US State of the Mobile Union 2H 2019

Carrier performance at national, state, and metro levels in 2H 2019, plus a look at how 5G can improve your connected experience

RootMetrics®
By IHS Markit

The importance of fast and reliable mobile connections has never been greater. With mobile subscriptions and wireless data usage exploding, mobile users today expect always-on connectivity and strong network performance anywhere they use their smartphone. And as the 5G era in the US continues to expand, demands for a flawless mobile experience will only become more important.

We recently conducted an extensive study of “always-on” mobile users to understand what consumers truly want from their mobile experience and to learn more about consumer pain points. We define “always-on” users as those who expect constant connectivity, either for work or other activities. While 30% of the population surveyed were “always-on” users, a subset of 12% of those users were deemed “wholly dependent power users” who rely on mobile connectivity for both work and lifestyle reasons. This small but influential group of wholly dependent power users are especially attuned to network performance and the importance of connectivity.

Key findings from wholly dependent power users:

73%

are aware of their mobile download and upload speeds.

52%

would consider switching mobile operators if they have just one or two poor experiences per month.

41%

won’t buy a new mobile plan or device unless it’s enabled for 5G.

39%

are affected by poor connectivity several times per day.

The data you need for the connections you need

Our test results show you how the major US carriers performed across all the spaces in which you use your smartphone, from the US as a whole to each of the 50 states and across the 125 most populated metro areas in the country. We've also provided a high-level look at early 5G results from testing in select cities to show you how 5G can affect your connected experience. Read on to see how the carriers compared in the second half of 2019.

We tested:

The entire United States

Each of the 50 states

The country's 125 biggest metros

Testing highlights and stats at a glance

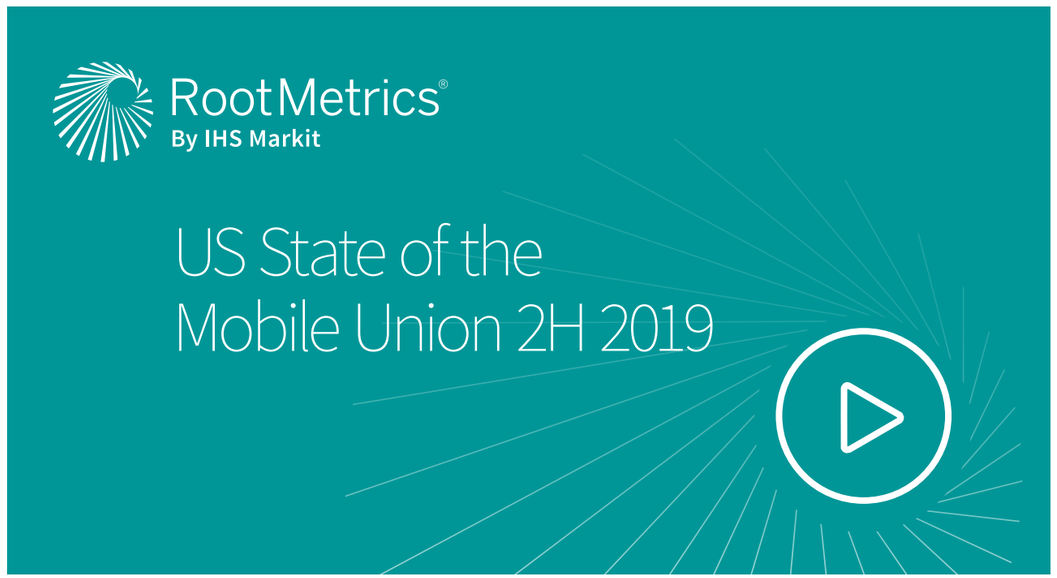
3,855,503
Tests performed

225,794
Miles driven

7,764
Indoor locations tested

125
Metro areas tested

Over 4,000
Total places visited



Performance across the United States

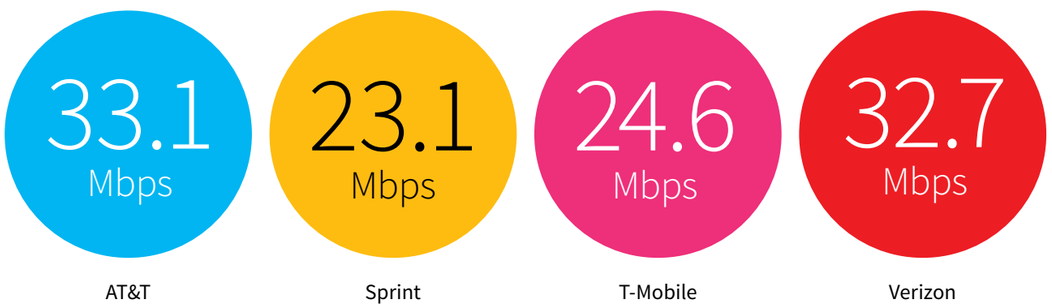
Providing strong service across the entirety of the US is a tall order. To earn our United States RootScore Awards, carriers need to offer outstanding performance across all the different spaces where consumers use their smartphones, from cities and towns of all sizes, to highways, rural areas, and all the places in between.

United States RootScores - 2H 2019

Rank	Overall	Reliability	Speed	Data	Call	Text
1	94.6	96.3	90.7	95.1	93.6	96.5, 96.8
2	93.2	94.9	90.2	94.7	90.7	
3	86.5	87.7	89.0	92.1	78.1	95.5
4	83.2	85.1	83.9	88.9	73.7	92.0

AT&T Sprint T-Mobile Verizon

United States speeds



The speeds above show each carrier's aggregate median download speed from our testing across the entirety of the US.

Key takeaways

AT&T remains a strong national performer with fast speeds: AT&T performed quite well in general, with second-place rankings in five categories and a tie for first with Verizon in the text category. AT&T was also fast: AT&T's national aggregate median download speed of 33.1 Mbps was much faster than those of Sprint (23.1 Mbps) and T-Mobile (24.6 Mbps) and was comparable to that of Verizon (32.7 Mbps).

Sprint's results remain generally consistent with those from 1H 2019: Sprint ranked fourth in five out of six categories at the national level, but the carrier's text results were generally strong and not far behind those of the leaders. And while Sprint's aggregate median download speed of 23.1 Mbps was the slowest among all carriers, that speed was still respectable; speeds faster than 20.0 Mbps are typically fast enough to handle most consumer data behaviors with ease.

T-Mobile shows improvement in 2H 2019: T-Mobile typically performs much better in metropolitan markets than it does at state or national levels, and that remained the case in 2H 2019. That said, T-Mobile's rankings in the categories of network reliability and call performance both improved in this test period, and T-Mobile registered a strong aggregate median download speed of 24.6 Mbps.

Verizon remains the carrier to beat at the national level: Verizon continued its run of excellence in our national testing, winning or sharing all six awards and delivering fast speeds. Verizon's aggregate median download speed of 32.7 Mbps was faster than those of Sprint and T-Mobile and was comparable to that of AT&T. Verizon also added to its record-setting performance streak, winning United States RootScore Awards outright in the categories of overall performance, network reliability, data performance, and call performance for the thirteenth straight time.

Keep in mind that if a carrier's ranking(s) declines in a given test period, it doesn't necessarily mean that the carrier's performance was worse compared to the previous test period. Rather, a strong performance from another carrier(s) can correspond with lower rankings for others.

Mobile performance across the 50 states

Providing strong service across an entire state isn't an easy task. Excelling in metropolitan markets or big cities doesn't necessarily mean that strong service will translate to success in other areas of a state. Our State RootScore Report studies balance performance from dense urban areas, smaller towns, rural spaces, and highways to paint a complete picture of the consumer mobile experience at the state level.

State RootScore Award tally - by category

	Overall	Reliability	Speed	Data	Call	Text	Total	Difference from 1H 2019
AT&T	20	21	25	18	21	38	143	30
Sprint	0	0	0	0	0	9	9	-1
T-Mobile	0	0	9	2	0	8	19	1
Verizon	44	44	37	37	46	38	246	-17

Key takeaways

AT&T shows improvement at the state level: AT&T improved its award total in this test period by a whopping 30 awards, and AT&T's tally of 143 state-level RootScore Awards trailed that of only Verizon (246).

Sprint delivers strong text results in state testing: While Sprint took home the fewest state-level awards among all carriers in 2H 2019, the carrier's text results remained strong, with Sprint earning all nine of its state-level awards for text performance.

T-Mobile's results remain generally consistent: T-Mobile's award total improved by one since 1H 2019. The carrier earned more awards than Sprint and showed modest improvements in our data and call performance categories.

