

5G in the UK - 1H 2021



5G in the UK is getting faster and more widespread:
the Everyday 5G experience in major UK cities,
plus a look at 5G in central London and greater London





Why 5G matters

The importance of fast and reliable connectivity has reached an all-time high. As 5G expands and people continue to rely on their mobiles more than ever before, demands for even better connectivity will only increase going forward.

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

Our series of **5G Scorecards** offered a high-level look at the Everyday 5G experience in the UK throughout the first half of 2021, while this report offers a deeper look at each operator's performance.

Read on to see how each operator's 5G performed across the 16 most populated cities in the UK in the first half of 2021. We've also taken a look at the Everyday 5G experience across the city of London and in central London (the London Central Activities Zone or CAZ).

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 an operator delivers a combination of both widespread Everyday 5G availability and strong performances for speed and reliability.

The maps and insights below offer a look at how well each operator is delivering on that critical combination of availability plus performance, which in combination marks an ideal 5G experience.

Key takeaways

EE delivers the top combination of consistently widespread Everyday 5G availability plus fast speeds:

EE's performance was outstanding across the board. Delivering the highest Everyday 5G availability in nearly every city we tested, along with impressive Everyday 5G median download speeds in all 16 cities, EE users should find both broad access to 5G and fast speeds.

Three shows faster speeds and 5G growth:

Three's Everyday 5G availability and speed results improved in nearly every city we tested since 2H 2020. While Three's speeds were generally slower than those of the other operators, Three has the **most mid-band spectrum of any operator**, putting Three in a strong position to deliver not only faster speeds going forward but also expanded availability.

Virgin Media O2 delivers consistently fast speeds:

Virgin Media O2's speeds were excellent. The operator clocked the fastest Everyday 5G median download speed in over half the cities we tested. While Virgin Media O2's availability was often lower than that of the other operators, the trend looking forward is good: Virgin Media O2 showed higher availability in nearly every city we tested since 2H 2020.

Vodafone clocks faster speeds and better availability:

Vodafone's Everyday 5G speeds were impressive in most cities, and that was especially true in Glasgow, where the operator clocked the fastest Everyday 5G median download speed we recorded in 1H 2021. Vodafone's Everyday 5G availability showed impressive growth since 2H 2020, but it still wasn't as widespread as that of EE in most cities.

To learn more about Everyday 5G results, view the appendix or visit our **blog**.

A look at the consistency of 5G availability and speed in the UK:

all operators show improvement since 2H 2020

The operator-by-operator section starting on page 5 offers detailed performance insights, with availability and speed results for every city we tested. The performance intervals and city tallies below provide a look at how consistently each operator delivered the critical mixture of broad availability plus fast speeds. The intervals also show performance trends, with the tables showing the number of cities that each operator reached or surpassed various performance thresholds in both 1H 2021 and 2H 2020 (with numbers in parentheses reflecting results from 2H 2020).

Key takeaways and stories of improvement (listed in alphabetical order by operator)

EE the clear leader for availability, with excellent speeds:

EE was the only operator to record availability above 55% in any city, doing so in five, a jump from three last time. EE was also the only operator that didn't record availability below 25% in a single city. Further, EE was one of two operators with speeds above 100 Mbps in all 16 cities tested, up from 12 last time, with speeds above 150 Mbps in two more cities than it did in 2H 2020.

Three users seeing better availability and speeds:

Three showed good improvement since 2H 2020. Three recorded availability above 40% in two more cities than it did in 2H 2020, while also registering availability below 10% in four fewer markets this time. While Three had the most cities with Everyday 5G median download speeds below 100 Mbps at 10, Three increased its number of cities with speeds above 100 Mbps from four in 2H 2020 to six this time.

Virgin Media O2 delivers impressive high-end speeds and better availability:

Virgin Media O2 clocked Everyday 5G median download speeds faster than 150 Mbps in six cities, a jump from two in 2H 2020, and a tally higher than those of EE (2), Three (0), or Vodafone (1). The operator also delivered speeds above 100 Mbps in all 16 cities, an increase from 9 last time. While Virgin Media O2's Everyday 5G availability was low compared to that of the other operators in many cities, its progress was impressive: Virgin Media O2 recorded availability above 25% in eight cities in 1H 2021, a huge jump from zero last time.

Vodafone also shows availability and speed gains:

In 2H 2020, Vodafone registered Everyday 5G availability above 25% in just two cities, but that number moved to eight this time, with three of those cities above 40%. Vodafone also didn't record availability below 10% in any city in 1H 2021, marking a strong improvement from five in 2H 2020. Moreover, Vodafone increased its number of cities with speeds of at least 100 Mbps from 8 in 2H 2020 to 12 this time.

Everyday 5G availability: 1H 2021 vs. 2H 2020							
Operator	0-10%	10-25%	25-40%	40-55%	55-70%	70-85%	Number of cities with 5G
EE	0 (0)	0 (1)	3 (5)	8 (7)	5 (3)	0 (0)	16 (16)
Three	1 (5)	4 (9)	9 (2)	2 (0)	0 (0)	0 (0)	16 (16)
Virgin Media O2	0 (3)	8 (9)	8 (0)	0 (0)	0 (0)	0 (0)	16 (12)
Vodafone	0 (5)	5 (5)	5 (1)	3 (1)	0 (0)	0 (0)	13 (12)

Values represent the number of cities out of 16 that fell into each interval in 1H 2021. Values in parentheses reflect the number cities in each interval in 2H 2020 across the same 16 cities.

Everyday 5G median download speeds: 1H 2021 vs. 2H 2020					
Operator	50-100 Mbps	100-150 Mbps	150-200 Mbps	200+ Mbps	Number of cities with 5G
EE	0 (4)	14 (12)	2 (0)	0 (0)	16 (16)
Three	10 (12)	6 (4)	0 (0)	0 (0)	16 (16)
Virgin Media O2	0 (3)	10 (7)	6 (2)	0 (0)	16 (12)
Vodafone	1 (4)	11 (6)	1 (2)	0 (0)	13 (12)

Values represent the number of cities out of 16 that fell into each interval in 1H 2021. Values in parentheses reflect the number cities in each interval in 2H 2020 across the same 16 cities.

Operator-by-operator performance highlights



EE offers the strongest combination of broad Everyday 5G availability plus fast speeds.

EE's 5G, in short:

EE's results were excellent in every city we tested. In fact, what separated EE's performance from those of the other operators was its consistently broad availability plus fast speeds and great reliability. Indeed, with the top combination of widespread availability plus strong performance, EE delivered the Best 5G experience of any network in 1H 2021.

EE certainly didn't rest on its laurels in 2021. EE's Everyday 5G availability increased in 13 cities since 2H 2020, and the operator recorded the highest availability in 14 out of 16 cities. Likewise, EE's Everyday 5G median download speeds improved in 14 cities since 2H 2020, and EE clocked the fastest speed in 6 cities. EE was also one of two operators whose Everyday 5G median download speeds topped 100 Mbps in every city. Even better news is that EE users could see even stronger performance once EE integrates the **new spectrum it acquired at auction**.

