Mike Dano | April 13, 2026

A Return to mmWave 5G

New data shines a light on the growth of mmWave 5G networks in the U.S., and their performance.

In the very, very early days of 5G in the U.S., millimeter wave (mmWave) spectrum was trumpeted as ground zero for the technology. Some even referred to the combination of 5G and mmWave as "wireless fiber."

Indeed, in 2017, a bidding war broke out between Verizon and AT&T over mmWave spectrum owner Straight Path. Verizon eventually won the company's mmWave holdings with a $3.1 billion acquisition deal.

But the noise surrounding mmWave 5G quickly died down after the FCC auctioned mid-band C-band spectrum in 2021. Unlike short-range mmWave spectrum, transmissions in midband spectrum like C-band (3.7 GHz) travel much further, thereby allowing operators including Verizon and AT&T to supercharge both the speed and the reach of their 5G connections.

Further, few other countries in the world followed in the mmWave footsteps of the U.S., with international spectrum regulators instead putting a focus on releasing mid-band spectrum for 5G.

However, mmWave networks haven't disappeared. New drive test data from Ookla's RootMetrics®, coupled with crowdsourced information from Ookla's Speedtest Insights™, shows the ongoing growth of mmWave 5G networks in the U.S., as well as the remarkable performance characteristics of those systems.

Key takeaways:

- **Across all of RootMetrics' testing in the second half of 2025, in both urban (metro) and rural (state) areas, mmWave showed up in 2.2% of Verizon's samples**. For AT&T, that figure was 0.2%. For T-Mobile, that figure was almost 0% (and as a result, this report will mainly focus on Verizon and AT&T).
- **Verizon's mmWave connections showed up in 75 markets in the first half of 2024 (out of a total of 125 markets), a figure that rose to 91 in the second half of 2025**. That's almost triple the number of markets where RootMetrics recorded AT&T mmWave systems in the second half of 2025. 5G mmWave

from T-Mobile, meanwhile, only showed up in 1 market covered by RootMetrics technicians during the second half of 2025.

- **Most mmWave samples were obtained within 150 meters (about 500 feet) of a mmWave transmission site**, reflecting the spectrum's relatively diminutive coverage area. However, download speeds over mmWave connections reached beyond 1 Gbps in some markets.
- **Denver, Atlanta, Philadelphia, and Boston are top mmWave cities for Verizon**. Roughly 60% of RootMetrics' outdoor testing samples landed on Verizon's mmWave in these cities in the second half of 2025.

Verizon leads the way

The story of mmWave in the U.S. primarily centers on Verizon. The company's acquisition of Straight Path (and later XO Communications) coupled with its subsequent spending in FCC mmWave spectrum auctions, gave the operator a solid footprint in the high-band spectrum. More importantly, Verizon then began a network buildout campaign that put mmWave-capable small cells (mini cell transmission sites) into stadiums and other big venues, as well as in outdoor, downtown areas with lots of foot traffic.

By 2020, Verizon's CEO sought to leverage the company's mmWave investments via an appearance during the unveiling of Apple's first mmWave-capable iPhone.

"5G just got real," Hans Vestberg, Verizon's CEO at the time, proclaimed during the event.

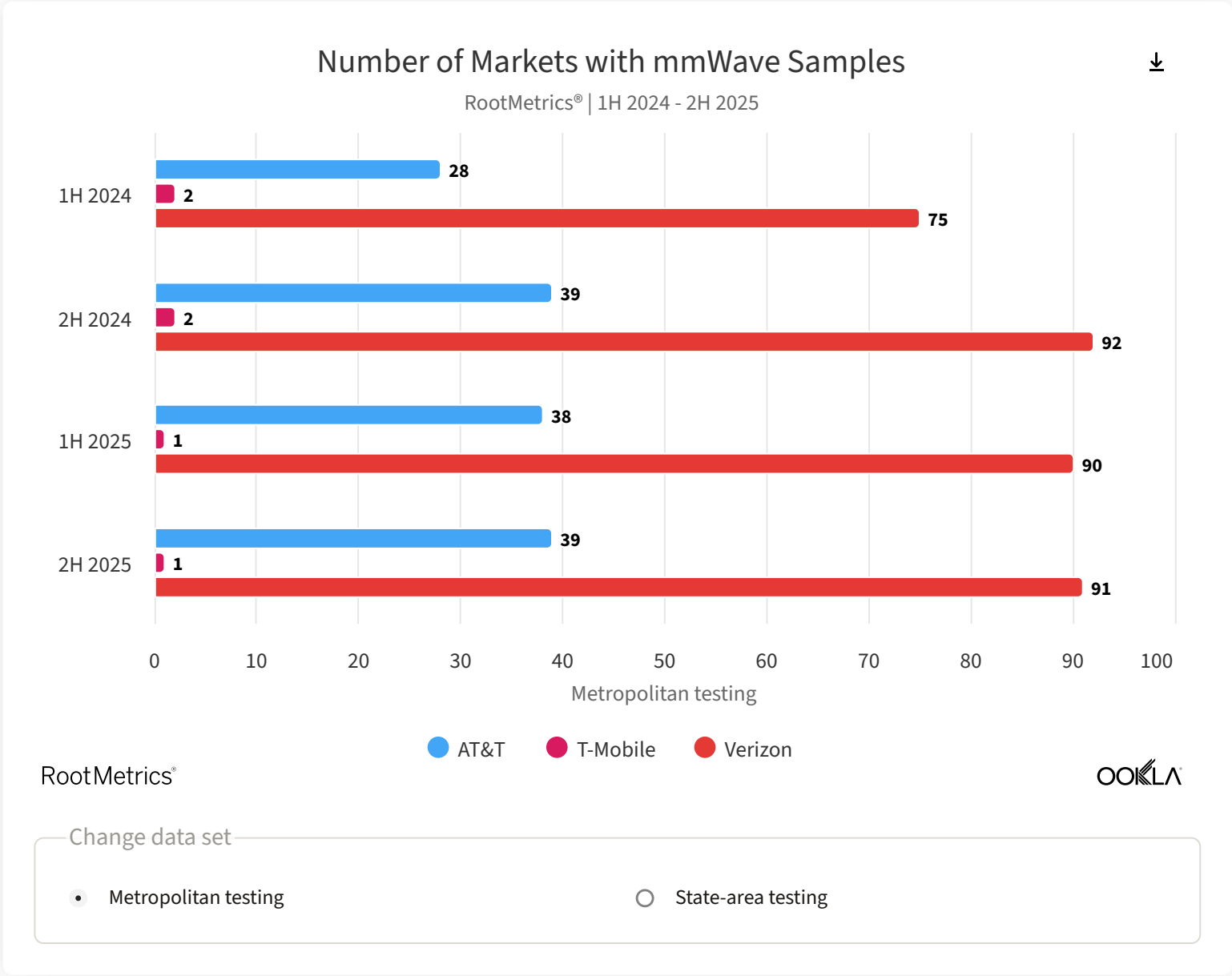
Since then, Verizon has expanded its mmWave footprint via services for both mobile and fixed wireless access (FWA) users.

