भादूविप्रा
TRAI

TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Mumbai LSA

September 2026

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1. Introduction

TRAI Act, 1997 mandates the Authority to ensure the services delivered through various telecommunications networks meet the required quality standards prescribed, to protect the interest of the consumers of telecommunication services. TRAI is also responsible for conducting the periodical audit of such services provided by the service providers so as to protect the interests of the consumers of telecommunications services.

Accordingly, TRAI has engaged M/s RedMango Analytics Pvt. Ltd. to undertake assessment of Quality of Service of mobile service through Independent Drive Test (IDT).

In IDT, the performance of all service providers providing service in a Licensed Service Area (LSA) through various technologies (like 2G/ 3G/ 4G/ 5G) for voice and data are measured by conducting drive test. The drive test routes are finalised based on various objective criteria like reported network performance, consumer complaints etc. Methodology adopted for conducting IDT is elaborated in **APPENDIX-I**.

2. Executive Summary (LSA)

2.1 Drive test details

This report covers the findings of the IDT undertaken in Mumbai License Service Area (LSA) during the month of September-2026 under the supervision of TRAI Regional Office (RO) Bengaluru. Details of route/area covered during the IDT are as given below:

S. No	Drive test route	Type of route	Distance covered (KMs)	From date	To date
1	Mumbai	City	212.6	23-Sep-2026	25-Sep-2026
2	Mumbai	Inter Operator Calling	1 Location	25-Sep-2026	25-Sep-2026
3	Mumbai	Hotspot	7 Locations	23-Sep-2026	25-Sep-2026

Table-1: Drive test summary.

2.2 Drive test routes

The map provides overview of drive test routes indicating city drive, Inter-operator calls test and hotspots as per the legends shown on the map.

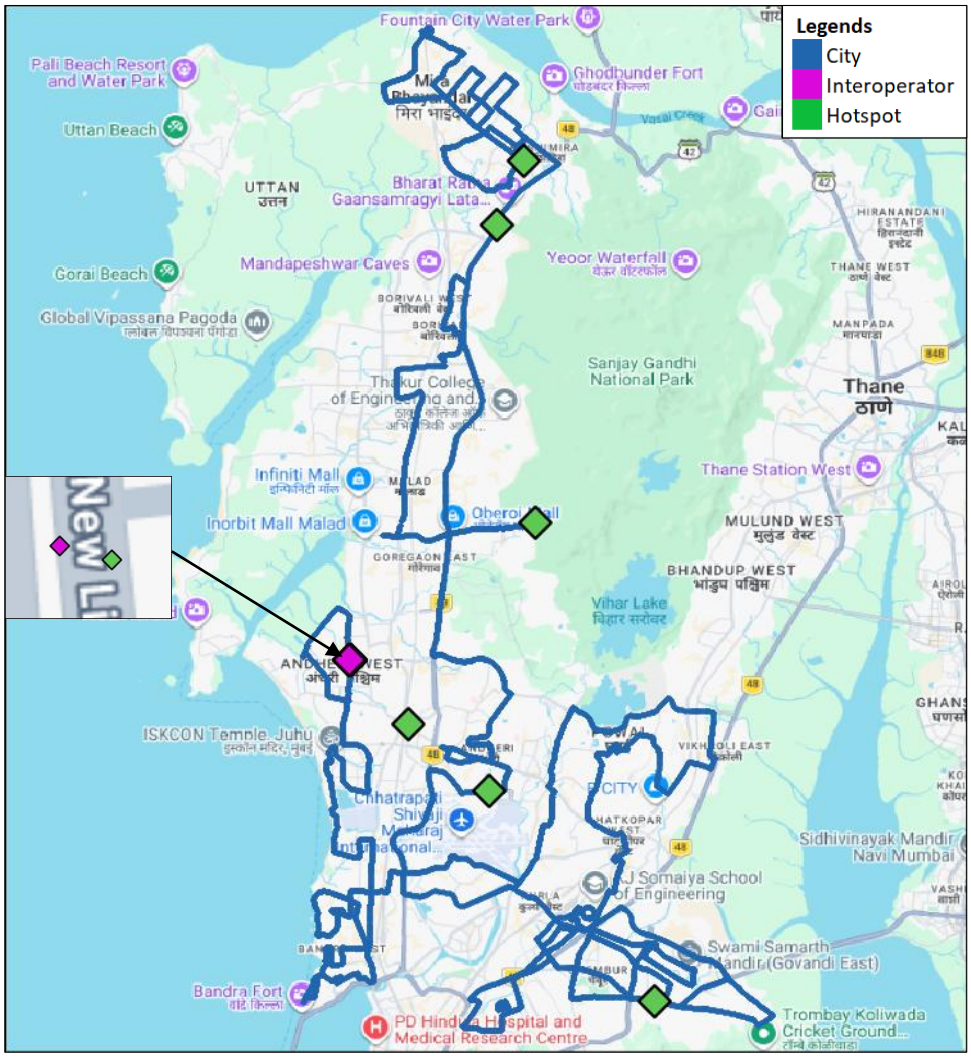


Figure-1: Drive test routes.

2.3 Summary of areas covered

a) City- Sion, Chembur, Deonar, Mankhurd Gaon, Tilak Nagar, Powai, Santacruz East, Khar West, Bandra West, Andheri East, Andheri West, Malad East, Kandivali, Borivali East, Mira Road East, Bhayandar East etc.

b) Hotspot

1. Andheri Railway Station
2. CSMI Airport-T2 Mumbai
3. Deonar Metro Station
4. Infiniti IT Park
5. Kashigaon Metro Station
6. Lower Oshiwara Metro Station
7. Pandurangwadi Metro Station

2.4 Telecom service providers detected frequency bands

Technologies covered during the IDT and frequency bands in use are summarised in table below:

S.no.	Name of TSP	Technology	Frequency Bands (In MHz)
1	Bharti Airtel Ltd.	2G	1800
2	Bharti Airtel Ltd.	4G	900,1800,2100,2300
3	Bharti Airtel Ltd.	5G	3500
4	MTNL	3G	2100
5	Reliance JIO Infocomm Ltd.	4G	850,1800,2300
6	Reliance JIO Infocomm Ltd.	5G	700,3500
7	Vodafone Idea Ltd.	2G	900,1800
8	Vodafone Idea Ltd.	4G	900,1800,2100,2500
9	Vodafone Idea Ltd.	5G	3500

Table-2: Telecom service provider (TSP) covered in IDT.

2.5 Key findings of Independent Drive Test

Drive Test Area: The overall mobile network performance across Mumbai city (Mumbai LSA) for the key Parameters has been summarized below:

a) Coverage Gap - The signal strength observed during voice testing on the drive test route in auto-selection mode (5G/4G/3G/2G). (refer Figure- 27 to 30)

Parameter	AIRTEL	MTNL	RJIL	VIL
Total Number of Samples captured on Drive test route	58003	3687	56138	58030
Number of Samples having poor signal strength	33	2502	87	11
Number of Samples having limited service (No Coverage)	0	13057	0	0

b) Dropped Calls - The TSP-wise details of dropped calls in auto selection mode (5G/4G/3G/2G). (refer figure 15 to 17)

Parameter	AIRTEL	MTNL	RJIL	VIL
Number of successful Calls Established	510	32	509	509
Number of dropped Calls	1	2	2	0

c) Call Silence Instance - The TSP-wise details of Call silence instance in Auto-selection mode (5G/4G). (refer Figure- 18 to 20)

Parameter	AIRTEL	MTNL	RJIL	VIL
Call Established (within service provider network)	479	NA	493	490
Number of silences calls for >3 Sec	2	NA	3	1
Total number of silence instances for >3 Sec	2	NA	3	1

d) Packet loss rate Downlink & Uplink- The TSP-wise details of packet loss rate in downlink & uplink for Auto-selection mode (5G/4G).

Parameter	AIRTEL	MTNL	RJIL	VIL
Call Established (within service provider network)	479	NA	493	490
Packet loss Rate Downlink %	0.43	NA	0.69	0.48
Packet loss Rate Uplink %	0.23	NA	0.46	0.41

e) Data Download and Upload Throughput-

i) Data Download Throughput: The TSP-wise details of **Average Download (DL) throughput** against declared typical DL Throughput for month, in Auto-selection mode (5G/4G/3G/2G). (refer Figure- 32 to 34)

Parameter	Measured in	AIRTEL (upto 5G)	MTNL (upto 4G)	RJIL (upto 5G)	VIL (upto 5G)
Typical Download Throughput declared by TSP	(Mbits/s)	23.00	2.86	15.00	15.00
Average Download Throughput measured during IDT	(Mbits/s)	133.86	-	248.93	89.04

ii) Data Upload Throughput: The TSP-wise details of **Average Upload (UL) throughput** against declared typical UL Throughput for month, in Auto-selection mode (5G/4G/3G/2G). (refer Figure- 35 to 38)

Parameter	Measured in	AIRTEL (upto 5G)	MTNL (upto 4G)	RJIL (upto 5G)	VIL (upto 5G)
Typical Upload Throughput declared by TSP	(Mbits/s)	10.00	0.25	7.00	8.00
Average Upload Throughput measured during IDT	(Mbits/s)	32.80	0.00	33.87	23.21

QoS Performance Analysis- Mumbai LSA

3. QoS performance analysis-LSA level

3.1 Overview

This section provides summary of overall QoS performance of the telecom service provider's network in the LSA by aggregating the results of drive tests conducted in the Mumbai LSA during the month of September-2026 covering city drive and hotspots. (Refer Table-1)

3.2 Voice performance

(a) Voice Call Performance in 3G/2G network mode only: 3G/2G network mode testing has been done to reflect experience for respective users as they have only 3G/2G compatible handsets.

Parameters	Service Provider		
	3G/2G network mode only		
	AIRTEL	MTNL	VIL
Call Attempts	487	771	491
Call Setup Success Rate %	99.79	5.84	98.78
Drop Call Rate %	1.03	6.67	1.65
Call Setup Time-Average (Second)	4.72	4.50	4.32
Handover Success Rate %	98.78	100.00	98.18

Table-3: Summary of voice call performance in 3G/2G network mode only.

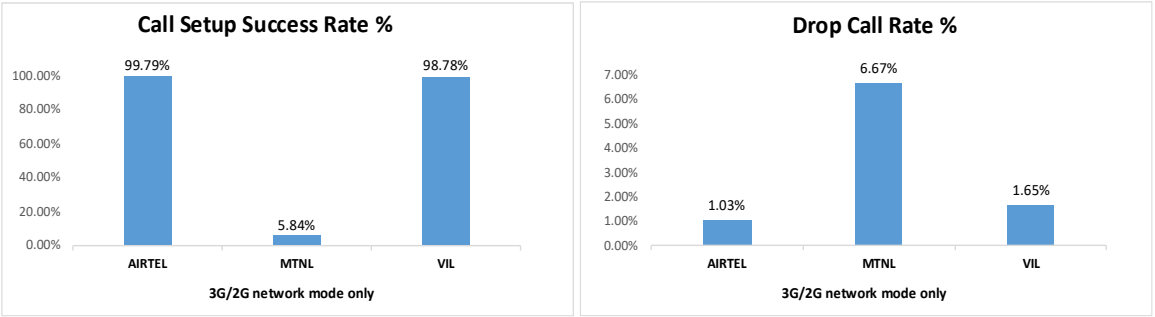


Figure-2: Call setup success rate and drop call rate performance.

Number of unique cell Id's covered in Voice test- Technology wise			
Technology	Service Provider		
	3G/2G network mode only		
	AIRTEL	MTNL	VIL
3G	NA	24	NA
2G	981	0	882

Table-4: Technology wise number of network cell Id's latched during drive test.

Note-

- RJIL does not have 3G/2G network.
- NA- Service provider doesn't provide services in respective technology.

(b) Voice Call Performance in auto network selection mode (5G/4G/3G/2G)

Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	MTNL	RJIL	VIL
Call Attempts	580	955	580	580
Call Setup Success Rate %	100.00	3.35	99.83	99.83
Drop Call Rate %	0.17	6.25	0.35	0.00
Call Setup Time-Average (Second)	0.46	3.81	0.47	0.46
Handover Success Rate %	100.00	100.00	99.91	100.00

Table-5: Summary of voice call performance in network auto-selection mode.

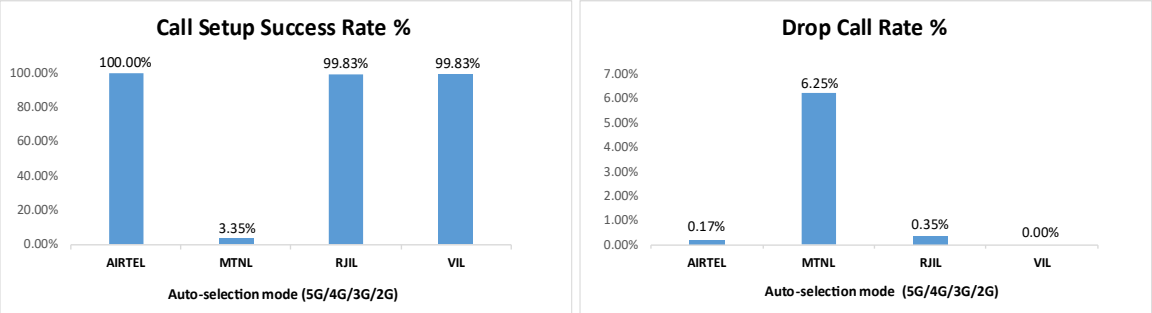


Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G – Open Mode)			
	AIRTEL	MTNL	RJIL	VIL
Call Established (within service provider Network)	479	25	493	490
Number of silences call for >4 Sec	1	NA	1	0
Silence Call Rate %	0.21	NA	0.20	0.00
Number of silence instances for >4 Sec	1	NA	1	0
Number of silence instances for >3 Sec	2	NA	3	1
Number of silence instances for >2 sec	4	NA	9	2
RTP Jitter (4G & 5G) in ms	6.66	NA	18.32	12.27
Packet loss Rate Downlink %	0.43	NA	0.69	0.48
Packet loss Rate Uplink %	0.23	NA	0.46	0.41

Table-6: Summary of silence instances & packet loss rate for mobile to mobile calls.

Note-
- NA- Due to unavailability of packet switched (VoLTE & VoNR) network in MTNL, silence instances are not captured.

Number of unique cell Id's covered in Voice test- Technology wise				
Technology	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	MTNL	RJIL	VIL
5G	4	NA	824	0
4G	2286	NA	706	1535
3G	NA	14	NA	NA
2G	0	0	NA	0

Table-7: Technology wise number of network cell Id's latched during drive test.

Note-
- NA- Service provider doesn't provide services in respective technology.
- 0- No cell Id's were found in respective technology.

(c) Mean Opinion Score (MOS) performance for speech quality:

Mean opinion score indicates quality of speech observed during the drive test across different technologies. This parameter has been calculated for mobile-to-mobile calls made within same operator network in auto mode (5G/4G/3G/2G). As per ITU-T Recommendation P.863.1, MOS values means: 5-Excellent, 4-Good, 3-Fair, 2-Poor, 1-Bad.

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	MTNL	RJIL	VIL
Total Number of MOS Samples for calls Table-6	2902	157	2990	3079
Speech Quality (Average MOS)	3.97	2.68	4.52	4.47
Number of samples with MOS >=4 to <5 (Excellent)	2249	0	2672	2705
Number of samples with MOS >=3 to <4 (Good)	538	63	219	305
Number of samples with MOS >=2 to <3 (Fair)	88	69	49	53
Number of samples with MOS >=1 to <2 (Poor)	27	25	50	16
%age of samples with MOS >=4 to <5 (Excellent)	77.50%	0.00%	89.36%	87.85%
%age of samples with MOS >=3 to <4 (Good)	18.54%	40.13%	7.32%	9.91%
%age of samples with MOS >=2 to <3 (Fair)	3.03%	43.95%	1.64%	1.72%
%age of samples with MOS >=1 to <2 (Poor)	0.93%	15.92%	1.67%	0.52%

Table-8: Summary of speech quality (MOS) samples.

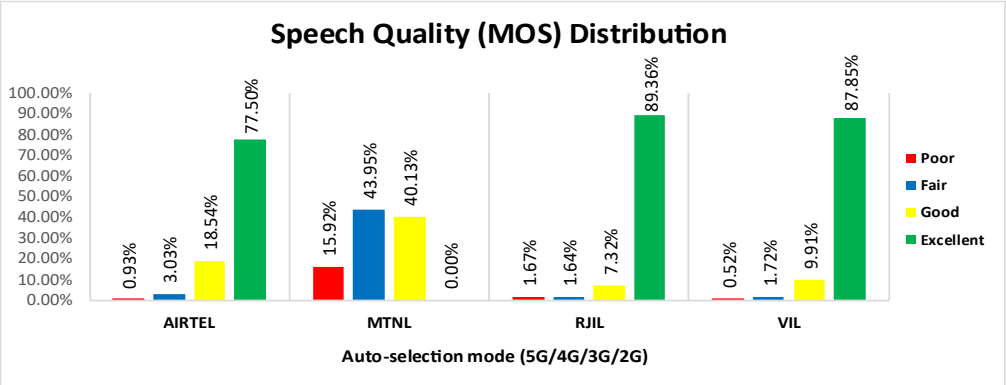


Figure-4: Distribution of samples in MOS range.

(d) Inter-service provider voice call performance: To check the performance of inter-service providers call setup success rate, total 15 inter operator calls were attempted at one location which is Lower Oshiwara Metro Station. The call setup success rate and call setup time observations are as below.

Call Setup Success Rate %				
From Service Provider	To Service Provider			
	AIRTEL	MTNL	RJIL	VIL
AIRTEL	NA	0.00	100.00	100.00
MTNL	0.00	NA	0.00	0.00
RJIL	100.00	0.00	NA	100.00
VIL	100.00	0.00	100.00	NA

Table-9: Call setup success rate across service providers.

Note-

- NA- Only inter-operator calls were measured during test.

Call setup time average (seconds)				
From Service Provider	To Service Provider			
	AIRTEL	MTNL	RJIL	VIL
AIRTEL	NA	-	1.41	0.88
MTNL	-	NA	-	-
RJIL	1.69	-	NA	1.45
VIL	1.61	-	1.20	NA

Table-10: Call setup time across service providers.

Note-
- NA- Only inter-operator calls were measured during test.
- "-"Call setup time has not been reported as all calls were failed for respective scenarios.

3.3 Data performance

(a) Data Parameters (Auto-selection mode- 5G/4G/3G/2G)

Parameters		Service Provider			
		Auto-selection mode (5G/4G/3G/2G)			
		AIRTEL	MTNL	RJIL	VIL
Download Throughput (Mbits/s)	Average	133.86	-	242.46	89.56
	80th Percentile	193.27	-	389.31	136.19
	20th Percentile	66.85	-	73.29	38.06
Upload Throughput (Mbits/s)	Average	32.96	0.00	32.79	23.50
	80th Percentile	49.08	0.00	53.57	35.57
	20th Percentile	14.99	0.00	9.60	10.58
Latency (ms)	50th Percentile	24.40	-	16.33	13.68

Table-11: Summary of data performance in network auto-selection mode.

Note-
- "-" All data tests were failed (Download and Ping) for MTNL.

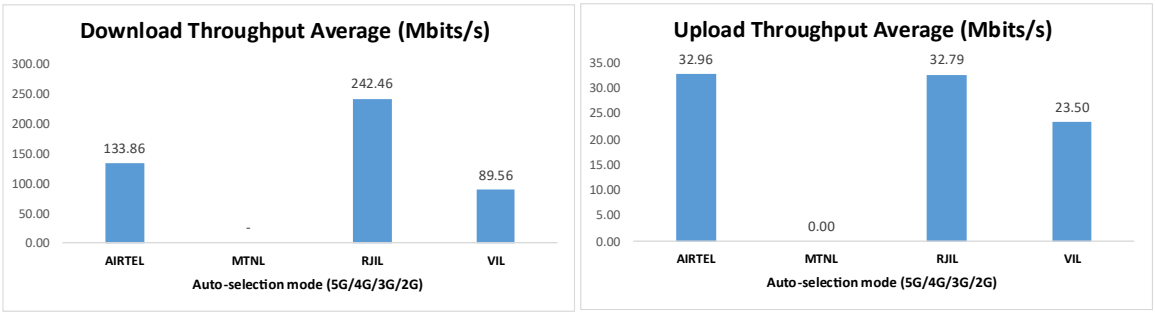


Figure-5: Download and Upload throughput.