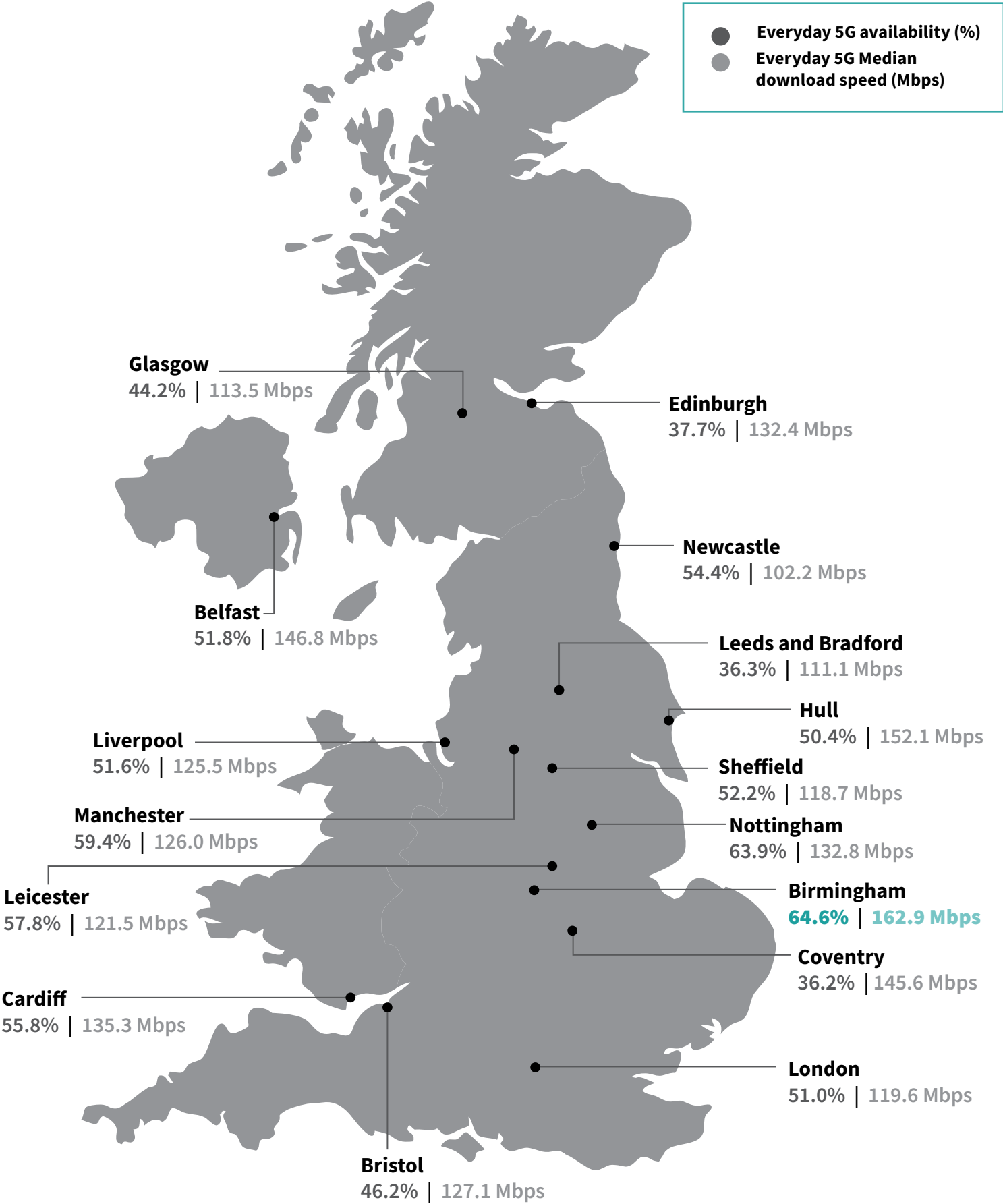
EE's median download speed intervals (all network technologies)						
Test period	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
2H 2020	0	0	0	1	3	12
1H 2021	0	0	0	0	0	16

Number of markets out of 16 in which median download speeds were recorded at various intervals.
Median download speeds on the table above represent speeds recorded on all network technologies.

Speed consistency on all network technologies

Similar to what we saw on 5G, the consistency with which EE delivered fast speeds across all technologies was unmatched. Not only did EE deliver the fastest overall median download speed in every city we tested, EE was the only operator to register median download speeds above 50 Mbps in all 16 cities. Even more impressive, EE topped 70 Mbps in 14 of those cities, recording a high of 104.2 Mbps in Birmingham, easily the fastest speed of any operator.

With EE providing widespread Everyday 5G availability in every city, its speeds were driven in large part by 5G. That said, the good news for users is that whether they're connected to 5G or not, they should be able access content and entertainment incredibly quickly.



Note:
- 5G availability is based on the percentage of tests recorded on 5G across all data tests (download, upload, and web and app tests).
- Highlighted figures represent the fastest 5G median download speed and highest 5G availability.

Three shows good progress, with growing Everyday 5G availability and faster speeds.

Three’s 5G, in short:

Three users should see stronger 5G performance in 1H 2021 than they did in 2H 2020. The operator recorded higher Everyday 5G availability in 15 out of 16 cities in 1H 2021, with faster Everyday 5G median download speeds in 10 cities. While Three’s 5G speeds were much, much faster than those on 4G LTE, the operator recorded the slowest Everyday 5G median download speed in 14 cities. Three’s Everyday 5G availability, meanwhile, trailed that of EE but was competitive with what we recorded for Virgin Media O2 and Vodafone.

