



NEW CANAAN
CONNECTICUT



Mobile Wireless Testing Project Executive Report

Project for: Utility Commission New Canaan

June 11 - 13, 2024





- ❑ Founded in 2006
- ❑ Global headquarters in Seattle, WA
- ❑ Additional offices in Denver, Memphis, Dublin, London (Guildford) and Dubai
- ❑ Physical presence in almost two dozen countries
- ❑ Enterprise clients in over 100 countries
- ❑ Customers include virtually every major telecommunications provider in the world, as well as industry leaders in technology, gaming, banking, and financial services
- ❑ Standalone subsidiary of Ziff Davis (NASDAQ: ZD)



OBJECTIVE

To provide an empirical assessment of mobile network coverage, voice and data call experience in the City of New Canaan using Ookla's drive test methodology.

This report captures data from the four tier-1 operators (AT&T, FirstNet, T-Mobile and Verizon Wireless) and aims to offer the Utility Commission of New Canaan an unbiased and independent analysis of the state of mobile connectivity in the town.

DISCLAIMER: The findings presented here are based on a point in time using Ookla's controlled testing methodology, including Speedtest® and Voice call tests conducted across the town of New Canaan, Connecticut. These metrics reflect test results obtained from June 11, 2024 through June 13, 2024, and should not be interpreted as a comprehensive assessment of network capability. Ookla recommends considering the context to avoid misinterpretation of the metrics and findings.

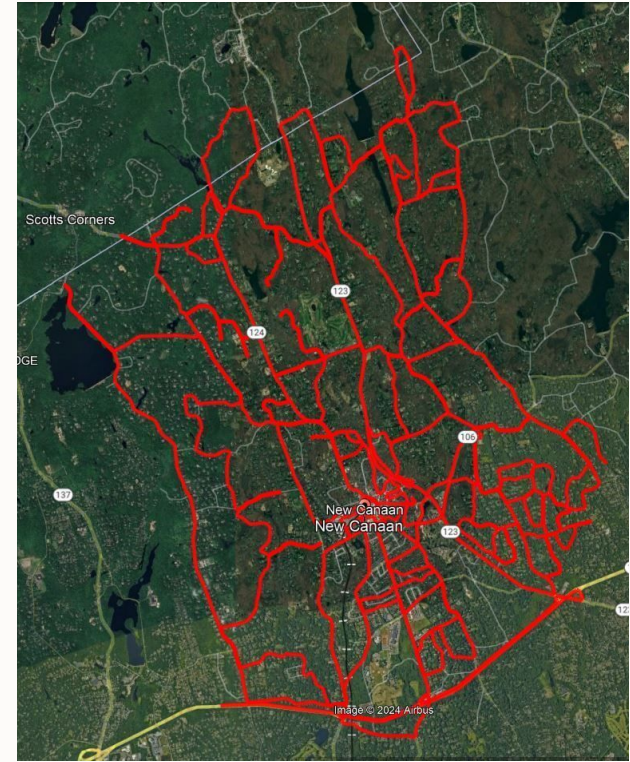


Methodology and Drive Route

The drive test methodology proposed for the project involved gathering empirical data on voice and data performance across multiple mobile network operators (MNOs).

Through a planned, systematic drive test on a pre-agreed route, Ookla's methodology aimed to provide insightful metrics on network coverage, signal strength, voice call success rate, and data throughput. By utilizing Ookla's controlled testing methodology, we ensured robust data collection, enabling informed decision-making for the Utility Commission.

The predetermined drive route spanned approximately 125 miles, as outlined by the Utility Commission of New Canaan. The route included both state and town roads. Testing took place with 8 devices and spanned 16+ hours.



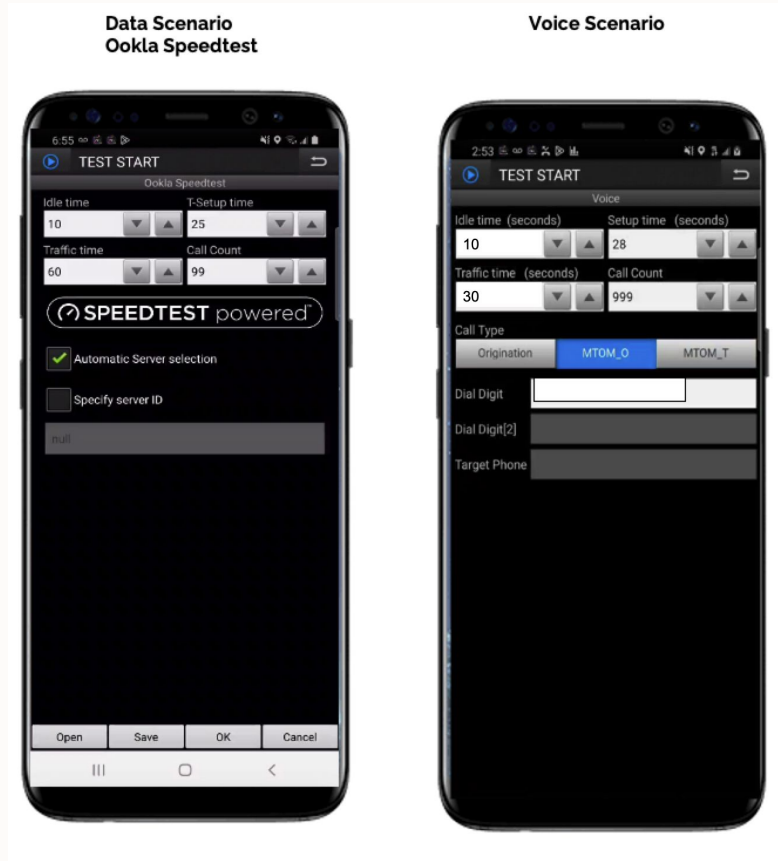
Test Call Setup

Voice Test: A scenario configuration for mobile-originated voice calls involved a 60-second duration with 10 seconds of idle time between each call. This allows the device to select the best available signal. Additionally, a maximum timer of 28 seconds ensures successful voice call setup within a specified time, simulating the customer experience.

Data Test: Speedtest was configured with a maximum duration of 60 seconds. During the time the device performs a Ping test to select the closest available server capturing Jitter and Latency and subsequently performs a download test followed by an upload test.

To ensure successful setup within a specified time, a maximum timer of 25 seconds is defined, replicating the customer experience.

Additionally, an idle time of 10 seconds is introduced between each data test event, allowing the device to select the strongest available signal.



Key Findings

01



Need to fill coverage gaps

The town would benefit from improved coverage. Across all operators, approximately 93% of collected samples fell into the average to weak (between -90 to -110 dBm) or weaker category (lower than -110 dBm). To improve coverage in the town for a better wireless experience, operators could identify coverage gaps and optimize their infrastructure.

02



Slow data speeds

The FCC defines the mobile network throughput threshold for downlink and uplink as 35 Mbps and 3 Mbps respectively. We recorded low data speeds performance across all operators with high setup failures (10-30%), indicating a poor experience for subscribers in the town.

03



Improve voice call performance

We recorded high dropped call (3-7%) and setup failure rates (10-30%) across all operators, most likely due to poor coverage conditions. Large number of subscribers in the town likely have a hard time placing or sustaining a voice call.

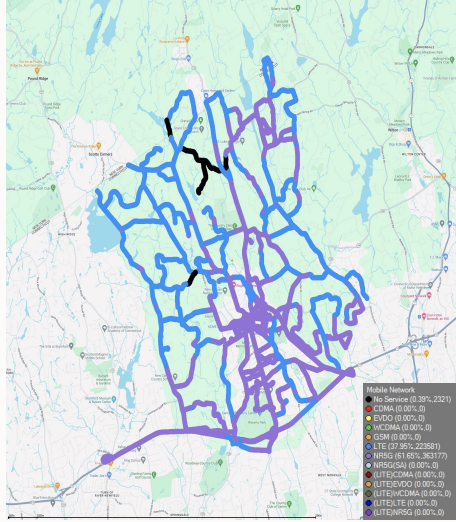
Network Coverage Metrics



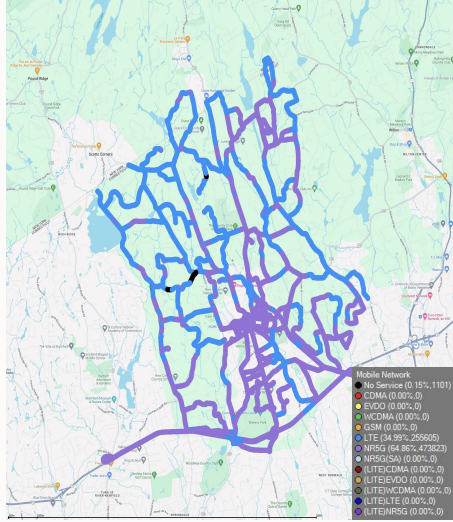
Mobile Network Coverage

Mobile Network coverage plot shows where the devices connected to LTE and NR 5G networks along the drive route.

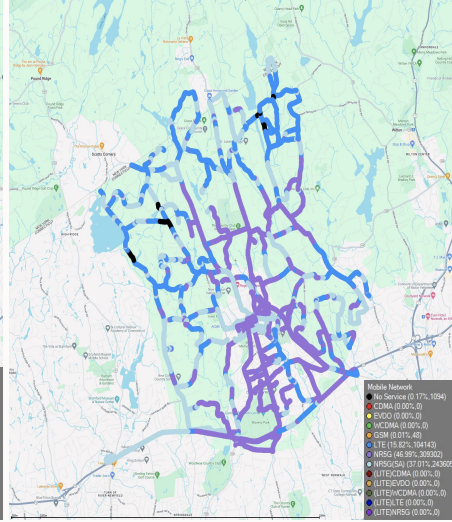
AT&T



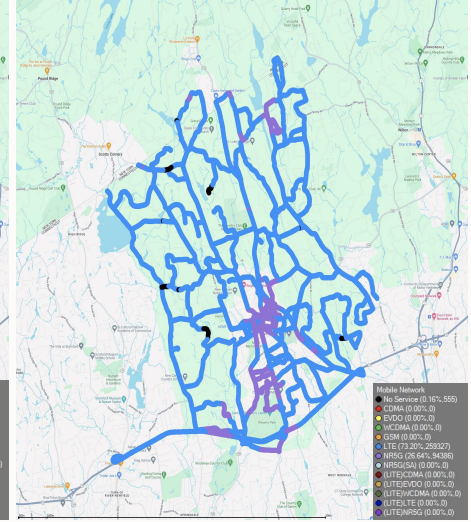
FirstNet



T-Mobile



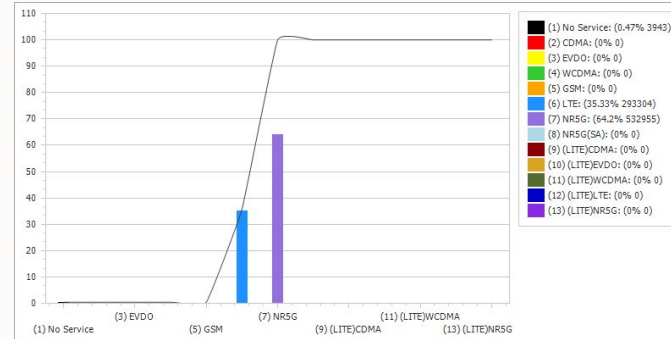
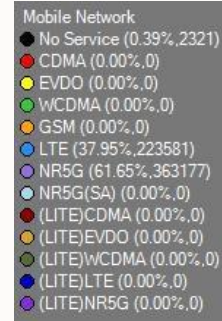
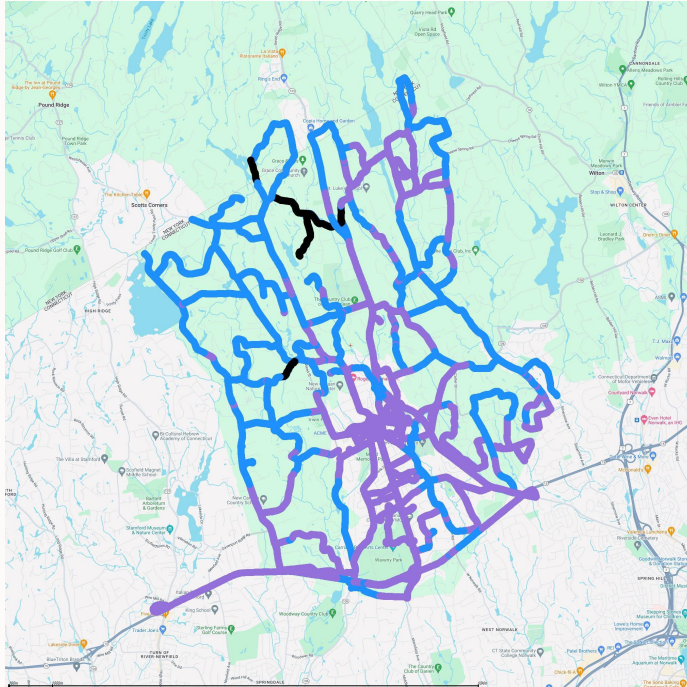
Verizon Wireless



*The maps above originate from the device used for data testing.