Now, RootMetrics' testing highlights the scope and breadth of Verizon's mmWave deployment. RootMetrics conducts controlled driving and walking tests using flagship Android smartphones across 125 of the nation's largest metropolitan markets twice a year.

According to this testing data, Verizon continued to add to its mmWave network footprint in big U.S. cities throughout 2025. The number of distinct U.S. metropolitan markets where RootMetrics' testing engineers registered Verizon mmWave samples increased from 75 in the first half of 2024 to 91 in the second half of 2025. That's almost triple the number of markets where AT&T has deployed mmWave systems.

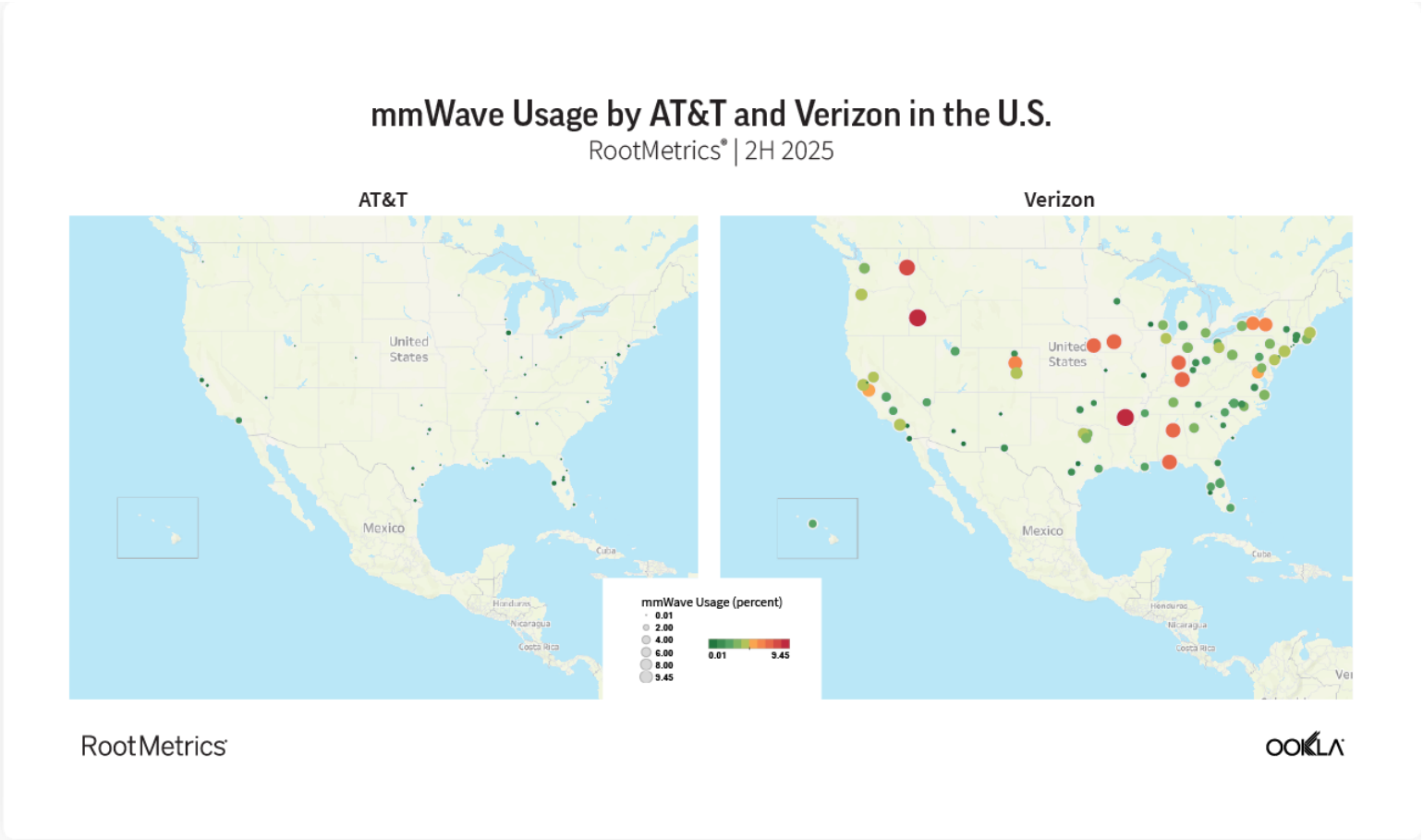
5G mmWave from T-Mobile, meanwhile, only showed up in one market covered by RootMetrics technicians during the second half of 2025 (a decline from two markets recorded in the first half of 2024). That lines up

with the operator's general approach toward mmWave.