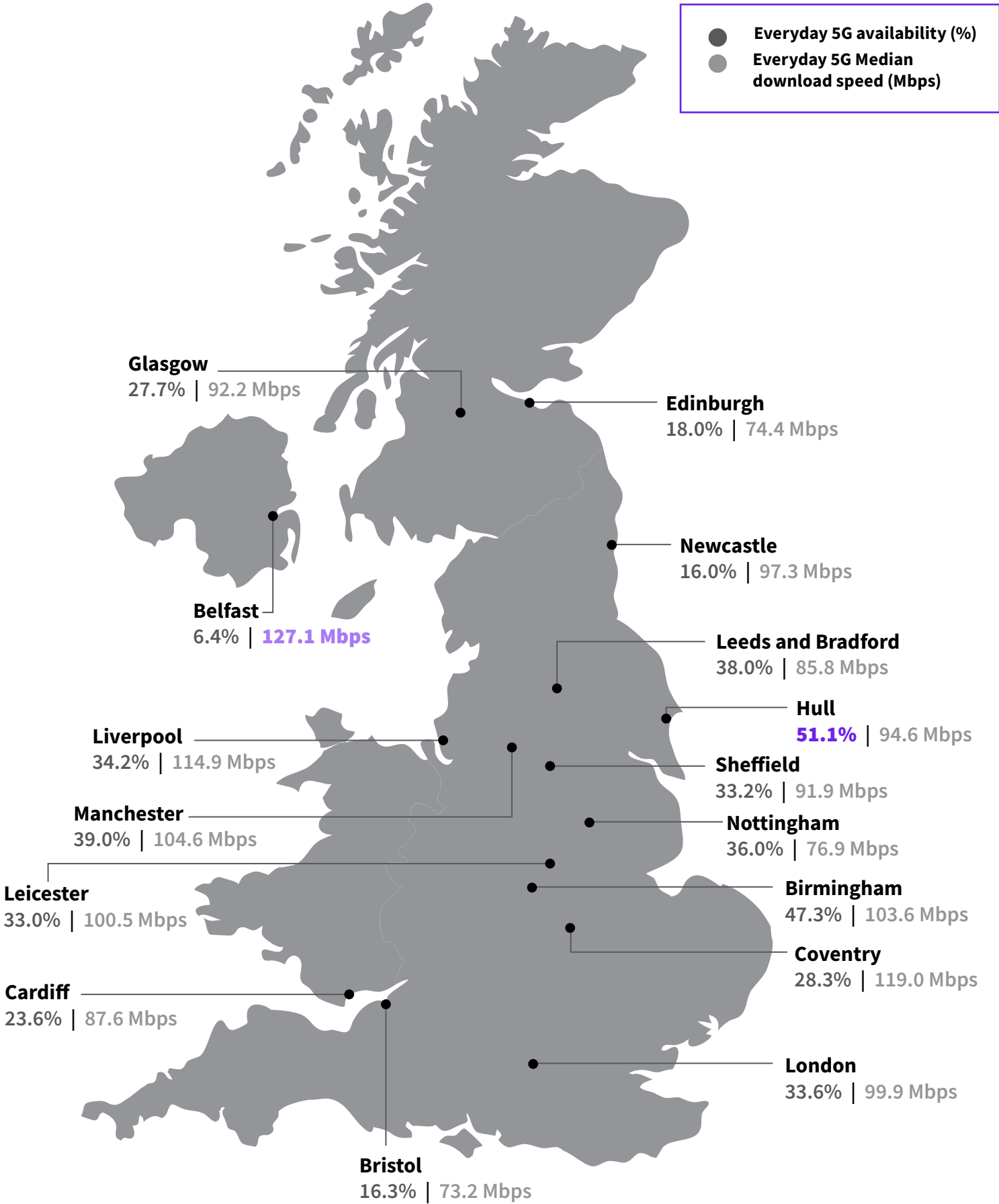
Overall, Three is clearly making good progress. Considering that Three has the **most mid-band spectrum of any operator**—and it added low-band spectrum to its repertoire at auction—Three is in a strong position to provide its users with faster speeds and broader availability going forward.

Three’s median download speed intervals (all network technologies)						
Scout half	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
2H 2020	0	13	3	0	0	0
1H 2021	0	4	9	3	0	0

Number of markets out of 16 in which median download speeds were recorded at various intervals.
Median download speeds on the table above represent speeds recorded on all network technologies.

Speed consistency on all network technologies

Three’s speed consistency results showed improvement compared to what we recorded in 2H 2020. In 2H 2020, Three was the only operator that didn’t register a median download speed above 30 Mbps. This time, however, Three clocked speeds above 30 Mbps in three cities, while also improving at the lower end of our intervals. Three registered speeds below 20 Mbps in 4 cities in 1H 2021, a significant improvement from 13 last time. As Three’s 5G expands and its Everyday 5G median download speeds improve over time, its overall speeds across all network technologies should also speed up.



Note:
- 5G availability is based on the percentage of tests recorded on 5G across all data tests (download, upload, and web and app tests).
- Highlighted figures represent the fastest 5G median download speed and highest 5G availability.

Virgin Media O2 shows consistently fast speeds and improving but still limited Everyday 5G availability

Virgin Media O2's 5G, in short:

Good news for Virgin Media O2 users: the operator's 5G is expanding and getting faster. Virgin Media O2 delivered the fastest Everyday 5G median download speed in 9 out of 16 cities, while clocking three of the five fastest speeds we recorded in 1H 2021. In addition, Virgin Media O2's Everyday 5G median download speeds improved in 13 out of 16 cities since 2H 2020, and the operator clocked speeds above 100 Mbps in every city.

Virgin Media O2's Everyday 5G availability improved in 15 cities since 2H 2020. However, the operator recorded the lowest Everyday 5G availability in eight cities (the most of any network), with its high of 34.3% recorded in Belfast. For context, EE's lowest Everyday 5G availability was 36.3%. Virgin Media O2 has clearly shown good progress, though, and if it can boost its availability thanks to the spectrum **it invested in at auction**, end users could see a nice combination of strong availability plus fast speeds in the near future.