AT&T Mobile Network Overview

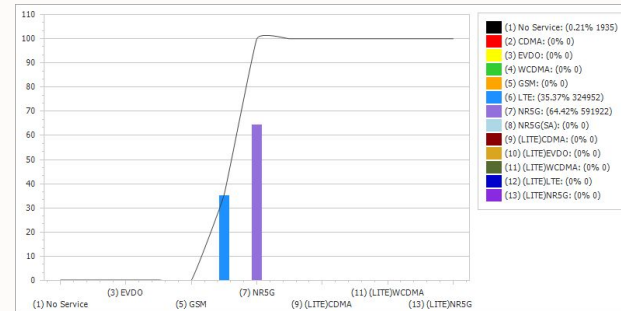
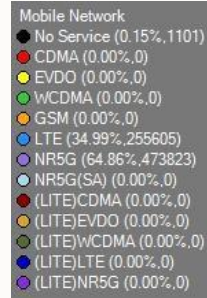
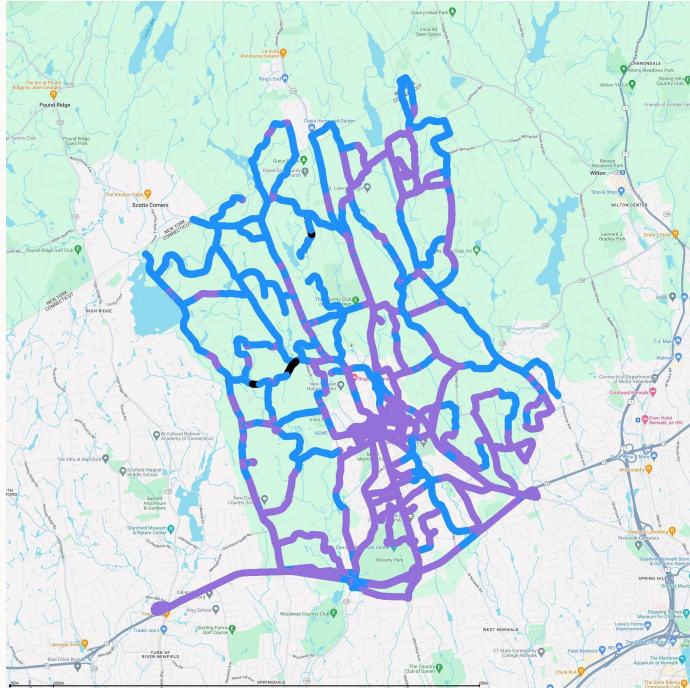
AT&T and FirstNet devices were predominantly connected to the NR (New Radio) 5G Non-Standalone network, accounting for over 60% of the drive duration. NSA mode uses a 5G radio network alongside the existing 4G LTE core network.



*The map and bar chart above originate from the device used for data testing. It's important to recognize that variations may exist between the GPS-based map plot and the aggregated data presented in the bar chart.

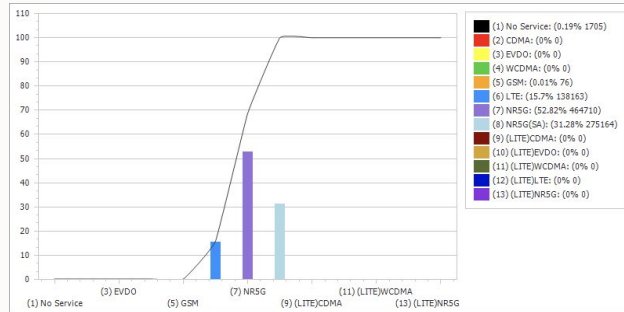
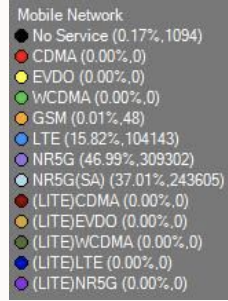
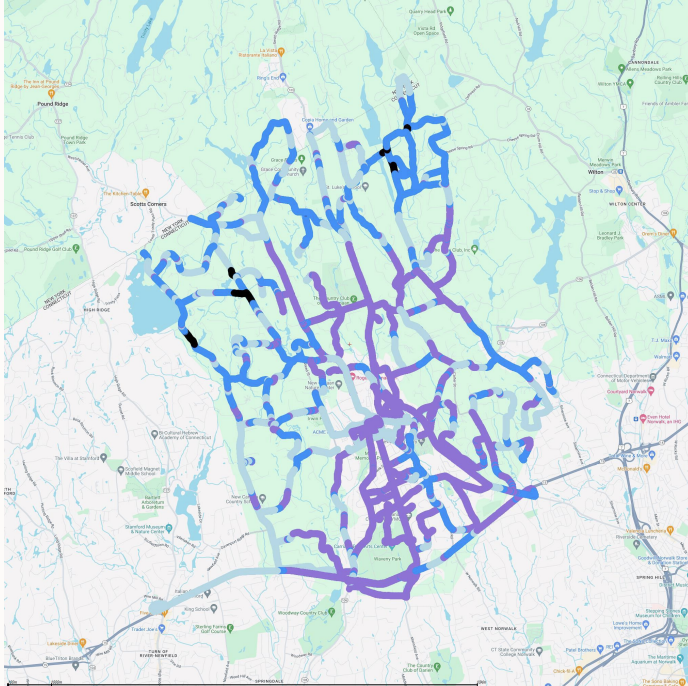
FirstNet Mobile Network Overview

FirstNet device connected to the NR 5G Non-Standalone network for 64% of the drive duration.



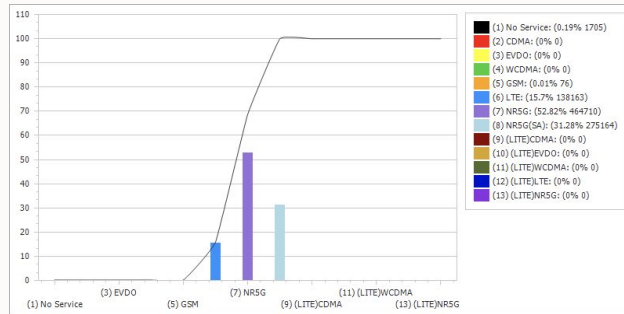
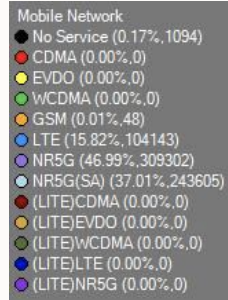
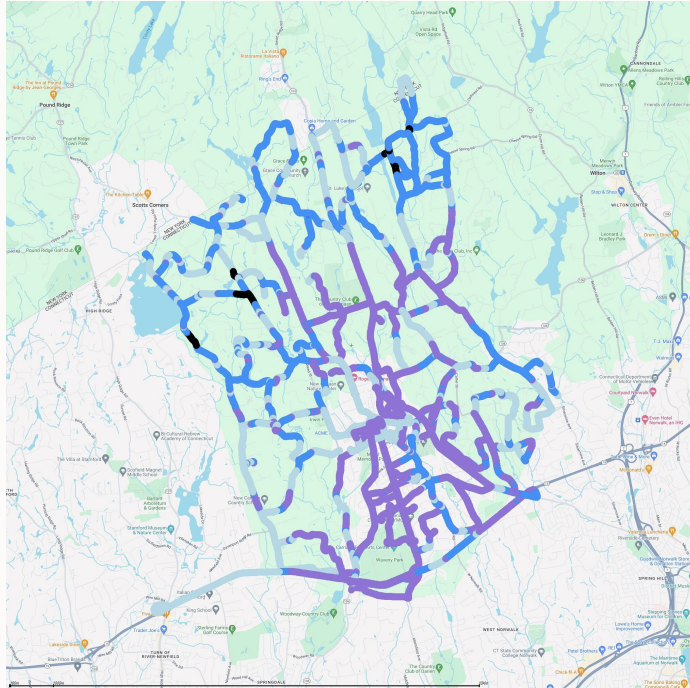
T-Mobile Network Overview

T-Mobile device, on the other hand, connected to both NR 5G Standalone (SA) and Non-Standalone (NSA) networks, representing 83% or more of the drive. NR 5G SA is a complete 5G system that doesn't rely on existing 4G infrastructure.



Verizon Wireless Network Overview

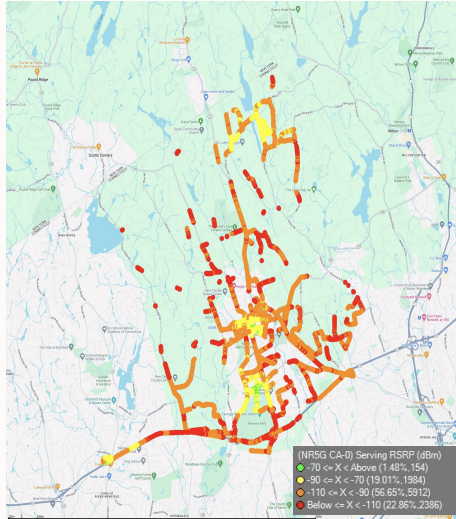
Verizon Wireless device remained connected to 4G LTE for over 70% of the drive test. LTE - Short for Long-Term Evolution, is the 4G technology that provides high-speed mobile data.



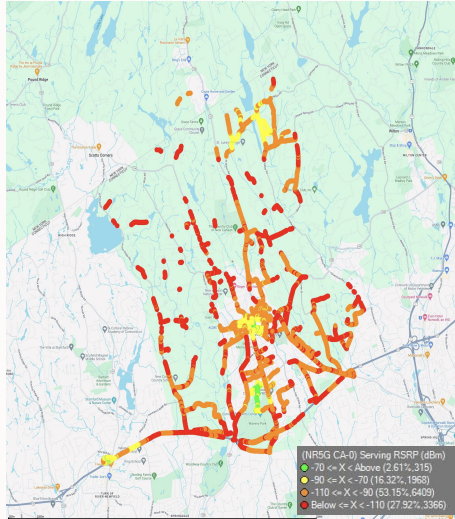
Signal Strength Overview

Signal level is the “loudness” of a signal. Metrics include RSSI, RSRP, NR-RSRP etc., measured in dBm units. The below images display NR 5G RSRP. All the operator devices had average signal strengths between -110 dBm and -90 dBm for over 50% of the drive and experienced lower strengths below -110 dBm for nearly 30% of the drive route.

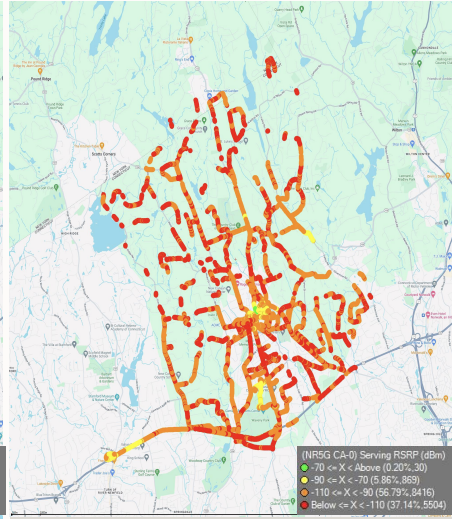
AT&T



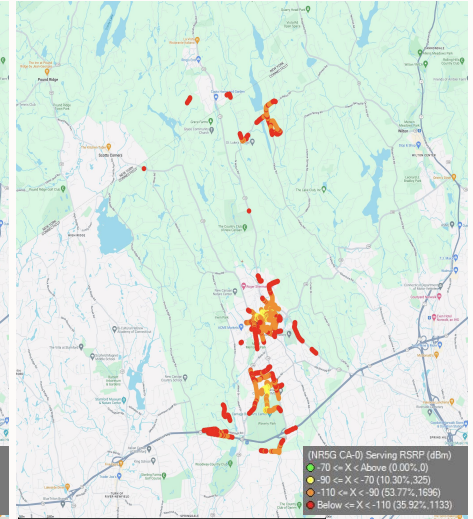
FirstNet



T-Mobile



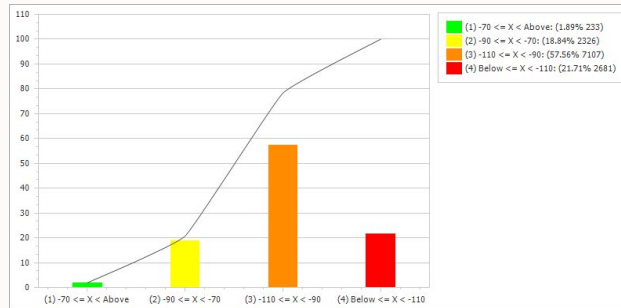
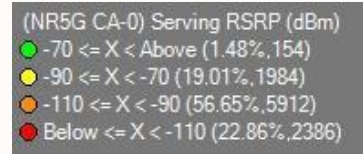
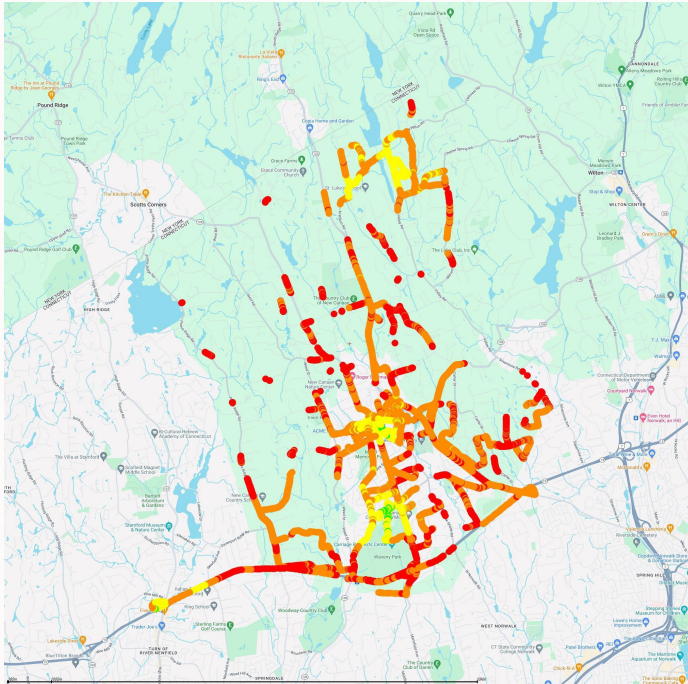
Verizon Wireless



*The maps above originate from the device used for data testing.