Number of unique cell Id's covered in Data test- Technology wise				
Technology	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	MTNL	RJIL	VIL
5G	527	NA	885	0
4G	1471	NA	162	1467
3G	NA	12	NA	NA
2G	0	0	NA	1

Table-12: Technology wise number of network cell Id's latched during drive test.

Note-
- NA- Service provider doesn't provide services in respective technology.
- 0- No cell Id's were found in respective technology.

Detailed QoS Performance Analysis

4. Detailed QoS performance analysis

4.1 Overview

This section covers analysis on performance of various categories of drives like city and hotspots for all telecom service providers, the results of drive tests conducted are shown individually for respective areas/locations.

4.2 City

Drive test has been conducted from 23rd September 2026 to 25th September 2026 in Mumbai city. (Refer Table-1)

4.2.1 Drive test route

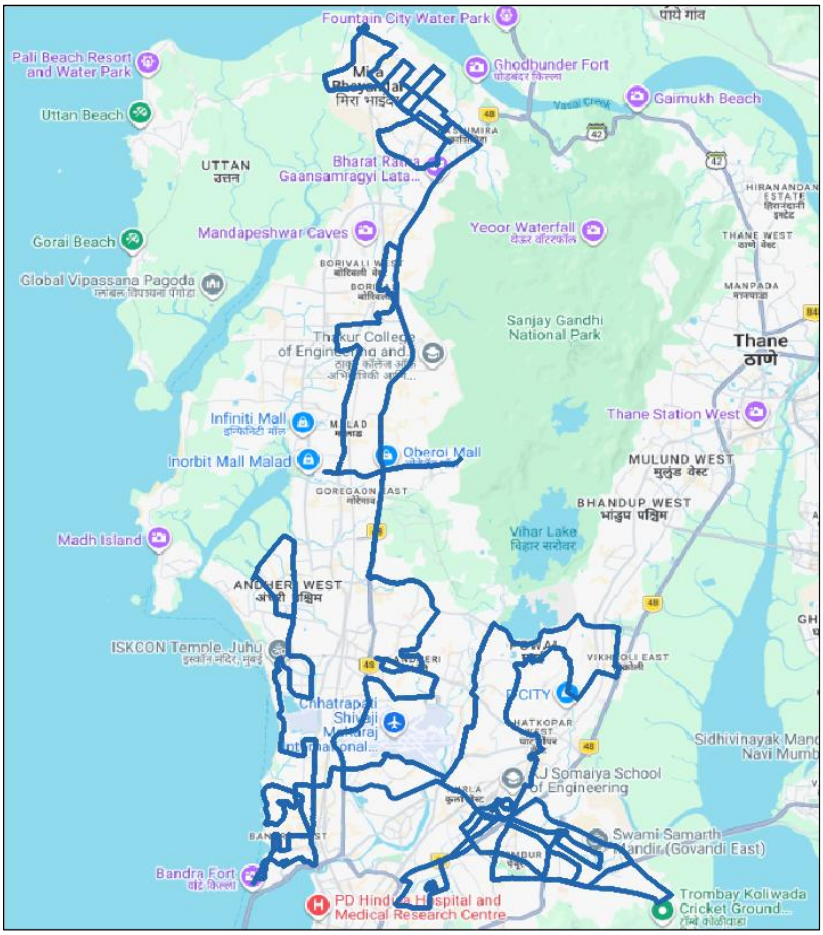


Figure-6: Drive test routes.

4.2.2 Areas covered

Sion, Chembur, Deonar, Mankhurd Gaon, Tilak Nagar, Powai, Santacruz East, Khar West, Bandra West, Andheri East, Andheri West, Malad East, Kandivali, Borivali East, Mira Road East, Bhayandar East etc.

4.2.3 Voice performance

(a) Voice Call Performance in 3G/2G network mode only: 3G/2G network mode testing has been done to reflect experience for respective users as they have only 3G/2G compatible handsets.

Parameters	Service Provider		
	3G/2G network mode only		
	AIRTEL	MTNL	VIL
Call Attempts	487	771	491
Call Setup Success Rate %	99.79	5.84	98.78
Drop Call Rate %	1.03	6.67	1.65
Call Setup Time-Average (Second)	4.72	4.50	4.32
Handover Success Rate %	98.78	100.00	98.18

Table-13: Summary of voice call performance in 3G/2G network mode only**.**

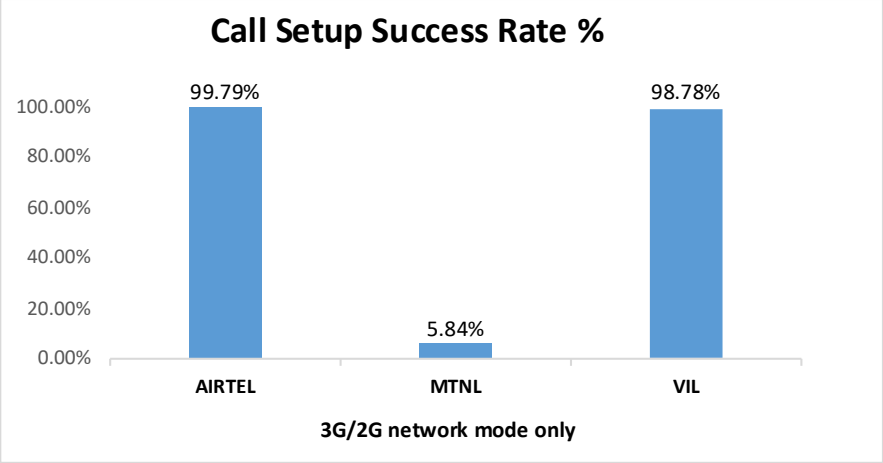


Figure-7: Performance for call setup success rate.

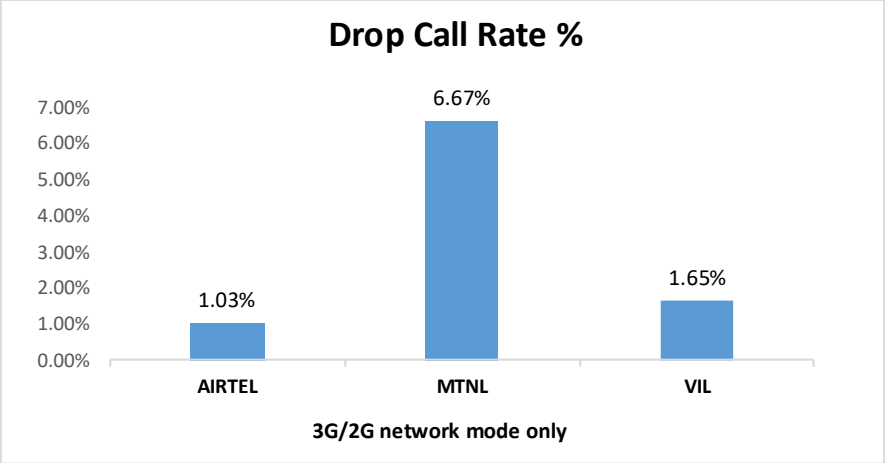


Figure-8: Performance for drop call rate.

(b) Network Technology: This section represents time spent on various network technologies.

Technology	Service Provider		
	AIRTEL	MTNL	VIL
3G	NA	26.05%	NA
2G	100.00%	0.00%	100.00%
Limited Service	0.00%	73.95%	0.00%

Table-14: Time spent on technology during drive test 3G/2G network mode.

Note-
- NA**-** Service provider doesn't provide services in respective technology.

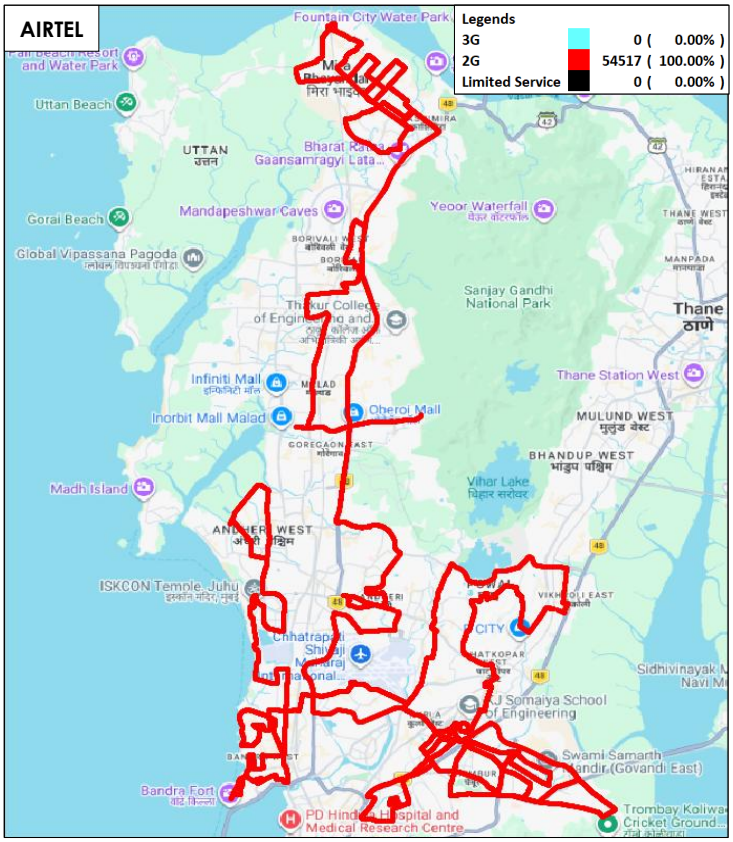


Figure-9: Serving technology plots 3G/2G network mode - AIRTEL.

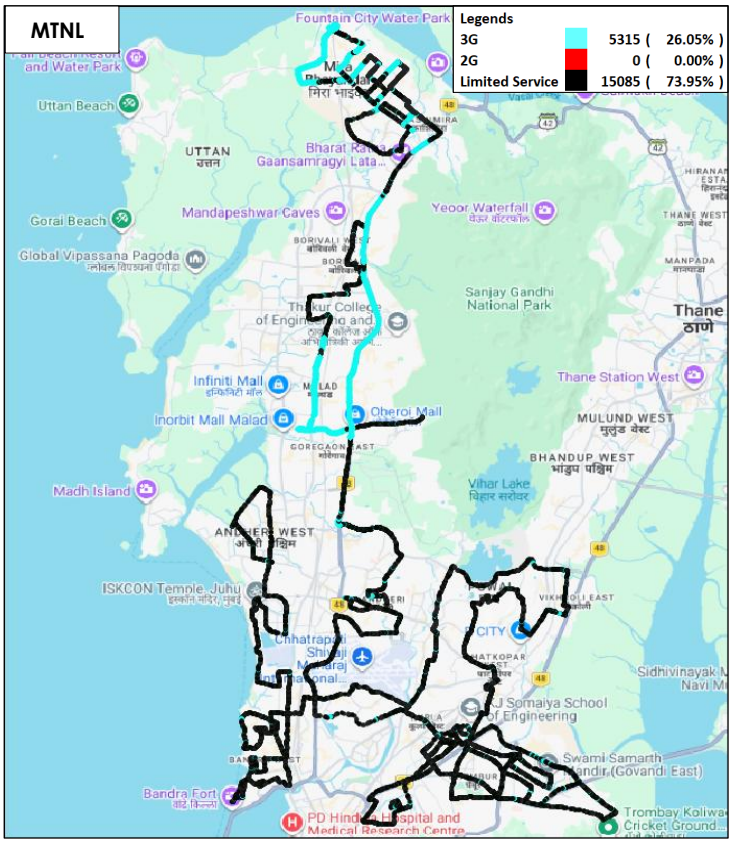


Figure-10: Serving technology plots 3G/2G network mode - MTNL.

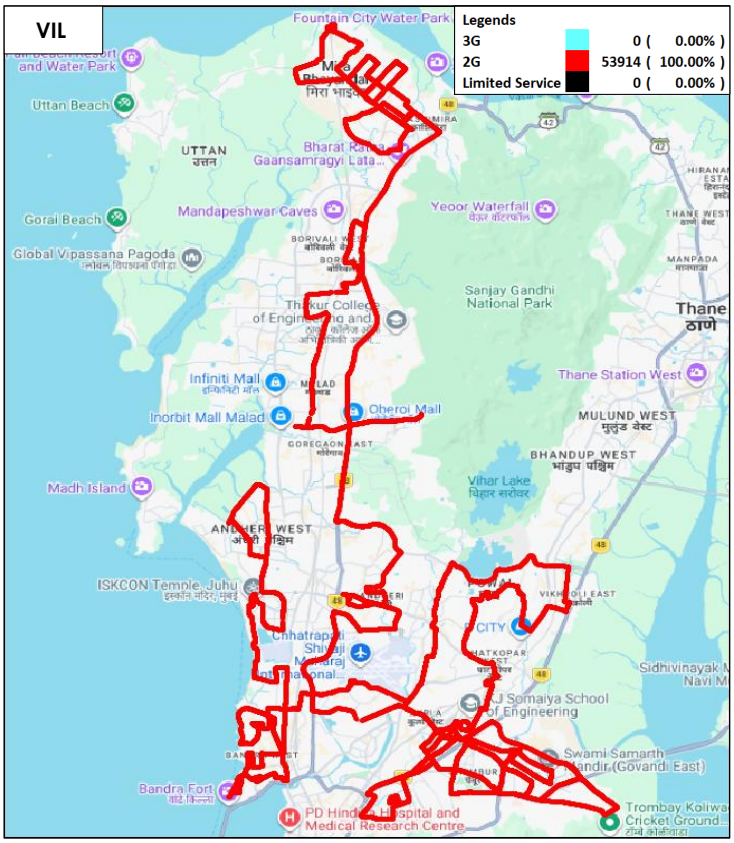


Figure-11: Serving technology plots 3G/2G network mode - VIL.

(c) Network Signal Strength Distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (Refer Figure- 45, 46 & 47 for map view)

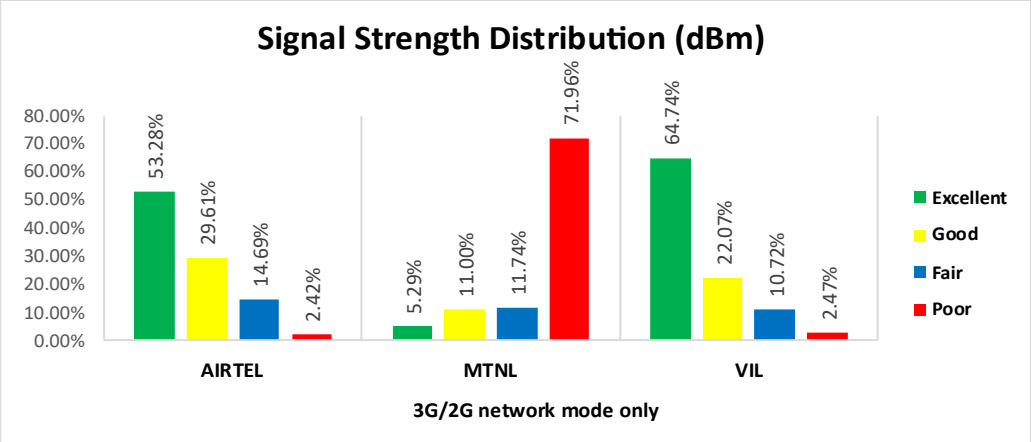


Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 53% of samples falling in the excellent signal strength category.
- MTNL has 5% of samples falling in the excellent signal strength category.
- VIL has 65% of samples falling in the excellent signal strength category.

(d) Voice Call Performance in auto network selection mode (5G/4G/3G/2G)

Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	MTNL	RJIL	VIL
Call Attempts	510	885	510	510
Call Setup Success Rate %	100.00	3.62	99.80	99.80
Drop Call Rate %	0.20	6.25	0.39	0.00
Call Setup Time Average (Second)	0.47	3.81	0.47	0.46
Handover Success Rate %	100.00	100.00	99.91	100.00

Table-15: Summary of voice call performance in network auto-selection mode.

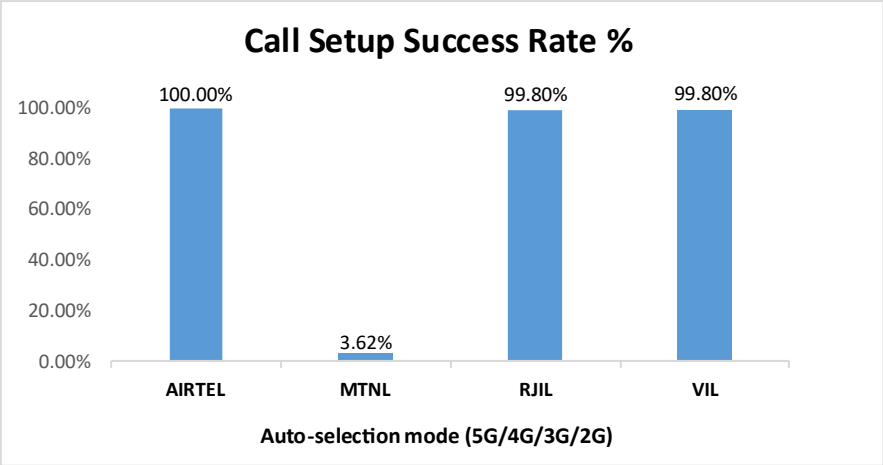


Figure-13: Performance for call setup success rate.

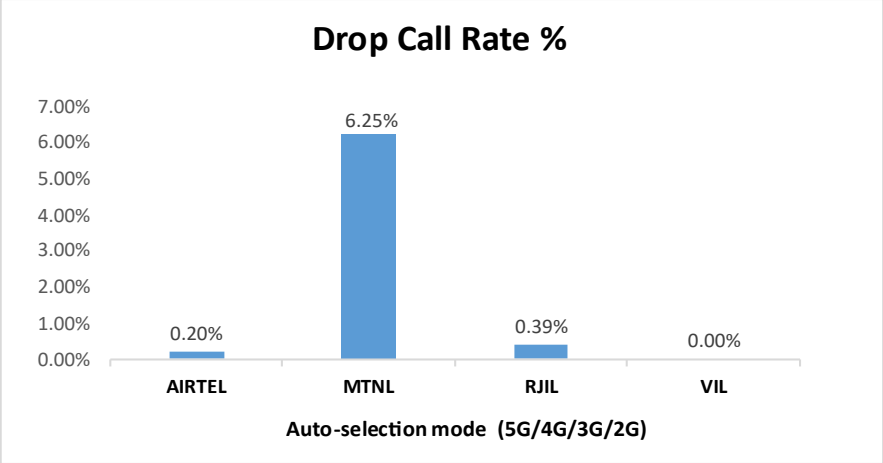


Figure-14: Performance for drop call rate.



Figure-15: Drop call locations in auto-selection mode (5G/4G/3G/2G) voice -AIRTEL.

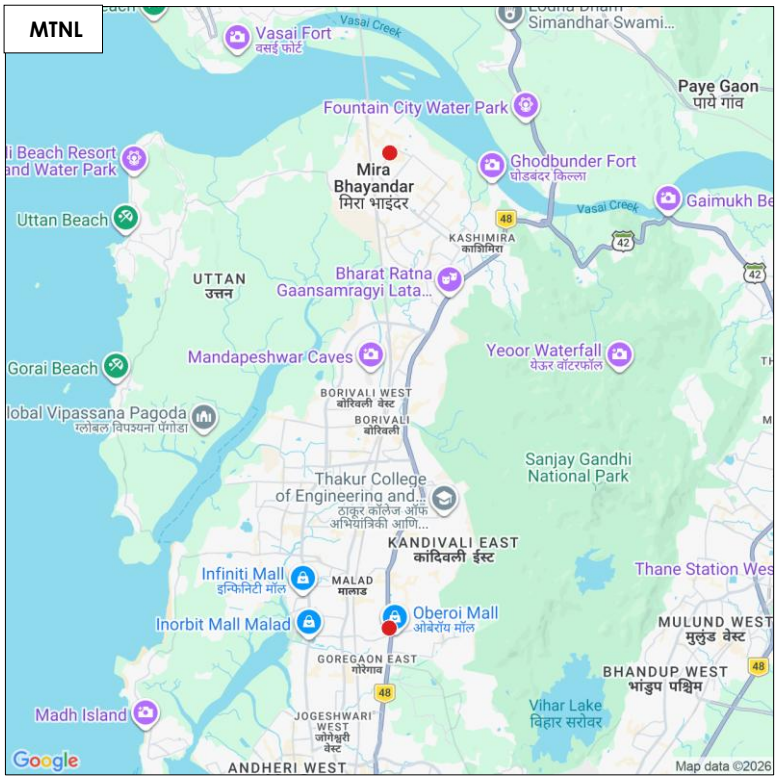


Figure-16: Drop call locations in auto-selection mode (5G/4G/3G/2G) voice - MTNL.

