5 GHz band framework and move forward with providing wireless access to the 3.7 – 4.2 GHz band.

The Administration. A continued emphasis on bringing together key agencies — like NTIA, the DOD, and the FAA — can unlock key spectrum at 1.3 GHz, 1.7 GHz, and 3.4 GHz. By moving swiftly to identify government spectrum that can be repurposed for 5G, the Administration can ensure these airwaves create a win-win for wireless consumers and federal operations that depend on wireless.

“Senators Gardner and Hassan and Representatives Lance and Doyle deserve real credit for the AIRWAVES Act — a bipartisan pipeline of spectrum that provides the certainty we need to win the 5G race.”

*CTIA President & CEO
Meredith Attwell Baker*

Infrastructure

5G networks will be powered by small cells — antennas about the size of a pizza box. Today, it takes too long and costs too much to deploy modern wireless infrastructure like small cells, which can be installed in an hour or two but require a year or more to receive government approval. Every level of government has a role to play in modernizing infrastructure rules for 5G networks.

Progress to Date

The FCC. In March 2018, the FCC importantly modernized environmental and historic/Tribal reviews for new wireless infrastructure, a move that will reduce the cost of deploying small cells by one-third, save over \$1.6 billion, and accelerate 5G deployment. The agency has also proposed a series of common sense and bipartisan actions that will help make existing wireless infrastructure available for 5G services and has rightly identified the need for federal guidelines for local siting rules as a key focus.

Congress. Earlier this year, Congress — on a bipartisan basis — adopted an important reform for wireless infrastructure on federal lands, enacting a shot clock for agencies to consider infrastructure applications.

In the States. Sixteen states have enacted legislation that sets clear timelines and cost-based rates for new wireless infrastructure like small cells, while nearly a dozen additional states have similar bills pending.

U.K. Infrastructure Reform

In 2017, the United Kingdom updated its Electronic Communications Code — the primary telecommunications infrastructure rules in the country — to modernize regulations related to network deployment, including 5G.

Key reforms included:

- Granting of a right for network providers to upgrade network equipment.
- Easing provider access to certain properties like utility providers enjoy.
- Enabling contractual agreements to be finalized more readily.
- Providing faster access for providers to maintain infrastructure sites.

These reforms are important because, as a key U.K. agency said, these changes “will directly address investment barriers, lower the cost of infrastructure rollout, and support further coverage enhancements.”

What Policymakers Can Do

Every level of government has a role to play to jumpstart the deployment of 5G wireless infrastructure.

The FCC. The FCC should move quickly to provide guidance on state and local infrastructure rules. Just as the agency acted decisively to provide leadership on federal reviews, the FCC should focus on providing federal guardrails for local infrastructure rules and regulations to incent investment while preserving local authority on health, safety, and aesthetics.

Congress. Congress has a critical role to play by reiterating the rapid, efficient deployment of wireless infrastructure as a national priority and setting nationwide guidelines for how localities should treat siting requests. Legislation like the discussion draft bill from Senators Thune and Schatz represent a bipartisan, balanced effort to set reasonable timelines and cost-based fees for small cells while preserving local authority.

In the States. States and localities can help by modernizing siting rules to ensure fair and reasonable access to utility poles and streetlights, setting reasonable fees that reflect the direct costs of deploying small cells, and updating review processes to provide reasonable timelines for siting applications.

Proposed EU Infrastructure Reform

The European Commission is considering establishing new rules designed to increase investment in 5G infrastructure. This draft directive would harmonize key regulations across the European Union.

Key proposed reforms include:

- Providing reasonable timelines for applications to install telecommunications infrastructure.
- Ensuring costs and any other conditions that apply to infrastructure siting are determined based on transparency and non-discrimination.
- Prohibiting any fees beyond administrative charges for small cells.

By removing “deployment barriers for the installation of small cells,” this “simplification of the deployment conditions for dense cellular networks would reduce costs and support investments,” as the EC’s 5G Action Plan said.

About the Research.

Analysys Mason

Analysys Mason compared 5G spectrum and infrastructure policies proposed in markets worldwide to advance 5G technology and facilitate successful network deployment, and to prepare a readiness comparison between markets.

Recon Analytics

This is the fifth report over the last thirteen years that Recon Analytics has authored on the impact of the wireless industry on the U.S. economy. Building on the same consistent framework, these reports have documented how the U.S. wireless industry has revolutionized society and the U.S. economy, relying on extensive primary and secondary research for these studies.

The research referenced in this report was commissioned by CTIA.



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