RootMetrics®
By IHS Markit

5G in the US

Checking in on 5G progress in 2021: Who's currently leading the 5G race?

5G performance across 45 US cities in the first half of 2021

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Why 5G matters

With the COVID-19 pandemic leading to unprecedented levels of remote learning and working, the importance of fast and reliable mobile connectivity has never been greater. As more and more people use their smartphones for streaming videos, mobile gaming, and much more, data usage in the US has continued to explode during the pandemic—and end-user demands for flawless connectivity will only increase as 5G continues to expand as we move further into 2021.

While we've seen strong and improving 5G availability and speeds from the carriers in many cities, it's important to keep in mind that with the major US networks utilizing different types of spectrum for 5G, the 5G availability and speeds that consumers experience can vary a great deal for different carriers across or even within different markets.

The good news is that 5G is expanding, speeds are getting faster, and we expect the 5G experience to become even faster and more widespread going forward as the networks continue to mature and bolster their spectrum holdings.

Read on to see how each carrier's 5G network performed across the first 45 cities we tested in the first half of 2021. We recorded 5G results for AT&T in 44 out of 45 cities, T-Mobile offered 5G in each of the 45 cities we tested, while Verizon registered 5G results in 43 markets.

A look at 5G performance, trends, and progress in 1H 2021

The 5G landscape is in a state of near-constant change. From boosting 5G availability with **dynamic spectrum sharing (DSS)** to acquiring spectrum at the recent **C-Band auction**, the carriers' 5G deployment strategies are shifting rapidly.

To show the progress and trends we're seeing with 5G during our testing in major metropolitan markets across the US in 1H 2021, the following report looks at results across the first 45 markets we've tested to date in the first half of the year.

We've collected millions of test samples so far in 2021 that allow us to accurately show each carrier's performance and the trends we've observed during testing.

To add more context and allow for apples-to-apples comparisons of performance in 1H 2021 compared to what we saw in 2H 2020, this report includes results across the same 45 markets tested in both the first half of 2021 and the second half of 2020. To see the full list of 45 cities tested, check the appendix on page 18.

Our 1H 2021 testing across the 45 cities discussed in this report was conducted from January 15 through March 4, 2021. Our 2H 2020 testing for those same 45 markets was performed from August 5, 2020 through November 6, 2020.

To learn more about 5G and the mobile landscape in general, sign up for our newsletter to make sure you don't miss anything.

Spectrum

The key to the end-user 5G experience

The key to understanding 5G is understanding spectrum—the different types, the advantages of each, and how those spectrum types can work together to deliver a top-notch 5G experience in the real world.

In the context of 5G, higher band spectrum above 24 GHz is considered millimeter wave (mmWave), while spectrum at or below 6 GHz can be separated into “low-band” or “mid-band” spectrum. While mmWave spectrum is used only for 5G, low- and mid-band spectrum is also used for 4G LTE service and isn’t intended to be used solely with 5G. For a deeper look at spectrum, watch our spectrum **video** and read our comprehensive report on **understanding spectrum and 5G**.

It’s important to keep in mind that there is no one-size-fits-all 5G solution, and no one spectrum type is “best” - each of the spectrum divisions has advantages and disadvantages, and an optimal 5G experience will be one in which different types of spectrum work together. Ultimately, there are two key considerations when it comes to spectrum:

Speed performance

Geographical coverage

The pros and cons of the spectrum divisions

Low-band spectrum 5G (under 1 GHz):

Low-band spectrum can cover long distances and penetrate deep within buildings and other structures, but it doesn’t have the capability to provide high-end speeds as fast as those of mid-band or, especially, mmWave spectrum. Indeed, while low-band spectrum can help operators bring 5G to rural areas, its speeds are generally closer to those on 4G LTE, rather than the game-changing speeds 5G can deliver on other types of spectrum.

Mid-band spectrum 5G (1 GHz – 6 GHz):

Mid-band spectrum is often considered the most desirable type of spectrum for 5G. It carries the advantages of both low-band and mmWave spectrum, with not only fast speeds but also broad geographic coverage. Mid-band spectrum also provides additional capacity in areas with heavy congestion such as event venues, busy city centres, and other areas where finding strong mobile service can be challenging.

High-band/mmWave spectrum 5G (24 GHz+):

The primary upside of mmWave spectrum is that it’s fast—very fast. It offers the potential to deliver speeds theoretically as high as 5.0 Gbps or better and can provide broadband connectivity to busy office buildings and other densely populated areas of cities much more easily (and cost effectively) than wired broadband. However, the downside to mmWave is that signals don’t travel more than about one city block, resulting in generally low 5G availability, and mmWave signals can be obstructed by architecture and other physical objects relatively easily.