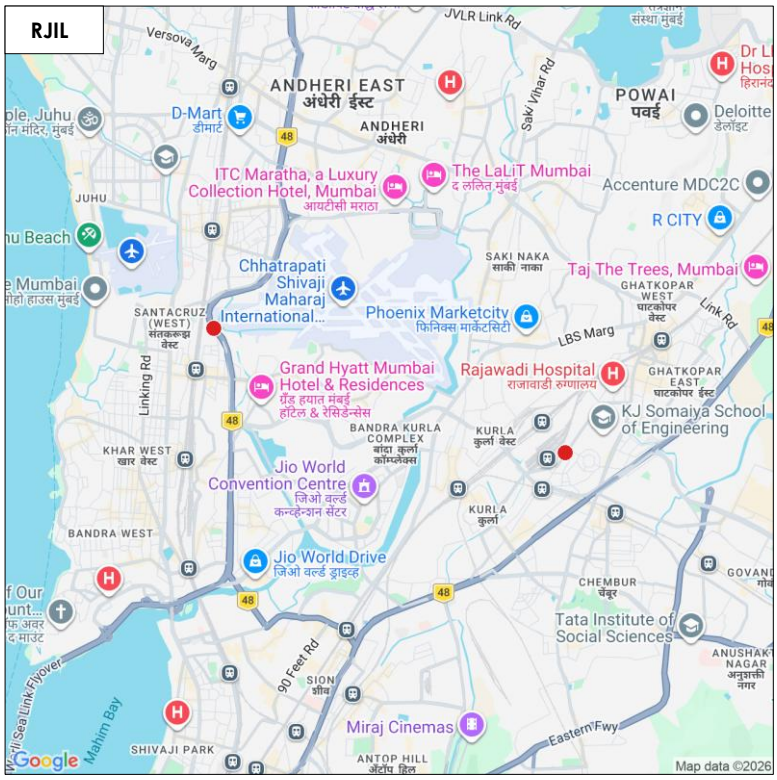


Figure-17: Drop call locations in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

	Mobile-to-Mobile (5G/4G – Open Mode)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Established (within service provider Network)	479	25	493	490
Number of silences call for >4 Sec	1	NA	1	0
Silence Call Rate %	0.21	NA	0.20	0.00
Number of silence instances for >4 Sec	1	NA	1	0
Number of silence instances for >3 Sec	2	NA	3	1
Number of silence instances for >2 sec	4	NA	9	2
RTP Jitter (4G & 5G) in ms	6.66	NA	18.32	12.27
Packet loss Rate Downlink %	0.43	NA	0.69	0.48
Packet loss Rate Uplink %	0.23	NA	0.46	0.41

Table-16: Summary of silence instances & packet loss rate for mobile to mobile call.

Note-

- NA- Due to unavailability of packet switched (VoLTE & VoNR) network in MTNL, silence instances are not captured.

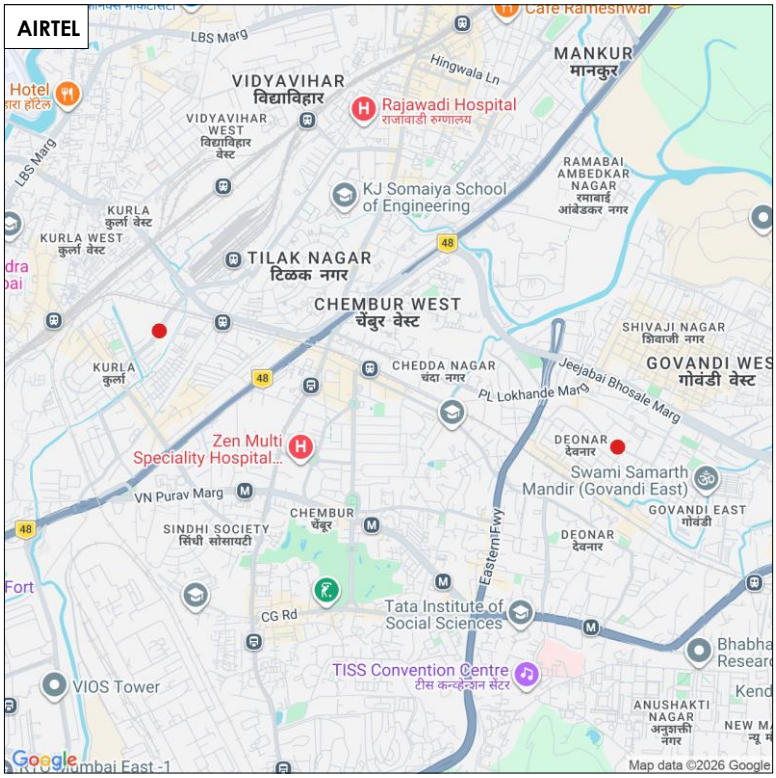


Figure-18: Number of silence instances for >3 Sec Mobile-to-Mobile (5G/4G-Open Mode) - AIRTEL

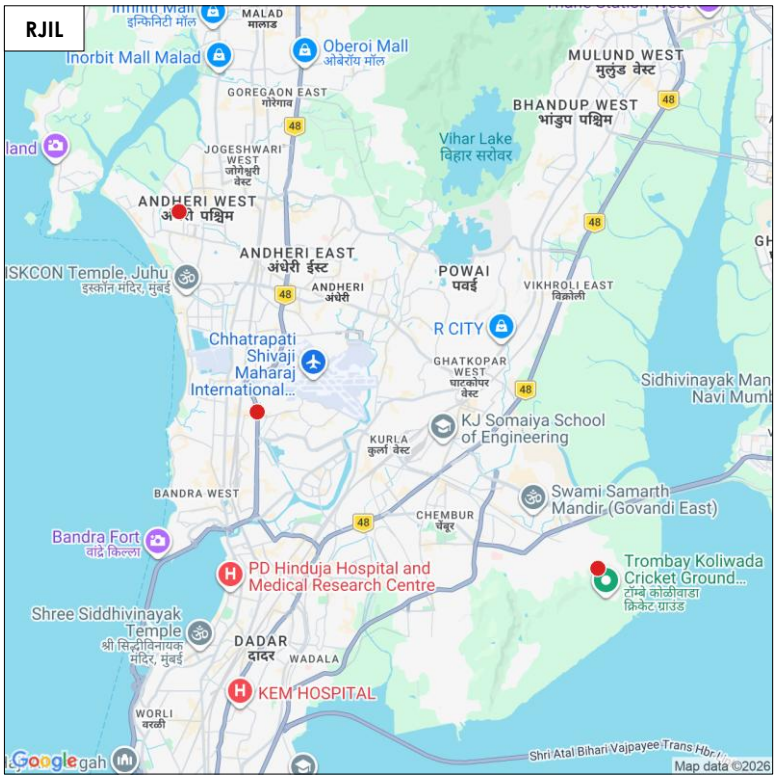


Figure-19: Number of silence instances for >3 Sec Mobile-to-Mobile (5G/4G-Open Mode) - RJIL.

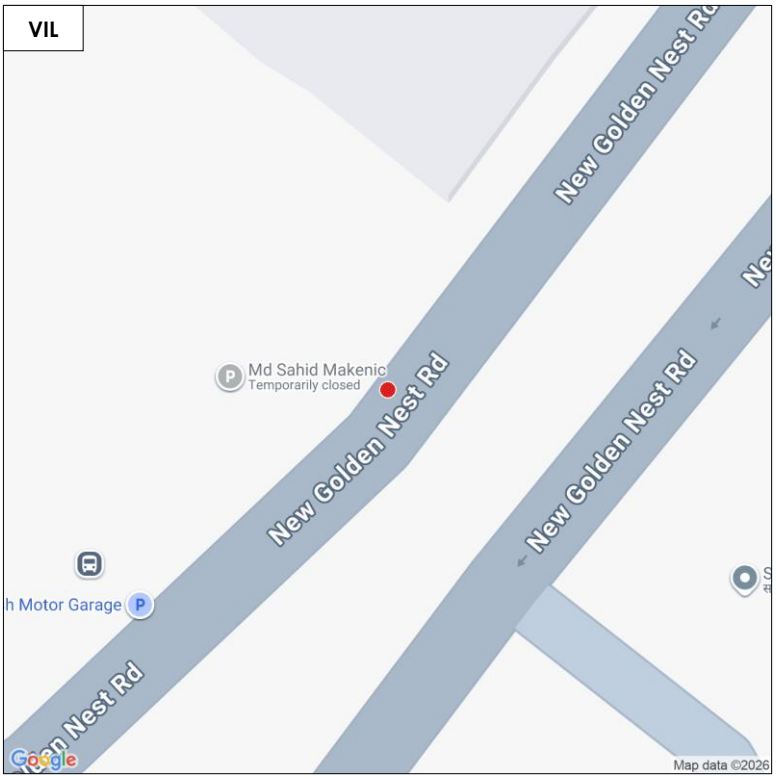


Figure-20: Number of silence instances for >3 Sec Mobile-to-Mobile (5G/4G-Open Mode) - VIL.

(e) Mean Opinion Score (MOS) performance for speech quality:

Mean opinion score indicates quality of speech observed during the drive test across different technologies. This parameter has been calculated for mobile to mobile calls made within same operator network in auto mode (5G/4G/3G/2G). As per ITU-T Recommendation P.863.1, MOS value means: 5-Excellent, 4-Good, 3-Fair, 2-Poor, 1-Bad.

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	MTNL	RJIL	VIL
Total Number of MOS Samples for calls in Table-16	2902	157	2990	3079
Speech Quality (Average MOS)	3.97	2.68	4.52	4.47
Number of samples with MOS >=4 to <5 (Excellent)	2249	0	2672	2705
Number of samples with MOS >=3 to <4 (Good)	538	63	219	305
Number of samples with MOS >=2 to <3 (Fair)	88	69	49	53
Number of samples with MOS >=1 to <2 (Poor)	27	25	50	16
%age of samples with MOS >=4 to <5 (Excellent)	77.50%	0.00%	89.36%	87.85%
%age of samples with MOS >=3 to <4 (Good)	18.54%	40.13%	7.32%	9.91%
%age of samples with MOS >=2 to <3 (Fair)	3.03%	43.95%	1.64%	1.72%
%age of samples with MOS >=1 to <2 (Poor)	0.93%	15.92%	1.67%	0.52%

Table-17: Summary of speech quality (MOS) samples.

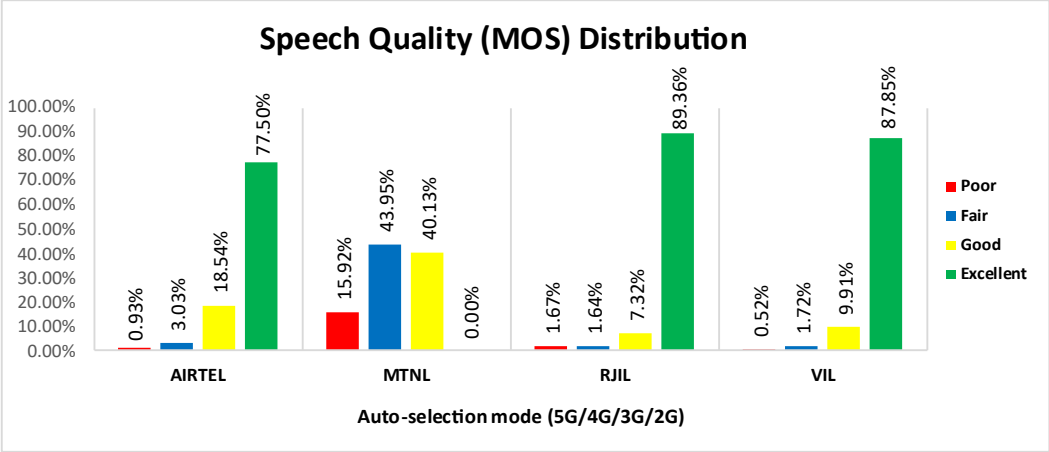


Figure-21: Distribution of samples in MOS range.

(f) Network Technology: This section represents time spent on various network technologies.

Technology	Service Provider			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
5G	13.60%	NA	81.21%	4.52%
4G	86.40%	NA	18.79%	95.48%
3G	NA	26.39%	NA	NA
2G	0.00%	0.00%	NA	0.00%
Limited Service	0.00%	73.61%	0.00%	0.00%

Table-18: Time spent on technology during drive test in auto-selection mode (5G/4G/3G/2G) voice.

Note-

- NA**-** Service provider doesn't provide services in respective technology.

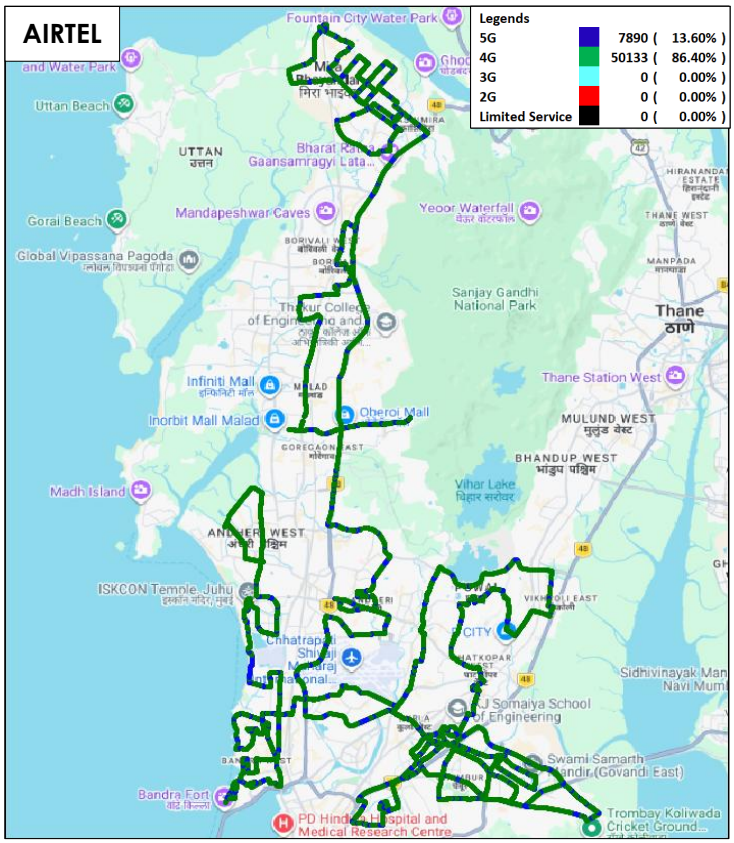


Figure-22: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

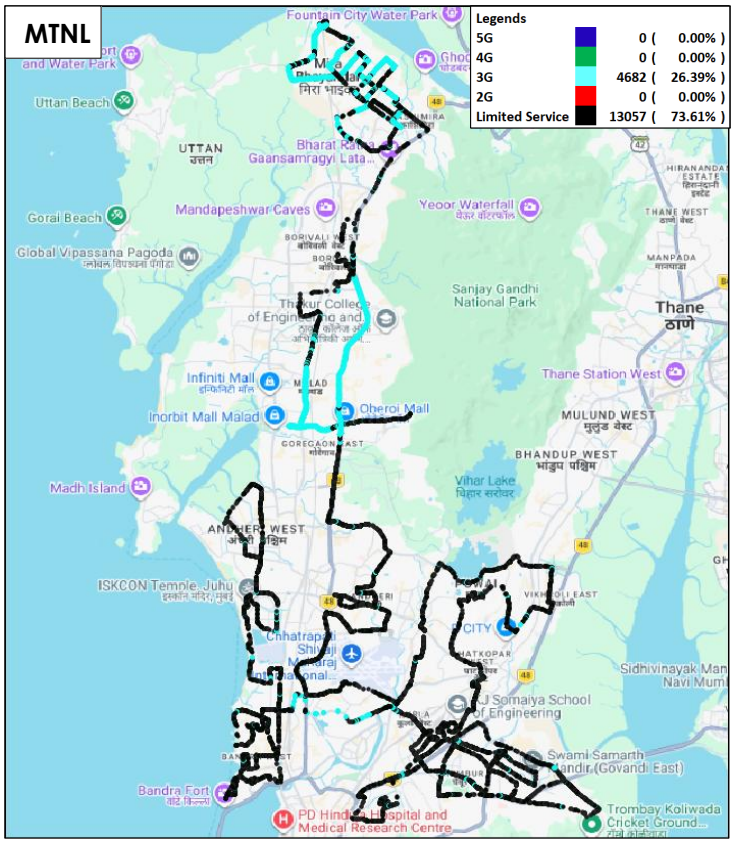


Figure-23: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - MTNL.

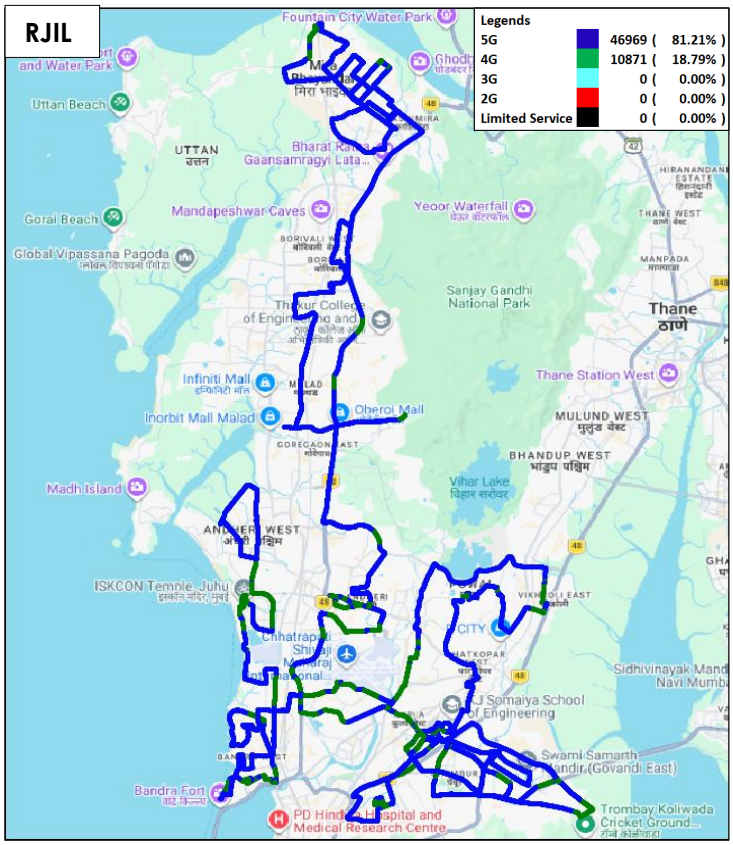


Figure-24: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

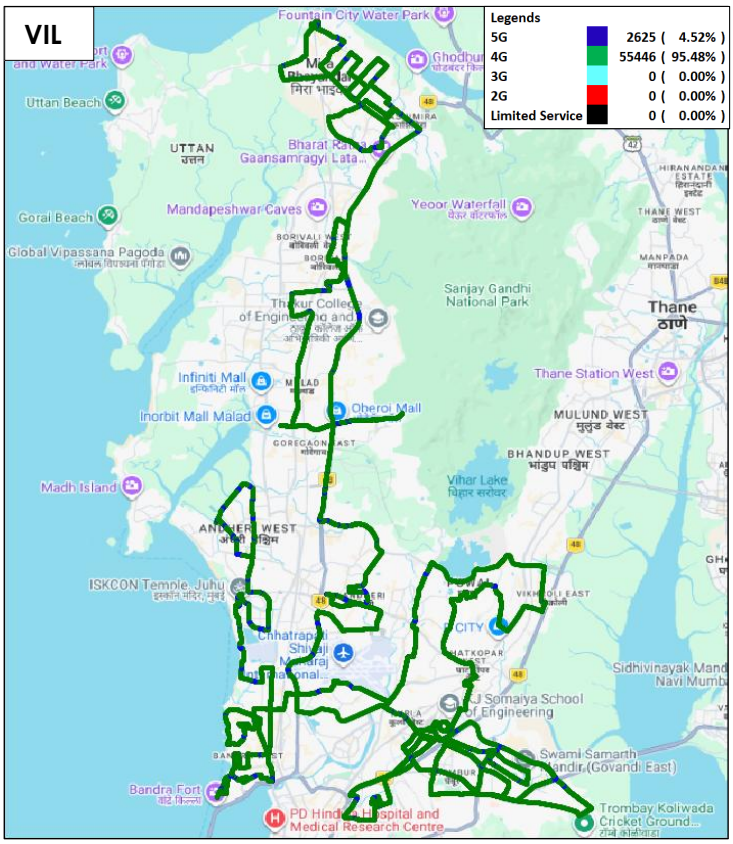


Figure-25: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - VIL.