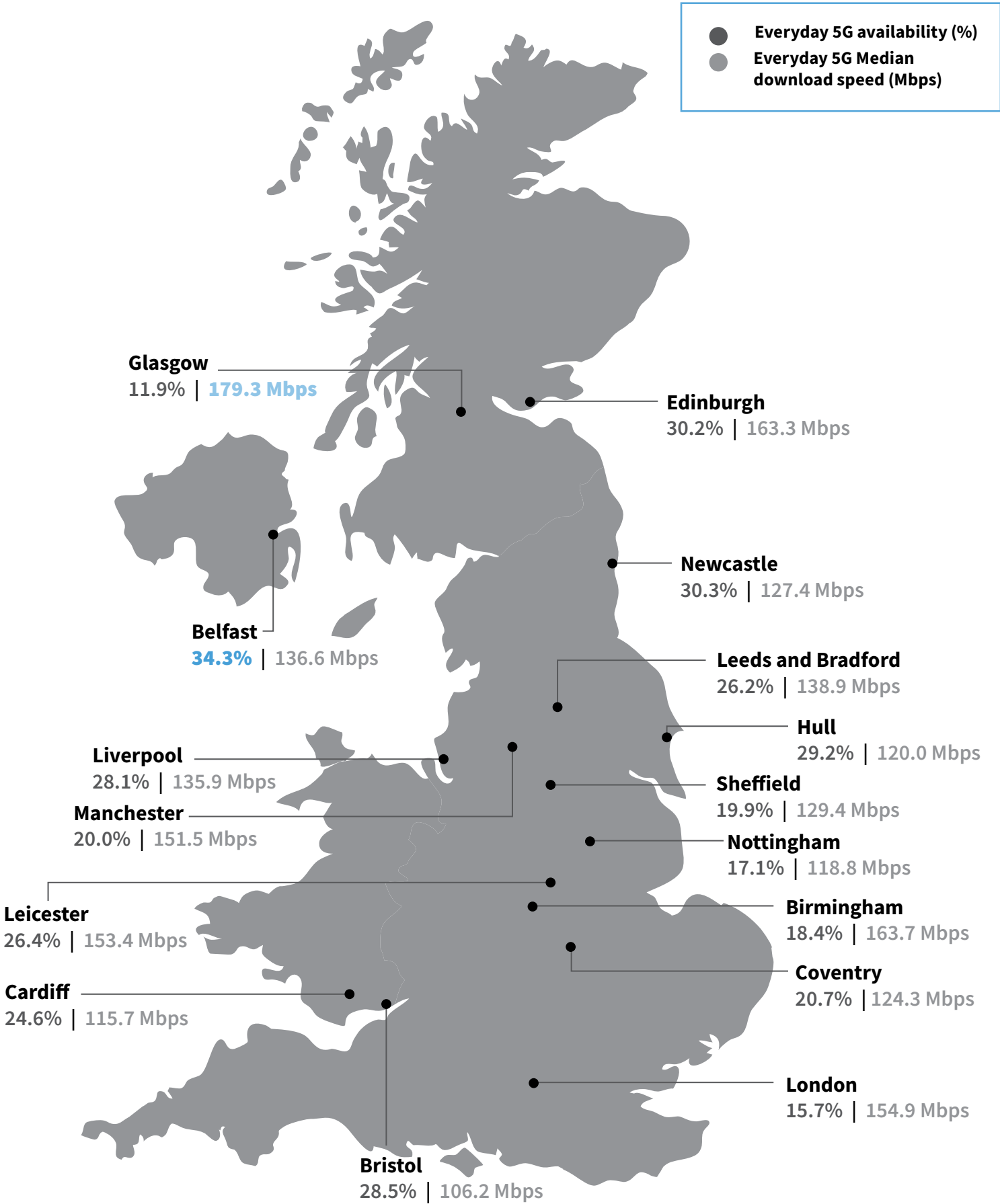
Virgin Media O2's median download speed intervals (all network technologies)						
Scout half	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
2H 2020	3	7	5	1	0	0
1H 2021	1	5	7	3	0	0

Number of markets out of 16 in which median download speeds were recorded at various intervals.
Median download speeds on the table above represent speeds recorded on all network technologies.

Speed consistency on all network technologies

Like we saw on 5G, Virgin Media O2's speeds across all network technologies improved since 2H 2020. While most of the operator's speeds remained in the 10-20 Mbps and 20-30 Mbps ranges, the operator recorded median download speeds above 30 Mbps in two more cities than it did in 2H 2020. Virgin Media O2 also delivered median download speeds below 20 Mbps in 6 cities in 1H 2021 compared to 10 last time.

While Virgin Media O2's 5G can be incredibly fast, its generally low availability means that a consumer's overall speed experience is likely to fall on the slower end of our testing. As the operator expands its Everyday 5G availability, its overall speeds should also improve.



Note:
- Everyday 5G availability is based on the percentage of tests recorded on 5G across all data tests (download, upload, and web and app tests).
- Highlighted figures represent the fastest 5G median download speed and highest 5G availability.

Vodafone shows good improvement and fast speeds, especially in Glasgow.

Vodafone’s 5G, in short:

While Vodafone was the only operator that didn’t record 5G results in each of the 16 cities we tested, its Everyday 5G availability improved in all 13 cities where it did offer 5G, and its speeds increased in 11 of those cities. Vodafone’s 5G speeds were strong across the board, and users in Glasgow should be particularly pleased: its Everyday 5G median download speed of 192.2 Mbps was the fastest speed we recorded in 1H 2021. With Everyday 5G median download speeds of at least 100 Mbps in 12 of Vodafone’s 13 cities with 5G, users should enjoy quick access to content in every city we tested.

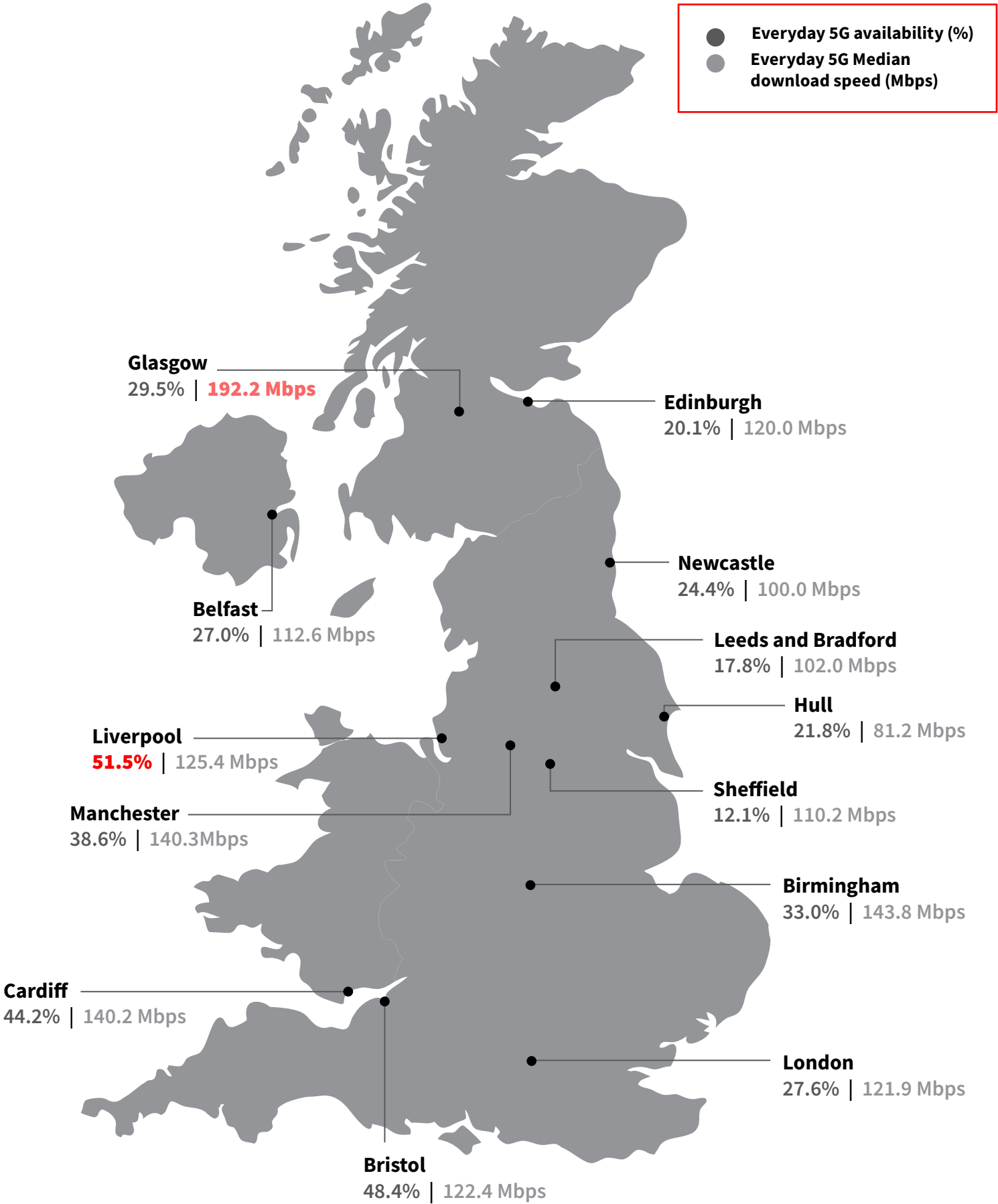
Vodafone’s 5G availability was a bit of a mixed bag. On one hand, its Everyday 5G availability was over 40% in far fewer cities than EE. On the other hand, its availability showed improvement since 2H 2020, and no operator offered more Everyday 5G availability than Vodafone in Bristol or Liverpool (in Liverpool, Vodafone and EE tied for offering the highest availability). As with the other operators, Vodafone’s investment in **additional spectrum at auction** could pay off for users in the form of better performance in general. Vodafone is also using DSS and spectrum **refarming strategies to expand its 5G**.