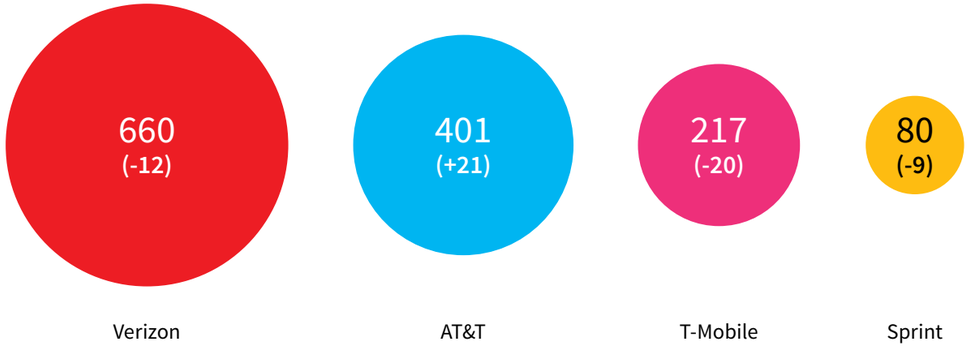
Verizon continues state-level dominance: Verizon won or shared an incredible 246 State RootScore Awards out of 300 possible award opportunities in 2H 2019, which was easily the highest total among all carriers.

Metro area performance

Major metropolitan markets are much more than just city centers. They also include the suburbs, business districts, tourist areas, and the highways that connect them. With the 5G era having begun in the US, end users expect fast and reliable mobile performance across all of these spaces, whether they live and work in a metropolitan market or are visiting on vacation.

This section of our report provides a carrier-by-carrier overview of speed performance across the 125 most populated metro areas in the country, as well as a high-level look at how 5G technology can affect (and improve) daily mobile life.

Metro Area RootScore Award tally



Numbers in parentheses represent each carrier's change in award total since 1H 2019.

Metro performance in a nutshell:

AT&T remains a strong performer: AT&T delivered fast speeds, strong reliability, and an improved award tally.

Sprint offers mixed results in 2H 2019: Sprint delivered generally solid speeds and good text results, but its blocked call reliability was relatively poor, and the carrier earned fewer awards in this test period.

T-Mobile provides generally fast speeds in metro areas: T-Mobile continued to deliver strong speeds in metro areas, but for the third straight test period, the carrier's award total decreased.

Verizon delivers outstanding results across the board: Verizon delivered an unmatched combination of fast speeds and exceptional reliability, once again earning the highest award total among all carriers.

AT&T delivers fast speeds, strong reliability, and an increased award tally.

Good news for AT&T subscribers looking for fast speeds: AT&T delivered median download speeds of at least 40 Mbps in more markets (37) than any other carrier in 2H 2019, with speeds faster than 50 Mbps in 10 of those metros.

Extremely fast in Baltimore, MD: AT&T's fastest median download speed of 66.6 Mbps in Baltimore ranked as a statistical tie for the fastest speed we recorded in the second half of 2019.

AT&T steps up award total: AT&T was the only carrier that increased its award total in this test period, jumping from 380 last time to 401 in 2H 2019.

AT&T launches low-band 5G in late 2019: We tested AT&T's low-band 850 MHz spectrum 5G network in select cities near the end of 2019. AT&T's 5G speeds showed room for improvement, but we expect performance to jump in 2020.

AT&T's median download speed intervals						
Median download speed intervals	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
1H 2019	1	11	35	42	23	13
2H 2019	1	16	31	40	27	10

Number of markets out of 125 in which AT&T delivered median download speeds at various intervals.

AT&T's fastest and slowest median download speeds
(and how long it takes to download a 5MB song)

Speeds above show the markets in which AT&T recorded its fastest and slowest median download speeds (Mbps), and the times indicate how long it typically takes to download a 5MB song at each speed (times in seconds).

AT&T Metro Area RootScore Award tally

AT&T	Outright	Ties	2H 2019 total	Difference from 1H 2019
Overall RootScore Award	6	47	53	-2
Reliability RootScore Award	2	52	54	-11
Speed RootScore Award	14	30	44	21
Data RootScore Award	14	28	42	19
Call RootScore Award	1	84	85	-5
Text RootScore Award	10	113	123	-1
Total awards	47	354	401	21

Sprint delivers generally fast speeds and strong text results.