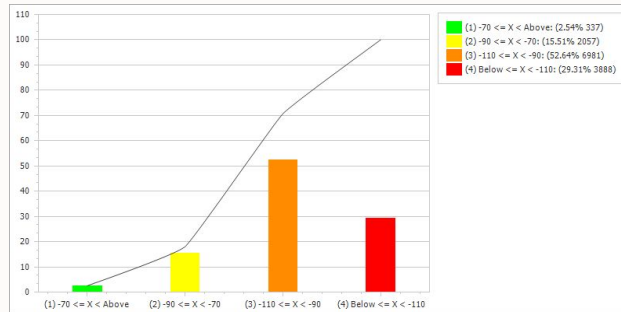
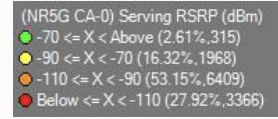
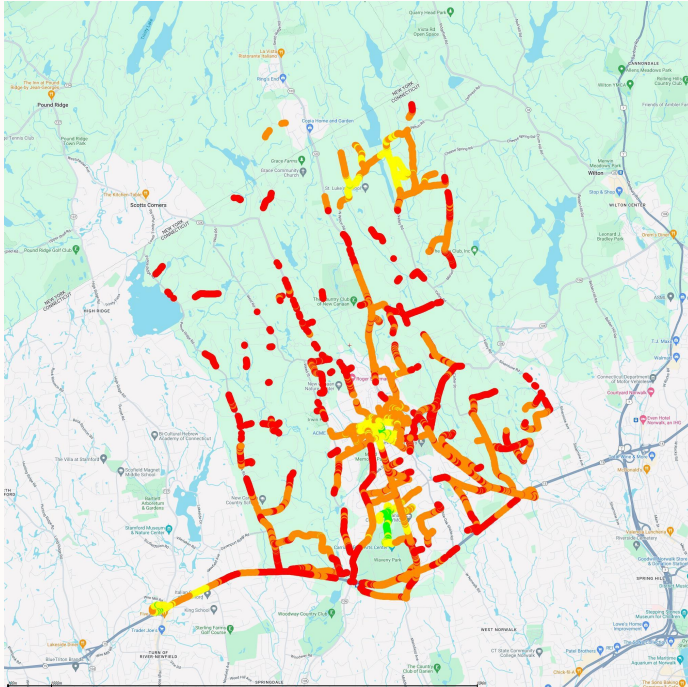
AT&T NR 5G Signal Strength

Device running Speedtest connected to AT&T experienced 22% of the NR 5G RSRP signal strengths below -110 dBm indicating poor signal coverage. In areas with weak NR 5G RSRP, users may struggle to connect to the network or experience frequent signal fluctuations.



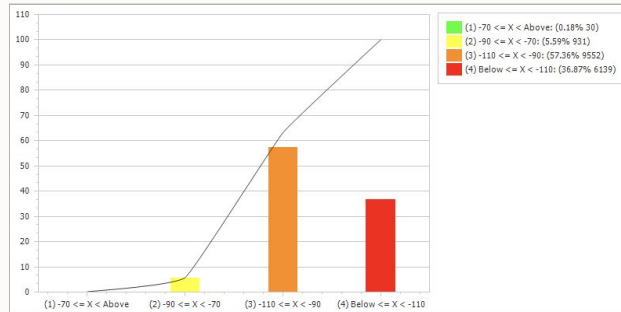
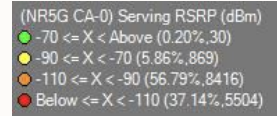
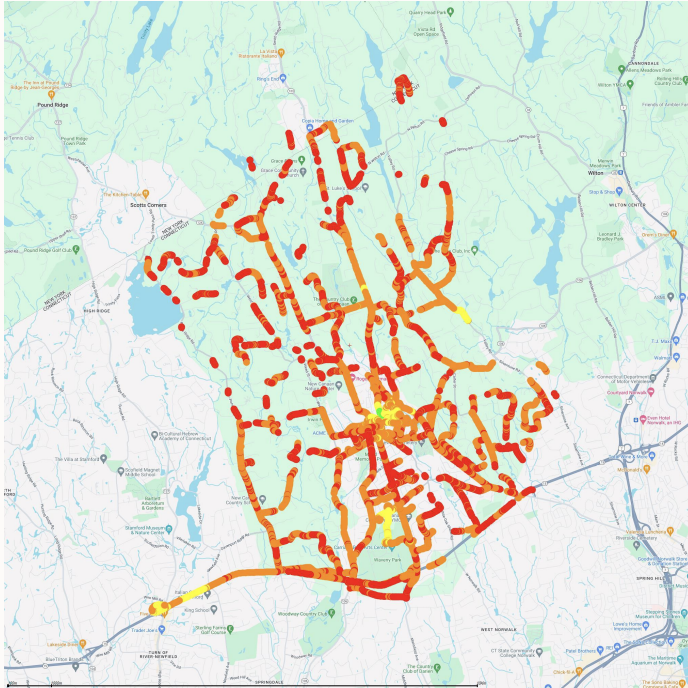
FirstNet NR 5G Signal Strength

During controlled data collection drive, the device connected to FirstNet encountered low NR 5G RSRP signal strengths, with over 81% of the drive route having signal levels below -90 dBm.



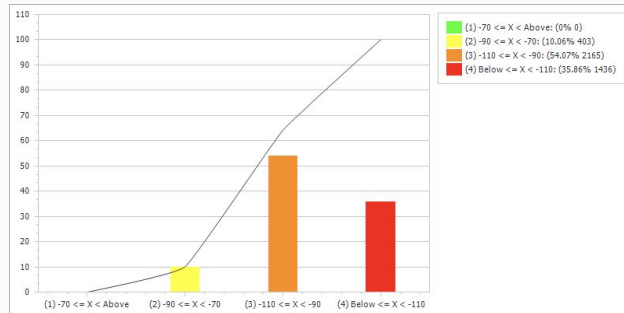
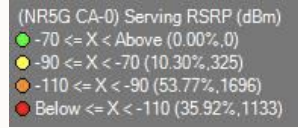
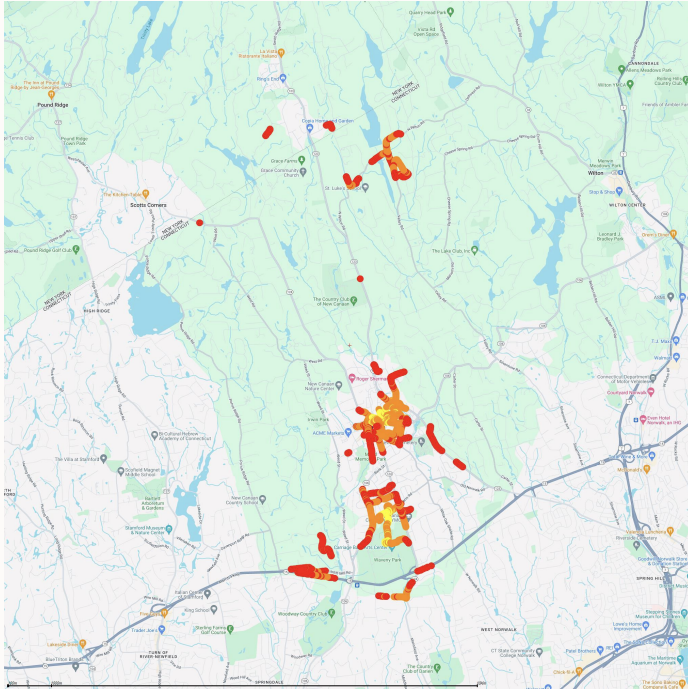
T-Mobile NR 5G Signal Strength

Higher RSRP values indicate a stronger connection to the cell tower. T-Mobile device connecting to NR 5G network for 83% of the drive route experienced NR 5G RSRP signal strengths less than -110dBm for 37% of the drive route.



Verizon NR 5G Signal Strength

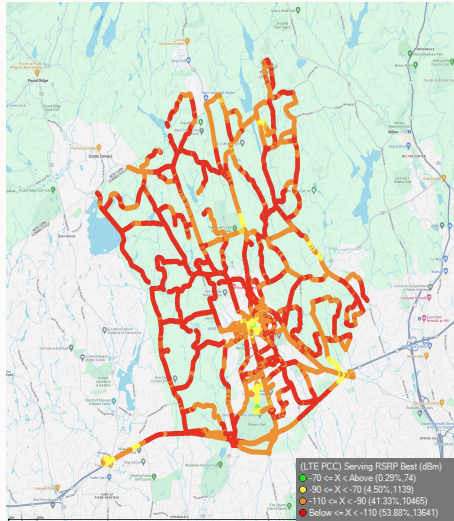
Device connected to Verizon Wireless experienced LTE network for over 70% of the drive route. When the device was connected to NR 5G NSA, it experienced low/poor NR 5G RSRP signal strengths less than -110 dBm for 35% of the drive route.



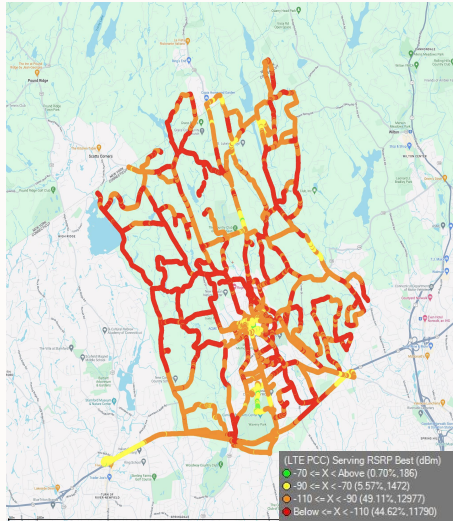
LTE RSRP Overview

All the operator devices experienced lower LTE RSRP strengths below -110 dBm for more than 40% of the drive route when connected to 4G LTE network. If a user experiences consistently low RSRP, it may lead to poor coverage, dropped calls, or slow data speeds.

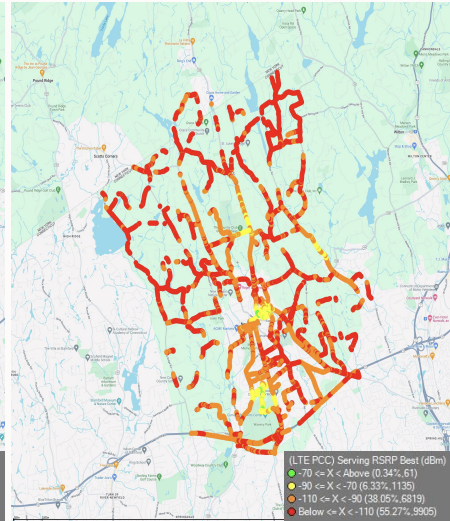
AT&T



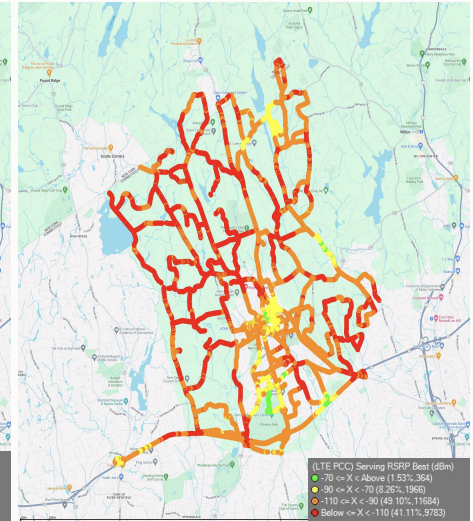
FirstNet



T-Mobile



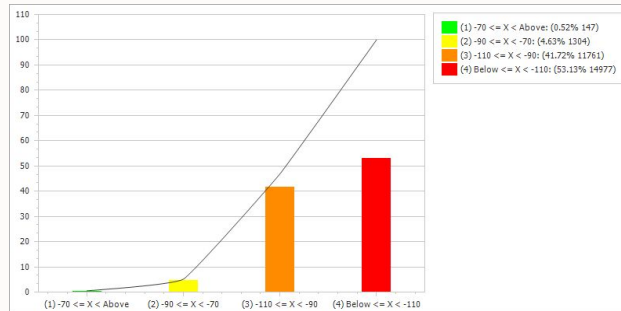
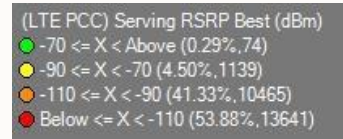
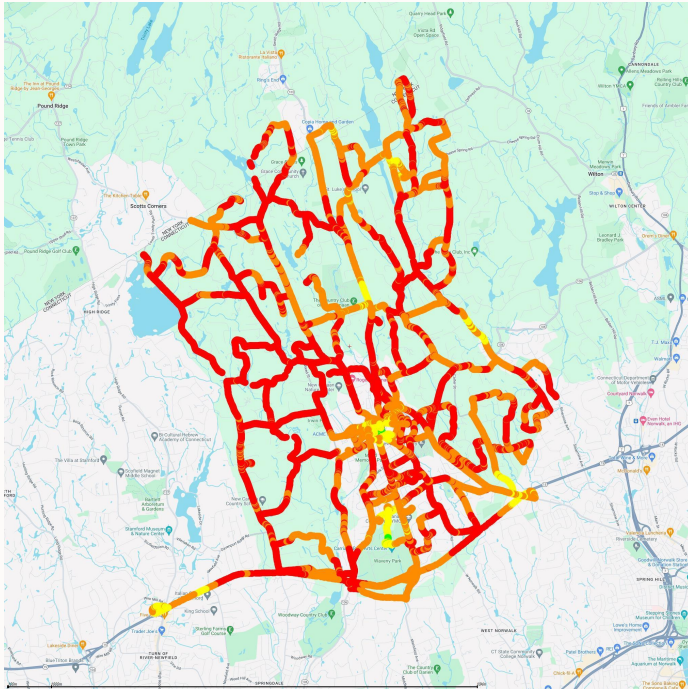
Verizon Wireless



*The maps above originate from the device used for data testing.