Vodafone’s median download speed intervals (all network technologies)						
Scout half	0-10 Mbps	10-20 Mbps	20-30 Mbps	30-40 Mbps	40-50 Mbps	50+ Mbps
2H 2020	0	4	6	1	3	2
1H 2021	0	2	7	2	1	4

Number of markets out of 16 in which median download speeds were recorded at various intervals.
Median download speeds on the table above represent speeds recorded on all network technologies.

Speed consistency on all network technologies

Vodafone was once again one of only two operators that delivered median download speeds faster than 50 Mbps, doing so in four cities, an increase from two last time. While Vodafone’s overall speed consistency results were a step above those of Virgin Media O2 and Three, they weren’t nearly as strong as those of EE. However, Vodafone’s overall speeds should become faster and more consistent as its 5G continues to grow.



Note:
- 5G availability is based on the percentage of tests recorded on 5G across all data tests (download, upload, and web and app tests).
- Highlighted figures represent the fastest 5G median download speed and highest 5G availability.

5G in greater London

A look at 5G across the UK's capital city

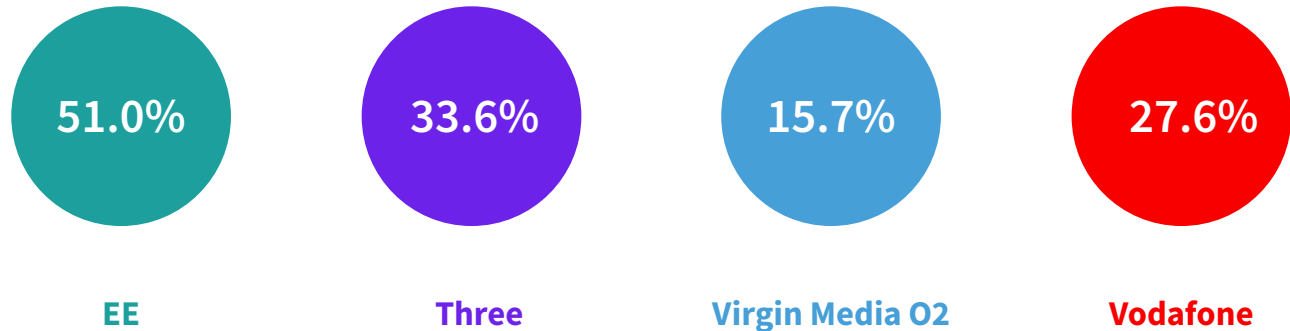
With 5G rollouts and optimisations typically occurring first and foremost in major cities—and even within specific sections of major cities—we’re using London as a case study to help show how technology deployments can occur and ultimately perform. To that end, we’re showing Everyday 5G results for the greater London area (as defined by the Eurostat’s Larger Urban Zone) as well as in central London (as defined by the London Central Activities Zone or CAZ).

The generally strong 5G results we found in greater London demonstrate just how quickly and effectively rollouts can cover an entire city, while our testing in central London shows how the operators perform across a concentrated and critical area of the city.

Take a look at the charts to see each operator’s Everyday 5G availability in greater London, as well as each operator’s Everyday 5G median and maximum download speeds on both 5G and 4G LTE. Median download speeds represent typical, everyday speeds, while maximum speeds show the potential of an operator’s 5G network.

To put the speeds of 5G in perspective, we’ve compared Everyday 5G median and maximum download speeds to those purely on 4G LTE, rather than overall speeds recorded across all network technologies.

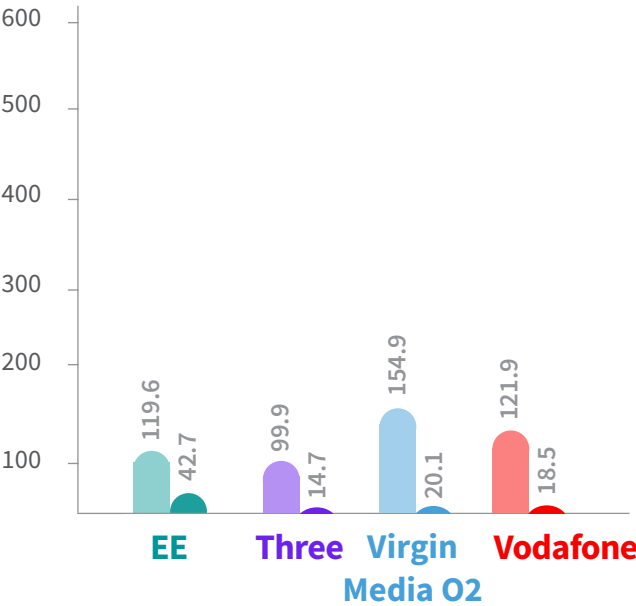
Greater London Everyday 5G availability (%)



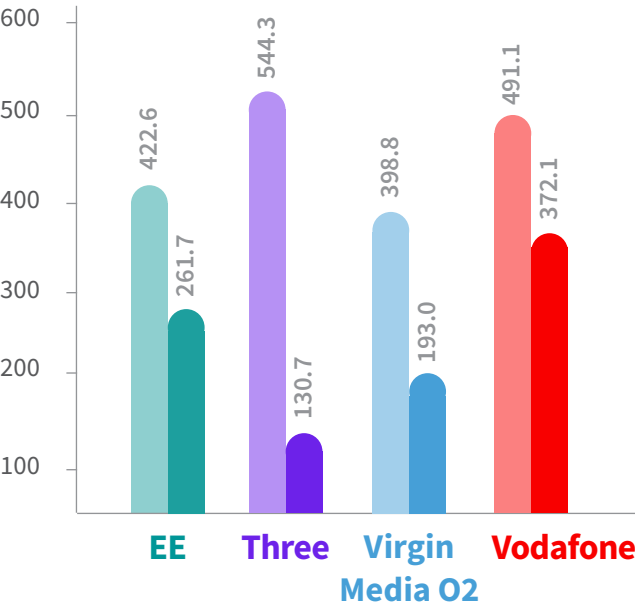
Note: 5G availability is based on the percentage of 5G recorded across all data tests (download, upload, and web and app tests).