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) voice. (Refer Figure-48, 49, 50 & 51 for map view)

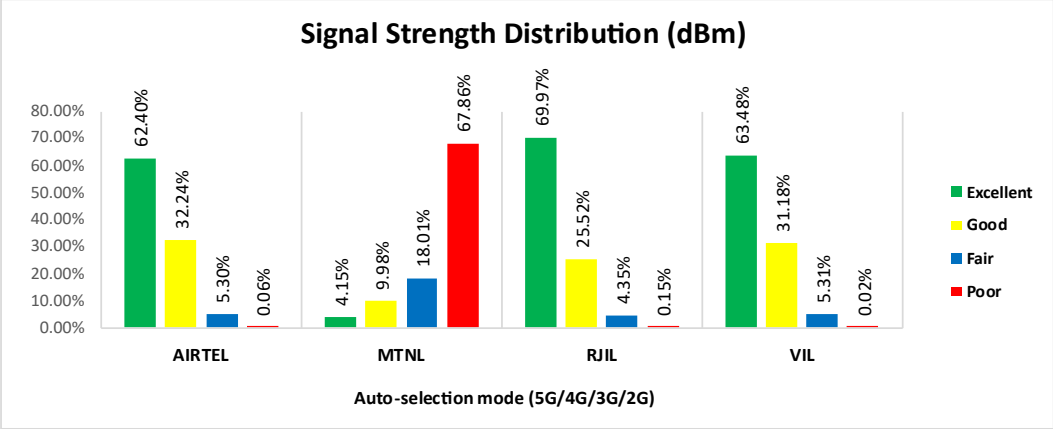


Figure-26: Signal strength distribution auto-selection mode (5G/4G/3G/2G) voice.

Observations:

- Airtel has 62% of samples falling in the excellent signal strength category.
- MTNL has 4% of samples falling in the excellent signal strength category.
- RJIL has 70% of samples falling in the excellent signal strength category.
- VIL has 63% of samples falling in the excellent signal strength category.

(h) Coverage Gap observed

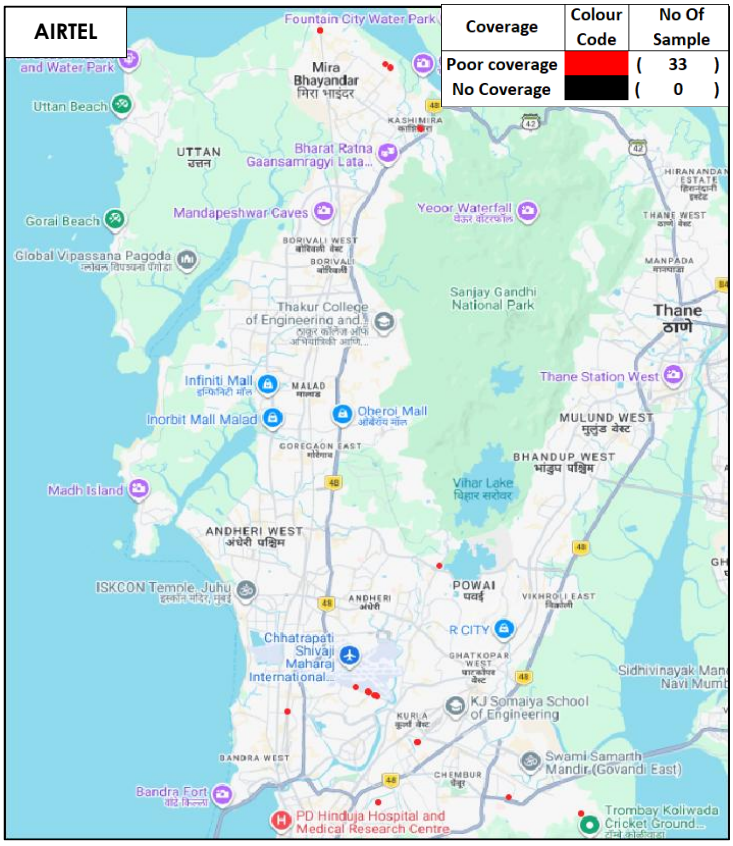


Figure-27: Poor coverage & no coverage locations in auto-selection mode (5G/4G/3G/2G) voice-AIRTEL.

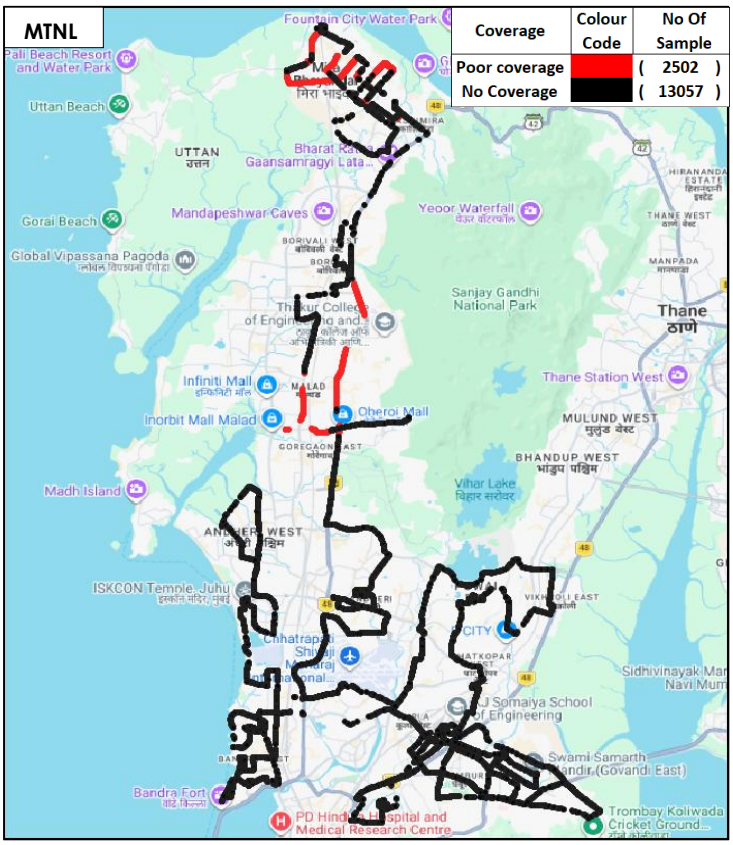


Figure-28: Poor coverage & no coverage locations in auto-selection mode (5G/4G/3G/2G) voice-MTNL.

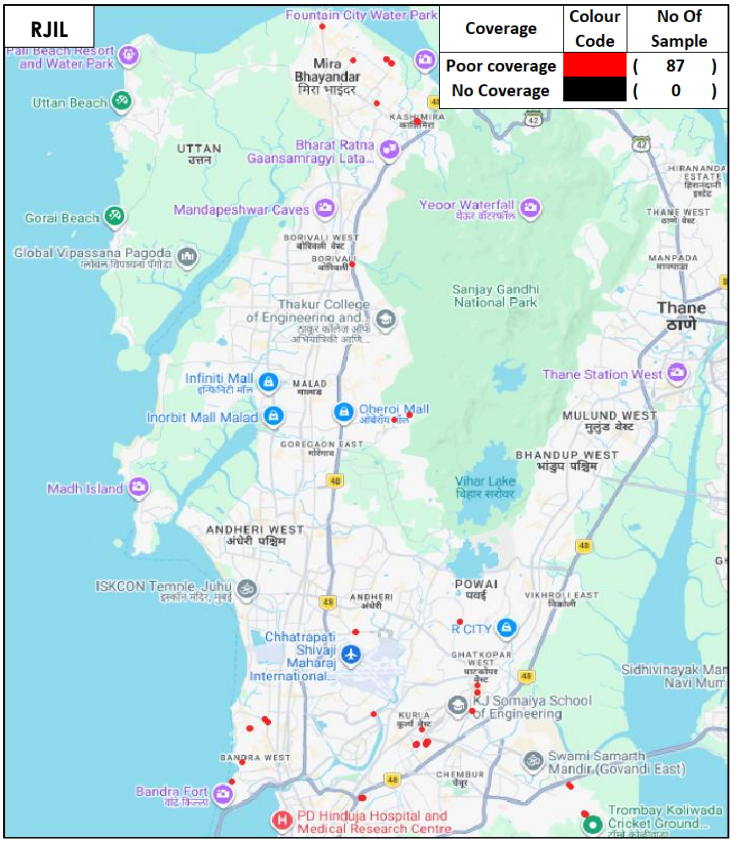


Figure-29: Poor coverage & no coverage locations in auto-selection mode (5G/4G/3G/2G) voice-RJIL.

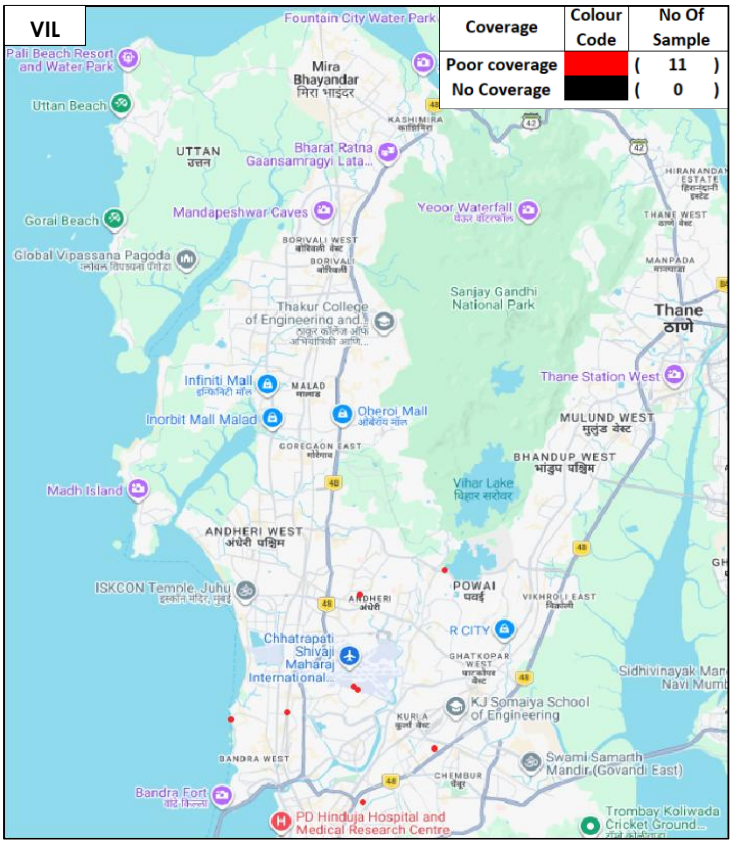


Figure-30: Poor coverage & no coverage locations in auto-selection mode (5G/4G/3G/2G) voice-VIL.

4.2.4 Data performance

(a) Data Parameters (Auto-selection mode- 5G/4G/3G/2G)

Parameters		Service Provider			
		Auto-selection mode (5G/4G/3G/2G)			
		AIRTEL	MTNL	RJIL	VIL
Download Throughput (Mbits/s)	Average	133.86	-	248.93	89.04
	80th Percentile	194.58	-	398.55	135.75
	20th Percentile	62.87	-	75.11	37.56
Upload Throughput (Mbits/s)	Average	32.80	0.00	33.87	23.21
	80th Percentile	49.08	0.00	55.02	35.29
	20th Percentile	14.99	0.00	10.92	10.32
Latency (ms)	50th Percentile	25.28	-	16.20	12.62

Table-19: Summary of Data performance in network auto-selection mode.

Note-

- "-" All data tests were failed (Download and Ping) for MTNL.

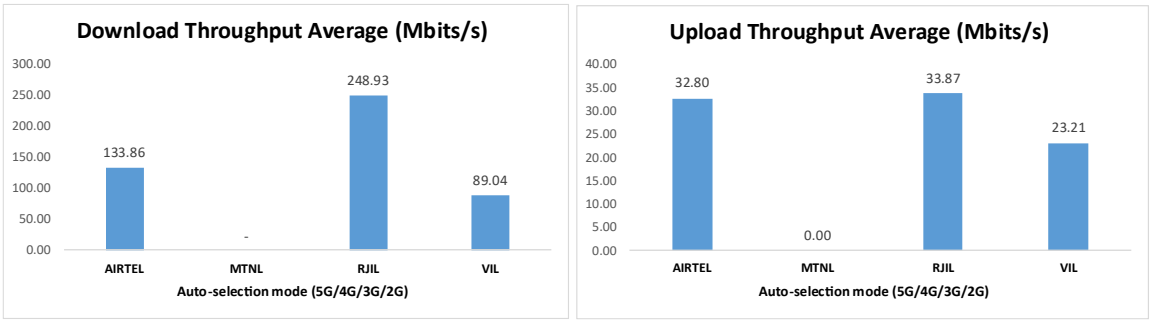


Figure-31: Download & Upload throughput.

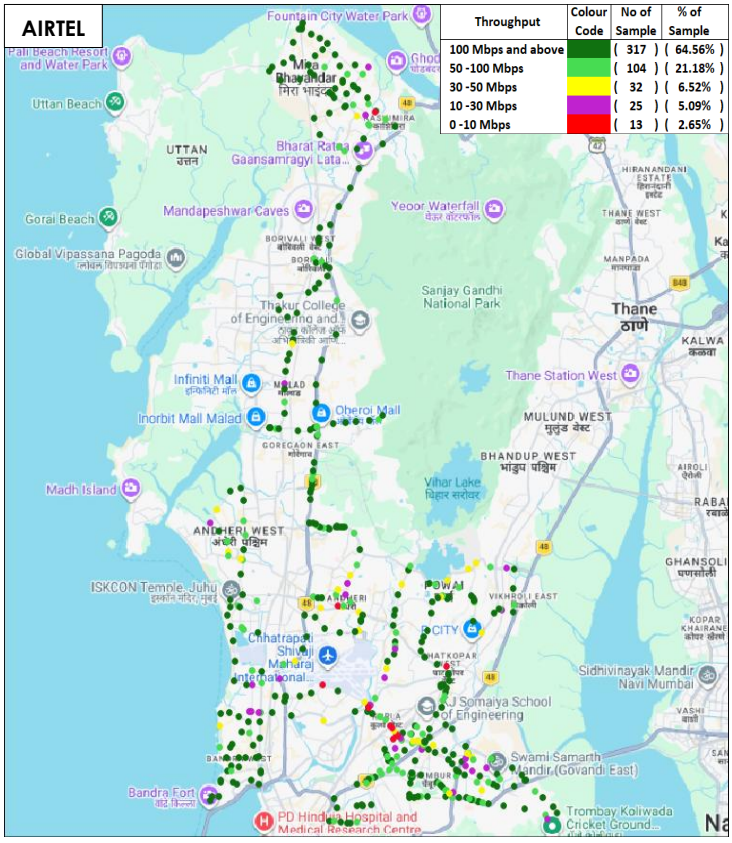


Figure-32: Download throughput distribution auto-selection mode (5G/4G/3G/2G) - AIRTEL.

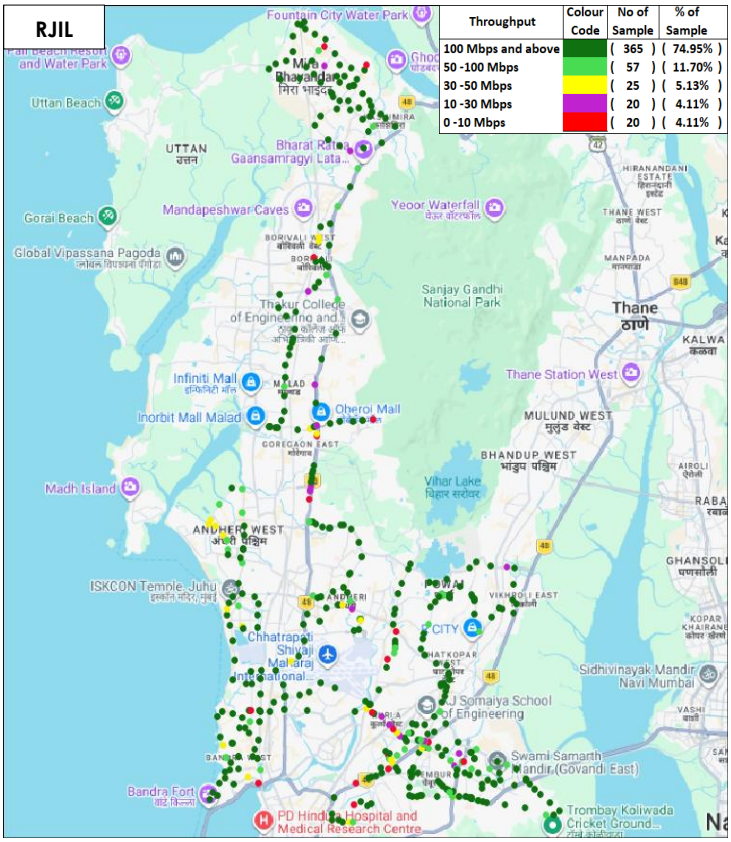


Figure-33: Download throughput distribution auto-selection mode (5G/4G/3G/2G) - RJIL.

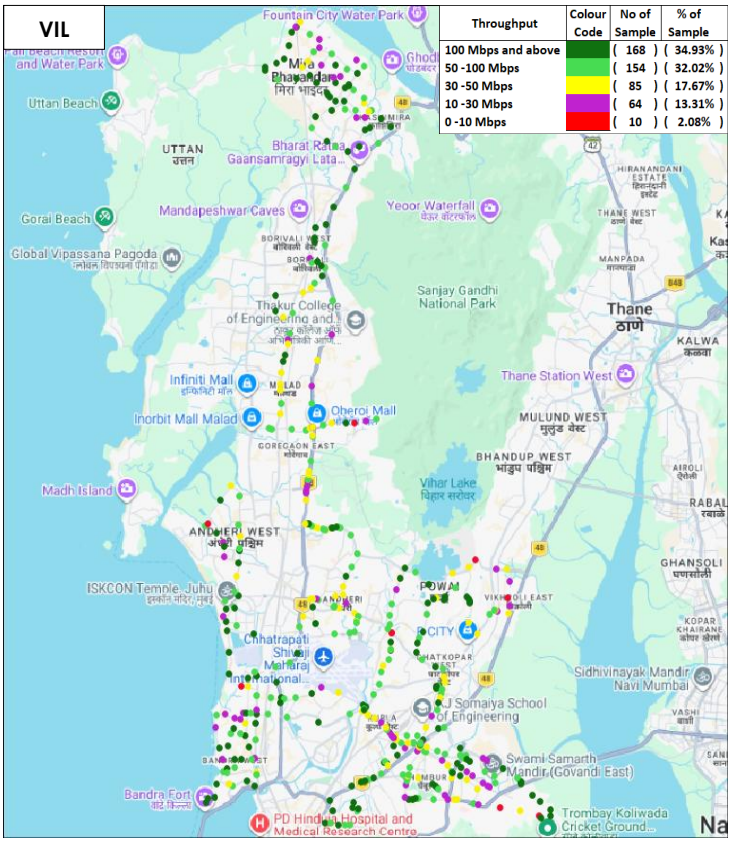


Figure-34: Download throughput distribution auto-selection mode (5G/4G/3G/2G) - VIL.