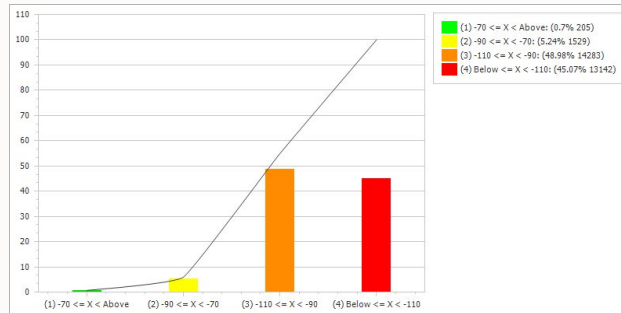
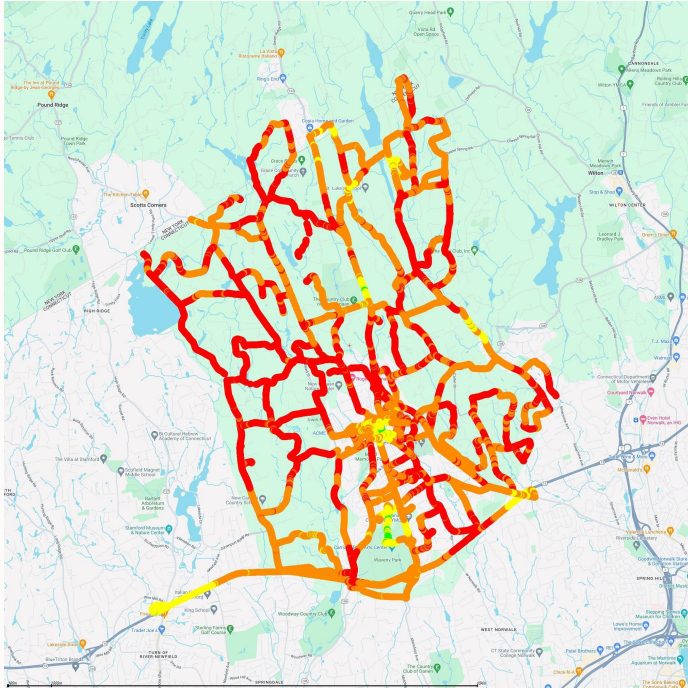
AT&T LTE Signal Strength

Device connected to AT&T experienced lower LTE RSRP strengths below -110 dBm for more than 50% of the drive route when connected to 4G LTE network. Lower RSRP values may lead to issues like dropped calls and/ or slower data rates affecting call continuity and causing interruptions.



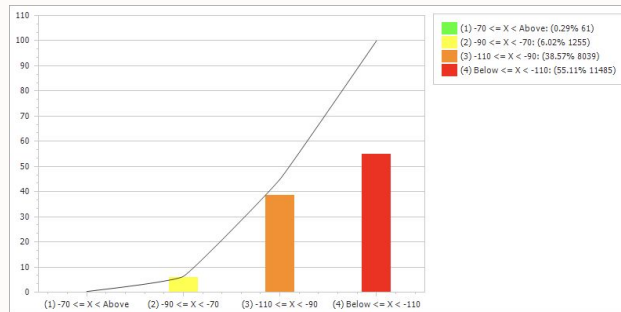
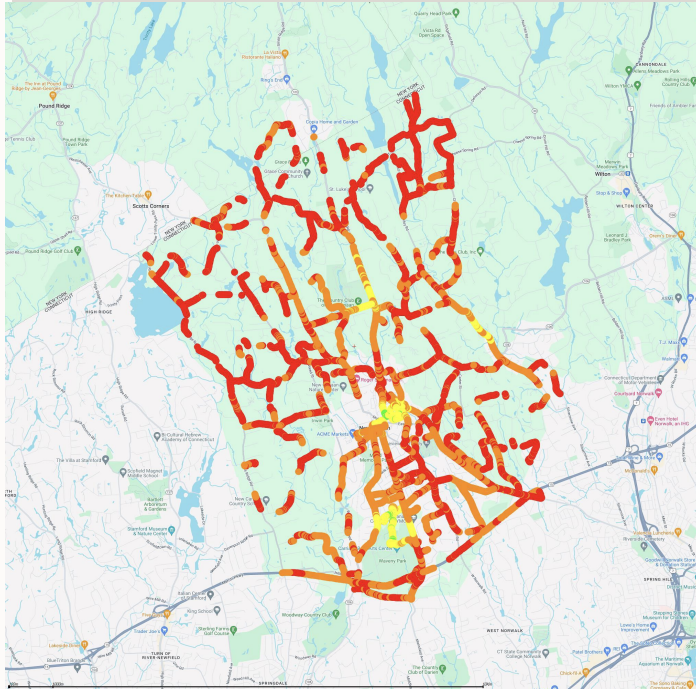
FirstNet LTE Signal Strength

Device connected to FirstNet experienced lower LTE RSRP strengths below -110 dBm for more than 40% of the drive route when connected to 4G LTE network. Low RSRP values often result in reduced coverage areas. Users in these areas may experience signal dropouts or poor call quality.



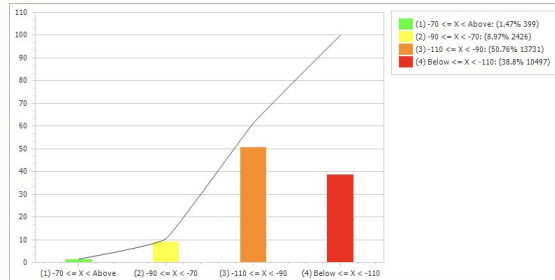
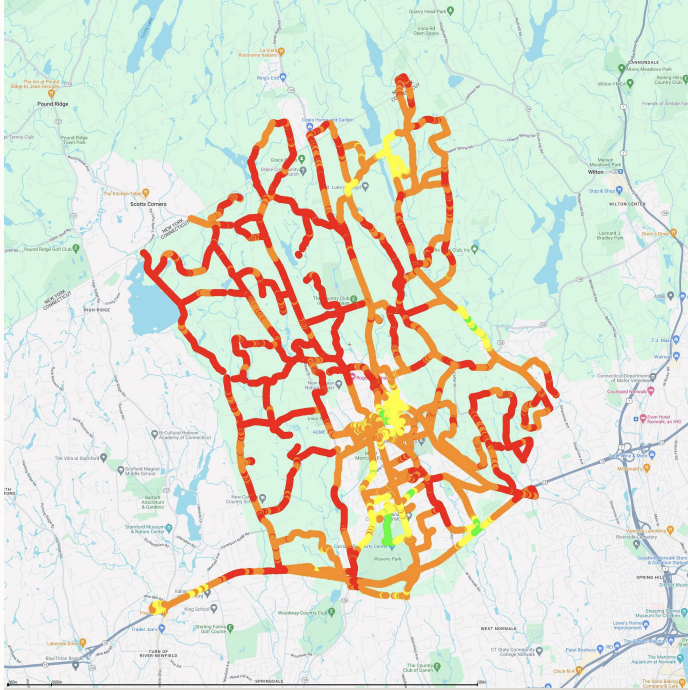
T-Mobile LTE Signal Strength

Device connected to T-Mobile experienced LTE RSRP signal strengths lower than -110 dBm for over 50% of the drive test. Users may experience high latency due to weak RSRP when using real-time applications like video calls, video streaming etc.,.



Verizon LTE Signal Strength

Device connected to Verizon Wireless remained connected to 4G LTE for over 70% of the drive test. It observed weak signal strengths below -110 dBm for a little over 41% of the drive route.



Data and Voice Test Performance Summary

The following slides present the Speedtest Data and Voice call performance. The performance is depicted by events such as Success, Drop, Setup Fail etc.

Understanding Call Events



Call Event	Applies to	Description
Success	All Test Scenarios	A “Success” event is reported when a test scenario session ends successfully without any issues for the specified Traffic Time in the set-up of the test scenario.
Setup fail	All Test Scenarios	A “Set-up Fail” event is reported when a test scenario session is unable to be set-up due to lack of radio bearer (resources) or poor coverage issues.
T-Setup fail	Data Test Scenarios	T-Setup Fail expands to Traffic Setup Fail. A “T-Setup Fail” event is reported when a data test scenario such as Speedtests,, are being run but the end-point specified for access in the test scenario set-up is inaccessible or log-in fail occurs. The inaccessibility can occur during data test scenarios when there is a test setup issue either due to network delay or server response issues.
Drop	All Test Scenarios	A “Drop” event is reported when a Voice call or Data session drops due to an abrupt network disruption issue resulting in the call or session not running through the specified Traffic Time duration in the set-up of the test scenario.
Timeout	Data Test Scenarios	A “Timeout” is reported when a Data session does not complete with-in the specified Traffic Time duration in the set-up of the test scenario. For example, a Timeout is reported when a 2GB file does not complete downloading via data test scenario with-in 60 seconds of Traffic Time.
End by user	All Test Scenarios	An “End by User” is reported when any Test Scenario is ended by the user after it has completed the Idle Time specified in the set-up of the test scenario.

Speedtest Performance Summary

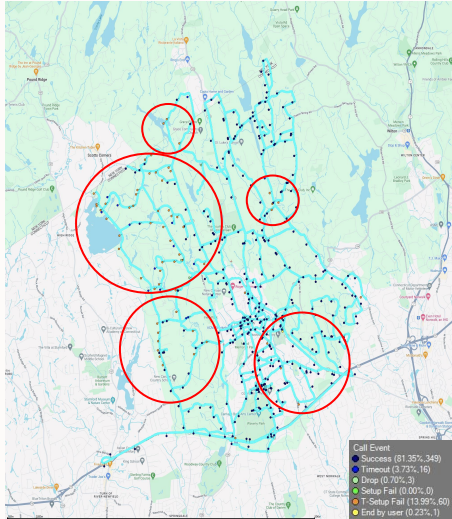
Please note that Ookla's "Speedtest", a world-renowned methodology for testing internet speed was used. The test device made repeated "data calls", each time running Speedtest on the device. Below metrics reflect the results obtained during June 11,2024 - June 13,2024 controlled testing and should not be interpreted as a comprehensive assessment of network capability.

	AT&T	FirstNet	T-Mobile	Verizon
Total Attempts	543	523	551	530
Success	400	458	429	281
Timeout	20	8	21	42
Drop	5	2	18	4
T-Setup Fail	74	35	71	196
End by User	4	4	5	6

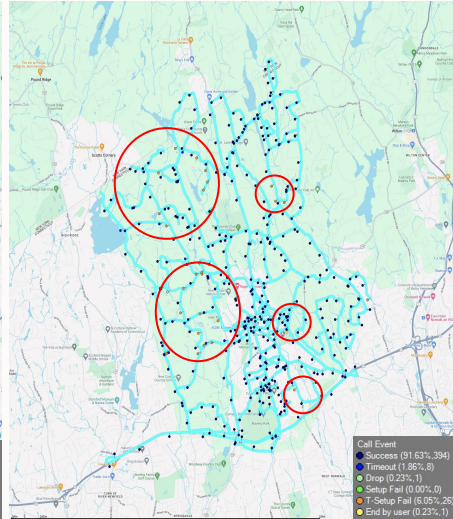
Speedtest Events

Speedtest, a data test scenario, was configured with a maximum traffic duration of 60 seconds. During the time the device performs a Ping test to select the closest available server capturing Jitter and Latency and subsequently performs a download test followed by an upload test. All operator devices experienced drops, set-up failures and timeouts, as indicated in the red-circled regions.