Verizon's mmWave signals also popped up in more rural RootMetrics state-area testing, which covers locations in large and small towns, as well as the highways between them. In state-area testing, RootMetrics' technicians recorded Verizon mmWave connections in 33 markets in the second half of 2025, up from 14 in the first half of 2024. AT&T's mmWave signals showed up in just 7 markets in the second half of 2025. T-Mobile mmWave didn't show in any of these areas.

Further, Verizon's mmWave connections also show up in a greater portion of RootMetrics' samples in each of those U.S. metro areas, when compared with AT&T:



Before continuing, it's worth explaining RootMetrics' network-testing methodology. The company conducted over 3 million tests in the second half of 2025 across the entire U.S. Unlike crowd-sourced data from Speedtest®, RootMetrics' data is derived from technicians who drive – and walk – around each city they test. Such tests are also randomized – meaning, RootMetrics technicians don't test the same route each time they travel through a particular market. Instead, they test different routes.

RootMetrics' technicians also visit a variety of different locations during their nationwide testing. In urban, metro areas, they drive through downtown areas and they walk along both indoor and outdoor routes. These outdoor routes typically traverse downtown streets and city parks.

In more suburban and rural settings ("state routes," in RootMetrics parlance), technicians typically drive through neighborhoods, along business corridors, and down interstates and highways.

These testing methods highlight the different types of spectrum that operators deploy in these various locations. For example, Verizon generally leverages its 700 MHz low-band spectrum to cover the more rural "state routes" tested by RootMetrics – which makes sense considering signals in such spectrum can typically travel several miles at least. mmWave signals, meanwhile, can only travel a few hundred yards, making them more appropriate for dense, urban downtown locations ("metro areas," in RootMetrics'

parlance).

Across all of RootMetrics' testing samples in the second half of 2025, in both urban (metro) and rural (state) areas, mmWave showed up in 2.2% of Verizon's samples. For AT&T, that figure was 0.2%. For T-Mobile, that figure was almost 0% (and as a result, this report will mainly focus on Verizon and AT&T).

For comparison's sake, it's clear that Verizon pivoted to mid-band C-band spectrum when the FCC made that spectrum available in 2021. According to RootMetrics data, Verizon increased its use of C-band spectrum to 81.3% of all samples in metro areas by the fourth quarter of 2025, up from 74.4% in the first quarter of 2025.

The reach of mmWave

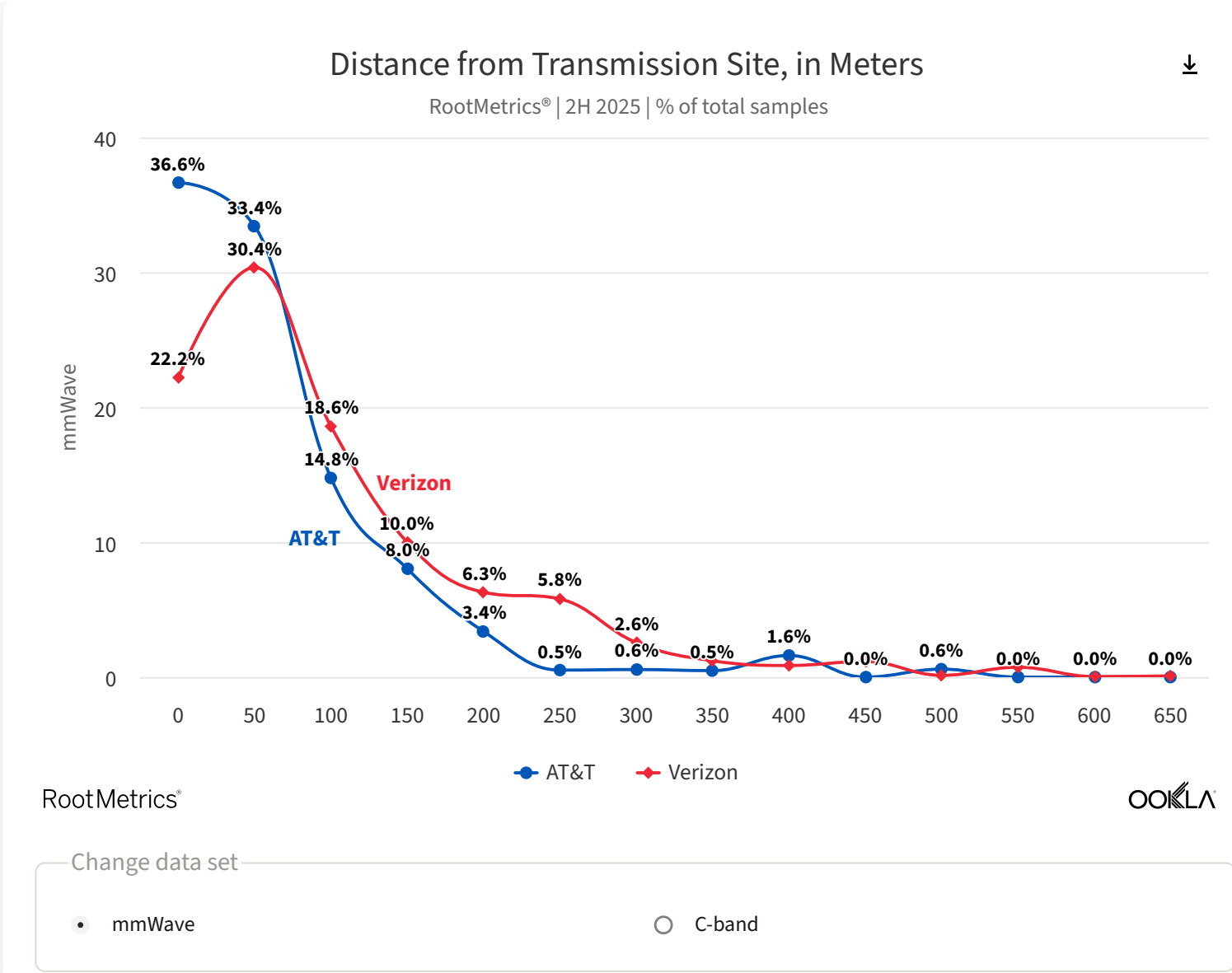
mmWave 5G is distinct because it sits way up in the millimeter wave spectrum bands (generally between 20 GHz and 40 GHz). Earlier cellular networks – from 1G in the 1980s to 4G in the 2010s – mostly sat in much lower spectrum bands, generally from 700 MHz to 1900 MHz.

mmWave spectrum was long considered unusable for mobile, cellular communications until early work on the 5G standard convinced some in the global wireless industry that advanced technologies could unlock mmWave spectrum bands for commercial, on-the-move applications. Operators like Verizon coveted such mmWave bands because they promised to create massive pipes of network capacity, spanning multiple 100 MHz blocks of mmWave spectrum. Those ample chunks of spectrum were unheard of even in the world of 4G, when spectrum blocks didn't get much wider than 20 MHz.