5G spectrum assets in use by each carrier

AT&T uses low-band spectrum extensively for its nationwide 5G network, while utilizing its **mmWave spectrum holdings in parts of 38 cities**, including urban centers, event venues, campuses, and other densely populated areas. AT&T has also used dynamic spectrum sharing (DSS) technology, which allows carriers to repurpose their existing 4G LTE spectrum for 5G deployments and therefore expand 5G availability. AT&T also spent over **$23B on mid-band spectrum at the C-Band auction.**

T-Mobile has deployed low-band, mid-band, and mmWave 5G as part of its **"Layer Cake" 5G strategy**. The ability of T-Mobile to acquire Sprint's mid-band spectrum, which offers fast speeds plus broad geographic coverage, was a key reason why the two companies merged and could prove hugely valuable for T-Mobile's 5G performance going forward. To further boost its mid-band spectrum holdings, T-Mobile spent over **$9B at the C-Band auction**.

Verizon began its 5G rollout with mmWave spectrum, which provides remarkable speeds but with limited 5G availability. Then in October of 2020, the carrier used DSS technology to launch its low-band nationwide 5G service, which greatly expanded Verizon's 5G offering across the country. To bolster its spectrum holdings Verizon spent **$1.9 billion** on mid-band spectrum at the CBRS auction. The carrier is currently using CBRS for its 4G LTE service, but CBRS can also be used for 5G. In addition, Verizon invested over **$45B at the recent C-Band auction**.

Benchmarking what matters most

the consistency of 5G availability and performance

To provide a holistic view of each network's real-world 5G performance, we've included visuals below showing market tallies and trend indicators for each carrier's 5G availability, speed, and data reliability performance, along with key insights and highlights for all three major carriers.

To evaluate the consistency of 5G performance, we looked at the number of markets in which each carrier reached or surpassed various performance thresholds during our testing of 45 metropolitan markets in the US in the first half of 2021. Taken together, this complementary information provides a full picture of the current end-user 5G experience.

The foundation of an optimal 5G experience: availability plus performance (not one or the other)

The end-user 5G experience is shaped by two main pillars: availability and performance. Not only do you need to know how much 5G is available, you also need to understand the speed and data reliability performances you're likely to experience when you access that 5G.

It's critical that the two pillars of availability and performance be considered together—not in isolation—because the ideal 5G experience is marked by those times when a carrier delivers a combination of both widespread availability and strong performances for speed and reliability.

The performance intervals and market tallies below offer a look at which carrier is currently delivering most often on this key combination of availability plus performance—you can see exactly how many cities each carrier offered broad 5G availability as well as fast speeds and outstanding reliability, all of which in combination reflect an ideal 5G experience.

The consistency of 5G availability and performance

5G availability

Our 5G availability results provide an understanding of how often we connected to 5G across our suite of data tests (download, upload, and web and app testing).

When people use their smartphones, they may switch between 5G, 4G LTE, and mixed mode (the user experience of switching between 5G and 4G LTE during the same data activity). Performance during mixed mode is typically not as strong as that of 5G-only, so to provide the most accurate view of a true 5G experience and to offer the most direct comparisons between operators, the 5G metrics in this report do not factor in results recorded on mixed mode.

5G speeds: median, worst-case (5th percentile), and best-case (95th percentile) download speeds

5G median download speeds offer a look at "everyday" 5G performance when connected to 5G, while "worst-case" or 5th percentile 5G speeds represent the floor of your 5G experience. Our "best-case" or 95th percentile speed results, in contrast, represent the ceiling of your 5G experience and provide an indication into the potential of a network's 5G. Consumers shouldn't experience best- or worst-case speeds often, but they do provide an important barometer for the progress of 5G.

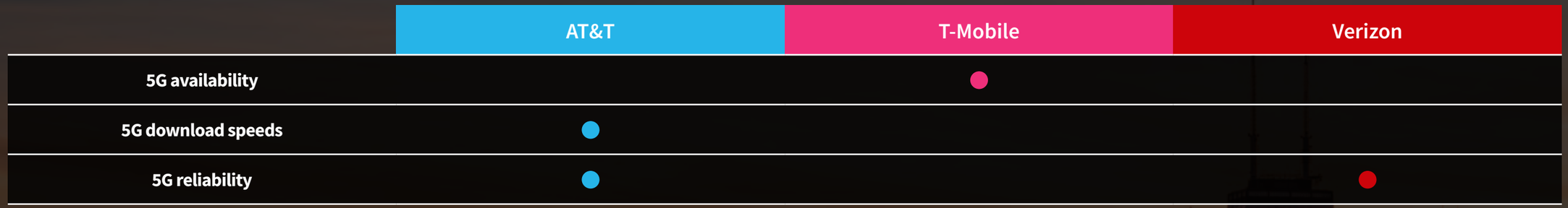
It's also worth noting that the **International Mobile Telecommunications Union (IMT-2020)** has set expectations for "true" 5G median download speeds as those consistently reaching or exceeding 100 Mbps. Our speed intervals show how the US carriers are progressing toward that expectation.