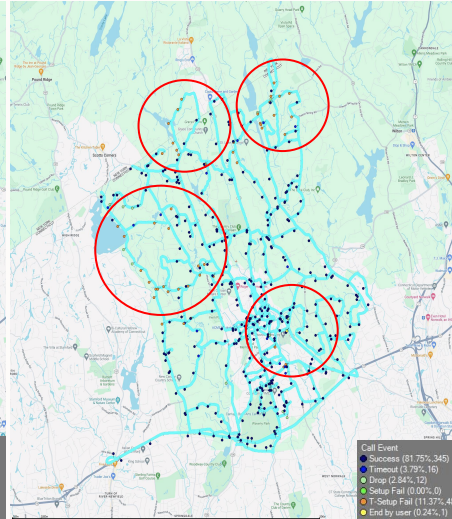
AT&T



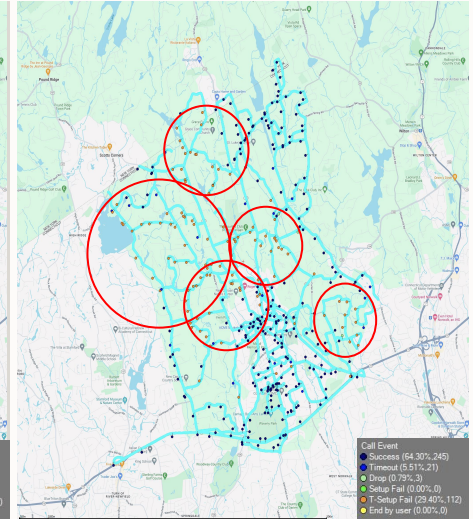
FirstNet



T-Mobile



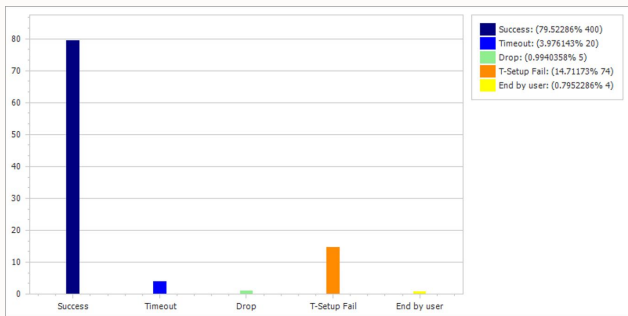
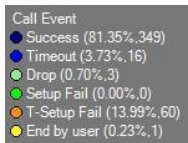
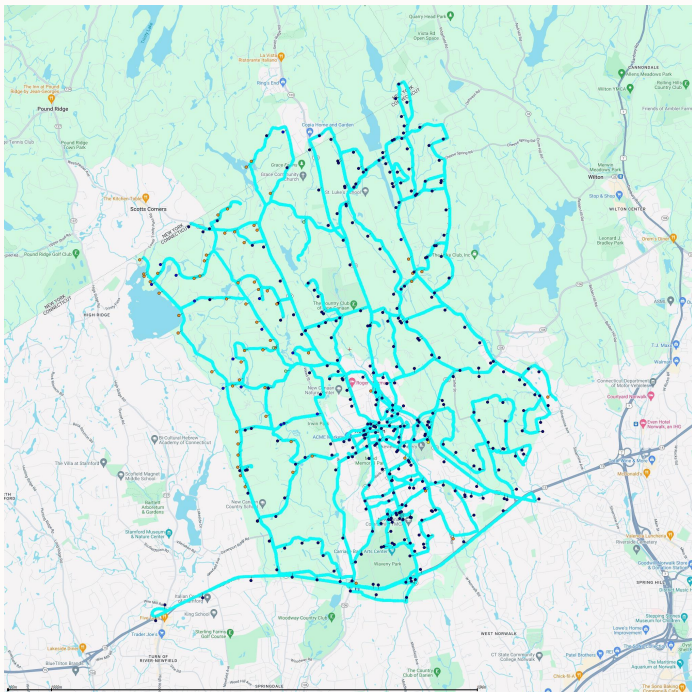
Verizon Wireless



*The maps above originate from the device used for data testing.

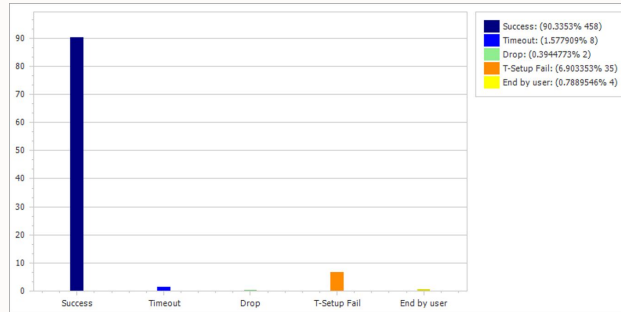
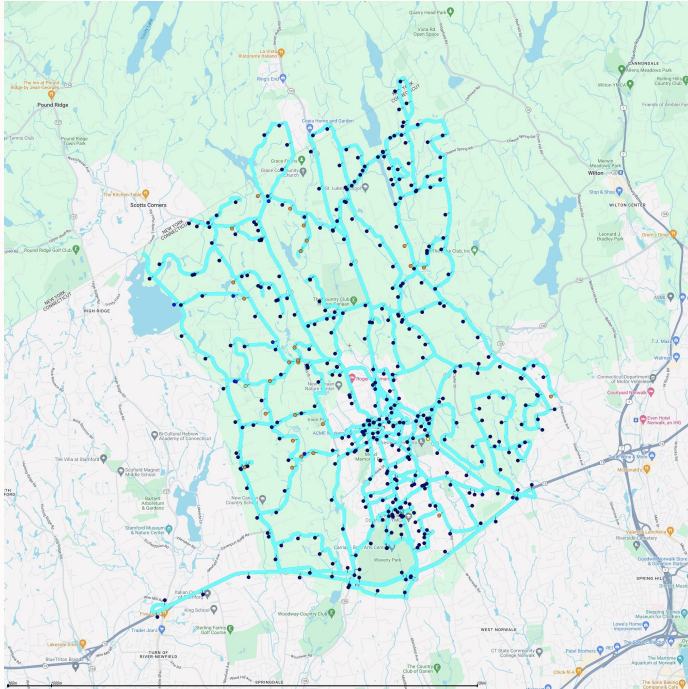
AT&T Speedtest Events

AT&T device initiated Speedtest events completed successfully over 80% of the drive test. However, the device experienced 70 Set-up Fail, 5 Drop and 20 Timeout events.



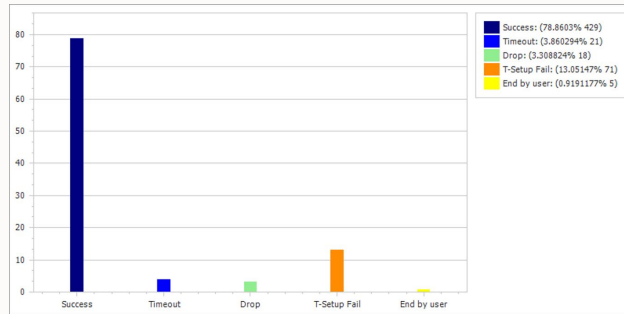
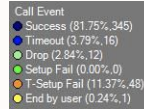
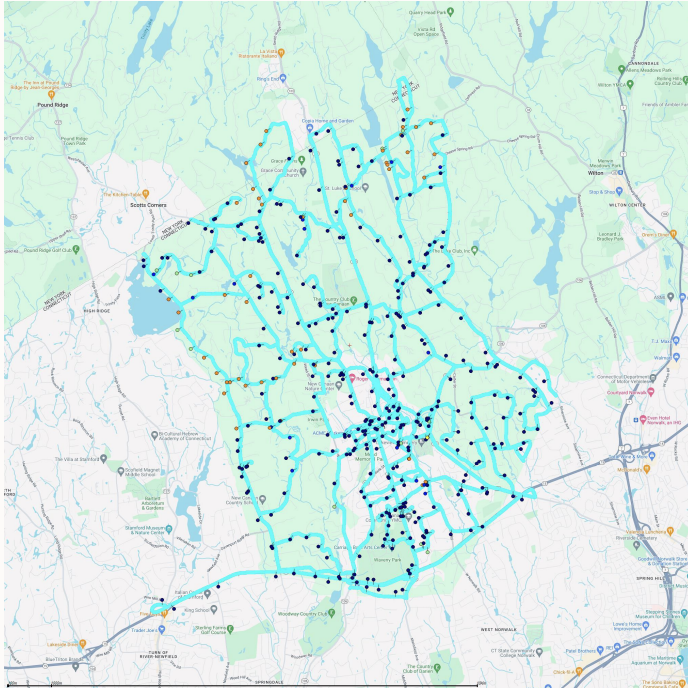
FirstNet Speedtest Events

Firstnet device initiated Speedtest events completed successfully over 90% of the drive test. However, the device experienced 35 Set-up Fail, 2 Drop and 8 Timeout events.



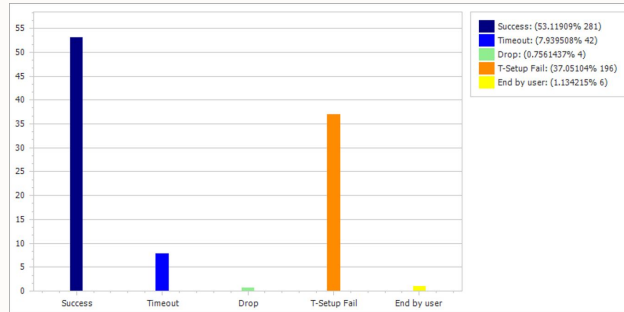
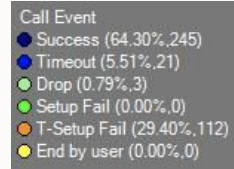
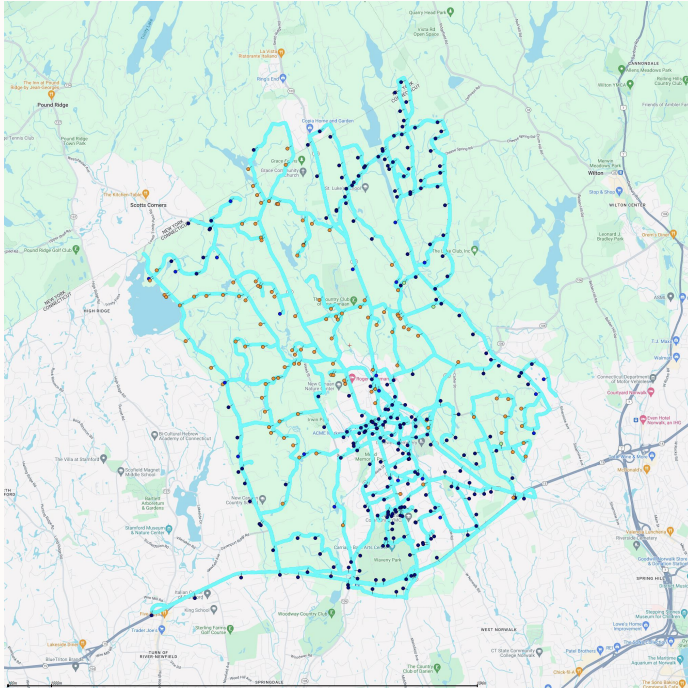
T-Mobile Speedtest Events

T-Mobile device initiated Speedtest events completed successfully over 80% of the drive test. However, the devices experienced 71 Set-up Fail, 18 Drop and 21 Timeout events.



Verizon Wireless Speedtest Events

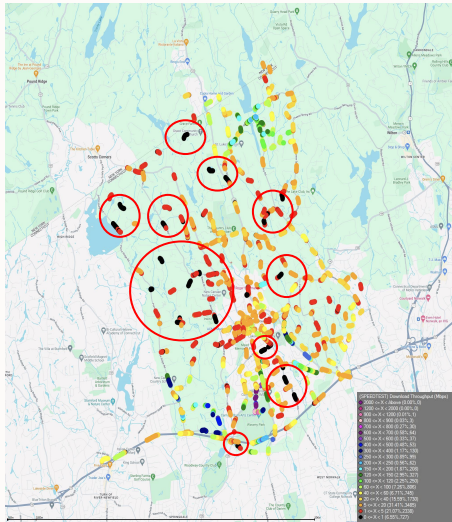
Verizon Wireless device initiated Speedtest events completed only 64% of the tests successfully. The device experienced 196 Set-up Fail, 4 Drop and 42 Timeout events.



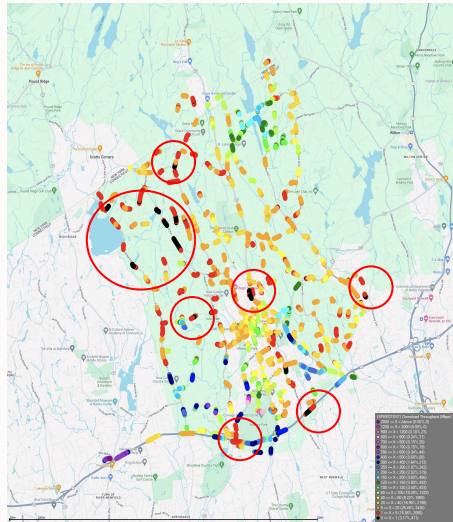
Speedtest Download Speeds

Download speed refers to how quickly data is transferred from the internet to mobile device (e.g., downloading files, streaming videos, loading web pages). A high download speed ensures a seamless experience for users, especially when consuming media or accessing large files. Slow download speeds can result in frustrating delays, buffering, and poor-quality video streaming.