However, due to the physics of signal propagation, transmissions in mmWave spectrum sport a few important characteristics: They cannot travel nearly as far as transmissions in lower spectrum bands, such as 700 MHz. As a result, 5G signals in low-band spectrum like 700 MHz can travel many miles; signals in high-band, mmWave spectrum like 26 GHz can only travel several hundred meters. Moreover, mmWave signals typically cannot penetrate into buildings or other structures.

T-Mobile's former CTO Neville Ray used a "layer cake" metaphor to explain this situation, with mmWave networks playing only in small, dense urban areas at the top of the cake:

However, such illustrations are mostly based on general networking principles rather than real-world data. Here, RootMetrics offers a clear look at the exact reach of mature, commercial mmWave networks. In general, 5G mmWave signals aren’t usable beyond 900 meters (or about half a mile). Further, most RootMetrics mmWave samples in the second half of 2025 were collected within just 150 meters (about 500 feet) of a mmWave transmission site.

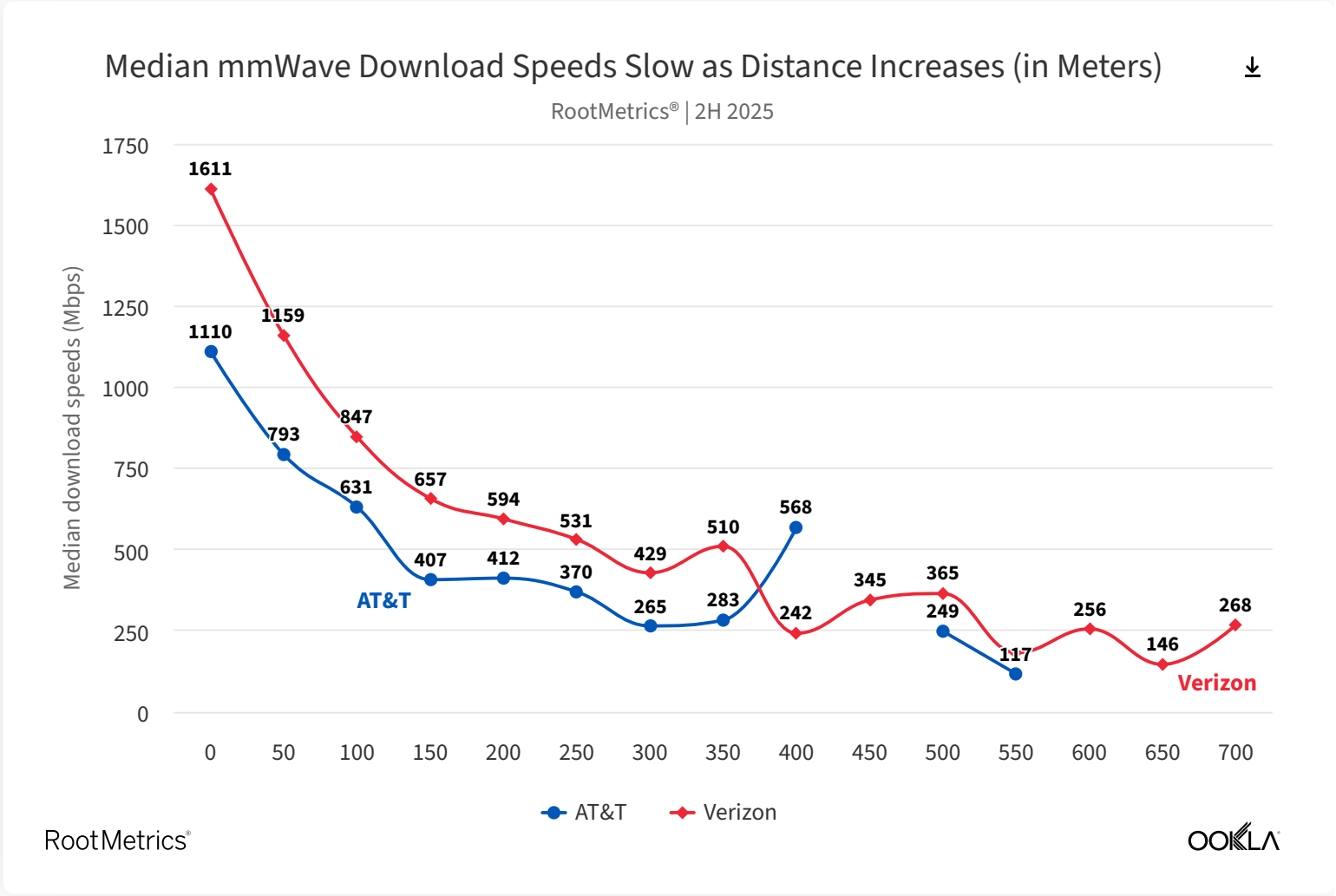


In comparison, most RootMetrics' C-band spectrum samples were collected within 1,000 meters (just over half a mile) from the transmission site – and in some cases they reached more than two miles from the transmission site.