Solid speeds in general with top-end improvement: Sprint didn't register speeds faster than 30 Mbps in as many markets as the other carriers, but Sprint's speeds were still solid, with median download speeds of at least 20 Mbps in 87 metros in 2H 2019. Sprint also showed high-end improvement, increasing the number of markets in which it delivered median download speeds of at least 40 Mbps from one in 1H 2019 to six in 2H 2019.

Strong text results: While Sprint's total number of awards declined in this test period, the carrier's tally of Text RootScore Awards improved from 75 in 1H 2019 to 80 this time. In fact, all of Sprint's Metro RootScore Awards were for text performance.

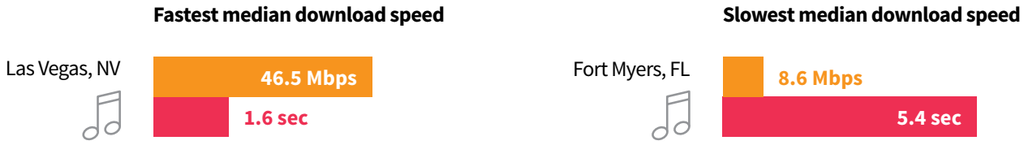
Strong dropped call results but poor blocked call reliability: While Sprint registered strong results during dropped call testing, the carrier's blocked call rates were comparatively high in most markets. Sprint's generally poor blocked call results were due in part to relatively long call setup times (the time between placing a call and when the recipient's phone starts ringing).

Sprint launches 5G in some cities: We tested Sprint's mid-band spectrum 5G network in select cities toward the end of 2019, and the carrier delivered impressive 5G speeds with generally wide 5G availability.

Sprint's median download speed intervals						
Median download speed intervals	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
1H 2019	4	38	49	33	1	0
2H 2019	3	35	50	31	6	0

Number of markets out of 125 in which Sprint delivered median download speeds at various intervals.

Sprint's fastest and slowest median download speeds
(and how long it takes to download a 5MB song)



Speeds above show the markets in which Sprint recorded its fastest and slowest median download speeds (Mbps), and the times indicate how long it typically takes to download a 5MB song at each speed (times in seconds).

Sprint Metro Area RootScore Award tally

Sprint	Outright	Ties	2H 2019 total	Difference from 1H 2019
Overall RootScore Award	0	0	0	0
Reliability RootScore Award	0	0	0	-2
Speed RootScore Award	0	0	0	0
Data RootScore Award	0	0	0	0
Call RootScore Award	0	0	0	-12
Text RootScore Award	0	80	80	5
Total awards	0	80	80	-9

T-Mobile provides strong speeds in metropolitan markets across the US.

Generally fast speeds: While T-Mobile registered median download speeds faster than 30 Mbps in a respectable 50 markets, the carrier lagged behind AT&T and Verizon when looking at speeds of 40 Mbps or faster. For instance, T-Mobile clocked median download speeds of at least 40 Mbps in 12 markets, whereas AT&T did so in 37 metros and Verizon in 28. However, T-Mobile's speeds were strong in most of the markets we tested.

Extremely fast in Omaha: T-Mobile's fastest median download speed of 66.3 Mbps, recorded in Omaha, NE, was a statistical tie for the fastest median download speed we recorded in the second half of 2019.

Strong data reliability but relatively high blocked call rates: While T-Mobile delivered good data reliability results, the carrier's blocked call rates were relatively high in several markets. Similar to what we noted above for Sprint, T-Mobile's comparatively poor blocked call results were partially due to generally long call setup times. That said, T-Mobile's dropped call results were quite good.

T-Mobile launches nationwide 5G in December 2019: We tested T-Mobile's low-band 850 MHz 5G network in select cities shortly after launch, and while T-Mobile's 5G footprint was generally widespread, the carrier's 5G speeds showed room for improvement. However, we expect to see faster speeds going forward.

T-Mobile's median download speed intervals						
Median download speed intervals	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
1H 2019	3	19	43	36	17	7
2H 2019	3	25	47	38	9	3

Number of markets out of 125 in which T-Mobile delivered median download speeds at various intervals.