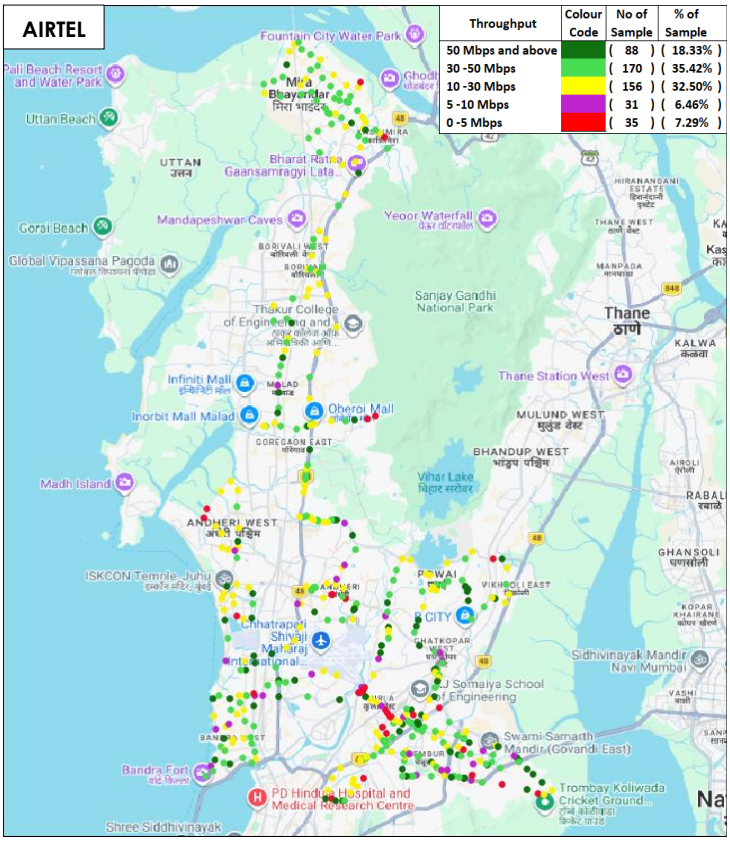


Figure-35: Upload throughput distribution auto-selection mode (5G/4G/3G/2G) - AIRTEL.

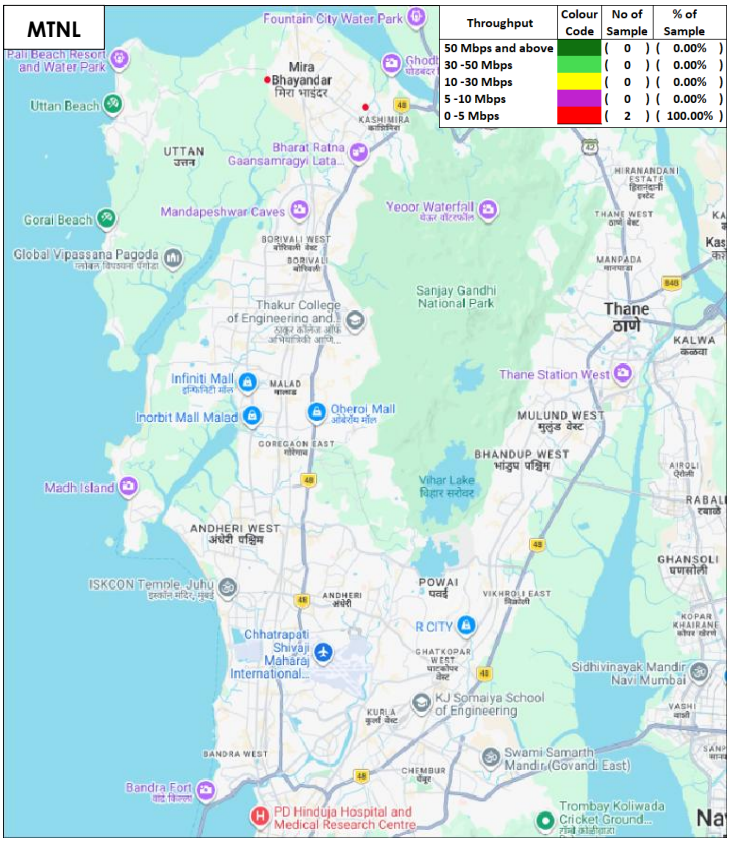


Figure-36: Upload throughput distribution auto-selection mode (5G/4G/3G/2G) - MTNL.

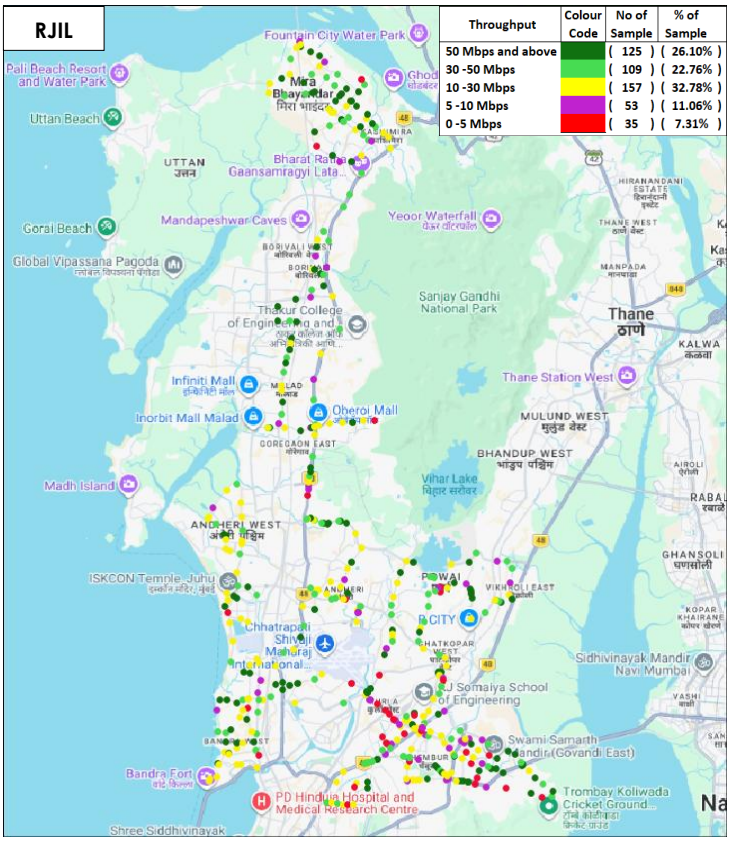


Figure-37: Upload throughput distribution auto-selection mode (5G/4G/3G/2G) - RJIL.

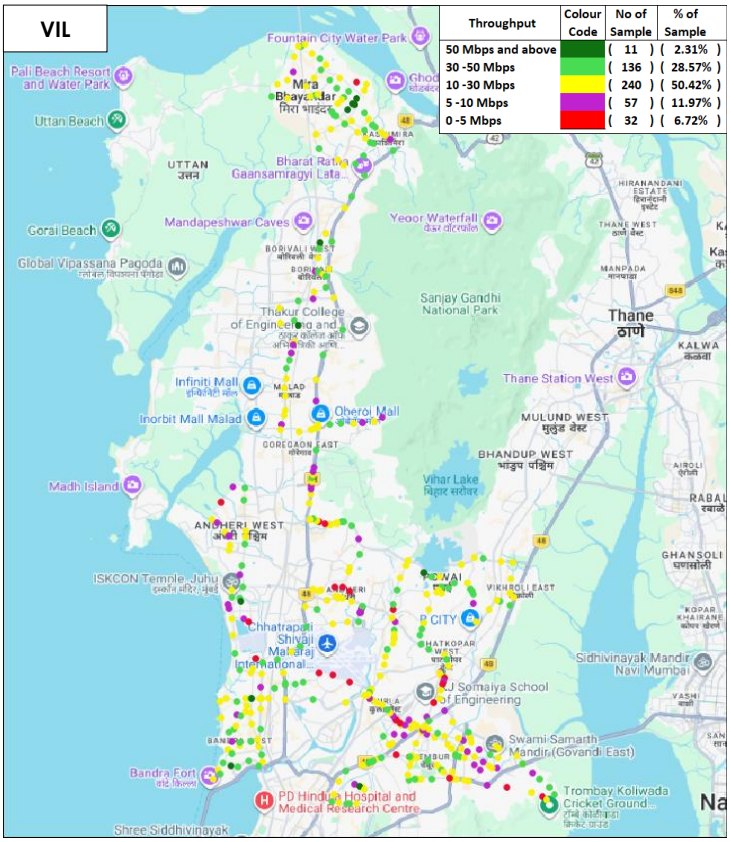


Figure-38: Upload throughput distribution auto-selection mode (5G/4G/3G/2G) - VIL.

(b) Network Technology: This section represents time spent on various network technologies.

Technology	Service Provider			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
5G	95.26%	NA	97.38%	87.92%
4G	4.74%	NA	2.62%	12.04%
3G	NA	16.93%	NA	NA
2G	0.00%	0.00%	NA	0.04%
Limited Service	0.00%	83.07%	0.00%	0.00%

Table-20: Time spent on technology during drive test in auto-selection mode (5G/4G/3G/2G) data.

Note-

- NA**-** Service provider doesn't provide services in respective technology.

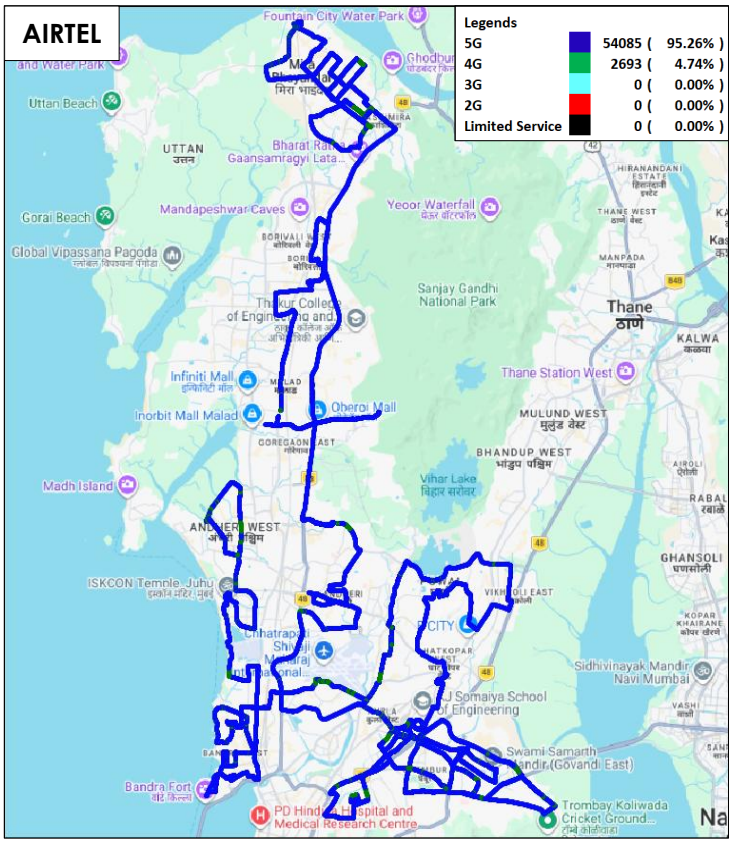


Figure-39: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

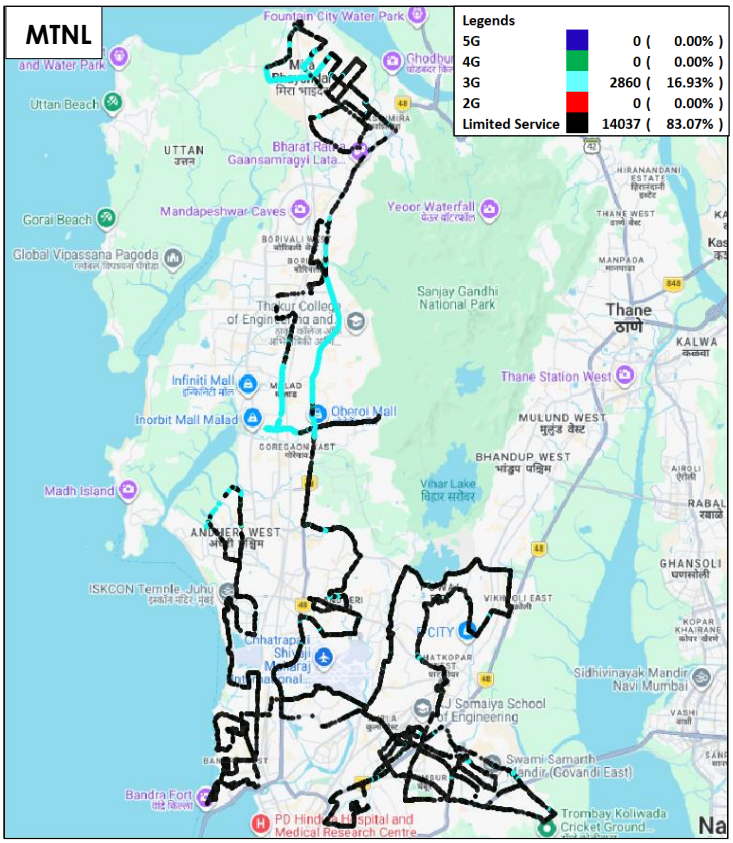


Figure-40: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - MTNL.

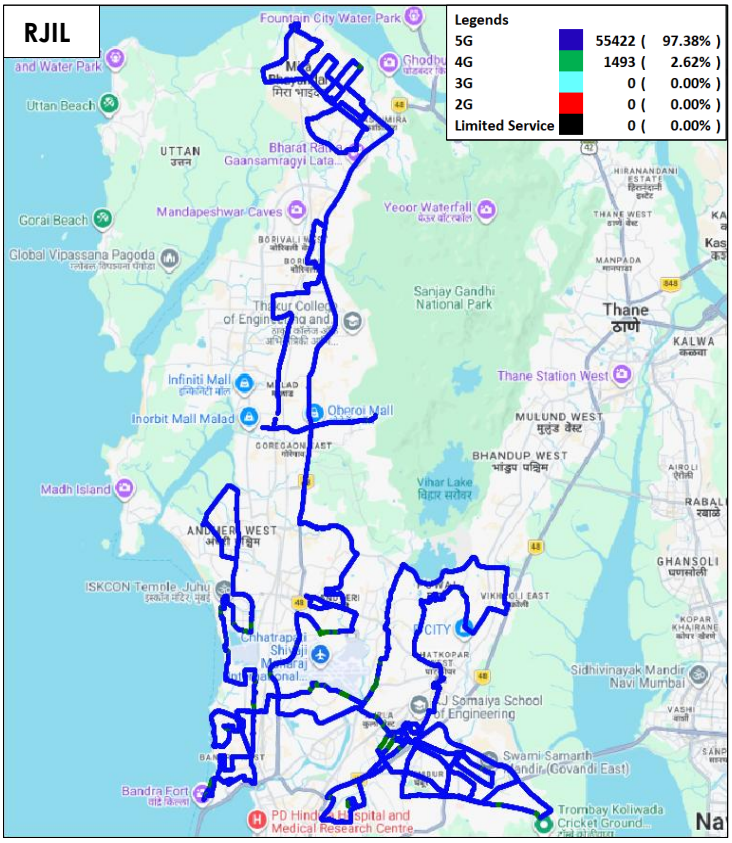


Figure-41: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data – RJIL

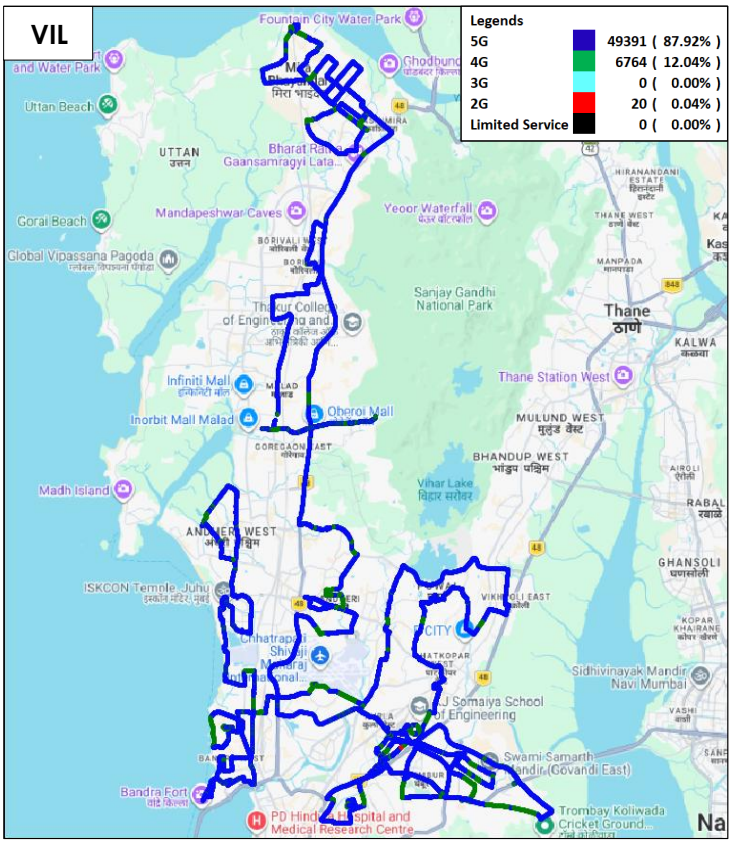


Figure-42: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - VIL.

(c) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) data. (Refer Figure-52, 53, 54 & 55 for map view)

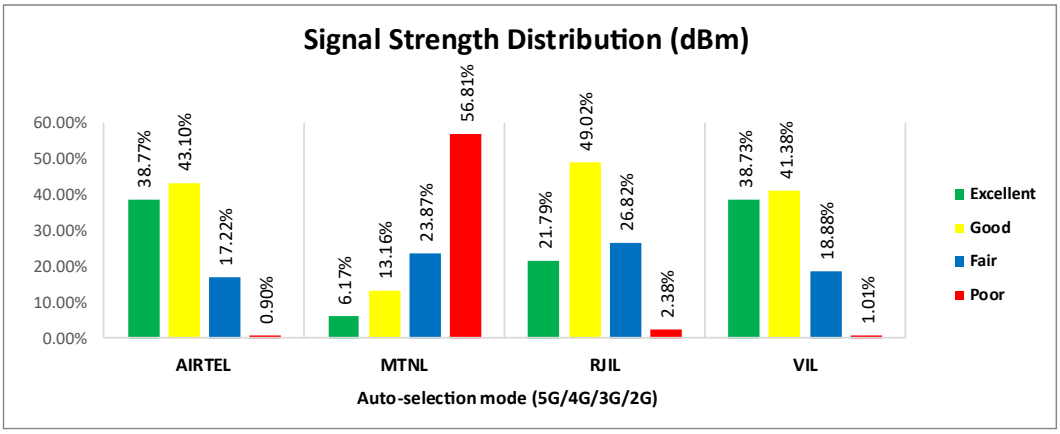


Figure-43: Signal strength distribution auto-selection mode (5G/4G/3G/2G) data.

Observations:

- Airtel has 39% of samples falling in the excellent signal strength category.
- MTNL has 6% of samples falling in the excellent signal strength category.
- RJIL has 22% of samples falling in the excellent signal strength category.
- VIL has 39% of samples falling in the excellent signal strength category.

