भादूविप्रा
TRAI

TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

UP East LSA

April 2025

Contents

1. Introduction

TRAI Act, 1997 mandates the Authority to ensure the services delivered through various telecommunications networks meet 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 interest of the consumers of telecommunications service.

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 UP East License Service Area (LSA) during the month of April 2025 under the supervision of TRAI Regional Office (RO), Bhopal. Details of route/area covered during the IDT is as given below:

Sl. No	Drive test route	Type of route	Distance covered (KMs)/ Locations	From date	To date
1	Varanasi	City	232.8	22-Apr-2025	24-Apr-2025
2	Varanasi	Hotspot	8 Locations	25-Apr-2025	25-Apr-2025
3	Varanasi	Walk Test	3.2	24-Apr-2025	25-Apr-2025
4	Varanasi	Inter Operator Calling	13.1	25-Apr-2025	25-Apr-2025

Table-1: Drive test summary

2.2 Drive test routes

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

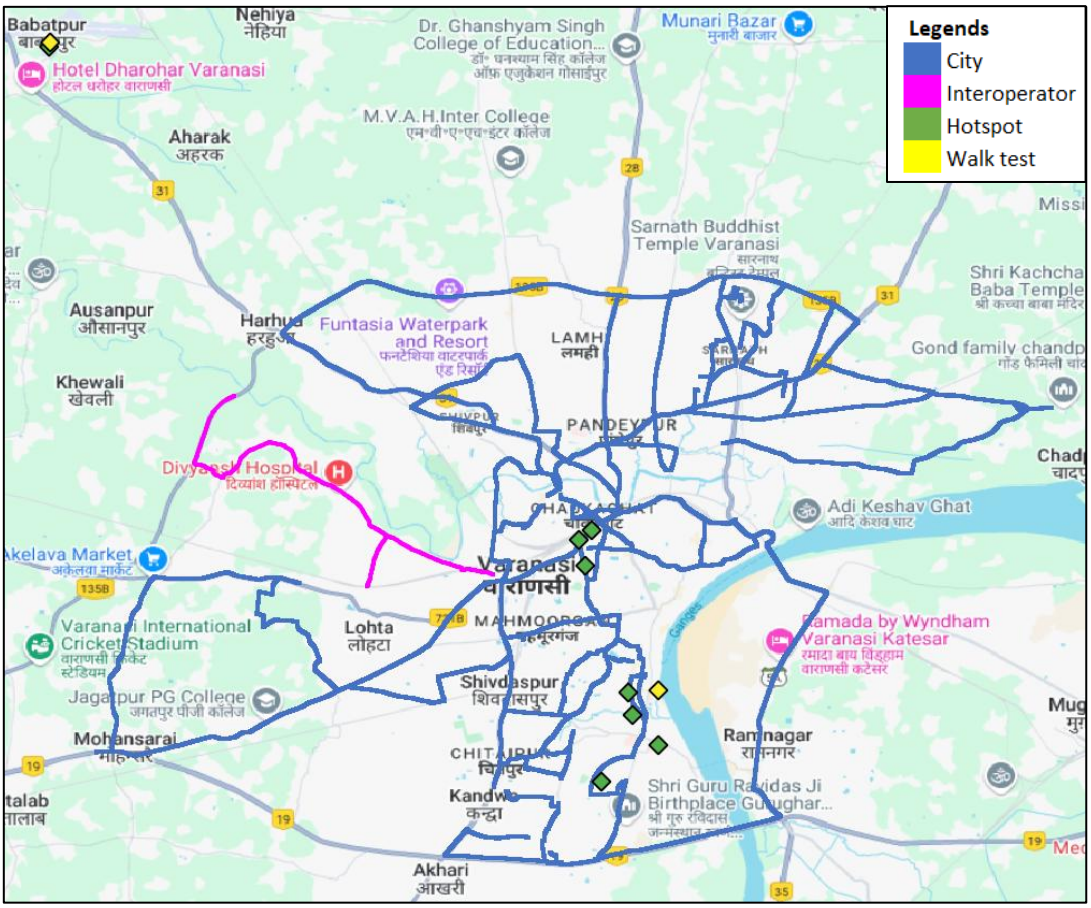


Figure-1: Drive test routes

2.3 Summary of areas covered

a) City- Mohansarai, Bhullanpur PAC, Chitaipur, Mahmoorganj, Jaitpura, Varanasi cantonment, Chaukaghat, Pandaypur, Asapur etc.

b) Hotspot

1. BHU
2. BHU Trauma Centre
3. Kashi Vidhyapeeth
4. Sankatmochan Mandir
5. Shree Durga Mata mandir
6. Varanasi Airport
7. Varanasi Bus stand
8. Varanasi Junction

c) Walk Test

1. Assi Ghat
2. Varanasi Airport

2.4 Telecom service providers detected frequency bands

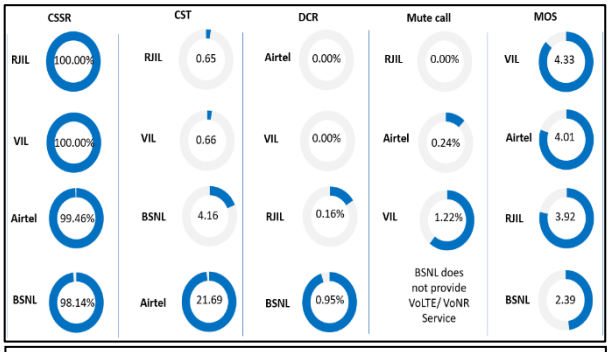
Technologies covered during the IDT and frequency bands in use are summarised in below table.