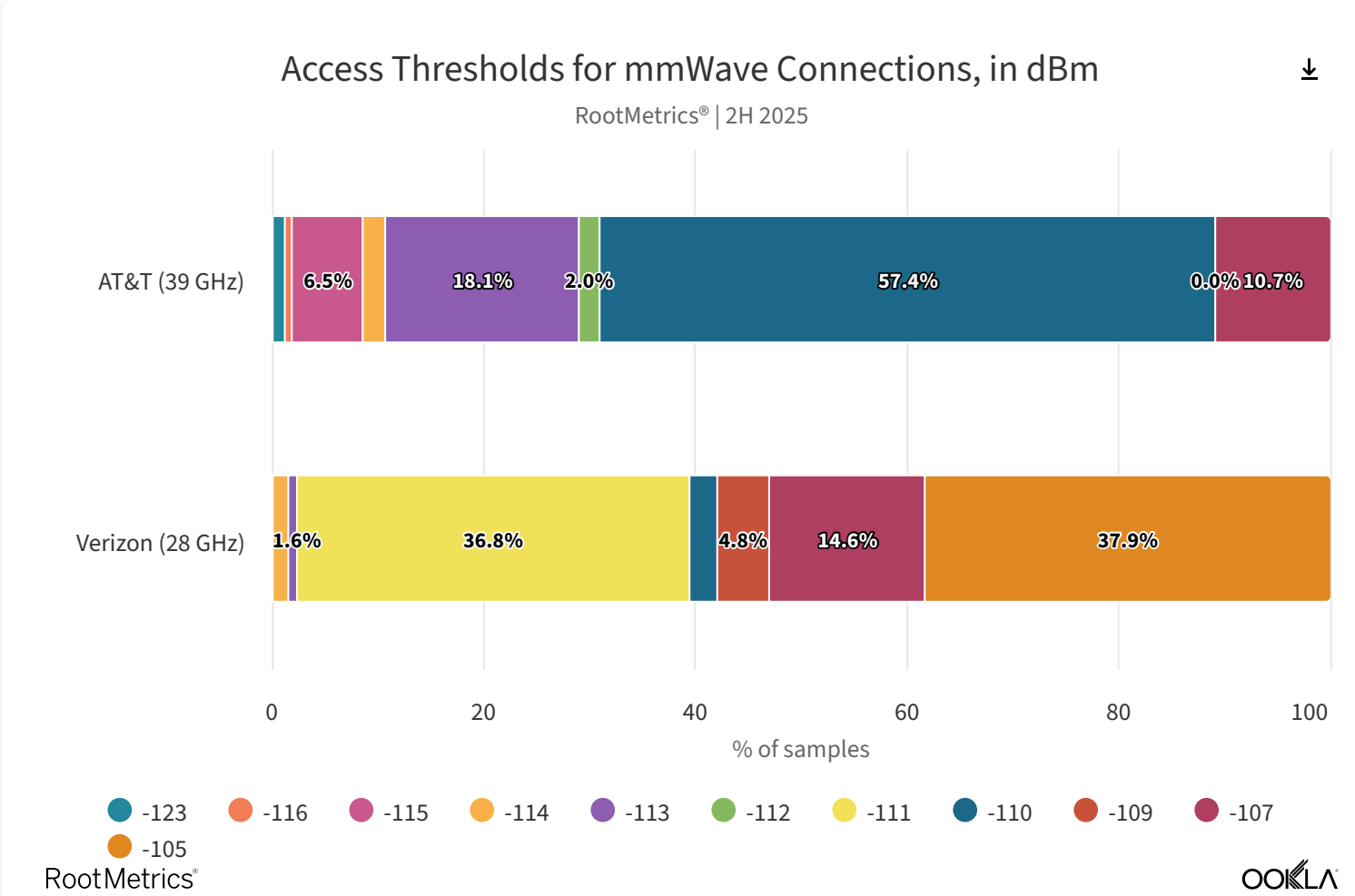
AT&T exclusively uses the 39 GHz mmWave band. Most of Verizon's mmWave transmissions travel over the 28 GHz mmWave band, but a very small amount use 39 GHz (just under 6% of samples in the second half of 2025). Verizon's mmWave signals don't show the same drop-off at 50 meters that AT&T's signals do – likely a consequence of the inherently broader propagation characteristics of signals in 28 GHz compared with the higher 39 GHz band.

RootMetrics data also highlights the performance of mmWave 5G signals as users move away from

mmWave transmission sites. All wireless networks show a degradation in performance as the distance between a user and a transmission site increases – but the situation can be measured in meters in 5G mmWave.