T-Mobile's fastest and slowest median download speeds
(and how long it takes to download a 5MB song)

Speeds above show the markets in which T-Mobile recorded its fastest and slowest median download speeds (Mbps), and the times indicate how long it typically takes to download a 5MB song at each speed (times in seconds).

T-Mobile Metro Area RootScore Award tally

T-Mobile	Outright	Ties	2H 2019 total	Difference from 1H 2019
Overall RootScore Award	0	18	18	0
Reliability RootScore Award	0	20	20	4
Speed RootScore Award	14	23	37	-6
Data RootScore Award	7	15	22	-7
Call RootScore Award	0	26	26	3
Text RootScore Award	0	94	94	-14
Total awards	21	196	217	-20

Verizon delivers excellent results across the board: fast speeds, excellent reliability, and the highest award total.

Consistently fast and reliable: Verizon once again delivered the strongest combination of stellar reliability and fast speeds among all networks. Verizon registered median download speeds faster than 30 Mbps in more markets (91) than any other carrier, and Verizon's 8 markets with speeds faster than 50 Mbps was topped by only AT&T (10). Verizon also delivered outstanding data and call reliability in nearly every metro we tested.

Fast even at the "slow" end of the spectrum: Verizon's "slowest" median download speed of 17.9 Mbps, recorded in Fresno, CA, was still quite strong and would allow end users to complete the majority of data tasks with ease. In fact, Fresno was the only market in which Verizon registered a median download speed below 20 Mbps. No other carrier came close to matching Verizon's consistency of delivering fast speeds in metros across the US.

By far the most awards: Verizon earned an exceptional 660 RootScore Awards out of 750 total award opportunities. For perspective, Verizon's next-closest competitor at the award level was AT&T, with 401 total awards.

Verizon's 5G is fast: Verizon has deployed millimeter wave (mmWave) 5G in targeted areas of select cities. Coverage on mmWave is limited due to propagation, but we recorded fast median download speeds, with remarkably fast maximum download speeds.

Verizon's median download speed intervals

Median download speed intervals	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
1H 2019	0	3	37	47	26	12
2H 2019	0	1	33	63	20	8

Number of markets out of 125 in which Verizon delivered median download speeds at various intervals.

Verizon's fastest and slowest median download speeds
(and how long it takes to download a 5MB song)

Speeds above show the markets in which Verizon recorded its fastest and slowest median download speeds (Mbps), and the times indicate how long it typically takes to download a 5MB song at each speed (times in seconds).

Verizon Metro Area RootScore Award tally

Verizon	Outright	Ties	2H 2019 total	Difference from 1H 2019
Overall RootScore Award	61	58	119	-1
Reliability RootScore Award	61	61	122	0
Speed RootScore Award	51	46	97	-3
Data RootScore Award	67	35	102	-11
Call RootScore Award	34	90	124	1
Text RootScore Award	1	95	96	2
Total awards	275	385	660	-12