4.3 Hotspots

Hotspot testing has been done from 23rd September 2026 to 25th September 2026. Seven locations have been tested in Mumbai City. (Refer Table-1)

4.3.1 Locations

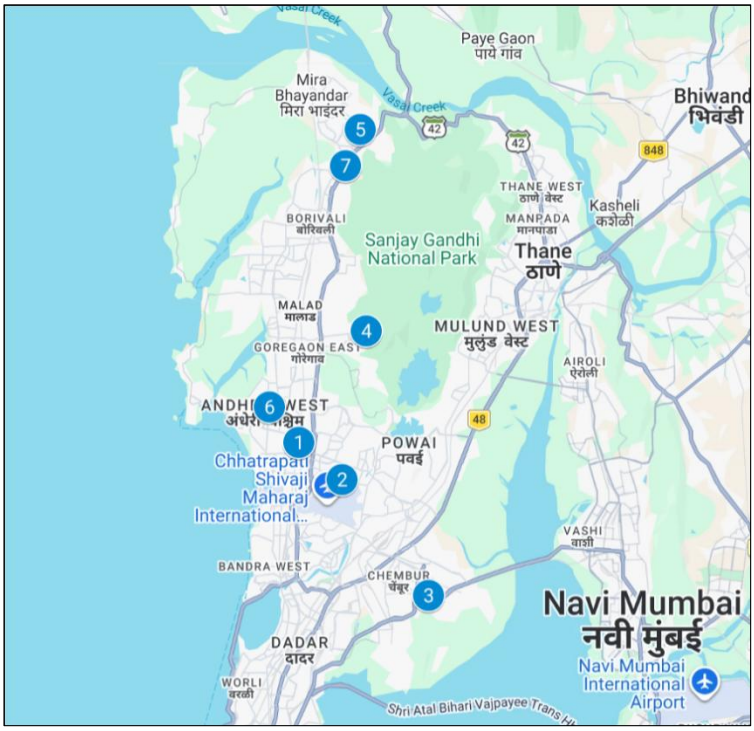


Figure- 44: Hotspot locations.

4.3.2 Hotspot covered

1. Andheri Railway Station
2. CSMI Airport-T2 Mumbai
3. Deonar Metro Station
4. Infiniti IT Park
5. Kashigaon Metro Station
6. Lower Oshiwara Metro Station
7. Pandurangwadi Metro Station

4.3.3 Voice performance

Overall Voice Performance				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	70	70	70	70
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.40	-	0.47	0.47

Table-21: Overall summary of voice call performance in network auto-selection mode (5G/4G/3G/2G).

Note-"-" Call setup time & drop call rate have not been reported as all calls were failed at all location.

Andheri Railway Station				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.43	-	0.47	0.36

Table-22: Summary of voice call performance in network auto-selection mode(5G/4G/3G/2G)

CSMI Airport-T2 Mumbai				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.35	-	0.51	0.71

Table-23: Summary of voice call performance in network auto-selection mode(5G/4G/3G/2G)

Deonar Metro Station				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.40	-	0.46	0.47

Table-24: Summary of voice call performance in network auto-selection mode(5G/4G/3G/2G)

Infiniti IT Park				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.35	-	0.54	0.36

Table-25: Summary of voice call performance in network auto-selection mode(5G/4G/3G/2G)

Kashigaon Metro Station				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.42	-	0.49	0.51

Table-26: Summary of voice call performance in network auto-selection mode(5G/4G/3G/2G)

Lower Oshiwara Metro Station				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.42	-	0.44	0.44

Table-27: Summary of voice call performance in network auto-selection mode(5G/4G/3G/2G)

Pandurangwadi Metro Station				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	0.42	-	0.41	0.48

Table-28: Summary of voice call performance in network auto-selection mode(5G/4G/3G/2G)

4.3.4 Data performance (Auto-selection mode 5G/4G/3G/2G)

Overall Data Performance				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	133.90	-	152.34	97.22
Download Throughput 80th Percentile (Mbit/s)	179.19	-	242.26	137.60
Download Throughput 20th Percentile (Mbit/s)	95.37	-	69.05	45.73
Download Session Setup Success Rate %	100.00	0.00	100.00	97.14
Upload Throughput Average (Mbits/s)	35.09	-	18.04	27.45
Upload Throughput 80th Percentile (Mbit/s)	46.52	-	35.11	40.34
Upload Throughput 20th Percentile (Mbit/s)	15.63	-	4.80	17.44
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	5.15	-	4.65	3.25
Youtube Initial Buffer Delay (Second)	1.60	-	1.27	0.87
Latency (ms) – 50th Percentile	22.56	-	16.58	16.70
Jitter (ms)	23.19	-	12.67	7.89
Packet Loss Rate%	2.96	100.00	0.49	0.30
Packet Loss Rate- 90th percentile	5.40	100.00	1.58	0.74

Table-29: Overall Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

- **Note**-"-" All data tests were failed in MTNL at all locations.

Andheri Railway Station				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	138.24	-	206.26	30.06
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	33.62	-	38.30	21.11
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	6.51	-	4.15	2.51
Youtube Initial Buffer Delay (Second)	1.87	-	0.51	1.34
Latency (ms) – 50th Percentile	20.05	-	15.87	18.48
Jitter (ms)	11.66	-	14.07	10.69
Packet Loss Rate%	0.40	100.00	0.10	0.70

Table-30: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

CSMI Airport-T2 Mumbai				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	183.73	-	292.42	89.95
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	43.40	-	21.92	28.53
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	4.98	-	3.69	5.96
Youtube Initial Buffer Delay (Second)	1.36	-	0.53	1.14
Latency (ms) – 50th Percentile	18.12	-	13.93	15.79
Jitter (ms)	1.82	-	3.28	8.68
Packet Loss Rate%	4.80	100.00	0.00	1.00

Table-31: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Deonar Metro Station				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	144.36	-	260.88	55.29
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	80.91	-	43.28	26.95
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	3.44	-	3.50	2.15
Youtube Initial Buffer Delay (Second)	0.65	-	0.58	0.83
Latency (ms) – 50th Percentile	22.96	-	15.83	20.76
Jitter (ms)	32.78	-	14.16	6.69
Packet Loss Rate%	1.00	100.00	0.30	0.00

Table-32: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Infiniti IT Park				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	160.90	-	13.71	59.19
Download Session Setup Success Rate %	100.00	0.00	100.00	80.00
Upload Throughput Average (Mbits/s)	5.42	-	2.27	12.55
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	6.52	-	8.48	2.26
Youtube Initial Buffer Delay (Second)	3.38	-	8.98	0.79
Latency (ms) – 50th Percentile	41.80	-	26.45	16.22
Jitter (ms)	68.98	-	26.43	4.42
Packet Loss Rate%	5.10	100.00	1.10	0.10

Table-33: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Kashigaon Metro Station				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	141.18	-	96.48	254.94
Download Session Setup Success Rate%	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	25.01	-	9.43	42.17
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	3.78	-	3.45	4.55
Youtube Initial Buffer Delay (Second)	1.21	-	0.88	0.90
Latency (ms)- 50th Percentile	20.15	-	15.46	12.16
Jitter (ms)	10.11	-	17.25	7.48
Packet Loss Rate%	0.20	100.00	0.40	0.20

Table-34: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Lower Oshiwara Metro Station				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	56.40	-	97.60	55.12
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	21.26	-	5.13	21.22
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	6.11	-	6.27	1.74
Youtube Initial Buffer Delay (Second)	0.66	-	3.76	0.54
Latency (ms) – 50th Percentile	40.82	-	19.50	14.36
Jitter (ms)	19.57	-	6.44	13.00
Packet Loss Rate%	4.10	100.00	1.50	0.10

Table-35: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Pandurangwadi Metro Station				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**MTNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	112.52	-	99.07	136.19
Download Session Setup Success Rate%	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	36.01	-	5.93	39.62
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	4.90	-	3.77	2.75
Youtube Initial Buffer Delay (Second)	2.44	-	0.81	0.63
Latency (ms)- 50th Percentile	42.02	-	18.65	20.48
Jitter (ms)	17.34	-	7.09	4.29
Packet Loss Rate%	5.10	100.00	0.00	0.00

Table-36: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

4.3.5 Data performance (5G Only & 4G Only Download & Upload Speed)

Overall Data Performance					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	114.65	-	144.57	75.78
	Upload Throughput Average (Mbits/s)	41.71	-	26.54	32.62
4G	Download Throughput Average (Mbits/s)	24.01	-	40.23	29.36
	Upload Throughput Average (Mbits/s)	7.69	-	12.67	10.89

Table-37: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

Andheri Railway Station					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	198.81	-	237.66	27.34
	Upload Throughput Average (Mbits/s)	38.25	-	63.54	25.86
4G	Download Throughput Average (Mbits/s)	4.41	-	17.18	23.62
	Upload Throughput Average (Mbits/s)	6.09	-	17.00	5.57

Table-38: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

CSMI Airport-T2 Mumbai					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	198.02	-	299.89	66.45
	Upload Throughput Average (Mbits/s)	53.64	-	18.02	33.97
4G	Download Throughput Average (Mbits/s)	5.81	-	42.14	18.76
	Upload Throughput Average (Mbits/s)	4.66	-	7.08	4.02

Table-39: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

Deonar Metro Station					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	133.25	-	75.88	38.92
	Upload Throughput Average (Mbits/s)	67.98	-	28.84	36.66
4G	Download Throughput Average (Mbits/s)	24.71	-	82.46	16.33
	Upload Throughput Average (Mbits/s)	9.85	-	11.93	14.12

Table-40: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

Infiniti IT Park					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	19.92	-	37.91	70.35
	Upload Throughput Average (Mbits/s)	3.28	-	4.77	19.93
4G	Download Throughput Average (Mbits/s)	64.52	-	9.94	11.10
	Upload Throughput Average (Mbits/s)	13.22	-	7.51	7.13

Table-41: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

Kashigaon Metro Station					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	133.46	-	103.24	234.46
	Upload Throughput Average (Mbits/s)	40.12	-	16.19	-
4G	Download Throughput Average (Mbits/s)	38.96	-	23.38	48.23
	Upload Throughput Average (Mbits/s)	11.14	-	10.00	16.41

Table-42: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

Lower Oshiwara Metro Station					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	77.99	-	146.03	42.28
	Upload Throughput Average (Mbits/s)	35.46	-	42.70	24.92
4G	Download Throughput Average (Mbits/s)	6.09	-	27.15	37.47
	Upload Throughput Average (Mbits/s)	1.70	-	8.04	5.71

Table-43: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

Pandurangwadi Metro Station					
Parameters		Service Provider			
		AIRTEL	MTNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	52.40	-	103.12	174.35
	Upload Throughput Average (Mbits/s)	52.28	-	11.74	47.06
4G	Download Throughput Average (Mbits/s)	23.55	-	79.33	50.00
	Upload Throughput Average (Mbits/s)	7.15	-	27.16	23.28

Table-44: Overall Summary of 5G only & 4G only data download & upload speed.

Note- "-"Respective technology was not observed during the test.

5. Voice & Data Key findings

5.1 Overall Voice

1. **Call Setup Success Rate:**
   a) Airtel, MTNL and VIL have 99.79%, 5.84% and 98.78% call setup success rate respectively in 3G/2G network mode. (refer table-3)

   b) Airtel, MTNL, RJIL and VIL have 100.00%, 3.35%, 99.83% and 99.83% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

   c) Airtel had a 100.00% call setup success when calling RJIL & VIL whereas call blocking was observed when calling MTNL. (refer table-9)

   d) All calls were blocked in MTNL when calling Airtel, RJIL & VIL for inter-operator calling. (refer table-9)

   e) RJIL had a 100.00% call setup success when calling Airtel and VIL whereas call blocking was observed when calling MTNL. (refer table-9)

   f) VIL had a 100.00% call setup success when calling Airtel and RJIL whereas call blocking was observed when calling MTNL. (refer table-9)

2. **Call Setup Time**:
   a) Airtel, MTNL and VIL call setup time is 4.72, 4.50 and 4.32 seconds respectively in 3G/2G network mode. (refer table-3)

   b) Airtel, MTNL, RJIL & VIL call setup time is 0.46, 3.81, 0.47 & 0.46 seconds respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

3. **Call Silence/Mute Rate**: In packet switched network (4G/5G) Airtel, RJIL and VIL have 0.21%, 0.20% and 0.00% silence call rate respectively. Further RJIL has higher RTP packet loss rate in downlink (0.69%) compared to VIL (0.48%) and Airtel (0.43%). In uplink the RTP packet loss rate is higher for RJIL (0.46%) compared to VIL (0.41%) and Airtel (0.23%). (refer table-6)

4. **Drop Call Rate**:
   a) Airtel, MTNL and VIL drop call rate is 1.03%, 6.67% and 1.65% respectively in 3G/2G network mode. (refer table-3)

   b) Airtel, MTNL, RJIL and VIL drop call rate is 0.17%, 6.25%, 0.35% and 0.00% respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

5.2 Overall Data

1. **Data download and upload performance (Overall i.e. LSA):**
   a) Airtel, MTNL, RJIL and VIL average download speeds are 133.86 Mbps, 0.00 Mbps, 242.46 Mbps and 89.56 Mbps respectively. (refer table-11)

   b) Airtel, MTNL, RJIL and VIL average upload speeds are 32.96 Mbps, 0.00 Mbps, 32.79 Mbps and 23.50 Mbps respectively. (refer table-11)

2. **Data download and upload performance (static i.e. while stationary):**
   a) Airtel, MTNL, RJIL and VIL average download speeds are 133.90 Mbps, 0.00 Mbps, 152.34 Mbps and 97.22 Mbps respectively. (refer table-29)

   b) Airtel, MTNL, RJIL and VIL average upload speeds are 35.09 Mbps, 0.00 Mbps, 18.04 Mbps and 27.45 Mbps respectively. (refer table-29)

3. **Data session setup success rate (static i.e. while stationary):**
   a) Airtel, MTNL, RJIL and VIL have 100.00%, 0.00%, 100.00% and 97.14% download session setup success rate respectively. (refer table-29)

   b) Airtel, MTNL, RJIL and VIL have 100.00%, 0.00%, 100.00% and 100.00% upload session setup success rate respectively. (refer table-29)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 99.79% call setup success rate and 1.03% drop call rate have been observed in 3G/2G network mode for LSA/City drive. (refer table-3 & 13)
- 100.00% call setup success rate and 0.17% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. (refer table-5)
- 100.00% call setup success rate and 0.20% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. (refer table-15)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. (refer Table-21)

Data

- Airtel has 133.86 Mbps average download speed & 32.96 Mbps average upload speed for LSA. (refer table-11)
- Airtel has 133.86 Mbps average download speed & 32.80 Mbps average upload speed across measured routes for city drive. (refer table-19)
- Lower Oshiwara Metro Station has less download speed (less than 100 Mbps) out of total 7 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-35)
- Infiniti IT Park has less upload speed (less than 20 Mbps) out of total 7 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-33)

2. MTNL:

Voice

- 5.84% call setup success rate and 6.67% drop call rate have been observed in 3G/2G network mode for LSA/City drive. (refer table-3 & 13)
- 3.35% call setup success rate and 6.25% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. (refer table-5)
- 3.62% call setup success rate and 6.25% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. (refer table-15)
- All hotspot locations have 0.00% call setup success rate in auto-selection mode (5G/4G/3G/2G). (refer Table-21)

Data

- MTNL has 0.00 Mbps average download speed & 0.00 Mbps average upload speed for LSA. (refer table-11)
- MTNL has 0.00 Mbps average download speed & 0.00 Mbps average upload speed across measured routes for city drive. (refer table-19)
- All hotspot locations have less download speed (less than 10 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-30 to 36)

- All hotspot locations have less upload speed (less than 2 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-30 to 36)

3. RJIL:

Voice

- 99.83% call setup success rate and 0.35% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. (refer table-5)
- 99.80% call setup success rate and 0.39% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. (refer table-15)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. (refer Table-21)

Data

- RJIL has 242.46 Mbps average download speed & 32.79 Mbps average upload speed for LSA. (refer table-11)
- RJIL has 248.93 Mbps average download speed & 33.87 Mbps average upload speed across measured routes for city drive. (refer table-19)
- Infiniti IT Park, Kashigaon Metro Station, Lower Oshiwara Metro Station & Pandurangwadi Metro Station have less download speed (less than 100 Mbps) out of total 7 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-33 to 36)
- Infiniti IT Park, Kashigaon Metro Station, Lower Oshiwara Metro Station & Pandurangwadi Metro Station have less upload speed (less than 20 Mbps) out of total 7 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-33 to 36)

4. VIL:

Voice

- 98.78% call setup success rate and 1.65% drop call rate have been observed in 3G/2G network mode for LSA/City drive. (refer table-3 & 13)
- 99.83% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. (refer table-5)
- 99.80% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. (refer table-15)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. (refer Table-21)

Data

- VIL has 89.56 Mbps average download speed & 23.50 Mbps average upload speed for LSA. (refer table-11)
- VIL has 89.04 Mbps average download speed & 23.21 Mbps average upload speed across measured routes for city drive. (refer table-19)
- Andheri Railway Station, CSMI Airport-T2 Mumbai, Deonar Metro Station, Infiniti IT Park and Lower Oshiwara Metro Station have less download speed (less than 100 Mbps) out of total 7 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-30, 31, 32, 33 & 35)
- Infiniti IT Park have less upload speed (less than 20 Mbps) out of total 7 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-33)

6. Annexure

6.1 Route wise coverage map

6.1.1 City

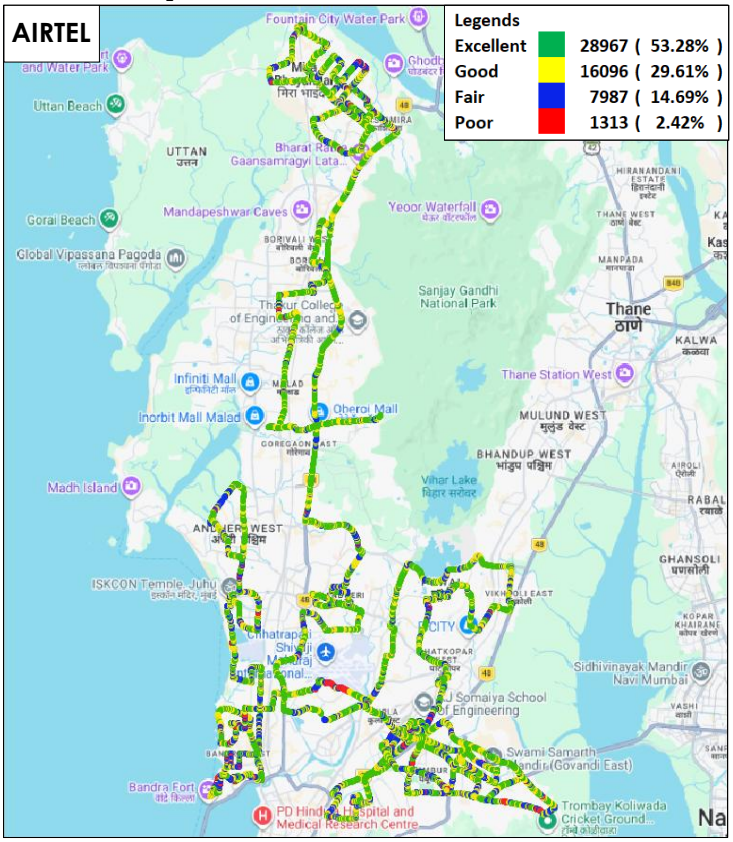


Figure-45: Signal strength 3G/2G network mode voice - AIRTEL.

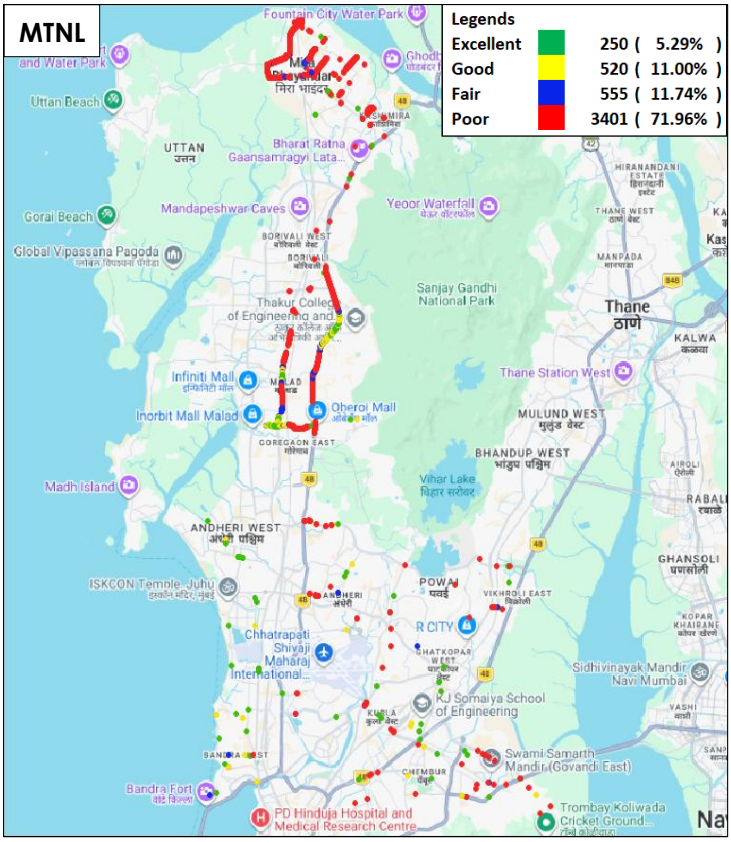


Figure-46: Signal strength 3G/2G network mode voice - MTNL.