5G data reliability

We measure data reliability during our secure web and app testing (which acts as a good proxy for overall data reliability), and we look at each carrier's ability to get connected to the network and then stay connected long enough to complete our tests. Our secure web and app reliability testing characterizes data reliability for use cases that require continuous data usage over secure connections.

While the reliability expectations in IMT-2020 are near-perfect at 99.9999%, to account for the early stages of 5G, our benchmark for excellent data reliability is success rates of 99.5% or higher for getting connected and staying connected.

The 5G race: who's currently in the lead?



Results above are based on testing across 45 markets to date in the first half of 2021. See metrics below for more details.

High-level 5G storylines in 1H 2021, in a nutshell:

Good news for 5G users: all three carriers showed progress across the first 45 cities we tested in the first half of 2021 compared to what we found in those same cities in the second half of last year. While some carriers are further ahead of others when it comes to delivering on the key combination of availability plus performance, our results showed that all three carriers have registered improved availability and speeds since the second half of 2020.

At a high-level, notable findings from our testing showed that:

- **AT&T** impressed at multiple levels during testing so far in 1H 2021, with broad 5G availability, strong speeds, and great 5G reliability. AT&T also delivered the fastest 5G experience across three key speed metrics in the most cities of any carrier (see page 12 for details).
- **T-Mobile** improved on its already widespread 5G availability and clocked much faster 5G speeds compared to those in 2H 2020. In 2020, the carrier's 5G speeds were relatively slow, but T-Mobile's speeds took a huge step forward in 1H 2021. That improvement was largely due to the carrier's increased usage of mid-band spectrum across the first 45 markets tested in 1H 2021.
- **Verizon**, which launched its nationwide 5G in the fall of 2020, showed incredibly fast progress in improving its 5G availability. The carrier delivered excellent 5G reliability, with 5G speeds generally similar to those of T-Mobile.

While T-Mobile is currently ahead of the competition when it comes to 5G availability, AT&T is in the lead for speed, and AT&T and Verizon are both offering the top 5G data reliability performance, it's important to keep in mind that the 5G race is a marathon and not a sprint.

The current leaderboard could shift quickly if T-Mobile can continue to show improved speeds along with its already broad availability, or if Verizon can pair its rapid 5G expansion with faster speeds going forward. We'll be keeping a close eye on this dynamic ecosystem moving forward.

The results

Consistency of 5G performance

5G availability

T-Mobile offers the most widespread 5G availability, AT&T posts broader availability than Verizon, while Verizon's 5G shows quick and impressive growth.

The only carrier offering 5G in each of the first 45 cities we tested, T-Mobile's already broad 5G availability led the competition and showed improvement since 2H 2020. The carrier recorded 5G availability above 55% in more markets than any other carrier at 30, an increase from 17 in 2H 2020. T-Mobile also improved at the lower end of our intervals: in 2H 2020, the carrier recorded 5G availability below 10% in four cities, but that number dropped to 0 in 1H 2021. In fact, T-Mobile's lowest 5G availability so far in 2021 was 19.2% in Sarasota, FL.

AT&T's 5G availability was also widespread and showed improvement since 2H 2020. AT&T posted availability greater than 55% in 20 markets, marking a jump from 3 such cities in 2H 2020. AT&T also improved at the lower-end, with only 6 markets below 25% 5G availability in 1H 2021 compared to 18 in 2H 2020. Moreover, AT&T also registered the single highest 5G availability of any carrier at 82.9% in Dayton, OH.

Verizon's 5G availability, meanwhile, showed massive and rapid progress since 2H 2020. In the second half of 2020, most of our testing took place before Verizon launched its nationwide 5G, and we recorded 5G results for Verizon in 1 of 45 cities. But in the first half of 2021, we registered results on Verizon's 5G in 43 of those 45 cities. While Verizon's 5G availability within markets wasn't as widespread as that of the other carriers, Verizon's rapid expansion could be a sign of continued growth for its 5G service.