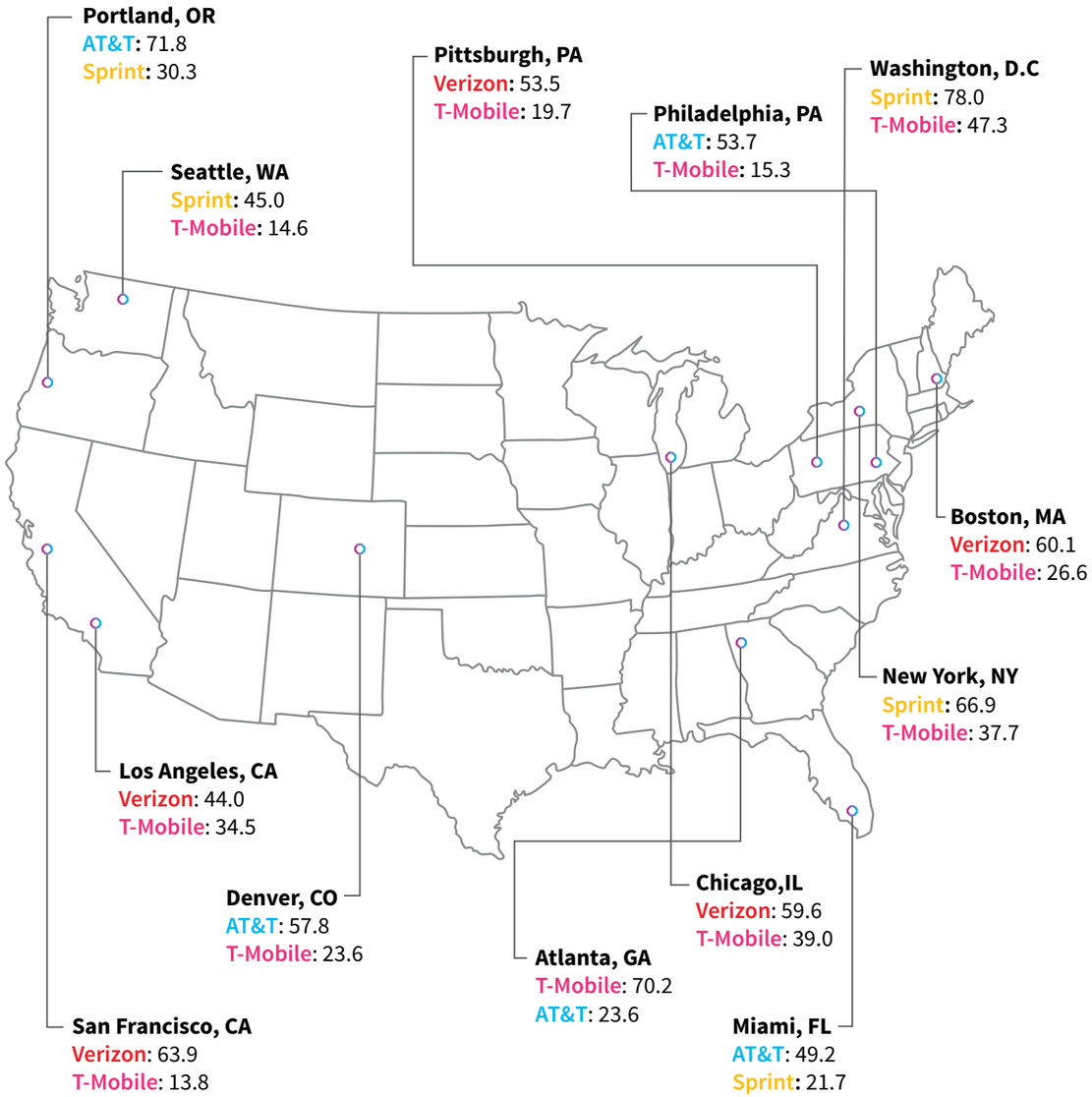
Mobile performance in highly congested urban areas

Demands for strong mobile performance are often greatest in highly congested areas, from dense pockets of major cities to large event venues and other areas where finding solid performance is often challenging. With 5G rollouts beginning across the US, however, end users could soon find outstanding performance in even the busiest areas of metropolitan markets. Why? While 5G promises blazing fast speeds, it will also allow for much greater capacity. The capacity of 5G will help users enjoy a smooth mobile experience, especially in areas of high congestion.

Current LTE performance in city centers

As noted above, capacity is critical for a good mobile experience in highly congested areas. To show you how the carriers performed in high-traffic areas of select cities, we measured each carrier's median download speed outdoors in the dense urban cores of 13 major cities across the country.

See the map below to learn which carriers delivered the fastest and slowest median download speeds outdoors in the most populated areas of each city:



Speeds shown are in Mbps

5G is here, but not all 5G is created equal (at least not yet)

The importance of 5G and spectrum

5G will eventually empower applications that hold the potential to transform everyday life, from remote surgery to driverless cars and much more, but those changes won't happen overnight. Instead, 5G will be implemented in a phased approach over the next few years. While 5G is a story that will unfold over time, our early results have shown promise for 5G both today and in the future.

Keep in mind, however, that not all 5G networks are created equal. A key component of the end-user's 5G experience depends on what type of spectrum the carriers use. In the context of 5G, spectrum above 6 GHz is considered millimeter wave (mmWave), and everything at 6 GHz or below is referred to as "sub-6 GHz" spectrum.

The bottom line is that mmWave is capable of delivering incredibly fast speeds over limited coverage areas, whereas sub-6 GHz can't match the speeds of mmWave but can travel farther, cover larger geographical areas, and provide deeper penetration within buildings. AT&T, Sprint, and T-Mobile currently utilize sub-6 GHz spectrum for 5G, while Verizon uses mmWave spectrum to provide 5G in targeted areas within select cities that require greater capacity. Note, however, that Sprint has paused its 5G rollouts until the outcome of its proposed merger with T-Mobile is complete. To learn more about spectrum, read our new article Understanding spectrum.