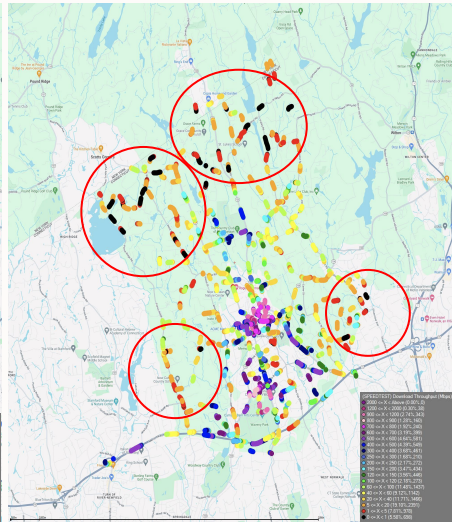
AT&T



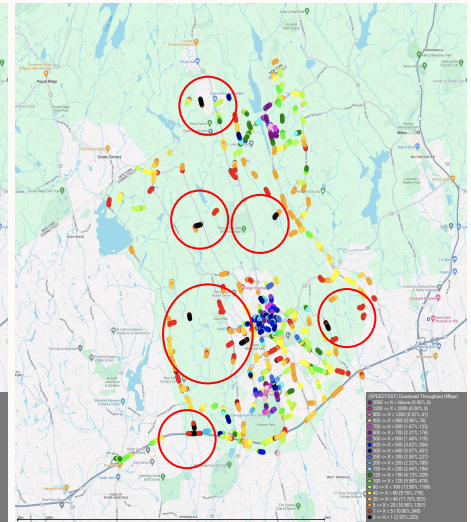
FirstNet



T-Mobile



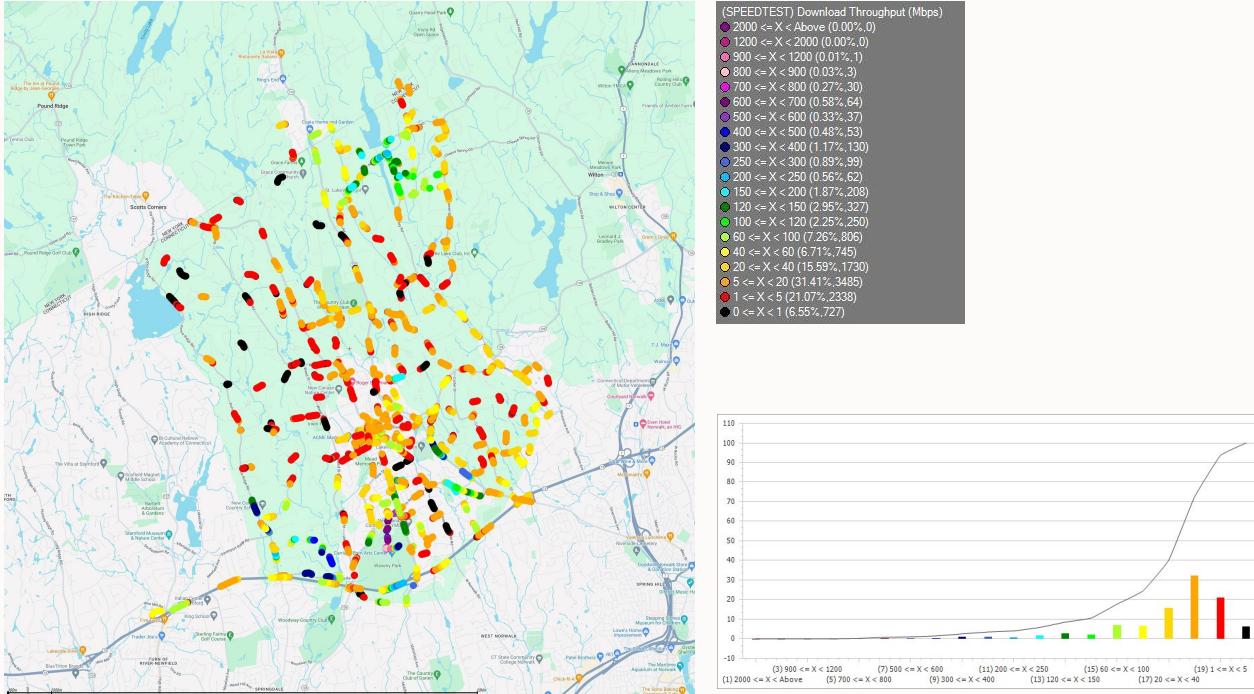
Verizon Wireless



*The maps above originate from the device used for data testing.

AT&T - Download Speed (Speedtest)

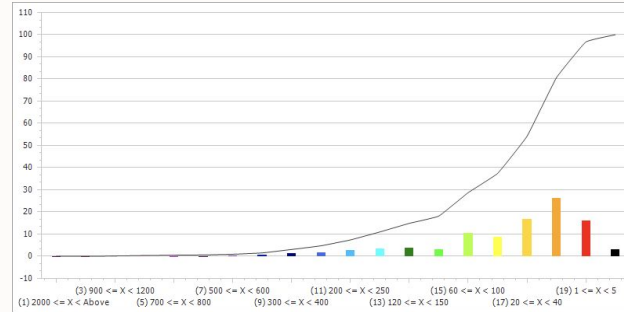
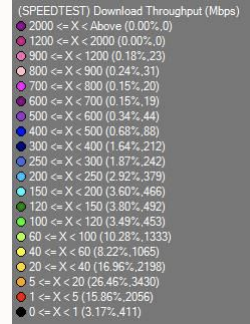
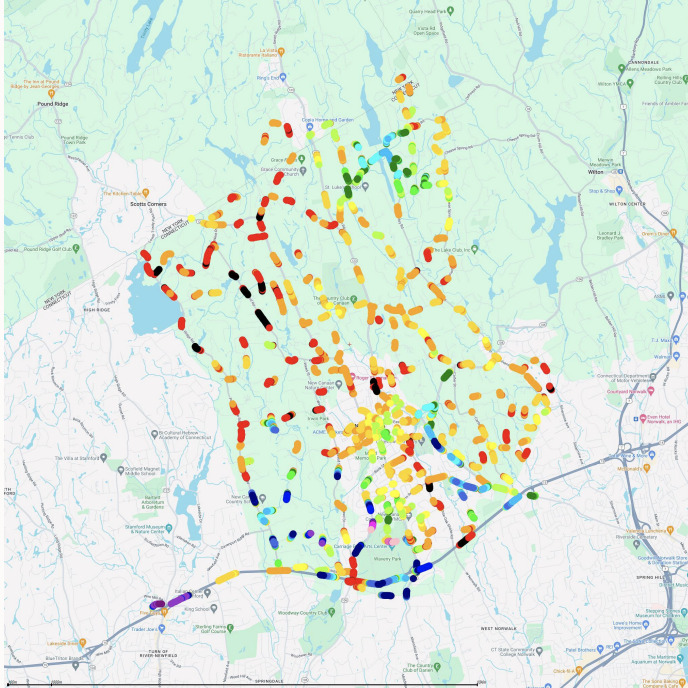
The FCC defined a 35 Mbps threshold for mobile downlink speeds. The AT&T connected device experienced 62% of download speeds below 40 Mbps.



*The map and bar chart above originate from the device used for data testing. It's important to recognize that variations may exist between the GPS-based map plot and the aggregated data presented in the bar chart.

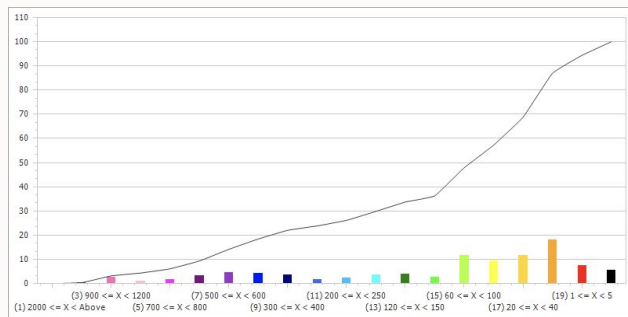
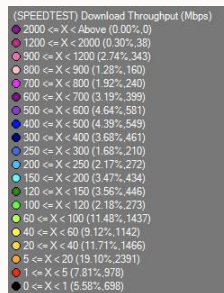
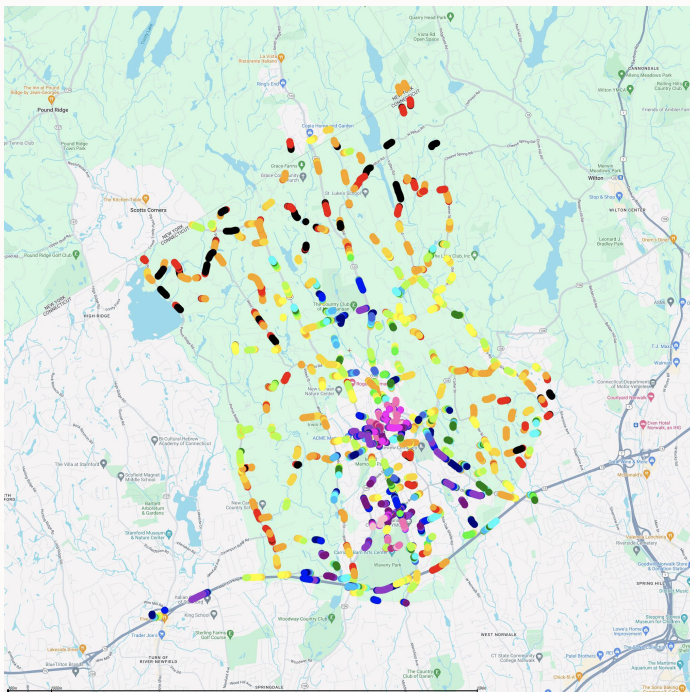
FirstNet - Download Speed (Speedtest)

The FirstNet connected device experienced 44.2% of download speeds below 40 Mbps.



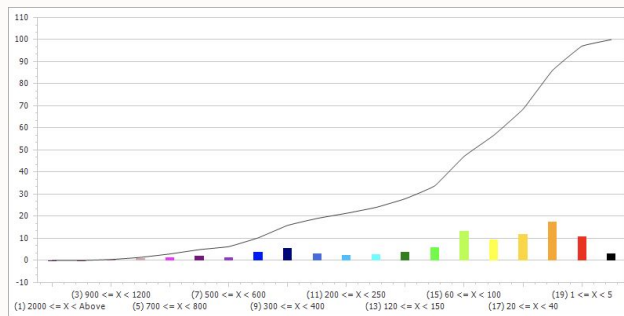
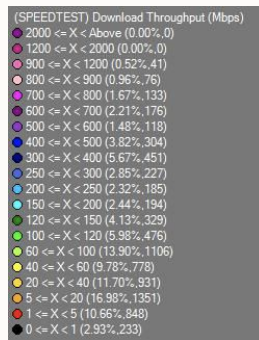
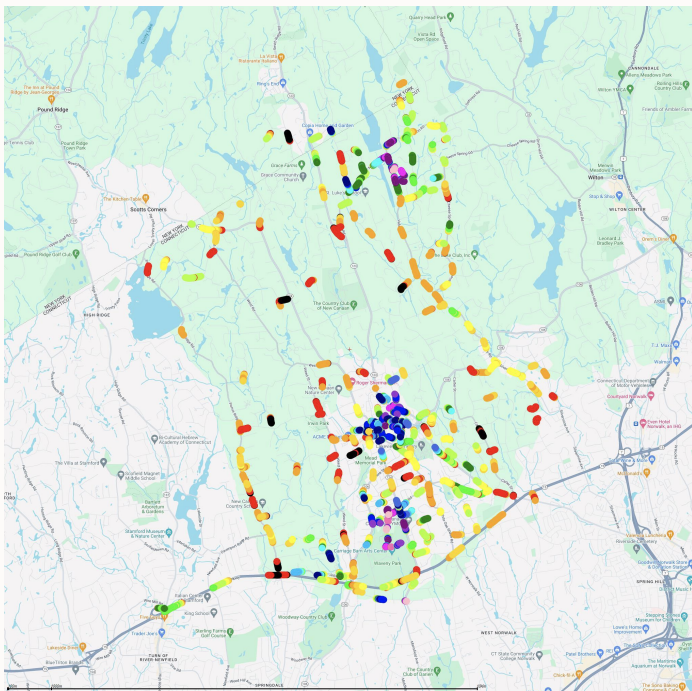
T-Mobile - Download Speed (Speedtest)

The T-Mobile connected device experienced 53% of download speeds below 40 Mbps.