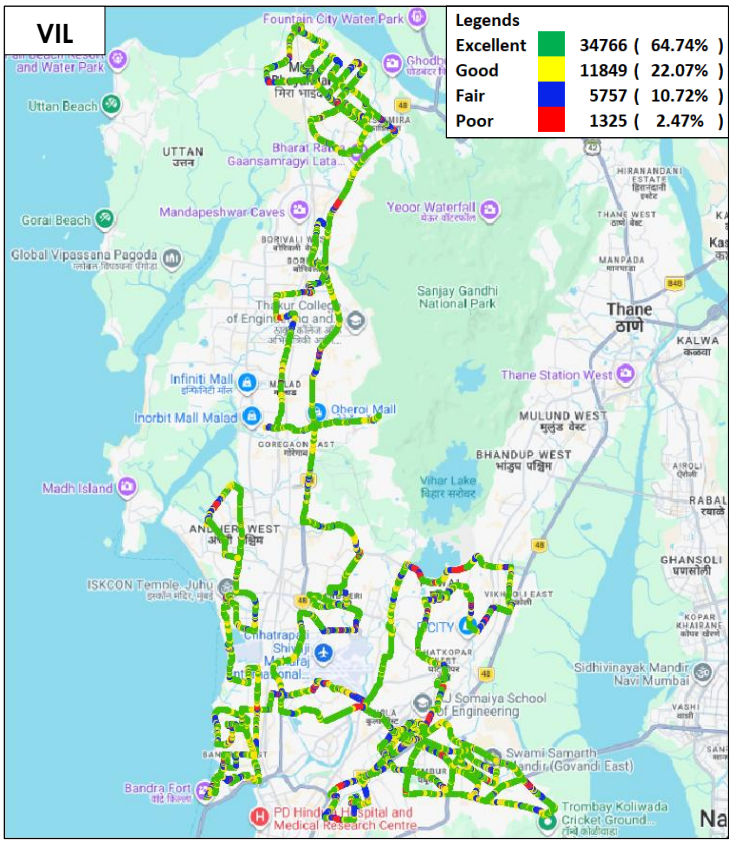


Figure-47: Signal strength 3G/2G network mode voice - VIL.

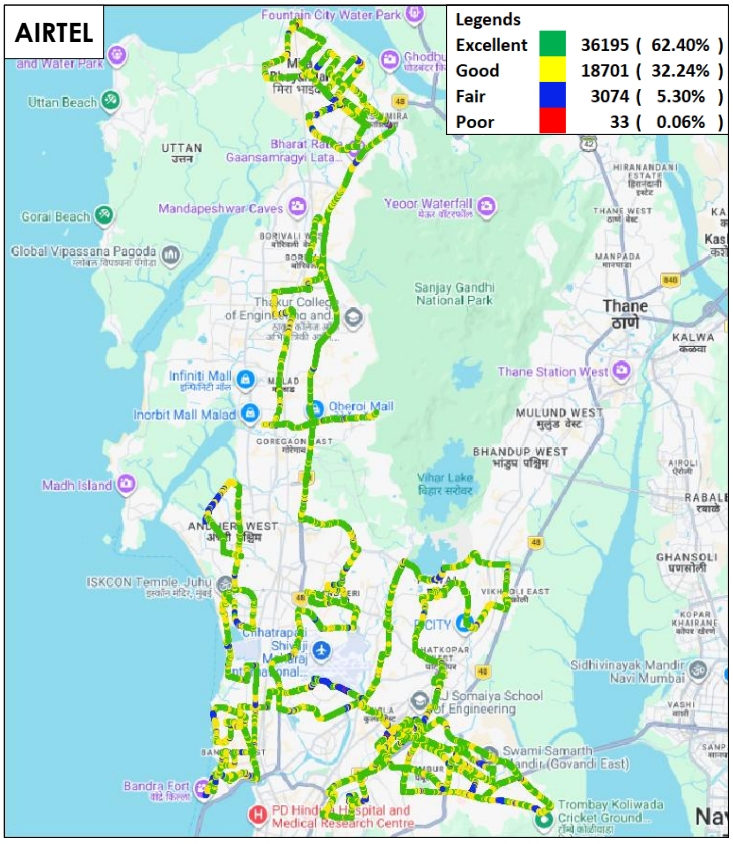


Figure-48: Signal strength auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

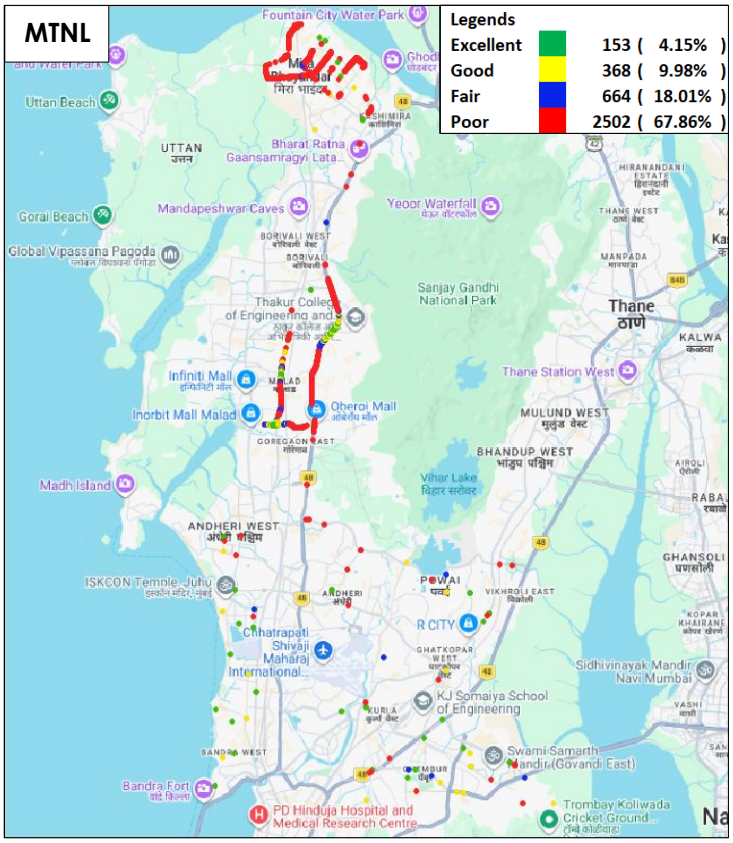


Figure-49: Signal strength auto-selection mode (5G/4G/3G/2G) voice - MTNL.

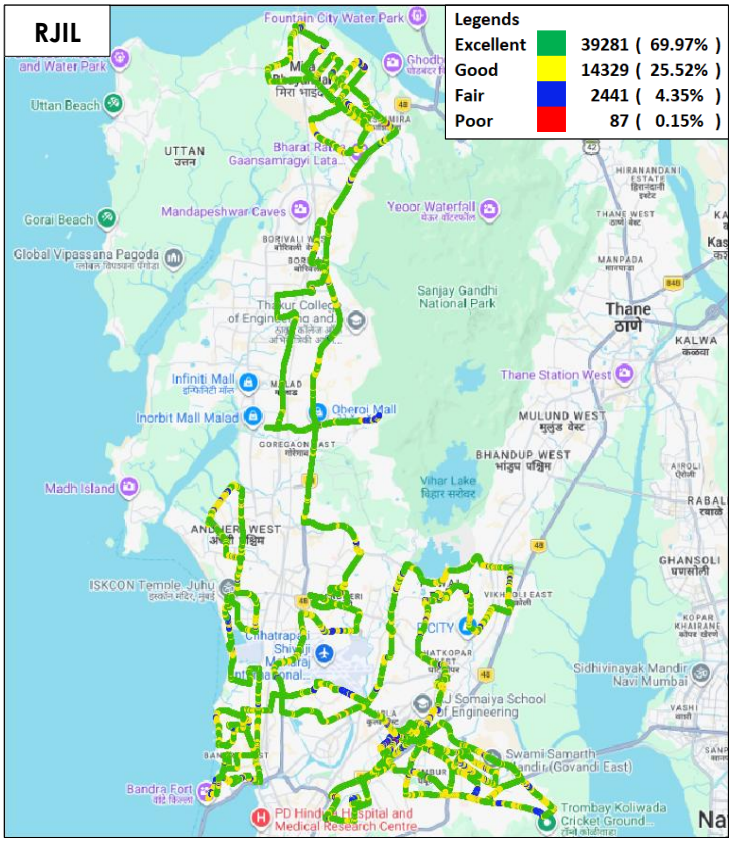


Figure-50: Signal strength auto-selection mode (5G/4G/3G/2G) voice - RJIL.

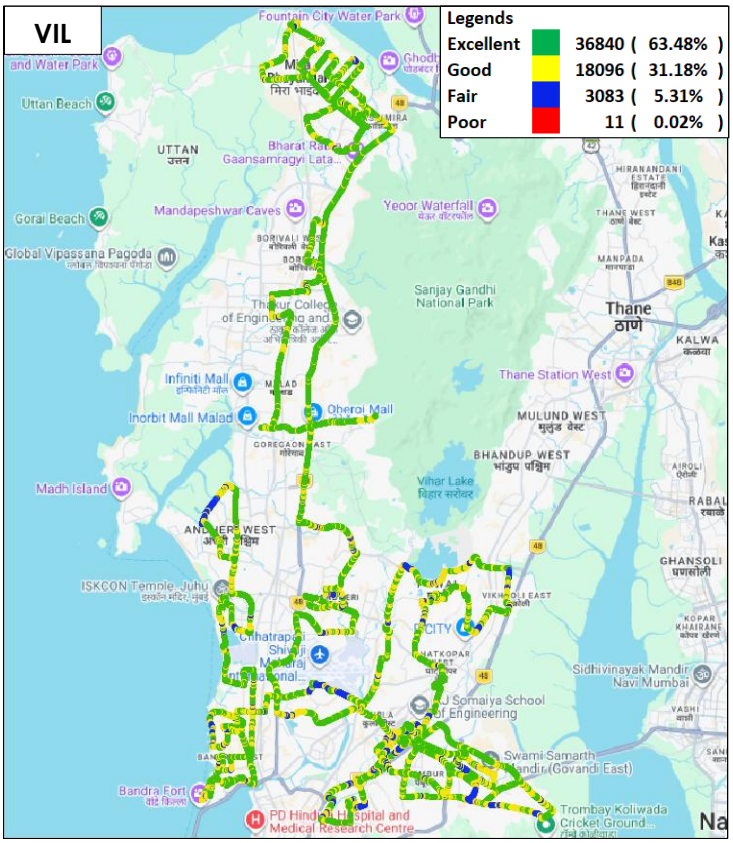


Figure-51: Signal strength auto-selection mode (5G/4G/3G/2G) voice - VIL.

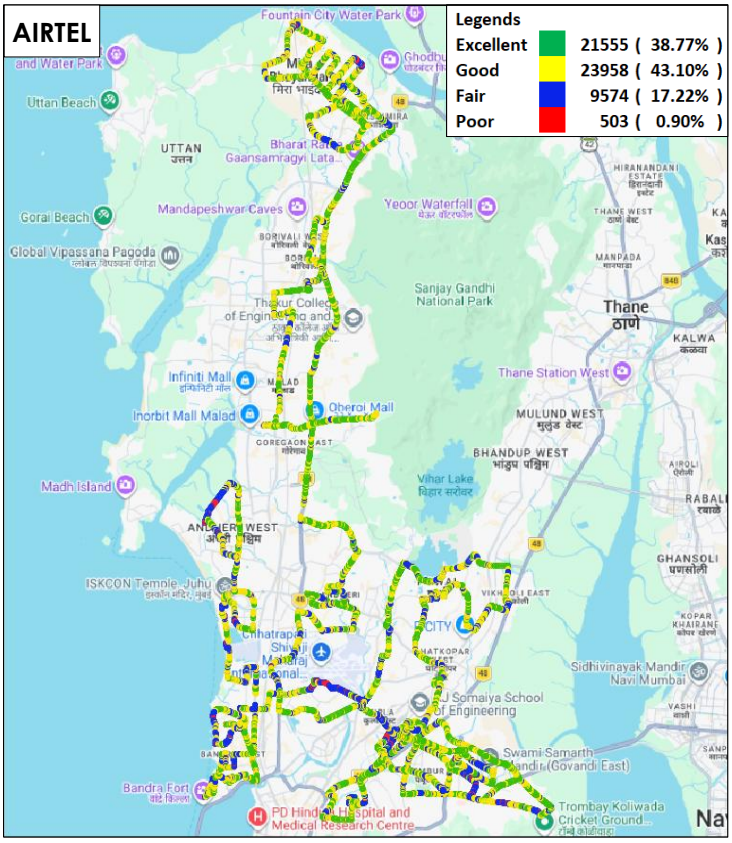


Figure-52: Signal strength auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

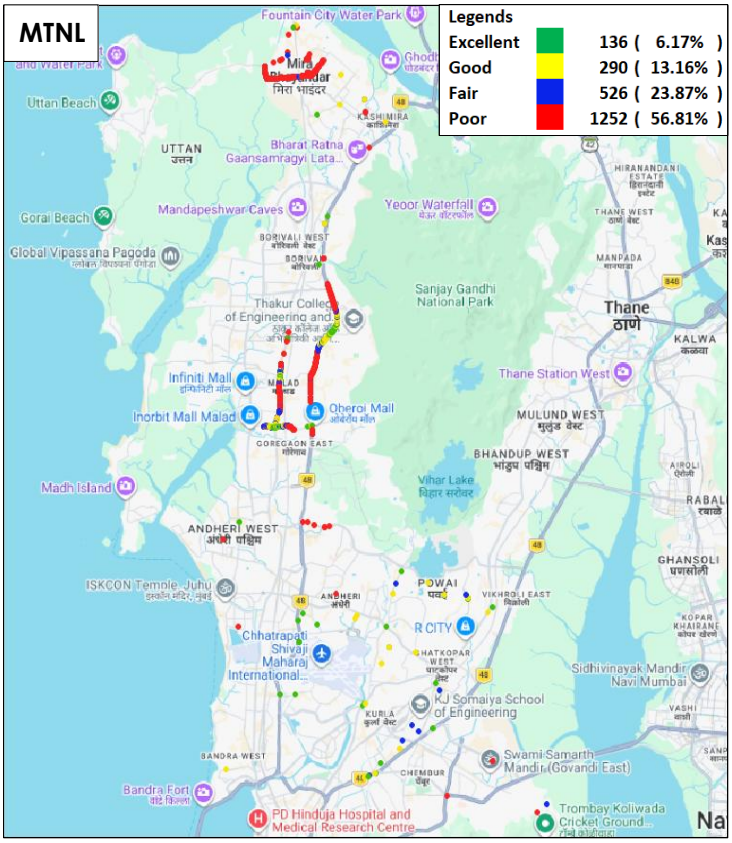


Figure-53: Signal strength auto-selection mode (5G/4G/3G/2G) data - MTNL.

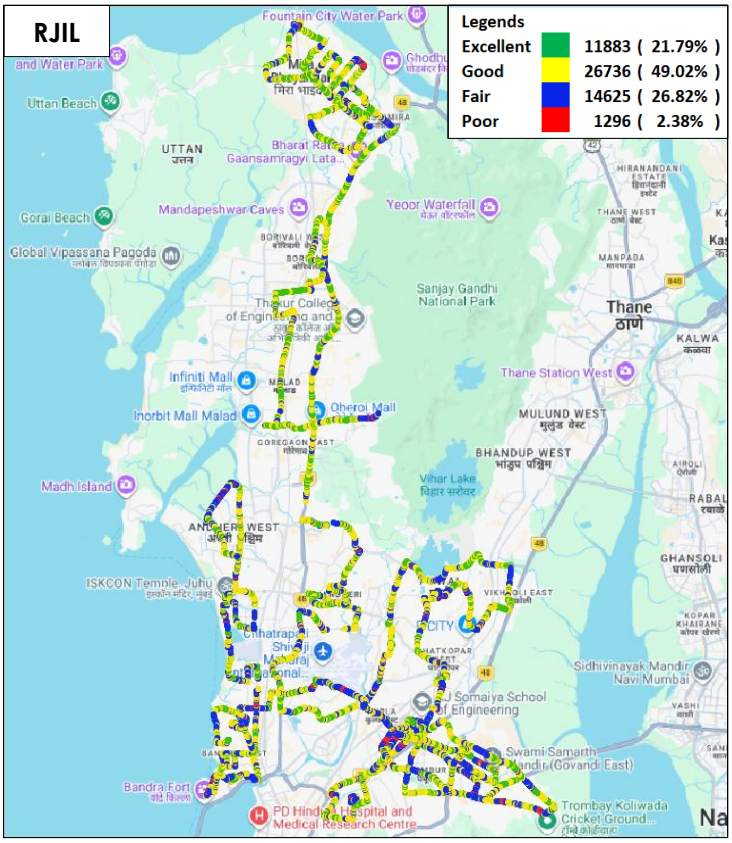


Figure-54: Signal strength auto-selection mode (5G/4G/3G/2G) data - RJIL.

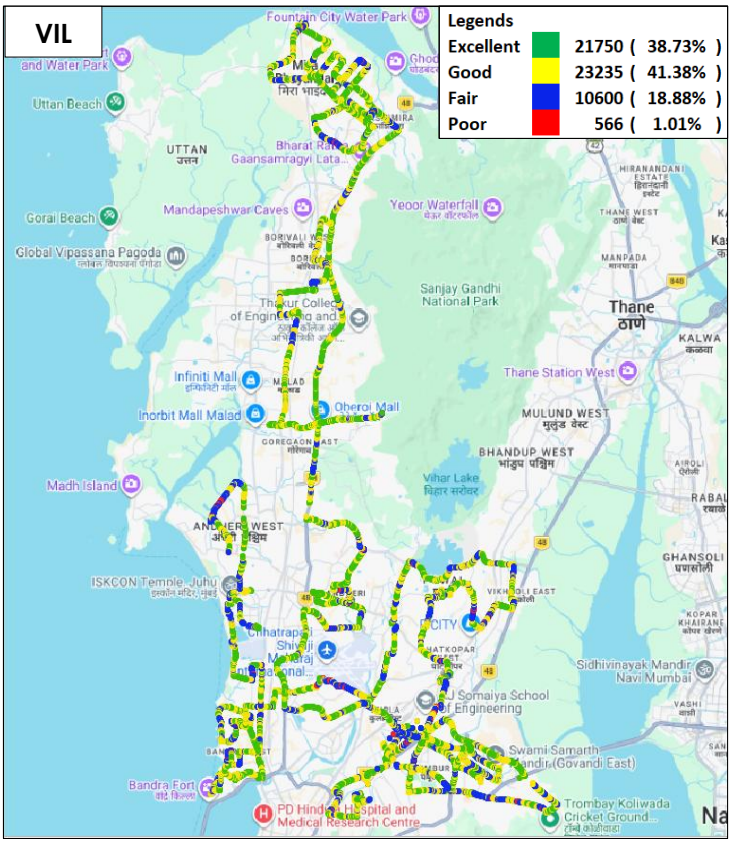


Figure-55: Signal strength auto-selection mode (5G/4G/3G/2G) data - VIL.

7. Appendix

The details of the setup used for conducting the drive test and the network or performance parameters captured under different conditions may be seen at Appendix-I. The calculation method of each QoS parameter is given in Appendix-II of the report. The summary of key equipment used in technical setup is as under

- **Device-1**: OnePlus Nord CE3 for 3G/2G CAT-15 Smartphone.
- **Device-2**: Samsung Galaxy S23 for 5G/4G/3G/2G CAT-20 Smartphone
- **Drive test Software**: Azenqos Engineering capable Applications to capture actual user experience.