5G availability - 1H 2021 & (2H 2020) market tally

Carrier	0.0%	0-10%	10-25%	25-40%	40-55%	55-70%	70-85%
AT&T	1 (2)	2 (5)	3 (11)	2 (15)	17 (9)	17 (3)	3 (0)
T-Mobile	0 (0)	0 (4)	2 (3)	4 (8)	9 (17)	28 (12)	2 (1)
Verizon	2 (44)	2 (0)	9 (1)	13 (0)	16 (0)	3 (0)	0 (0)

Values represent the number of markets out of 45 cities tested that fell into each interval in 1H 2021.
Values in parentheses reflect the number of markets in each interval in 2H 2020 across the same 45 cities

5G availability plus performance is key—not just one or the other:

Keep in mind that 5G availability is only side of the end-user 5G equation; you also need 5G to perform well. Read on to learn more about how the carriers performed across several key 5G metrics.

5G median download speeds

AT&T delivers consistently strong speeds, T-Mobile's speeds see a large boost, while Verizon's 5G speeds were similar to those of T-Mobile.

With a strong combination of availability plus speed, we found speeds above 50 Mbps in more markets on AT&T's network compared to those of the other carriers.

Since early deployments, T-Mobile has been known for providing broad 5G availability. But the other side of the coin for T-Mobile has been offering speeds similar to those on 4G LTE. That story changed In 1H 2021, however, as T-Mobile's speeds took a leap forward. A key reason why T-Mobile delivered faster speeds in 1H 2021 was because the carrier utilized its mid-band spectrum for 5G far more often in 1H 2021 (24.44% of the time) than it did in 2H 2020 (0.94%).

T-Mobile posted 5G speeds above 50 Mbps in 12 cities, an increase from just 2 in 2H 2020. T-Mobile also clocked 5G median download speeds below 25 Mbps in just 7 markets in 1H 2021, an improvement from 23 in 2H 2020. T-Mobile is clearly taking advantage of the mid-band spectrum it acquired from Sprint, and its "**Layer Cake**" 5G strategy could soon pay off with even faster speeds to go along with its already broad availability. In fact, T-Mobile was the only carrier that surpassed the 100 Mbps threshold identified by IMT-2020, with its 5G median download speed of 103.0 Mbps in Syracuse, NY.

Verizon delivered 5G median download speeds in the 25-50 and 50-100 Mbps ranges in almost exactly the same number of cities as T-Mobile. While the low-band 5G Verizon uses for its nationwide 5G helped boost its availability, the tradeoff with low-band is that speeds are generally slower than those of mid-band or, especially, mmWave spectrum. Verizon still uses mmWave 5G in busy city centers and other congested areas where added capacity is key. Its mmWave 5G can offer blazing 5G speeds (often in excess of 400 Mbps) but can be more difficult to find due to smaller coverage areas.

As mid-band spectrum continues to be integrated, the 5G landscape could shift significantly. We've already seen T-Mobile's speeds rise because of its additional usage of mid-band. In fact, C-Band spectrum could ultimately improve speeds for all three carriers, but AT&T and especially Verizon stand to benefit the most given that both carriers invested far more than T-Mobile at auction, with Verizon's spend of $45B more than those of AT&T ($23B) and T-Mobile ($9B) combined.

5G median download speeds - 1H 2021 & (2H 2020) market tally

Carrier	0-25 Mbps	25-50 Mbps	50-100 Mbps	100-150 Mbps	Number of cities with 5G
AT&T	0 (9)	13 (27)	31 (7)	0 (0)	44 (43)
T-Mobile	7 (30)	26 (13)	11 (2)	1 (0)	45 (45)
Verizon	8 (0)	25 (0)	10 (1)	0 (0)	43 (1)

Values represent the number of 5G markets out of 45 cities tested that fell into each interval in 1H 2021.
Values in parentheses reflect the number of 5G markets in each interval in 2H 2020 across the same 45 cities

4G LTE median download speeds

AT&T offers high-end 4G LTE speeds in the most cities, T-Mobile's speeds remain consistent with those in 2H 2020, while Verizon delivers generally good results.

With 5G in the US in its early stages, we also looked at each carrier's speed results on 4G LTE. These results give an indication of what users can expect when they can't connect to 5G and provide a broad look at the difference between speeds on 5G and 4G LTE.

AT&T led the way with high-end speeds above 50 Mbps in 12 markets, easily the most of any carrier. While AT&T recorded lower-end speeds below 25 Mbps in 20 cities, that number marked an improvement from 36 in 2H 2020. In short, AT&T is showing better speeds on both 4G LTE and 5G in 1H 2021 compared to 2H 2020.