Note that results from 5G testing were not factored into our scoring for national, state, or metro results in 2H 2019.

The 5G landscape is already changing

AT&T and T-Mobile initially launched 5G in the summer of 2019 with mmWave spectrum, but both carriers have recently deployed 5G using low-band spectrum (spectrum below 1 GHz). Given the shifting 5G deployment strategies of AT&T and T-Mobile, we recently tested 5G in five select cities to see how the 5G networks of Sprint (which uses mid-band 2.5 GHz spectrum) and Verizon compared to the newly deployed 5G networks of AT&T and T-Mobile. We'll soon create a larger, standalone report of 5G results across additional cities, but for now we've included a quick overview of results from Chicago and Los Angeles.

Key takeaways

The promises of 5G include dramatically faster data speeds and lower latency. That said, access to the fastest 5G speeds depends on what spectrum each carrier has available. We're still in the early days of 5G and expect to see even faster speeds over time as 5G network coverage expands and as the carriers make technology upgrades.

5G availability has room for improvement: Early results showed that while the sub-6 GHz 5G networks of AT&T, Sprint, and T-Mobile provided higher 5G availability rates than Verizon, each carrier's 5G coverage was relatively limited in general.

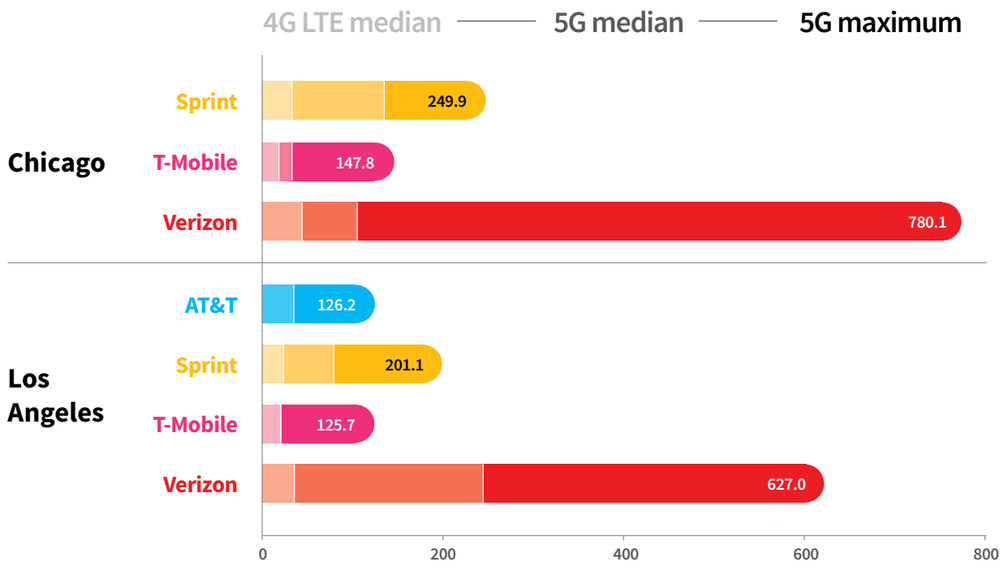
Verizon's mmWave 5G brings top-notch speeds to focused areas: Given the propagation characteristics of mmWave, Verizon is taking advantage of 5G to maximize performance in especially dense areas of cities. While mmWave spectrum isn't intended for launching 5G across entire cities, things could change with the release of Dynamic Spectrum Sharing (DSS) technology, expected to launch in late 2020. DSS will allow Verizon and other carriers to take advantage of all types of spectrum and provide 5G on a much broader scale. In the meantime, Verizon continues to expand mmWave 5G to new cities and to new areas within existing 5G markets.

A note on 5G availability rates: During the nascent stages of 5G deployments, connecting to 5G at relatively low percentages isn't surprising. Operators often choose to launch 5G only in certain areas of a city and/or may target very specific audience segments, such as enterprise customers. That said, we do expect 5G service to become better and more widespread as the networks mature over time.