7.1 Appendix-I

7.1.1 Drive test setup

Voice Call		
Call details	**Technology**	**Detail**
Call Setup Timeout	• 3G/2G auto mode- switch Call • 5G/4G/3G/2G auto mode- switch Call • 5G/4G MOS Call	30 Sec
Call Duration		90 seconds
Wait/ Guard Time		15 Sec

Table-45: Voice test detail

Note-

- There is 15 sec wait time after locking and before starting first call in 3G/2G call.
- 10 calls to be made at each Hotspot location.
- Minimum 10 Calls to be made during the walk test. Call count will be increased based on walk test distance.
- Speech quality (MOS) has been measured only in city drive & highway by making Mobile to Mobile call.

Data Test		
Test Type	**Technology**	**Detail**
FTP/HTTP Download	5G/4G/3G/2G Auto Mode	500 MB File- 30 Sec Timeout, (Multithread 3- TCP Connection at a time)
FTP/HTTP Upload		250 MB File- 30 Sec Timeout, (Multithread 3- TCP Connection at a time)
YouTube Streaming		20 Sec Video & 25 sec Timeout (Only at Hotspot)
Web Browsing		3 popular websites (www.google.co.in, www.irctc.co.in, www.sbi.bank.in) 20 sec timeout (only at Hotspot)

Latency & Jitter (TWAMP-UDP)		25 count- Dynamic 500 count- Hotspot Payload- 42 bytes in all drive
Packet Loss Rate (TWAMP-UDP & TCP)		500 counts (TWAMP-UDP) 500 counts (TCP) at each hotspot Payload- 42 bytes in all drive

Table-46: Data test detail

Note-

- 5 Data iteration to be done at each hotspot location.
- Minimum 5 iteration to be made during the walk test. Iteration count will be increased based on walk test distance.
- TWAMP-UDP & TCP test to be performed only once at hotspot location.
- Youtube & Web browsing test to be performed at static location only.
- All values are taken up to two decimal places with round off.
- Airtel server was used for FTP Download, FTP Upload, TCP and TWAMP testing, for Airtel
- Delhi-based TRAI server was used for HTTP Download, HTTP Upload, TCP and TWAMP testing, for MTNL.
- RJIL server was used for FTP Download, FTP Upload, TCP and TWAMP testing, for RJIL.
- VIL server was used for HTTP Download, HTTP Upload, TCP and TWAMP testing, for VIL.

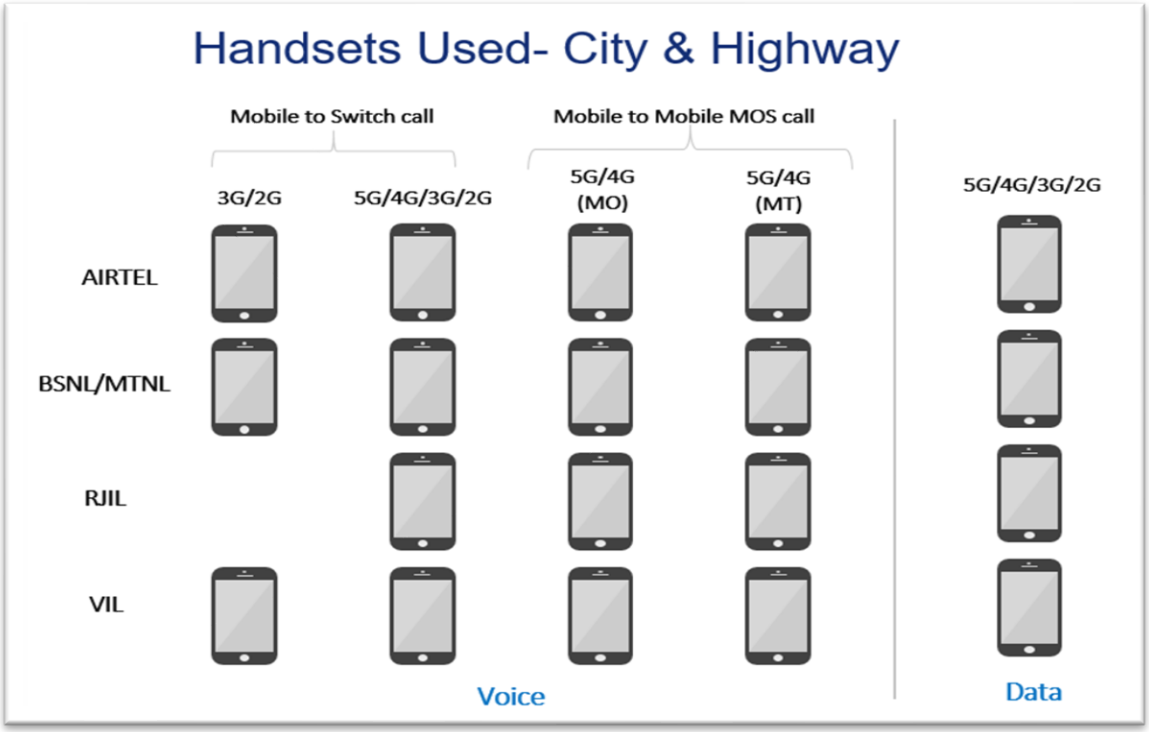


Figure-56: Number of handsets used in city & highway drive

MO: Mobile originating

MT: Mobile terminating

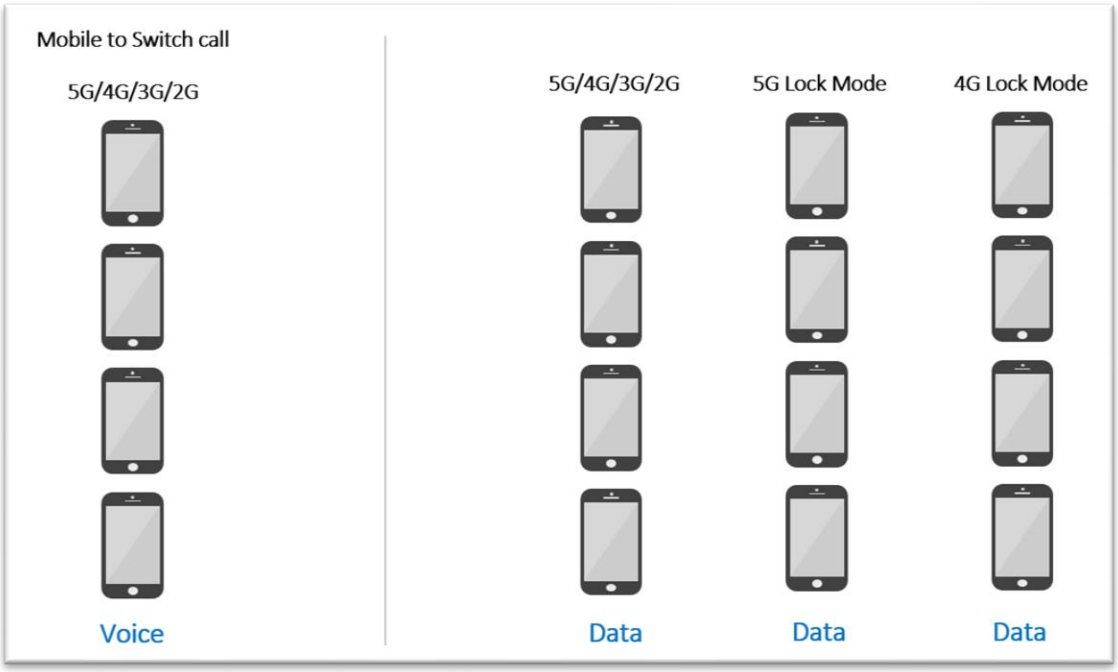


Figure-57: Number of handsets used in railway/metro/walktest/hotspot/ coastal area

Note- 5G & 4G Lock mode testing has been performed at hotspot locations only.

7.1.2 Drive test Methodology

(a) Dynamic voice testing (on the move)

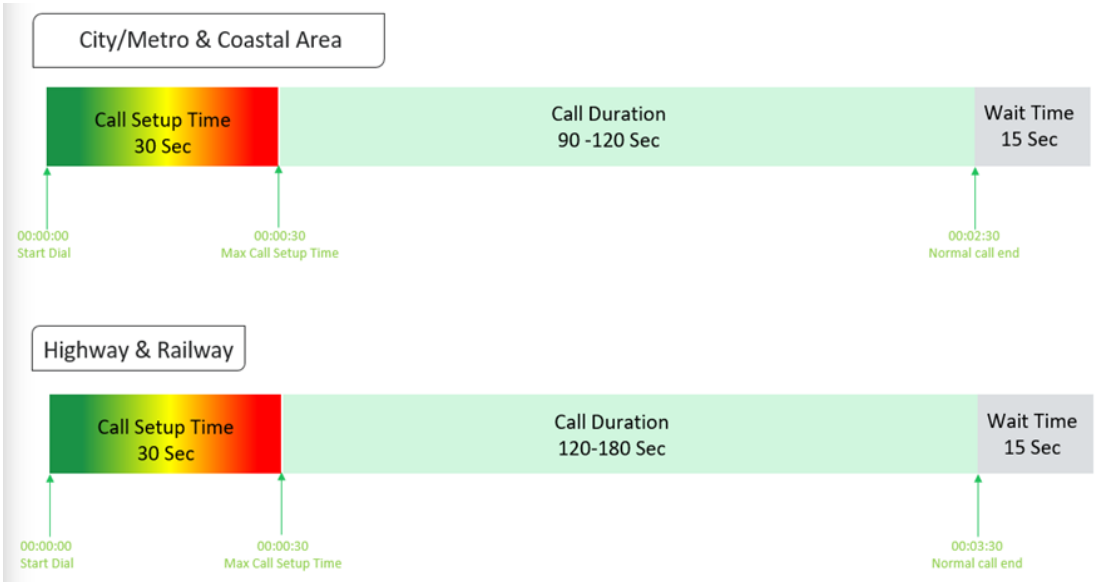


Figure-58: Voice test script for city/railway/metro/highway & coastal area

- 15 sec wait time is applied after locking Radio Access Technology (RAT) to 3G/2G and before starting first call in 3G/2G call.
- Speech quality (MOS) will be measured only City & Highway drive by making Mobile to Mobile calls.

(b) Hotspot voice testing



Figure-59: Voice test script for walktest/hotspot

- 10 calls to be made at each Hotspot location.
- Minimum 10 Calls to be made during the walk test. Call count will be increased based on walk test distance.

(c) Dynamic Data (internet) test

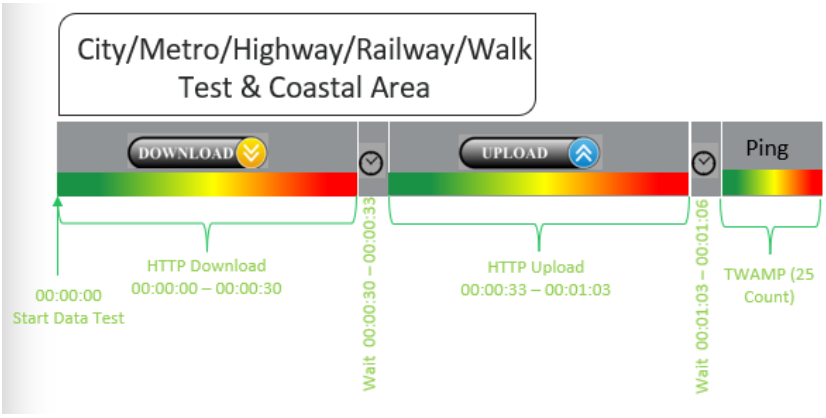


Figure-60: Data test script used in city/metro/railway/highway/walk test & coastal area

(d) Static Data(internet) testing

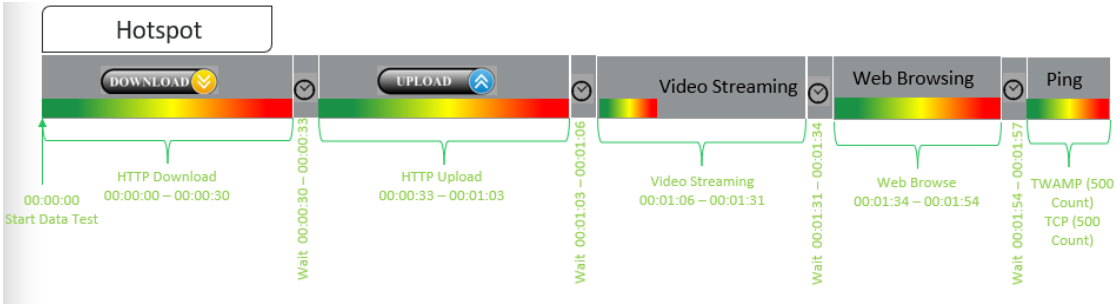


Figure-61: Data test script used at hotspot

- 5 Data iteration done at each hotspot location
- Min. 5 iteration made during the walk test.
- Web browsing duration mentioned above is for one web site only.
- One ping iteration (with 500 Count of each- TWAMP & TCP) done at hotspot location.

7.2 Appendix-II

7.2.1 Network Performance Parameters for Voice calls

Parameter Name	Definition
Call Setup Success Rate	(i) Call Setup Success Rate is defined as the ratio of Established Calls to Call Attempts. 'Established Calls' mean the following events have happened in call setup: (a) Call attempt is made (b) The signaling channel is allocated (c) The call is routed to the outwards path of the terminating network (d) An alert signal is received by caller in the form of ring back tone, busy tone, or an announcement. CSSR = (Total Call Established/ Total Call Attempt) *100 As per QoS Regulation 2024 benchmark value is **>=98%**
Drop Call Rate	Call drop represents the service provider network's ability to maintain a call once it has been successfully established. This parameter shall include both incoming calls and outgoing calls which, once they have been established and have an assigned traffic channel/ bearer, are dropped, or interrupted before their normal completion by the user, the cause of the early termination being within the service provider's network Drop Call Rate = (Total Call Drop/Total Call Established) *100 As per QoS Regulation 2024 benchmark value is **<=2%**
Call Setup Time	Time taken from call initiate to call alerting/ringing. Call Setup Time = T2- T1 T2- Ringing (VoLTE/VoNR) & Alerting (for WCDMA & GSM), T1- Invite (VoLTE/VoNR) & CM Service Request (for WCDMA & GSM)
Voice Quality (MOS)	Voice quality in mobile networks is measured with algorithms based on ITU-T P.863 (POLQA). The grading for Voice quality has been given as: Excellent: MOS $\geq$ 4 and < 5 Good : MOS $\geq$ 3 and < 4 Fair : MOS $\geq$ 2 and < 3 Poor : MOS $\geq$ 1 and < 2
Handover Success Rate	Handover Success Rate = Count of successful handovers (All Technology Handover combined) / Total count of Handover Attempt (All Technology Handover combined) *100 Handover type which are considered- 2G Inter & Intra cell, 3G Soft & IRAT, 4G Inter & Intra frequency & SRVCC, 5G Inter & Intra frequency & 5G to 4G handovers.
Silence Call	A call which has ≥ 4 sec continuous RTP gap is considered as a Silence Call. Silence call rate = (count of silence call / Total calls established) *100 If a call observes multiple silence count >=4 sec in a particular established call it has been taken as one silent event.

<table>
<tr><td>Jitter</td><td>The inter arrival jitter is the difference in the relative transit time for two packets. The relative transit time is the difference between a packet's Real-time Transport Protocol (RTP) timestamp and the receiver's clock at the time of arrival, measured in the same units. If Si is the RTP timestamp from packet i, and Ri is the time of arrival in RTP timestamps units for packet i, then for two packets i and j the inter-arrival jitter D can be expressed as:
D(i,j) = (Rj - Ri) - (Sj - Si)

The interarrival jitter is calculated continuously as each data packet i is received from source SSRC_n, using this difference D for that packet and the previous packet i-1 in order of arrival (not necessarily in sequence), according to the formula
J(i) = J(i-1) + (|D(i-1,i)| - J(i-1))/16 or 8</td></tr>
<tr><td>Downlink Packet Drop Rate</td><td>Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call originating handset.
This KPI is calculated from MOS call for packet call only (VoNR/VoLTE)</td></tr>
<tr><td>Uplink Packet Drop Rate</td><td>Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call terminating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE).</td></tr>
<tr><td>Signal Strength</td><td>Signal strength is the signal power level received by the wireless user.

<table>
<tr><td rowspan="2">Parameter Name</td><td rowspan="2">Technology</td><td colspan="4">Signal Strength (dBm)</td></tr>
<tr><td>Excellent</td><td>Good</td><td>Fair</td><td>Poor</td></tr>
<tr><td>Rx Level</td><td>GSM</td><td>0 to ≥ -65</td><td><-65 to ≥ -75</td><td><-75 to ≥-85</td><td><-85 to min</td></tr>
<tr><td>RSCP</td><td>WCDMA</td><td>0 to ≥ -70</td><td><-70 to ≥ -80</td><td><-80 to ≥ -90</td><td><-90 to min</td></tr>
<tr><td>RSRP</td><td>LTE</td><td>0 to ≥ -80</td><td><-80 to ≥ -95</td><td><-95 to ≥-110</td><td><-110 to min</td></tr>
<tr><td>SS_RSRP</td><td>NR</td><td>0 to ≥ -80</td><td><-80 to ≥ -95</td><td><-95 to ≥-110</td><td><-110 to min</td></tr>
</table>
</td></tr>
</table>

Table-47: Network performance parameter and definition voice

7.2.2 Network Performance Parameters Data tests

Parameter Name	Definition
Download Speed (Mbps)	The download speed is defined as the data transmission rate that is achieved for downloading a test file from a test server to a test device. Download Speed = Total bytes transferred during download / Total time for transfer • 80th percentile (upper range) & 20th percentile (lower range) value has been calculated for download throughput in dynamic drive and Hotspot combine data
Upload Speed (Mbps)	The upload speed is the data transmission rate that is achieved for uploading a test file from a test device to a test server. Upload Speed = Total bytes transferred during upload / Total time for transfer. • 80th percentile (upper range) & 20th percentile (lower range) value has been calculated for upload throughput in dynamic drive and Hotspot combine data.
Download Session Setup Success Rate	(total download session established (successfully connected to server)/ total download session attempt) *100. This KPI has been calculated for Hotspot only.

Upload Session Setup Success Rate	(total upload session established (successfully connected to server)/ total upload session attempt)*100. This KPI need to report for Hotspot only.
Web Page Download Time	Web browsing test is used to measure performance in terms of opening a web/HTTP page. Time taken to open the web page successfully is considered as web browsing delay/web page download time.
Video Streaming Delay	The Video streaming delay is time taken from start of video transfer to First video frame displayed in player.
Latency (TWAMP-UDP)	Latency is the time it takes for a small data set to be transmitted from a device to a server on the Internet and back to the same device again. The Latency is measured in milliseconds (ms). To calculate the one-way latency, we just do half of the round-trip time. 50th percentile of one-way latency has been reported.
Jitter (TWAMP-UDP)	Measure of variation in time in arrival of packets from a source to destination The consideration of packet delay jitter is considered by standard deviation of Inter Packet Delay Variation. If IPDV is used. By standard deviation is meant the average of standard deviation of IPDV on DL IPDV(i) = D(i) – D(i-1) then Stdvs of IPDV is considered as jitter.
Packet Loss Rate (TWAMP-UDP & TCP)	Number of packets lost out of total packet transferred during test. Packet loss rate = (Total packet lost / Total packet sent) *100 * Packet delay (using TWAMP-UDP & TCP) >90 ms considered as packet loss and included in packet loss rate. * Packet loss rate is calculated based on TWAMP-UDP & TCP. *90th percentile for Packet loss rate has been reported in overall Hotspot performance summary.

Table-48: Network performance parameter and definition Data

Disclaimer: The observations presented above and, in the reports, represent the performance of the service providers on the area/route under test on the day/time of conducting the drive test and no inference whatsoever may be drawn regarding the quality of the telecom service by the service providers in the whole city/state/licensed service area.

Hardik Rajeshbhai Patel

Digitally signed by Hardik Rajeshbhai Patel
Date: 2026.10.08 15:26:43 +05'30'