T-Mobile's speed interval results were almost identical to those from 2H 2020. The key story here, though, is that in 2020, T-Mobile's 5G speeds were similar to those on 4G LTE, but that's no longer the case in 2021; its 5G speeds clearly jumped ahead of its speeds on 4G LTE.

Verizon is offering relatively good speeds on 4G LTE, with most of its speeds above 25 Mbps. In 2H 2020, Verizon was the only carrier that didn't record a single median download speed below 25 Mbps. In 1H 2021, however, Verizon had 10 markets below 25 Mbps. Verizon also had seven fewer markets with 4G LTE speeds above 50 Mbps than it did in 2H 2020.

Keep in mind, however, that 5G is only one piece of the overall speed experience; when it comes to speeds on all technologies, including 4G LTE and 5G, Verizon's overall speed results have typically been excellent. Indeed, as shown in our recent **State of the Mobile Union report**, Verizon won more Speed RootScore Awards than any other carrier. With the rapid changes we're seeing in 1H 2021, we'll be interested to see how Speed RootScore Awards compare at the end of the half.

4G LTE median download speeds - 1H 2021 & (2H 2020) market tally

Carrier	0-25 Mbps	25-50 Mbps	50-100 Mbps
AT&T	20 (36)	13 (9)	12 (0)
T-Mobile	32 (33)	12 (12)	1 (0)
Verizon	10 (0)	33 (36)	2 (9)

Values represent the number of markets out of 45 cities tested that fell into each interval in 1H 2021.
Values in parentheses reflect the number of markets in each interval in 2H 2020 across the same 45 cities

Worst-case 5th percentile 5G download speeds

AT&T registers faster "worst-case" speeds in more cities than any other carrier.

When looking at "worst-case" or 5th percentile download speeds on 5G, AT&T clocked speeds at the higher-ends of our intervals (at least 10 Mbps) in more markets than any other carrier at 30, marking a huge improvement from 6 such cities in 2H 2020. AT&T was also the only carrier with zero markets falling in the 0-5 Mbps speed interval. That indicates that in these "worst-case scenarios," AT&T users are less likely to see a huge drop in speeds compared to those of the other carriers.

In contrast, T-Mobile registered worst-case download speeds above 10 Mbps in just three cities. And perhaps more importantly, T-Mobile's worst-case speeds clocked in below 5 Mbps in 22 markets. While T-Mobile users are seeing much faster median (or typical) speeds on 5G, at times when speeds lag and fall into worst-case scenarios, users might feel some pain points. Worst-case speeds aren't reflective of a typical experience, but the carrier's worst-case 5G speeds slowed to below 5 Mbps in nearly half of the 45 metros we tested.

Verizon's worst-case speed results showed similarities with those of T-Mobile. While Verizon clocked speeds faster than 10 Mbps in seven markets (compared to two for T-Mobile), Verizon's 22 cities with speeds below 5 Mbps was identical to the tally of T-Mobile. As with T-Mobile, these aren't typical experiences, but they do represent potential pain points for consumers when speeds fall into those worst-case scenarios.

With all that said, it's worth noting that as 5G speeds improve in general over time, the carriers' worst-case 5G speeds should also get faster.

Worst-case (5th percentile) 5G download speeds - 1H 2021 & (2H 2020) market tally

Carrier	0-5 Mbps	5-10 Mbps	10-30 Mbps	30+ Mbps	Number of cities with 5G
AT&T	0 (26)	14 (11)	28 (6)	2 (0)	44 (43)
T-Mobile	22 (40)	20 (4)	2 (1)	1 (0)	45 (45)
Verizon	22 (0)	14 (0)	7 (1)	0 (0)	43 (1)

Values represent the number of 5G markets out of 45 cities tested that fell into each interval in 1H 2021.
Values in parentheses reflect the number of 5G markets in each interval in 2H 2020 across the same 45 cities

Best-case 95th percentile 5G download speeds

T-Mobile stands out with higher-end "best-case" speeds in the most cities.

At the opposite end of the spectrum, T-Mobile's best-case or 95th percentile 5G download speeds results were particularly strong and showed outstanding improvement since the second half of 2020. T-Mobile clocked best-case 5G speeds above 200 Mbps in far more cities than the other carriers at 27, compared to 4 each for AT&T and Verizon. T-Mobile's tally of 13 markets with speeds of at least 250 Mbps was also much higher than the totals of either AT&T (0) or Verizon (2).

