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# 5G mmWave: SRG Executive Summary

How 5G Millimeter Wave  
(mmWave) augments mid-band  
5G to provide critical additional  
Network Capacity in Indoor  
Venues and Outdoor  
Environments

January 2022

Research conducted by  
Signals Research Group

We conducted this benchmark study on behalf of Qualcomm Technologies, Inc. SRG was solely responsible for collecting and analyzing the drive test data presented in this report. We collected the results in commercial networks with commercial smartphones in September and October 2021. The comments provided in this whitepaper are based on our analysis of the data, which is also included to the maximum extent possible in this paper.

In addition to providing consulting services on wireless-related topics, including performance benchmark studies, Signals Research Group is the publisher of the Signals Ahead and Signals Flash! research reports

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# Executive Summary

Discover the benefits of 5G mmWave when deployed in an operator's existing network.

A recent benchmark study of 5G millimeter wave (mmWave) performance conducted by Signals Research Group (SRG) discovered and demonstrated how 5G mmWave provides critical additional network capacity, throughput, coverage, and performance in both indoor and outdoor environments in the United States and Europe.

In this study, SRG explored the capacity thresholds and performance of 5G mmWave across a large number of mobile devices and networks to quantify system and network-level performance with LTE, mid-band 5G, and 5G mmWave.

### Test Objectives

To determine the potential downlink and uplink capacity of the operator's network and then the additional capacity 5G mmWave provided. And, to determine if those results varied based on the location of the venue and network (indoor vs. outdoor, US vs. Europe) and the daily traffic volume.

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## Key Findings

### Capacity and Network-Wide Benefits

Operators with existing mid-band 5G networks can also benefit from deploying 5G mmWave. LTE and mid-band 5G networks have impressive performance traits, but they quickly reach a breaking point in spectrum availability and traffic support, even in low-bit rate applications.

- Tests showed a 4.4X increase in the “capacity density”<sup>1</sup> when 5G mmWave is deployed within a 5G mid-band network in both indoor venues and outdoor spaces. (see visual at end of document)
- When added to a sub-6 GHz network, 5G mmWave offloads traffic, freeing up network resources for all users on the network.
- 5G mmWave increases overall sector throughput which benefits even consumers without a 5G mmWave smartphone.

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5G mmWave delivered a **4.4x increase** in capacity over 5G mid-band (n78)

<sup>1</sup>Per SRG, the capacity density quantifies the total throughput (Mbps) delivered across at target area (m2)  
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### Regarding Coverage

Overall, Signals Research Group found that 5G mmWave coverage is surprisingly robust and doesn't necessarily require significantly higher cell densities compared to the existing cell grid.

- In an indoor venue, 5G mmWave coverage was nearly ubiquitous in the areas where it was intended to provide coverage.
- In a high-traffic outdoor deployment in Europe, 5G mmWave coverage provided significant capacity over much of the targeted, significantly cell-dense coverage area.

### Streaming Video

Lower throughput has a noticeable, negative impact on user experience when live streaming video content (uplink) or viewing video content (downlink). In this study, SRG tested video performance in the uplink and downlink direction on LTE-only and 5G mmWave enabled devices in networks of varying congestion.

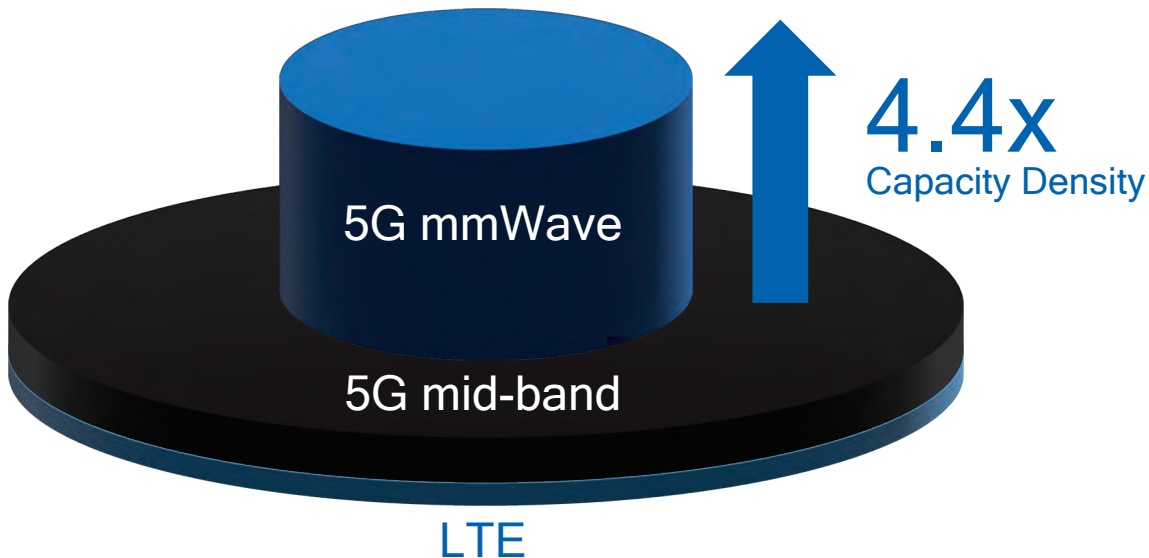
As 5G mmWave increases overall sector throughput and offloads traffic, video performance improves substantially with 5G mmWave, even for consumers without a 5G mmWave smartphone.

- 5G mmWave enabled on the smartphones eliminated freezes and impairments in field tests.
- The 5G mmWave site supported nearly 3.7 Gbps of downlink data while simultaneously supporting an uplink YouTube Live session.

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Figure 1. LTE and 5G NR Capacity Densities



Source: Signals Research Group

## In Conclusion

Supercharge uplink/downlink throughput and network capacity with 5G mmWave.

After thorough testing across devices and device capabilities, networks, venues, and countries, 5G mmWave proved invaluable in providing critical additional network capacity, coverage, throughput, and video streaming performance, even in the presence of LTE and mid-band 5G. While U.S. operators have been at the forefront of deploying 5G mmWave, the value and benefit has become clear to operators around the world.



Download the complete research at [qualcomm.com/mmWave](https://www.qualcomm.com/mmWave)