● Evryday 5G ● 4G

Everyday 5G & 4G LTE median download speeds (Mbps)



Everyday 5G & 4G LTE maximum download speeds (Mbps)



London 5G, in short:

EE stands out when it comes to providing 5G availability plus speed in London:

EE’s broad Everyday 5G availability of 51.0% in greater London was nearly twice as high as that of any other operator, and its Everyday 5G median download speed of 119.6 Mbps was also impressive. In short, even though EE’s speed wasn’t as fast as those of Virgin Media O2 or Vodafone, EE’s combination of widespread availability plus fast speeds was unmatched in the UK’s capital.

Virgin Media O2 clocks the fastest Everyday 5G median download speed in London:

At 154.9 Mbps, Virgin Media O2’s Everyday 5G median download speed was easily the fastest in greater London. That said, with the lowest Everyday 5G availability in the city at 15.7%, Virgin Media O2 users might have trouble connecting to the operator’s 5G and enjoying that blazing speed. However, if the operator’s speeds remain consistently fast and its 5G continues to grow, Virgin Media O2 users could be primed for a very strong 5G experience going forward.

5G in greater London is fast:

5G speeds in the city were outstanding, with each operator delivering an Everyday 5G median download speed of at least 99.9 Mbps. With fast speeds across the board, users should find incredibly quick access to content. While Virgin Media O2 clocked the fastest Everyday 5G median download speed in the city, Three stood out for offering the fastest Everyday 5G maximum download speed at 544.3 Mbps, providing an indication of Three’s impressive potential.

5G speeds were much faster than those on 4G LTE:

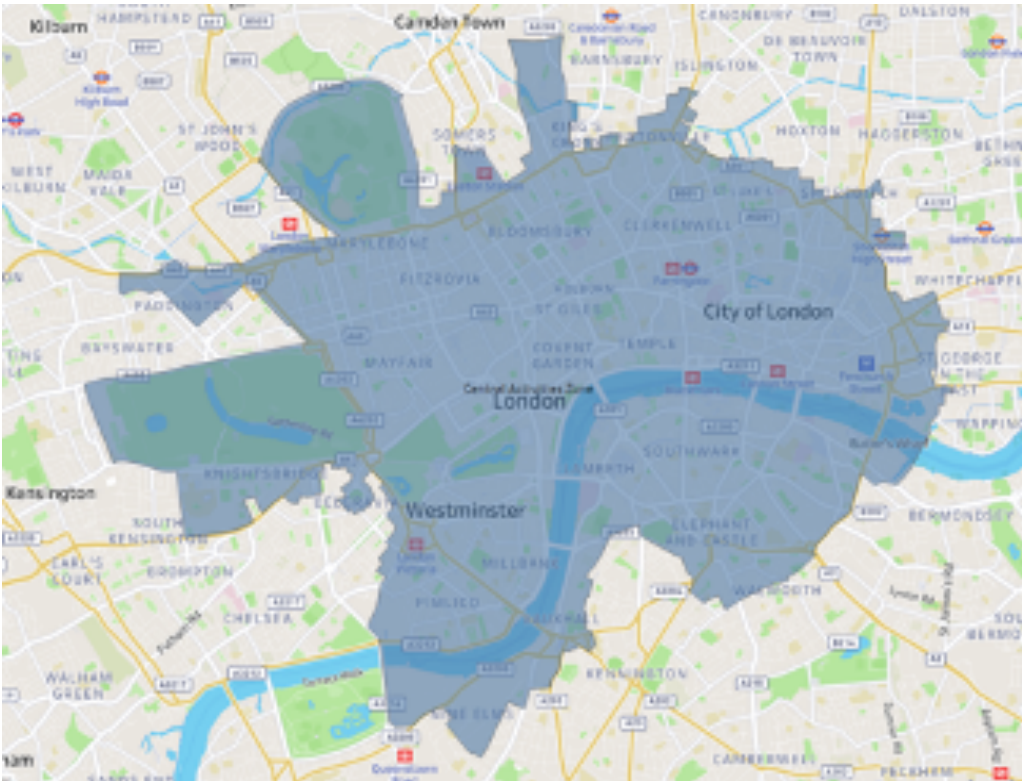
Virgin Media O2’s Everyday 5G median download speed of 154.9 Mbps in London was almost eight times faster than its speed on 4G LTE. In fact, each operator’s Everyday 5G median download speed in London was at least 2.8 times faster than that its speed on 4G LTE. EE was the only operator whose speed on 5G wasn’t at least six times higher than that on 4G LTE, and that’s because EE’s median download speed on 4G LTE was over twice as fast as that of any operator, clocking in at a strong 42.7 Mbps.

5G in central London

The London Central Activities Zone (CAZ)

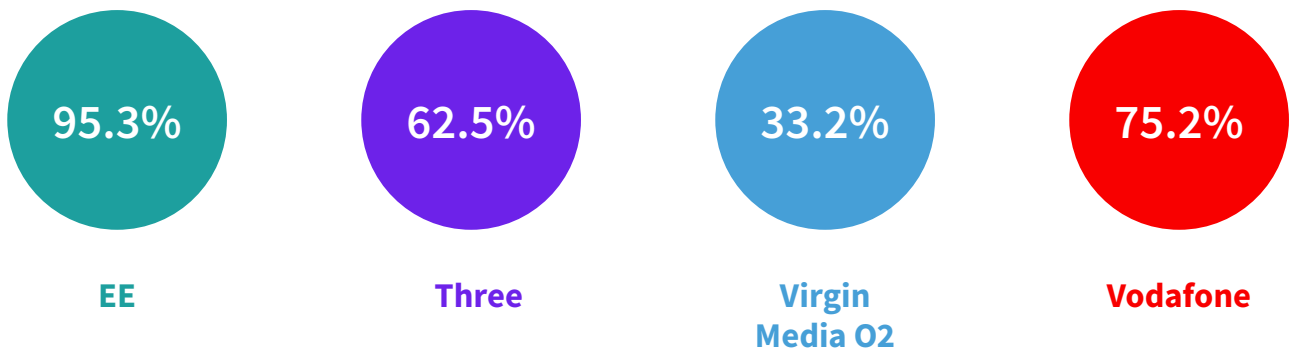
While London is the UK’s most populated city and one of the largest cities on the planet, central London is one of the world’s most competitive business centres, and 5G is an important driver of economic growth in the area. Home to the seat of national government and world renowned for its culture, shopping, and heritage, central London is a major centre of activity for consumers, businesses, and government agencies alike, and the need for seamless connectivity in the area is of critical importance. Throughout this report, we refer to central London and the London CAZ interchangeably.