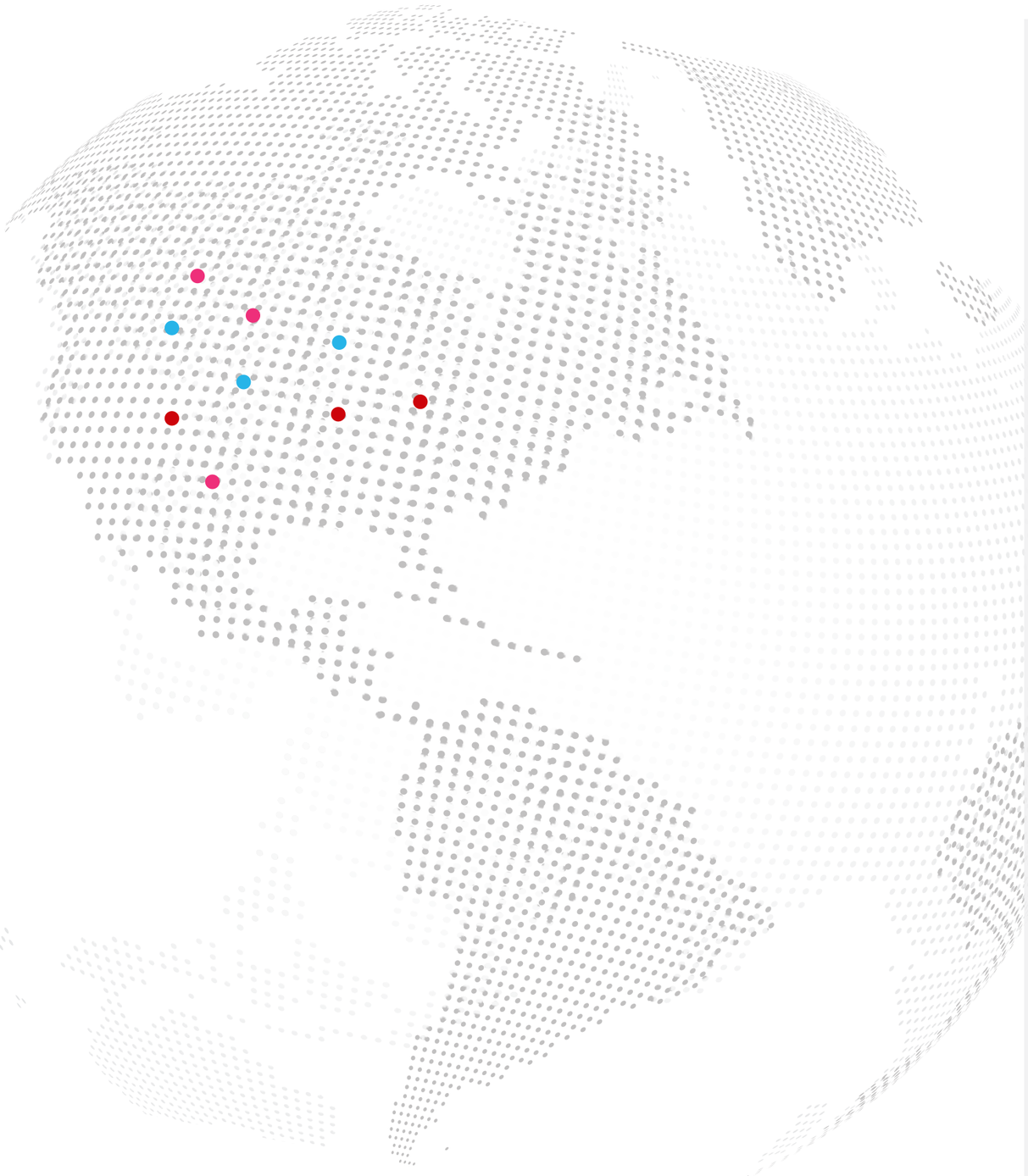
Our results showed a dramatic difference between T-Mobile's best-case and worst-case speeds, and users could certainly feel a difference if either scenario happens. On one hand, when the carrier's 5G speeds fall into a worst-case or 5th percentile scenario, users could find their speeds screech to a near-halt in many cities. On the other hand, if the carrier's speeds see a boost, consumers could enjoy speeds above 200 Mbps in several markets. As noted before, best- and worst-case speeds don't happen often, but they do suggest that T-Mobile users could see vastly different performance in those rare occurrences when speeds do fall into a best- or worst-case scenario.

While all three carriers clocked best-case speeds above 100 Mbps in most markets, T-Mobile clearly led the way at the higher-ends of our intervals.