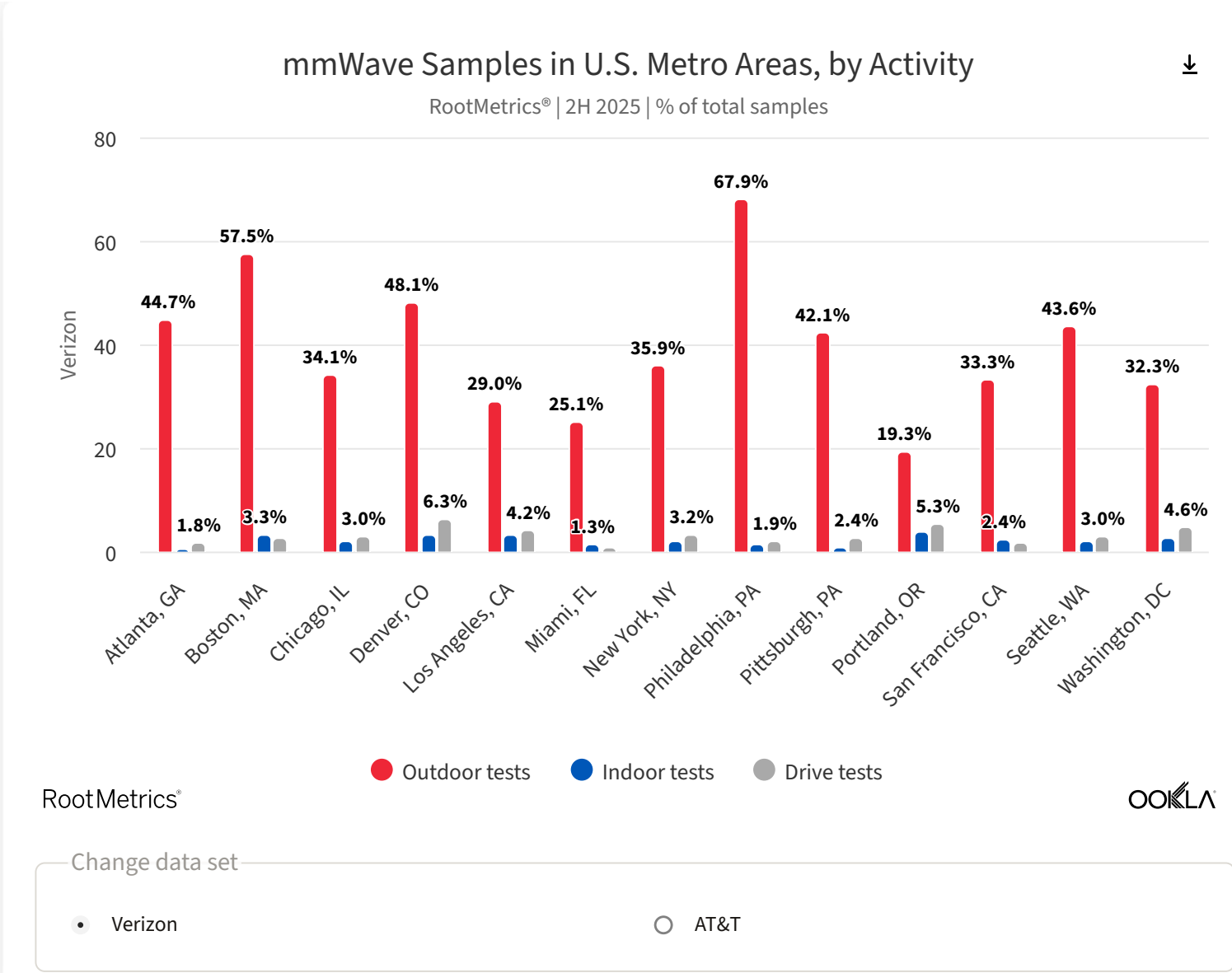
Finally, RootMetrics data can also show the exact signal characteristics that create connections between mmWave-capable devices and mmWave transmission sites. These “access thresholds” essentially show how strong a mmWave signal must be before the network will allow a user’s phone to connect to a mmWave site. If the signal isn’t strong enough, the network won’t allow the phone to connect to mmWave, and the phone will instead remain on a mid-band or low-band connection.



In a 5G network, dBm (decibels-milliwatts) is a measure of the power level of the radio signal received by a device. Values closer to zero indicate a stronger, more reliable connection.

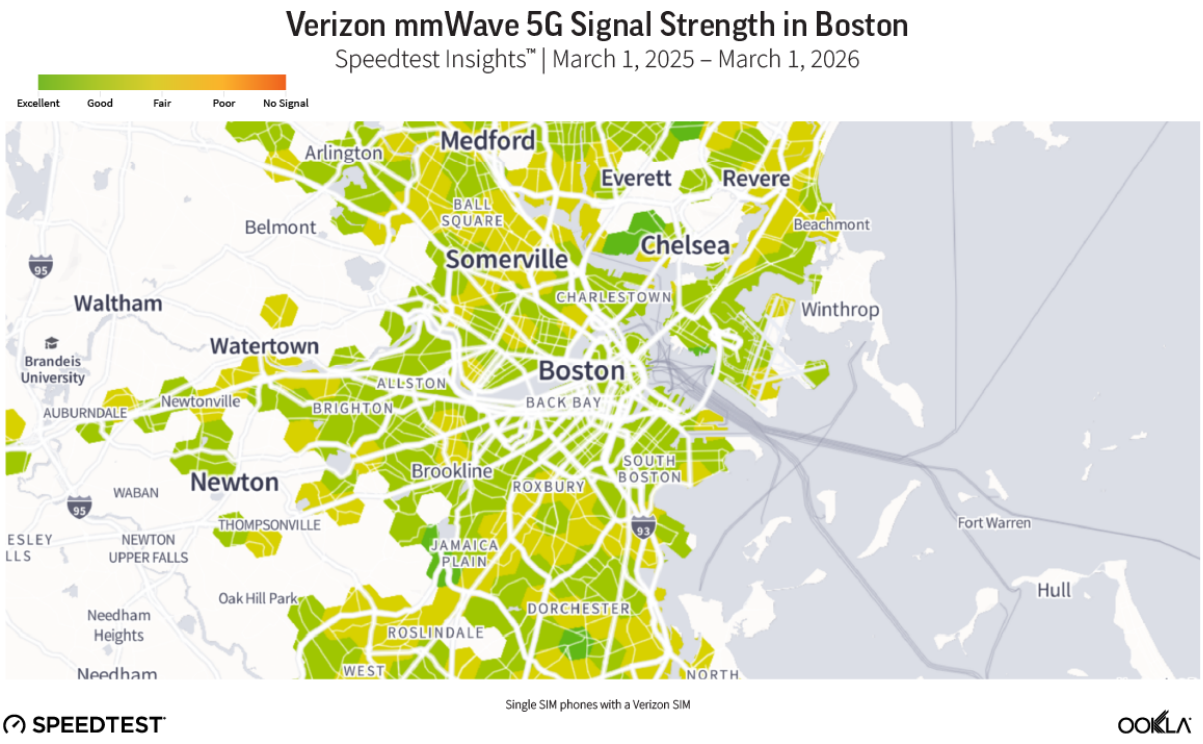
Looking for signals: mmWave in big U.S. cities

Denver, Atlanta, Philadelphia, and Boston are top mmWave cities for Verizon. Roughly 60% of RootMetrics' outdoor testing samples landed on Verizon's mmWave in these cities in the second half of 2025. For AT&T, Philadelphia, Chicago, and Los Angeles are top mmWave cities – although AT&T's mmWave touched roughly 20% of RootMetrics' outdoor testing samples in these cities in the second half of 2025.