Performance in central London surpassed what we found across greater London and showed clear advantages for users, including much higher Everyday 5G availability and faster speeds. Even better news for those in central London is that the 5G results we recorded in the area could be a harbinger of stronger 5G results to follow across the rest of London and other cities.

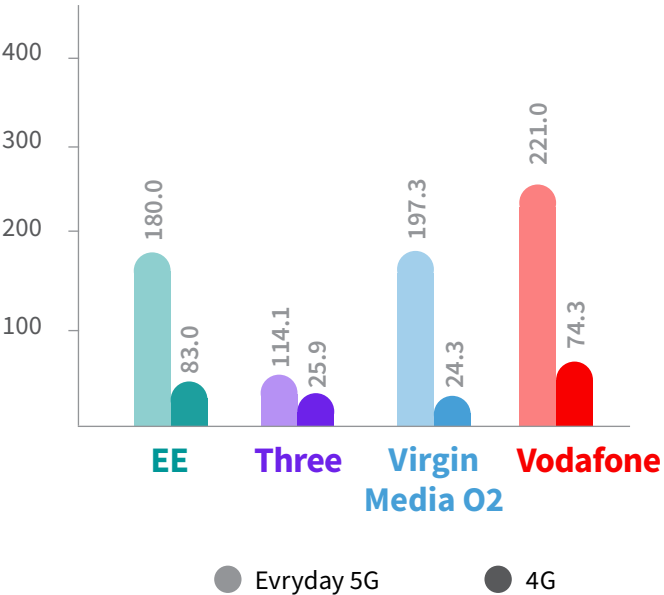


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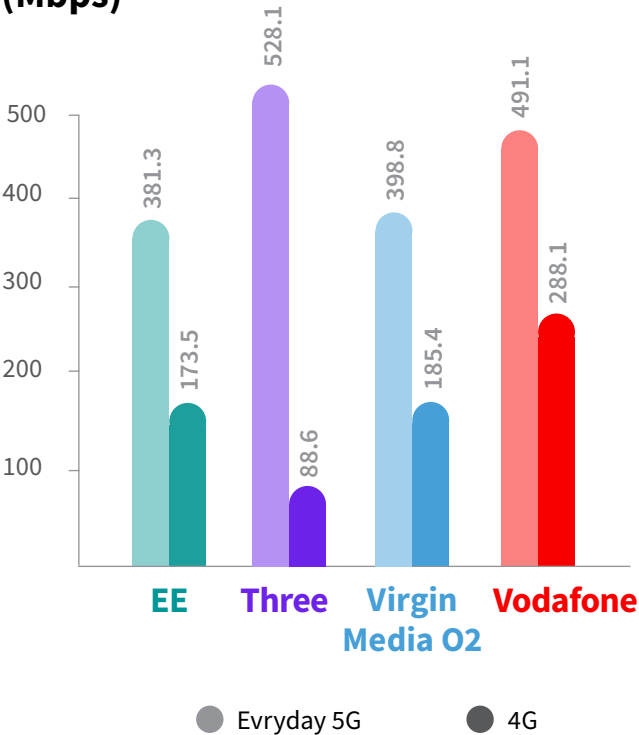
Everyday 5G availability for each operator in central London



Everyday 5G and 4G LTE median download speeds in central London (Mbps)



Everyday 5G and 4G LTE maximum download speeds in central London (Mbps)



Key takeaways from testing in central London (takeaways listed in alphabetical order)

EE’s 5G was fast and nearly ubiquitous in central London:
Great news for EE users: EE’s remarkable Everyday 5G availability of 95.3% in central London will allow EE users to access the operator’s excellent Everyday 5G median download speed of 180.0 Mbps nearly all the time. In fact, EE’s Everyday 5G availability in central London was nearly twice as high as that in greater London (51.0%) and much higher than that of any other operator in central London. In short, EE once again offered an excellent combination of wide 5G availability and fast 5G speeds.

Three’s 5G performs much better in central London:
Three’s Everyday 5G availability in central London of 62.5% was nearly double its availability in greater London (33.6%), and the operator’s Everyday 5G median download speed of 114.1 Mbps was faster than its speed in London (99.9 Mbps). While Three recorded the slowest speeds in both greater and central London, Three’s customers will still have quick access to content, and Three’s results in central London showed encouraging progress for the operator in general.

Virgin Media O2’s 5G delivers impressive speeds and a jump in availability:
Virgin Media O2’s Everyday 5G median download speed of 197.3 Mbps in central London was incredibly fast but not quite as fast as that of Vodafone (221.0 Mbps). While Virgin Media O2’s Everyday 5G availability was the lowest in central London at 33.2%, that number was more than twice as high as its availability in greater London. Considering that Virgin Media O2 didn’t record any 5G during our testing in central London just one year ago, the operator has made remarkable progress in relatively short order.

Vodafone delivers a nice mix of availability and speed in central London:
Vodafone’s Everyday 5G median download speed of 221.0 was easily the fastest in central London, and its Everyday 5G availability of 75.2% was impressive by nearly any standard (though not as high as that of EE). In greater London, Vodafone’s availability showed room for improvement, but in central London, the operator provided its users with an impressive combination of broad availability plus fast speeds.



Conclusion and looking ahead

The good news for users is that 5G in the UK is getting faster and more widespread. While EE clearly leads the way when it comes to providing users with the key combination of broad Everyday 5G availability plus fast speeds, the other operators have continued to expand and improve. Virgin Media O2 delivered particularly impressive speeds in 1H 2021—faster than those of EE in many cities—though availability for Virgin Media O2 and the other operators remained lower than that of EE in nearly every city we visited.

More good news is that the **spectrum auction** earlier this year could be a catalyst that leads to even better speeds for all four operators, along with more widespread availability. While all four networks boosted their spectrum considerably at auction and should provide users with stronger performances going forward, Three is in a particularly interesting position as the operator with the most mid-band spectrum of any network at 140 MHz (compared to 90 MHz for Vodafone and 80 MHz each for EE and Virgin Media O2). The addition of low-band spectrum at auction for EE, Three, and Virgin Media O2 also holds the potential to expand 5G to rural areas, helping fulfill the UK's **Shared Rural Network (SRN)** goal to bring connectivity to 90% of the country.

The results we found in central London were particularly impressive and encouraging for the rest of the UK. If the broad Everyday 5G availability and outstanding speeds we found in central London expand to other cities and/or rural areas, we could witness a fundamental improvement to the end-user experience, as well as further growth of our connected communities.