Best-case (95th percentile) 5G download speeds - 1H 2021 & (2H 2020) market tally

Carrier	25-50 Mbps	50-100 Mbps	100-150 Mbps	150-200 Mbps	200-250 Mbps	250+ Mbps	Number of cities with 5G
AT&T	0 (1)	1 (10)	17 (24)	22 (8)	4 (0)	0 (0)	44 (43)
T-Mobile	0 (3)	4 (23)	4 (18)	10 (1)	14 (0)	13 (0)	45 (45)
Verizon	0 (0)	7 (0)	25 (0)	7 (1)	2 (0)	2 (0)	43 (1)

Values represent the number of 5G markets out of 45 cities tested that fell into each interval in 1H 2021.
Values in parentheses reflect the number of 5G markets in each interval in 2H 2020 across the same 45 cities



Putting all three 5G speed metrics together: AT&T leads the competition

Your absolute best 5G speed experience will be one in which a carrier delivers fast speeds across all three metrics in the same city: 5th percentile, median, and 95th percentile. To provide an easy and at-a-glance view of which carrier offered the fastest 5G service across all three metrics, we looked at the number of markets in which the carriers clocked not only the fastest 5G median download speed, but also the fastest best- and worst-case 5G download speeds.

AT&T led the competition, delivering a combination of the fastest worst-case, median, and best-case 5G download speeds together in 14 cities. T-Mobile registered the fastest speeds across all three metrics in six markets, while Verizon did so in three cities.

Carrier	Number of fastest 5G cities (across all three speed metrics)	Number of cities with 5G
AT&T	14	44
T-Mobile	6	45
Verizon	3	43

Values on the table above represent the number of cities in which each carrier delivered the fastest 5th percentile, median, and 95th percentile 5G download speeds in the same city.

In 2020, T-Mobile's availability was broad compared to that of the other carriers, but its 5G speeds generally trailed those of the other carriers.In early 2021, however, T-Mobile added improved speeds to its already widespread availability. The carrier's improved speed results were largely due to using the mid-band spectrum it acquired in its merger with Sprint far more often 1H 2021 than in 2H 2020 across the 45 cities we've tested to date this year.

While Verizon's nationwide 5G is in its early stages, our testing showed impressive and rapid availability growth, with 5G results recorded in 43 out of 45 metros compared to just 1 of those 45 cities in 2H 2020. Verizon's 5G speeds, meanwhile, were generally similar to those of T-Mobile but trailed those of AT&T. Considering how quickly Verizon's 5G has grown, broader availability and faster speeds could soon be in the cards as we move further into 2021.

At present, and across these 45 cities, AT&T stands out as the carrier offering the fastest 5G speeds in a market across the 5th percentile, median, and 95th percentile metrics more often than the other networks. In short, when considering that critical combination of availability plus performance, you're currently more likely to find fast 5G speeds plus broad availability with AT&T than with T-Mobile or Verizon.

5G data reliability

5G data reliability was strong across the board, but AT&T and Verizon led the way.

All three carriers delivered generally exceptional 5G data reliability.

From a market count perspective, AT&T registered 5G data reliability success rates of 99.5% or better for getting connected in the most markets at 40. In terms of staying connected, AT&T also had the most markets with 5G data reliability success rates above 99.5%, with 34. The competition in both measures of 5G data reliability, however, was close.

5G data reliability - getting connected market tally - 1H 2021 & (2H 2020)

Carrier	99.5% +	Number of cities with 5G
AT&T	40 (31)	44 (43)
T-Mobile	34 (17)	45 (45)
Verizon	37 (1)	43 (1)

5G data reliability - staying connected market tally - 1H 2021 & (2H 2020)

Carrier	99.5% +	Number of cities with 5G
AT&T	34 (23)	44 (43)
T-Mobile	33 (27)	45 (45)
Verizon	30 (1)	43 (1)

Values represent the number of 5G markets out of 45 cities that exceeded data reliability success rates of 99.5% for getting connected and staying connected.
Values in parentheses reflect the number of 5G markets surpassing success rates of 99.5% in 2H 2020 across the same 45 cities.

When looking at which carrier provided the highest 5G data reliability success rates for both getting connected and staying connected in the same city, AT&T and Verizon posted very similar results, with both carriers' market tallies surpassing that of T-Mobile.

In fact, with outstanding 5G data reliability results across the board, differences in the carriers' data reliability performances on 5G were slim and might not even be noticeable to users.

Reliability combined: ranked 1st across both getting and staying connected in the same market - 1H 2021

Carrier	Outright	Tie	Total	Number of cities with 5G
AT&T	5	28	33	44
T-Mobile	2	21	23	45
Verizon	3	28	31	43

Values on the table above represent the total number of 5G markets in which each carrier registered the highest 5G data reliability success rates for both getting connected and staying connected in the same city.
Note: in cases where one carrier led in getting connected and another led in staying connected, no winner was awarded.