Real-world 5G performance: A look at 5G speeds and availability in Chicago and Los Angeles

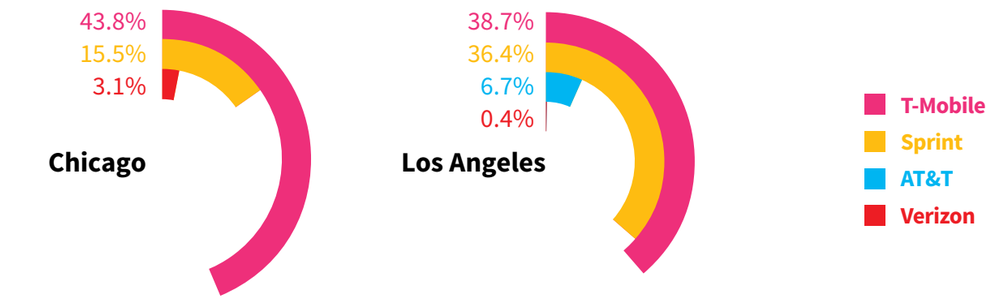
Our recent 5G user-experience testing revealed somewhat of a mixed bag in terms of speed results. Verizon's 5G speeds, for example, could change the game for users in some cities, while T-Mobile's 5G speed in Los Angeles was similar to its 4G LTE speed in the same city. That said, it's important to remember that new technologies always take time to expand and mature, and we should see both faster speeds and greater availability over time.

5G and 4G LTE speeds in Chicago and Los Angeles (Mbps)



* AT&T hadn't launched its low-band spectrum 5G in Chicago at the time of our testing.
* Verizon's 5G median download speed in Los Angeles was based on a very small sample (7).

5G availability (%)



* AT&T hadn't launched its low-band spectrum 5G in Chicago at the time of our testing.

Key takeaways

AT&T's 5G speeds have room to improve, but 4G LTE still offers strong service: AT&T's 5G speeds were similar to (or in some cases slower than) its 4G LTE speeds. However, given AT&T's strong 4G LTE network, end users should still experience solid performance even when 5G isn't available, and AT&T's 5G results should only improve over time.

Sprint's 5G provides fast speeds and generally strong results: Sprint's 5G speeds were faster than those of T-Mobile in each city we tested, and Sprint's 5G speeds were similar to or faster than AT&T's 5G speeds. Based on spectrum characteristics, Sprint's mid-band spectrum 5G could continue to provide faster speeds than the low-band spectrum 5G networks of AT&T and T-Mobile, though Sprint's speeds will likely trail the top speeds of Verizon on mmWave.

T-Mobile offers a wide 5G footprint: The good news is that T-Mobile offered more 5G than any other carrier in most of the cities we tested. On the other hand, the carrier's 5G median download speeds didn't exceed 34.0 Mbps in our user-experience testing. In some cities, T-Mobile's early 5G speeds were slower than its 4G LTE speeds. Considering the early state of the carrier's 5G, however, we expect to see faster speeds in the future.

Verizon's 5G was fast: Verizon's 5G speeds were fast, and its maximum download speeds were remarkable. Verizon's combination of ultra-fast speeds but a smaller initial coverage area wasn't necessarily a surprise, however, given the propagation characteristics of mmWave spectrum.

Verizon 4G LTE faster than some carriers' 5G: That smaller mmWave coverage area doesn't mean that Verizon customers have to miss out on top-notch performance: Verizon's 4G LTE speeds were faster than the low-band 5G median download speeds of T-Mobile in Chicago and Los Angeles and identical to AT&T's low-band 5G median download speed in LA.

Note that results from 5G testing were not factored into our scoring for national, state, or metro results in 2H 2019.

How we test

We believe that real-world results come from real-world testing. All RootMetrics testing is conducted from the consumer's point of view. Testing is performed indoors and while driving, and select metro markets include testing while walking within dense urban areas. For national, state, and metro testing, we used Samsung Galaxy S9 smartphones purchased off the shelf from carrier stores. For 5G testing, we used a Samsung Galaxy Note10+ 5G to test the 5G networks of AT&T, T-Mobile, and Verizon, and we used a Samsung Galaxy S10 5G to test Sprint's 5G.

We utilize random sampling techniques to ensure our results offer a robust characterization of performance in the places consumers most often use their smartphones, and all testing is focused on the activities for which consumers typically use their smartphones, including data, call, and text usage. To learn more about our testing, visit our methodology.

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