Verizon - Download Speed (Speedtest)

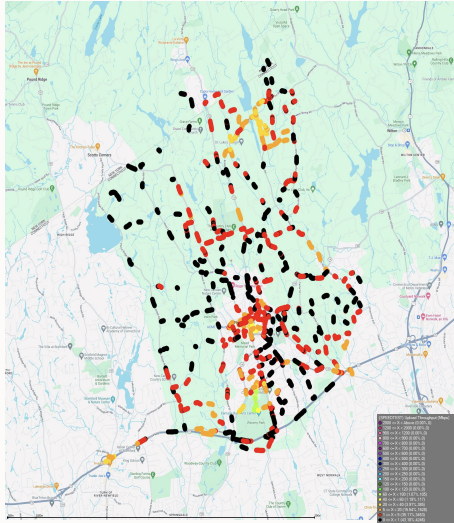
The Verizon Wireless operator device experienced 42% of download speeds below 40 Mbps.



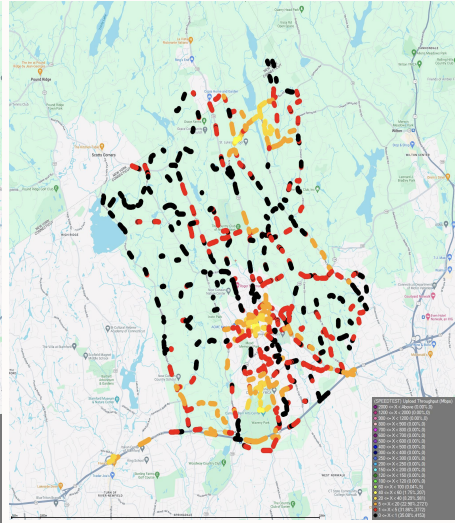
Speedtest Upload Speeds

Upload speed measures how fast data is sent from a device to the internet (e.g., uploading photos, videos, or sharing files). Low upload speeds can lead to delays in sending files, poor video call quality and customer experience.

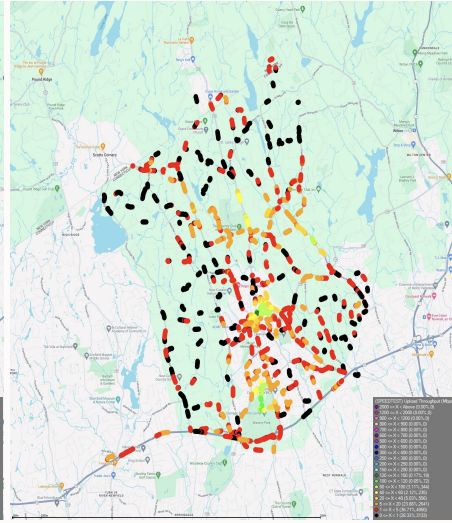
AT&T



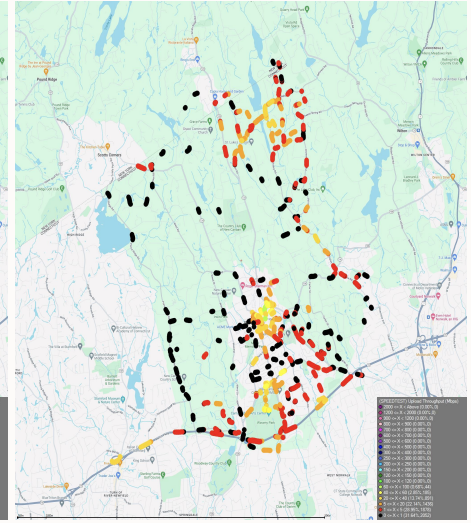
FirstNet



T-Mobile



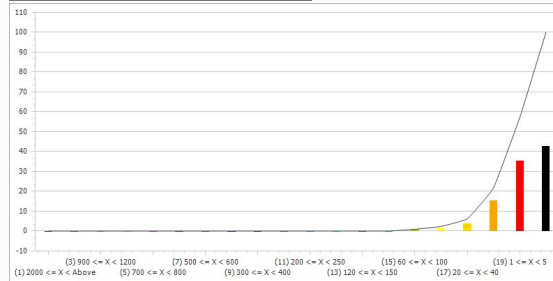
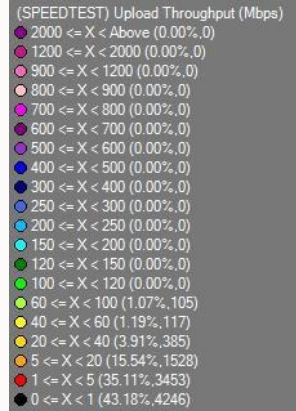
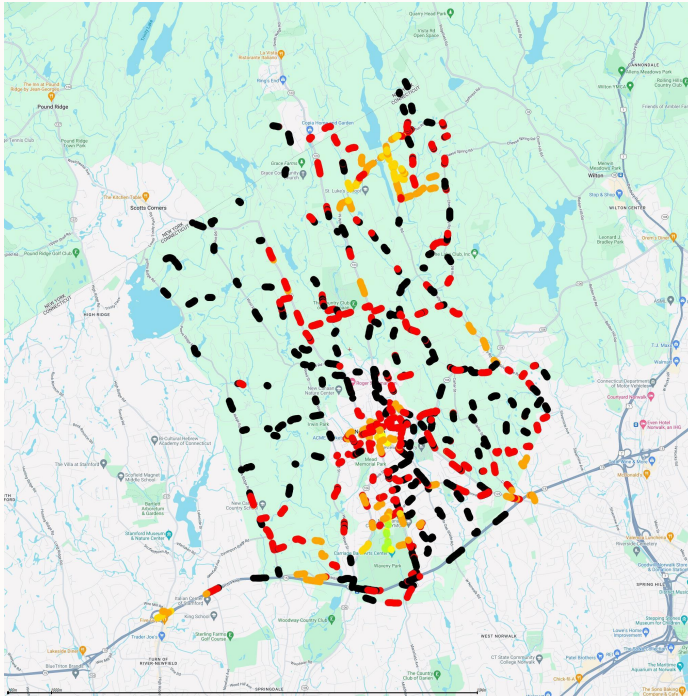
Verizon Wireless



*The maps above originate from the device used for data testing.

AT&T - Upload Speed (Speedtest)

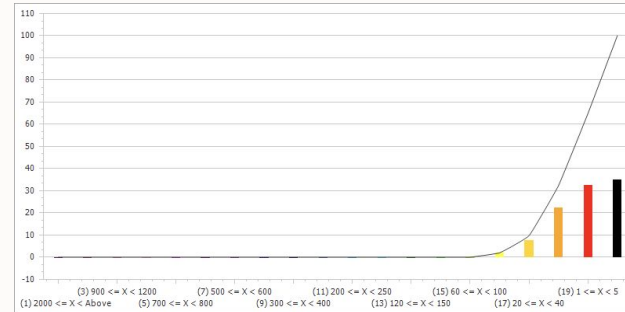
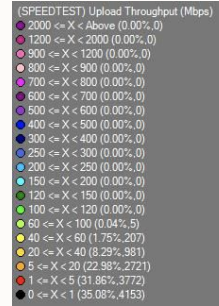
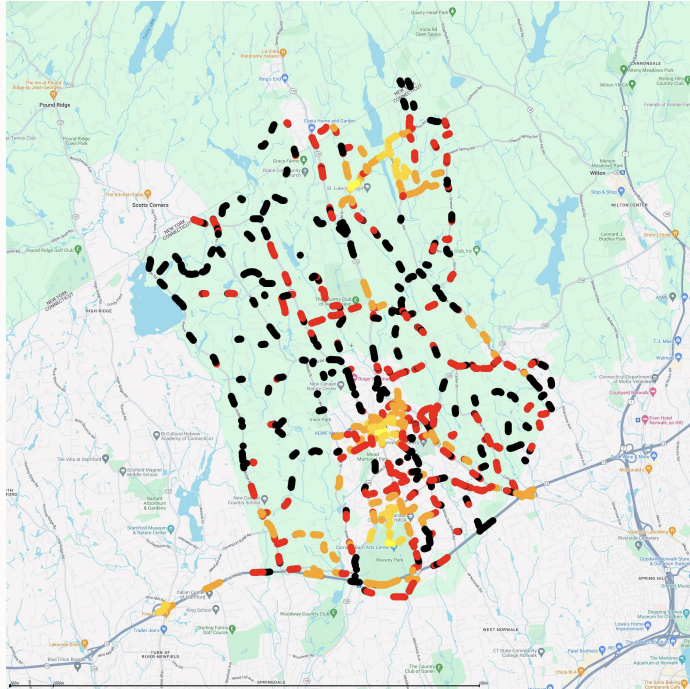
FCC defines upload speeds with a threshold of 3 Mbps. AT&T Speedtest running device observed 78.29% of upload speeds below 5 Mbps.



*The map and bar chart above originate from the device used for data testing. It's important to recognize that variations may exist between the GPS-based map plot and the aggregated data presented in the bar chart.

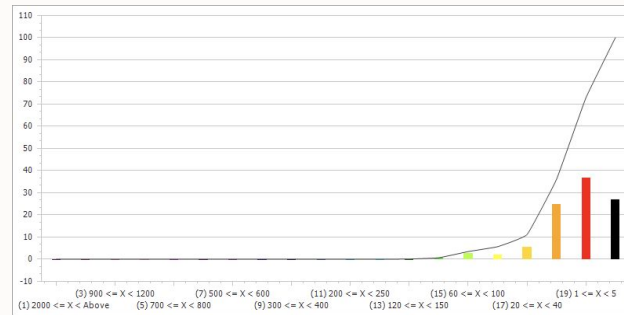
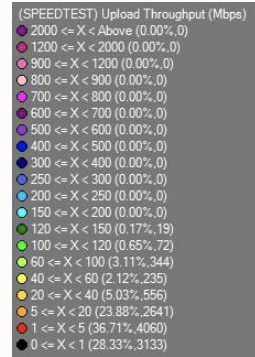
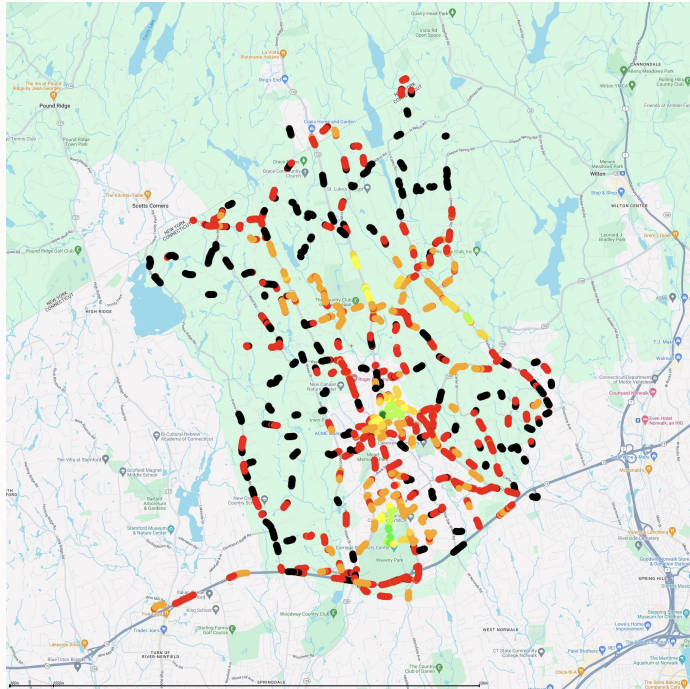
FirstNet - Upload Speed (Speedtest)

Device with FirstNet connectivity observed 66.94% of upload speeds below 5 Mbps.



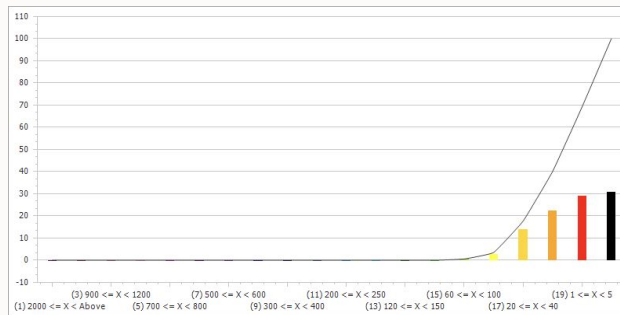
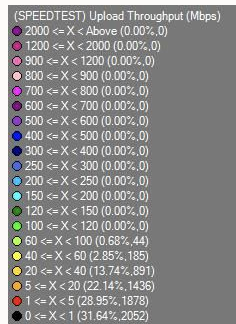
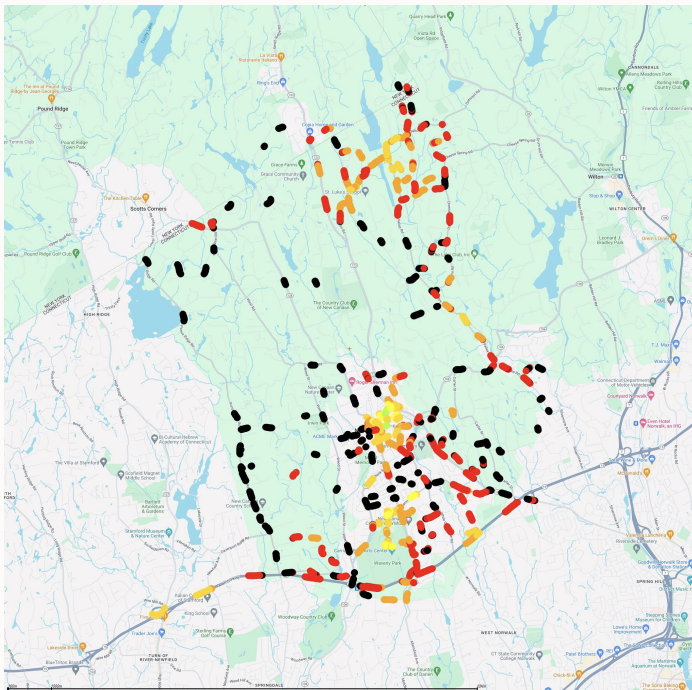
T-Mobile - Upload Speed (Speedtest)

T-Mobile Speedtest running device observed 65.04% of upload speeds below 5 Mbps.