4G LTE service still matters: While this report is focused on 5G results, keep in mind that 5G is only one piece of the puzzle. 4G LTE service is still a key factor in the end-user mobile experience, and it will likely remain that way until 5G eventually becomes the default mobile technology.

Carrier performance highlights

Each carrier's top 5G results across 45 cities

A snapshot of carrier highlights across the first 45 markets tested in 1H 2021

Highest 5G availability

82.9%

Dayton, OH

Highest 5G availability

74.9%

Corpus Christi, TX

Highest 5G availability

60.2%

Victor Valley, CA

5G

89.0

Fastest 5G median download speed (Mbps)

Denver, CO

4G

90.1

Fastest 4G LTE median download speed (Mbps)

St. Louis, MO

5G

103.0

Fastest 5G median download speed (Mbps)

Syracuse, NY

4G

52.6

Fastest 4G LTE median download speed (Mbps)

New Haven, CT

5G

76.9

Fastest 5G median download speed (Mbps)

Jacksonville, FL

4G

53.7

Fastest 4G LTE median download speed (Mbps)

Corpus Christi, TX

Highest 5G reliability

Getting connected

38 cities — 100% — 20 cities

Staying connected

Highest 5G reliability

Highest 5G reliability

Getting connected

17 cities — 100% — 12 cities

Staying connected

Highest 5G reliability

Highest 5G reliability

Getting connected

33 cities — 100% — 20 cities

Staying connected

For a complete list of all 45 cities tested so far in 1H 2021, see the appendix on page 18.

Conclusion and looking ahead

As the 5G era in the US continues to expand, some carriers are further ahead of others when it comes to delivering on the key combination of availability plus performance, but 5G is clearly making progress. Our results showed impressive and improved 5G results for all three carriers across the first 45 cities we tested so far in 1H 2021. That said, the 5G speed results we've seen in the US to date trail what we've found in the **UK** and (especially) **South Korea**.

As 5G continues to expand across the country, we expect to see 5G availability and performance improve across this dynamic and rapidly shifting landscape going forward. That's particularly true since all three carriers acquired mid-band spectrum at the **C-Band auction**.

As we saw with T-Mobile in the first half of 2021, mid-band spectrum can certainly help contribute to faster 5G speeds. As the carriers add more mid-band to the repertories, we could see faster speeds sooner rather than later. In the meantime, we'll continue testing the networks to keep an eye on the state of 5G in the US and around the world.

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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. In 2H 2020, we used Samsung Galaxy S20+ 5G smartphones purchased off the shelf from carrier stores to test both 4G LTE and 5G performance for all three carriers. In 1H 2021, we used the Samsung Galaxy S20+ 5G to measure performance for AT&T and Verizon, and we used the Samsung Galaxy Note 20 Ultra 5G to test T-Mobile's performance.

Tests were conducted during the day and night while walking and driving. 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 RootMetrics testing, visit the **methodology** page of our website.

A note about our 5G results

We used 5G-enabled smartphones to test carrier performance on both 5G and other network technologies, such as 4G LTE or sub-4G LTE technologies. While 5G users can sometimes switch between 5G and 4G LTE during the same data activity, which is known as "mixed mode" technologies, performance on mixed mode typically isn't as strong as that on 5G-only. Therefore, to provide the most accurate view of a true 5G experience and to assure the most direct comparisons between 5G and 4G LTE, mixed mode results are not included in this report.

Appendix

The complete list of all 45 cities tested

Akron, OH
Albuquerque, NM
Allentown, PA
Ann Arbor, MI
Antelope Valley, CA
Bakersfield, CA
Baton Rouge, LA
Buffalo, NY
Colorado Springs, CO
Columbus, OH
Corpus Christi, TX
Dayton, OH
Denver, CO
El Paso, TX
Fresno, CA
Greenville, SC
Hartford, CT
Jacksonville, FL
Lancaster, PA
Las Vegas, NV
Louisville, KY
Madison, WI
Milwaukee, WI
Modesto, CA
New Haven, CT
Ogden, UT
Oxnard, CA
Pensacola, FL
Phoenix, AZ
Port St. Lucie, FL
Providence, RI
Provo, UT
Salt Lake City, UT
San Antonio, TX
San Jose, CA
Sarasota, FL
Scranton, PA
Springfield, MA
St. Louis, MO
Syracuse, NY
Temecula, CA
Tucson, AZ
Tulsa, OK
Victor Valley, CA
Youngstown, OH

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