In the meantime, keep checking back with RootMetrics for more on the Everyday 5G experience in the UK and for mobile performance insights in general.

How do 5G speeds in the UK compare to those in the US?

In short, 5G speeds in the UK are, at the moment, much faster. In the first half of 2021, for instance, all four UK operators clocked Everyday 5G median download speeds faster than 100 Mbps in at least 6 out of 16 cities, with two operators hitting the 100 Mbps mark in all 16 cities. In the US, on the other, where we tested 125 cities in 1H 2021, we recorded only **two Everyday 5G median download speeds** above 100 Mbps in total.

In addition, not one operator in the UK delivered an Everyday 5G median download speed below 50 Mbps in 1H 2021. In the US, meanwhile, all three major carriers recorded speeds below 50 Mbps in at least 73 out of 125 cities. While 5G speeds in the US are making rapid progress, UK users are currently seeing speeds above 100 Mbps far more often than their US counterparts. With operators in both countries recently boosting their spectrum holdings, it will be interesting to see how speeds compare going forward.

Reliability on 5G was outstanding across the board, while latency remains a work in progress

Good news for users in the UK who put a premium on reliability: all four operators delivered great data reliability on 5G in the vast majority of cities tested. Each operator's latency, meanwhile, was generally low enough for smooth gaming and video streaming. However, until **standalone 5G** networks become the norm and 4G LTE is no longer a part of the 5G equation, latency on 5G will likely remain similar to that on 4G LTE.

Appendix

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.

For UK-wide, nation, and metro testing in 1H 2021 (including that in central London), we used the latest Samsung 5G-enabled smartphones purchased off the shelf from operator stores to test both 4G LTE and 5G performance on the networks of EE, Three, Virgin Media O2, and Vodafone. Tests were conducted during the day and night while walking and driving.

We utilise random sampling techniques to ensure our results offer a robust characterisation of performance in the places consumers most often use their mobiles. All testing is focused on the activities for which consumers typically use their mobiles, including data, call, and text usage.

To learn more about our testing, visit the [methodology](#) page of our website.

A note about Everyday 5G results

The Everyday 5G results in this report include a combination of results recorded on both 5G-only and "5G mixed mode." 5G mixed mode is the user experience of switching between 5G and 4G LTE during the same data activity, an increasingly common user experience.

With 5G growing fast and users switching between 5G-only and 5G mixed mode more and more often, Everyday 5G results offer the most accurate picture of the daily 5G experience when connected to 5G at least a portion of the time.

To learn more about Everyday 5G results, check out our new [blog](#).

Appendix

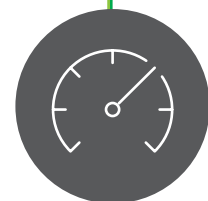
Benchmarking what matters most

To provide a holistic view of each network's real-world 5G performance, we've included visuals below showing each operator's Everyday 5G availability and speed results along with key insights for the end-user 5G experience. We've also taken a look at how consistently the operators delivered median download speeds across all network technologies (4G LTE and 5G, where available) to show the speeds end users are likely to experience when not connected to 5G. Taken together, this complementary information provides a full picture of the current end-user Everyday 5G experience.



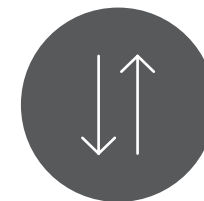
Everyday 5G availability

Our Everyday 5G availability results provide an understanding of how often we connected to both 5G-only and 5G “mixed mode” (the increasingly common user experience of switching between 5G and 4G LTE during the same data task), across our suite of data tests, including download, upload, and web and app testing.



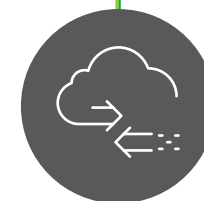
Everyday 5G median download speeds

Everyday 5G median download speeds offer a look at “everyday” 5G performance. It's 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, and every operator in the UK hit that mark in multiple cities in 1H 2021.



4G LTE median download speeds

We also looked at speed results on 4G LTE. Comparing 4G LTE speeds to Everyday 5G speeds helps give a more nuanced view of the experience on different network technologies. 4G LTE median download speeds offer a look at typical 4G LTE speed performance and indicate what to expect when not on 5G.



Speed consistency across all network technologies

At the end of the day, consistency of speed performance has the biggest impact on the end-user experience. Our speed intervals bring together overall speed results across all network technologies (4G LTE, any sub-4G technologies, and 5G, where available) to show how many cities each operator reached or surpassed various median download speed thresholds across the 16 most populated cities in the UK. Until 5G becomes more widely available, overall median download speeds reflect the most typical real-world speed experience.

To learn more about Everyday 5G results, visit our [blog](#).



Appendix

5G and spectrum

When it comes to the real-world 5G experience, spectrum is key. There is no one-size-fits-all 5G solution, and the end-user 5G experience can vary considerably depending on the type of spectrum operators use for deployments. In the context of 5G, spectrum at or below 6 GHz can be separated into “low-band” or “mid-band” spectrum, while spectrum at 24 GHz or higher is considered millimeter wave (mmWave) spectrum. It’s worth noting that low- and mid-band spectrum can also be used for 4G LTE service, whereas mmWave cannot be used for 4G LTE.

UK operators bolster spectrum holdings at auction in 2021

Since early 5G deployments, all four operators in the UK have been utilising mid-band spectrum for 5G, which is considered a spectrum “sweet spot,” offering both fast speeds and broad geographic coverage. In early 2021, however, the operators **boosted their spectrum holdings at auction**, which is great news for users.

EE and Virgin Media O2 both acquired additional mid-band spectrum as well as low-band spectrum, allowing for a combination of fast speeds plus broader coverage than that of mid-band alone. Three, which currently has the most mid-band spectrum of any UK operator, invested in low-band spectrum to increase its availability, while Vodafone added more mid-band spectrum to its toolbox. Vodafone also has a strategy to refarm some of its existing 900 MHz low-band spectrum for 5G, and the operator is also using **Dynamic Spectrum Sharing (DSS)** technology to boost its Everyday 5G availability.



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. 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 blistering speeds 5G can deliver on other types of spectrum.

Mid-band spectrum 5G (1 GHz – 6 GHz):

Mid-band spectrum, which is also used for 4G LTE networks, 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 a problem. All four UK operators currently use mid-band spectrum (3.5 GHz) for 5G.

mmWave spectrum 5G (24 GHz+):

mmWave is currently being used in limited fashion in the US at frequencies of 28 GHz and 39 GHz, but operators in the UK are not using mmWave. The primary upside of mmWave spectrum is that it’s 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 and can be obstructed by architecture and other physical objects relatively easily.

*Not currently used by UK operators

To learn more the spectrum auction, visit our recent **blog**. You can also learn about spectrum in general at our article called **Understanding spectrum** or watch our spectrum **video**.



For more information, visit