Verizon - Upload Speed (Speedtest)

Verizon Wireless Speedtest running device experienced 60.59% of upload speeds below 5 Mbps.



Voice Call Performance Summary

VoLTE (Voice over Long-Term Evolution) is an LTE communication standard that enables voice calls using mobile phones and data terminals. VoLTE provides up to three times more voice and data capacity than older 3G UMTS and up to six times more than 2G GSM.

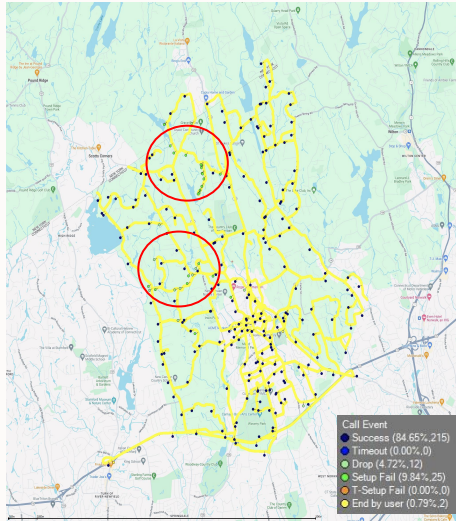
Please note that the test device made repeated “voice calls” by calling a test number during the drive. Below metrics are based on the results of those tests:

Call Event	AT&T	FirstNet	T-Mobile	Verizon
Total Attempts	325	343	373	352
Success	263	247	235	255
Drop	13	15	22	10
Setup Fail	44	75	110	82
End by User	5	6	6	5

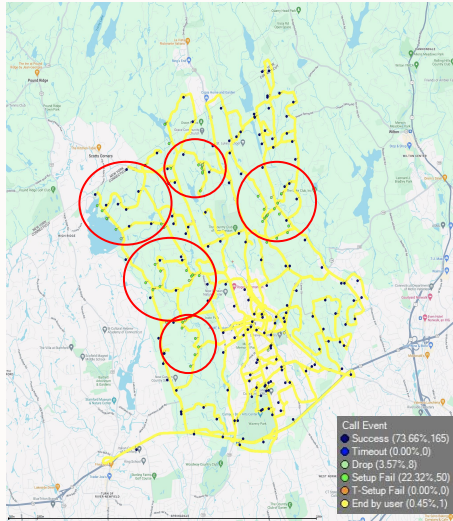
Voice Call Events

Good performance of Voice call experience is essential for personal conversations, business meetings, and customer support. All operator devices experienced drops, set-up failures and timeouts, as indicated in the red-circled regions.

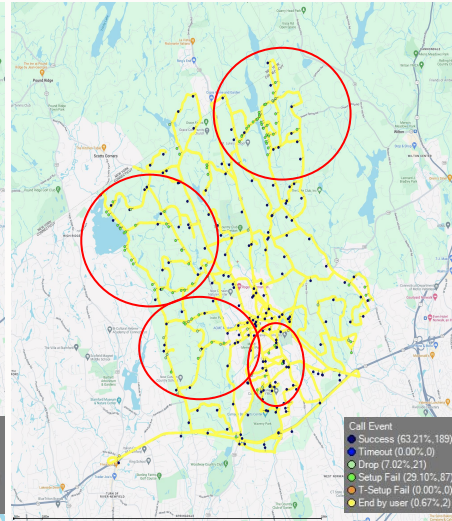
AT&T



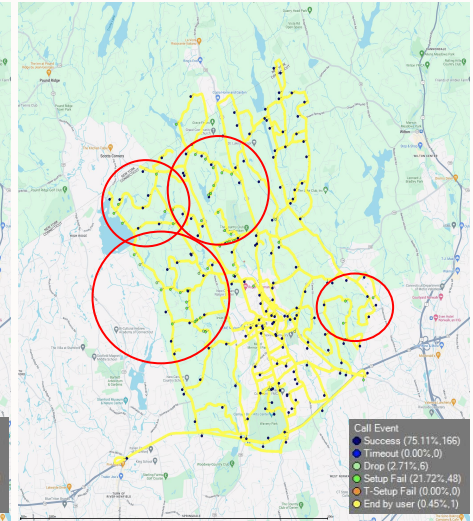
FirstNet



T-Mobile



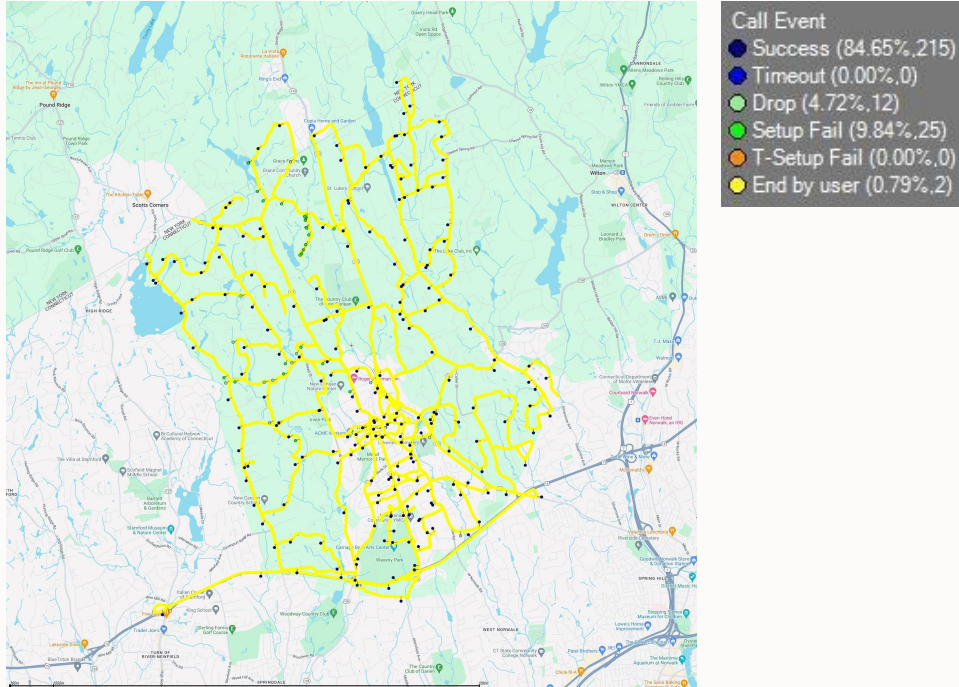
Verizon Wireless



*The maps above originate from the device used for voice call testing.

AT&T - Voice Call Events

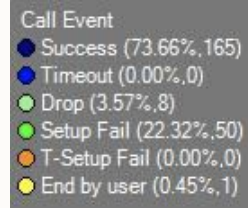
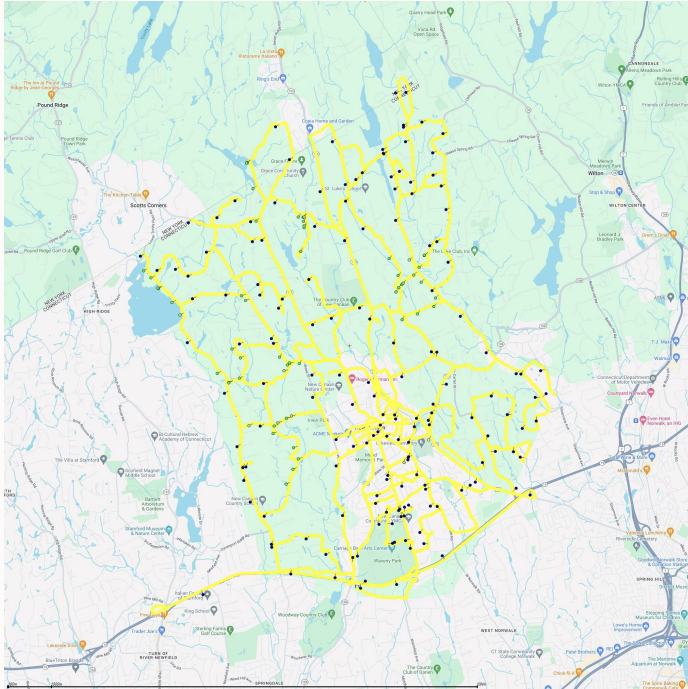
AT&T Voice call device experienced over 4% of drops and 9% of setup fails.



*The map above originates from the device used for voice call testing.

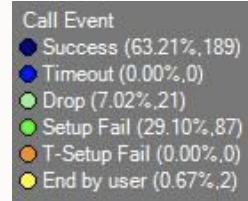
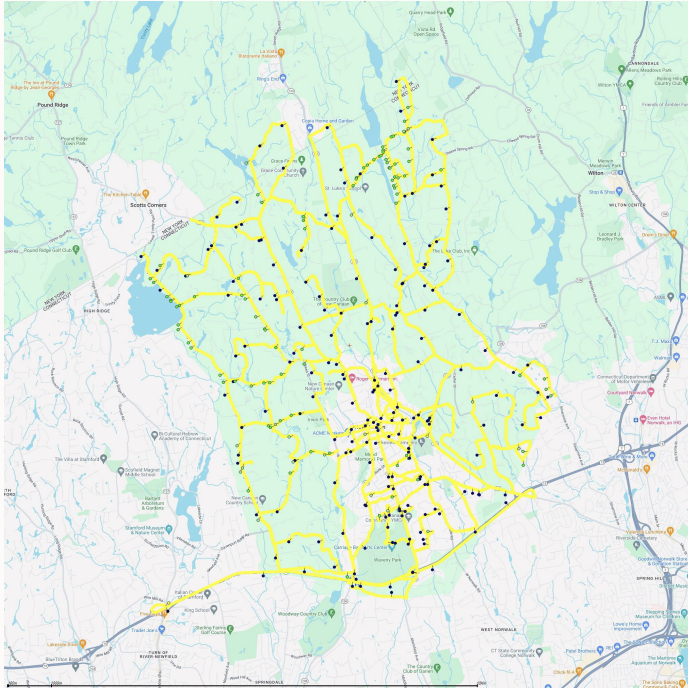
FirstNet - Voice Call Events

Firstnet device experienced close to 4% of call drops and 22% of setup fails.



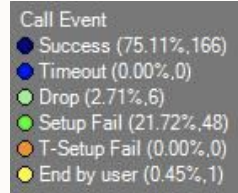
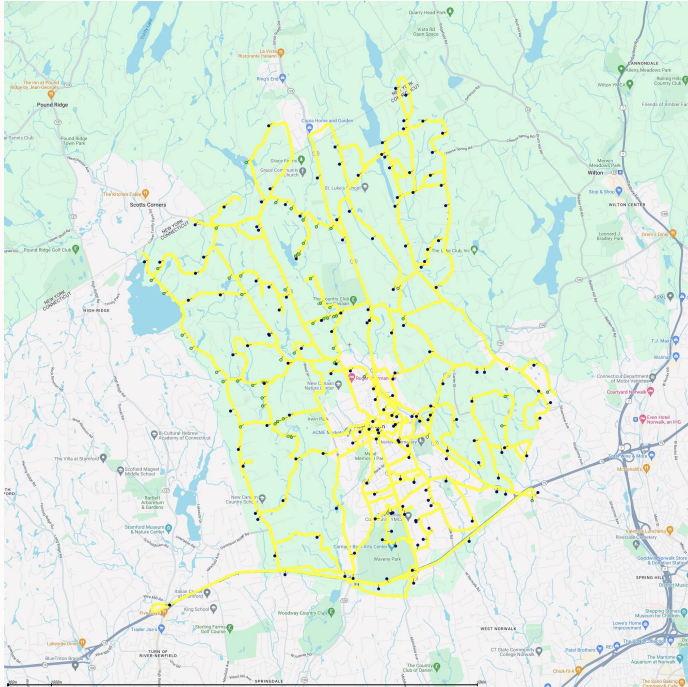
T-Mobile - Voice Call Events

T-Mobile device had the high number of drops and setup fail results with only 63% of the calls completing successfully.



Verizon Wireless - Voice Call Events

Verizon Wireless Voice call device experienced close to 3% of call drops and 22% of setup fails.



How Ookla Can Help You

Ookla offers complimentary datasets that provide a comprehensive assessment of your Fixed and Mobile Network Performance with customized solutions for every stage of your network lifecycle.

- **Identify** underserved areas that could benefit from increased coverage or connectivity performance
- **Prioritize** where to distribute funding in order to enhance connectivity and bridge the digital divide
- **Monitor** funded areas to see improvements in performance and ensure compliance with regulatory requirements
- **See** where mobile connectivity can be improved to fill coverage gaps, especially in rural areas where fixed broadband connectivity is not possible
- **Gather** mobile connectivity information to support IoT use cases and build smart cities
- **Perform** state- or city- wide drive tests to capture controlled coverage and performance metrics

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