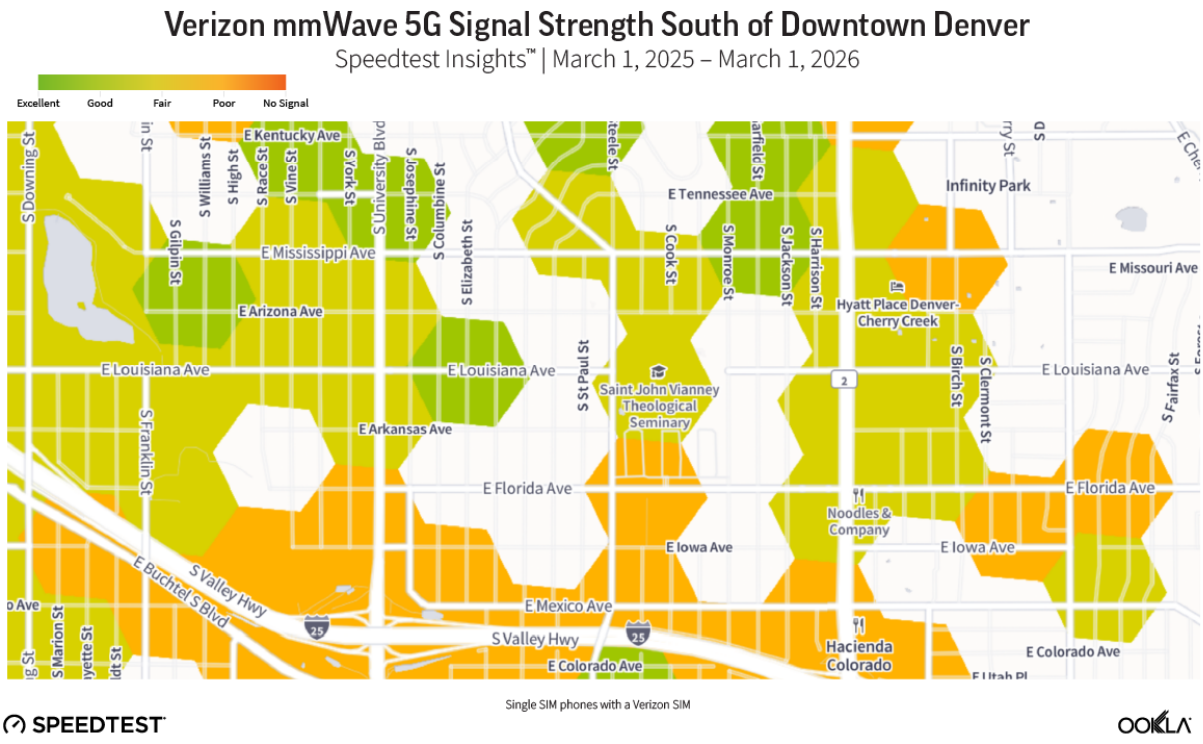


That both AT&T and Verizon view mmWave networks as an outdoor coverage solution is noteworthy. In the early days of mmWave 5G – before mid-band spectrum like C-band became available – mmWave networks were touted as a reasonable solution for urban outdoor areas, like downtown corridors. More recently, mmWave has been viewed as an ideal option for covering massive indoor locations, like stadiums, convention centers, and other high-traffic buildings.

Nonetheless, 5G signal scans from Ookla's Speedtest Insights show Verizon's extensive indoor and outdoor mmWave coverage throughout downtown Denver and Boston:



However, a closer look at Verizon's coverage throughout the southern part of downtown Denver tells the story of mmWave's relatively diminutive propagation characteristics, particular when compared with transmissions across all of Verizon's spectrum bands, including both low-band and mid-band:

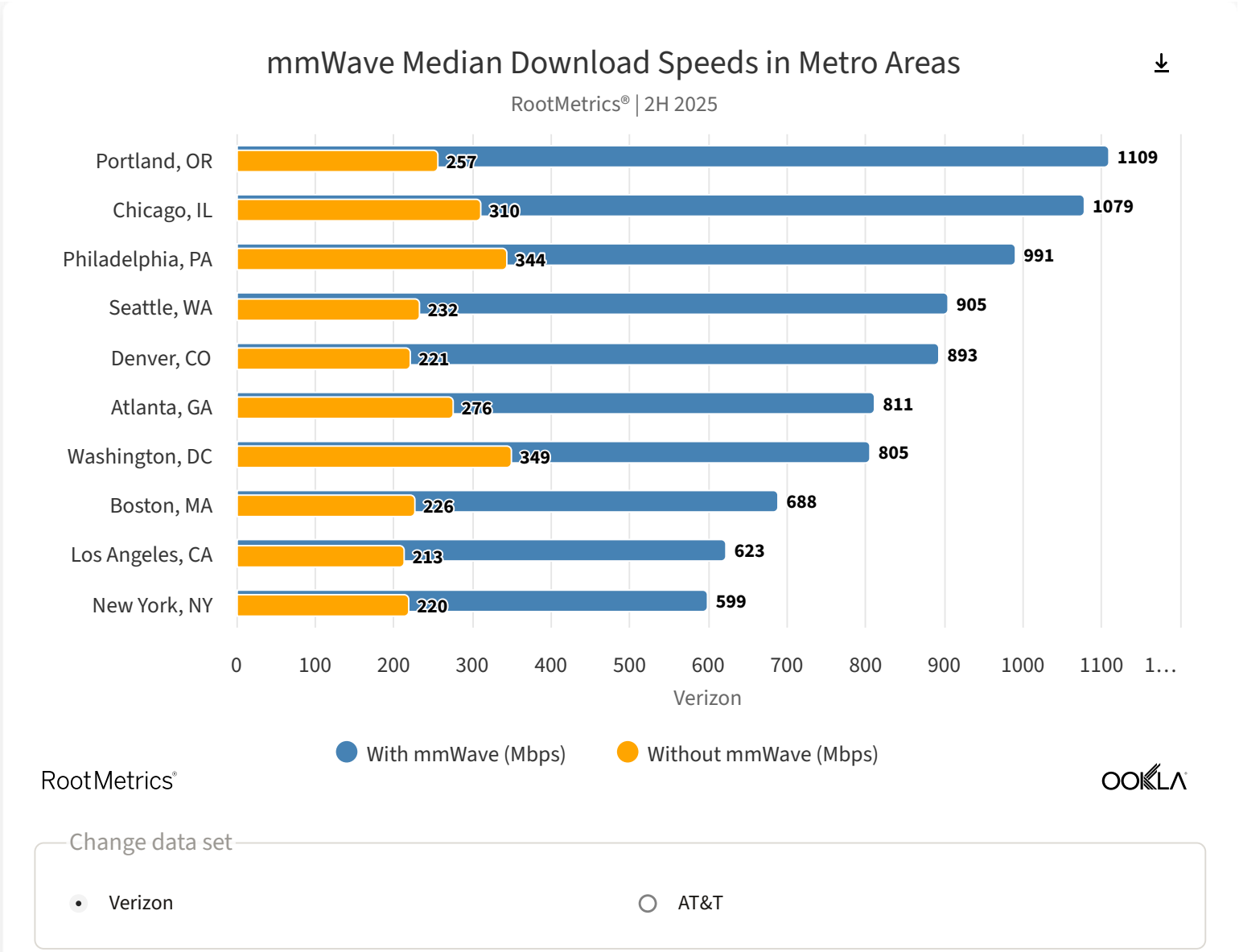


Finally, it's worth noting that Speedtest Insights also shows some of T-Mobile's mmWave deployments. For example, mmWave shows up in one of T-Mobile's retail stores in its hometown of Bellevue, Washington. It also shows up in SoFi Stadium in Inglewood, California.

mmWave: Very, very fast

For operators, the economic calculation for mmWave can be tricky. Since coverage is measured in hundreds of meters, and mmWave transmitters are decidedly expensive to purchase, install and maintain, is the juice worth the squeeze?

The performance of mmWave connections helps to illustrate the reasons driving such deployments.



Uplink speeds see a similar boost from mmWave.

The reason for these speeds is clear: Both AT&T and Verizon devote an eye-watering amount of mmWave spectrum to their deployments. Most of Verizon's mmWave deployments using the initial 5G non standalone (NSA) version of the technology span eight 100 MHz channels. When combining all those channels together, Verizon is using an astounding 800 MHz worth of spectrum, mostly in the 28 GHz band, for its mmWave transmissions. That spectrum "depth" is the primary reason the operator is able to supply connections in some cases exceeding 1 Gbps.

AT&T also devotes a substantial amount of spectrum to its mmWave deployments. In some cities, like Seattle, the operator is using 800 MHz worth of spectrum. In others, like Atlanta, it's using 400 MHz.

To be clear though, a variety of factors go into raw download speeds beyond spectrum depth, including users' distance from transmission sites, their phone's capabilities, their operator's networking settings, and other factors.

mmWave: Across the globe, and into the future

Roughly six years on from the introduction of mmWave 5G, the U.S. remains the technology's most visible proponent.

According to a Global mobile Suppliers Association (GSA) report from July of last year, 203 operators in 56 countries and territories were investing in 5G mmWave network deployments. Of those, 24 operators in 17 countries had launched 5G networks using mmWave spectrum.

Similarly, in a report released in December of last year, GSMA Intelligence found that 35 operators from 17 countries had launched 5G services in the mmWave bands. The firm reported that, at the end of the third quarter of 2025, mmWave spectrum for 5G had been assigned in 25 markets globally.

On the device side of things, the GSA recorded 150 devices that supported mmWave transmissions by June 2025, up from just 21 at the end of 2019.

However, the GSA reported a "considerable decrease" in spending on mmWave spectrum since the end of 2020. Indeed, operators in India didn't bid in a 2024 mmWave spectrum auction, and operators in South Korea didn't meet mmWave buildout requirements and ultimately returned their spectrum licenses to the country's regulator. Among device vendors, companies like Apple have shown some recent ambivalence toward mmWave, going so far as to remove the technology from newer phones bound for the U.S. market. Such moves can help reduce the overall cost of devices.

Thus, it's not clear whether Verizon's new CEO, Dan Schulman, will continue the mmWave expansion spearheaded by the company's former CEO.

Regardless, mmWave momentum continues. Ofcom in the U.K. recently conducted an auction of mmWave spectrum in that country, drawing some operator interest. Regulators in India, Japan and Canada may release additional mmWave spectrum as well. And KDDI in Japan has touted an expanding mmWave footprint in some downtown areas. Such moves could push more phone makers to add mmWave support into their devices – a key requirement for broad deployments.

Broad, international support for mmWave 5G is important because it can drive economies of scale for both

equipment manufacturers and device vendors, potentially lowering costs and accelerating global adoption.

Finally, all of this mmWave gyration may affect the future of 6G. For example, U.S. officials are pushing for the 7 GHz band to be incorporated into future 6G networks. The 7 GHz band is much lower than mmWave bands like 28 GHz, but it's higher than the 3.5 GHz band used for most mid-band spectrum deployments globally. Thus, networks in the 7 GHz band may suffer from some of the same propagation challenges that affect 5G mmWave networks. Support – and equipment – for the 7 GHz band will be a critical test for its success.

5G AT&T Verizon mmWave

About the author

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Mike Dano is a Lead Industry Analyst in Ookla's research and content team. He covers the North and South American markets, and global technology trends. Previously, Mike was a journalist covering the global telecom industry for 25 years at publications including RCR Wireless News, Fierce Network and Light Reading.

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