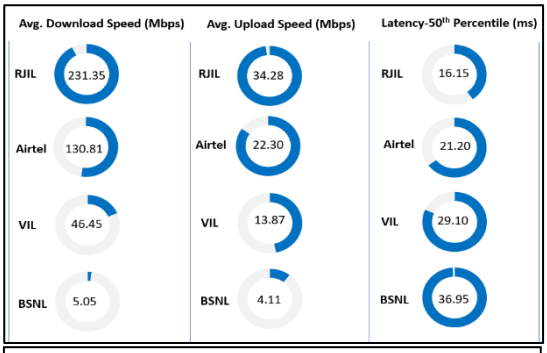
S.No.	Name of TSP	Technology	Frequency Bands (In MHz)
1	Bharti Airtel Ltd.	2G	900
2	Bharti Airtel Ltd.	4G	900,1800,2100,2300
3	Bharti Airtel Ltd.	5G	3500
4	BSNL	2G	900
5	BSNL	3G	2100
6	BSNL	4G	700,2100
7	Reliance JIO Infocomm Ltd.	4G	850,1800,2300
8	Reliance JIO Infocomm Ltd.	5G	700,3500
9	Vodafone Idea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

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

2.5 Performance against key QoS parameters

CSSR: Call Setup Success Rate (in %), **CST**: Call Setup Time (in milli seconds), **DCR**: Drop Call Rate (in %) & **MOS**: Mean Opinion Score.





Summary-Voice Service

Call Setup Success Rate: Airtel, BSNL, RJIL and VIL have call setup success rate of 99.46%, 98.14%, 100.00% and 100.00% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Setup Time: Airtel, BSNL, RJIL and VIL have call setup time of 21.69, 4.16, 0.65 & 0.66 seconds respectively in Auto-selection mode (5G/4G/3G/2G).

Drop Call Rate: Airtel, BSNL, RJIL and VIL have drop call rate of 0.00%, 0.95%, 0.16% & 0.00% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Silence/Mute Rate: Airtel, RJIL and VIL have silence call rate 0.24%, 0,00% and 1.22% respectively in packet switched network (4G/5G).

Mean Opinion Score (MOS): Airtel, BSNL, RJIL and VIL have Average MOS Score of 4.01, 2.39, 3.92 & 4.33 respectively.

Summary-Data Service

Data Download performance (Overall): Average download speed of Airtel (5G/4G) is 130.81 Mbps, BSNL (4G/3G/2G) is 5.05 Mbps, RJIL (5G/4G) is 231.35 Mbps and VIL (4G/2G) is 46.45 Mbps.

Data Upload performance (Overall): Average upload speed of Airtel (5G/4G) is 22.30 Mbps, BSNL (4G/3G/2G) is 4.11 Mbps, RJIL (5G/4G) is 34.28 Mbps and VIL (4G/2G) is 13.87 Mbps.

Data performance - Hotspots (in Mbps):

Airtel- 4G D/L: 63.07 4G U/L: 6.68
5G D/L: 89.33 5G U/L: 13.46
BSNL- 4G D/L: 6.42 4G U/L: 4.83
RJIL- 4G D/L: 40.17 4G U/L: 10.43
5G D/L: 163.13 5G U/L: 32.71
VIL- 4G D/L: 29.49 4G U/L: 9.17

Note- "D/L" Download speed, "U/L" Upload speed

QoS Performance Analysis-
UP East 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 LSA during the month of April-2025 covering city drive, inter-operator call test, hotspots and walk test. (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	BSNL	VIL
Call Attempts	434	537	496
Call Setup Success Rate %	99.54	98.14	96.57
Drop Call Rate %	0.00	0.76	0.00
Call Setup Time-Average (Second)	19.67	3.51	4.55
Handover Success Rate %	99.48	99.86	98.02

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

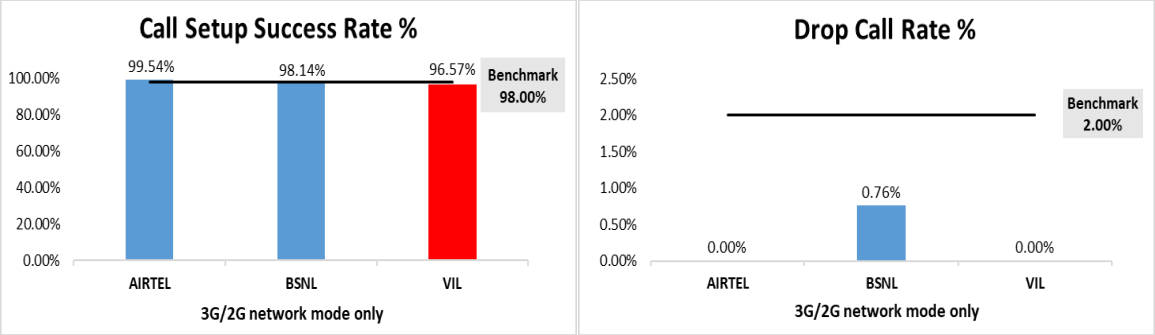


Figure-2: Call setup success rate and drop call rate performance.

Number of unique cell id's covered in Voice test- Technology wise			
Technology	Service Provider		
	3G/2G network mode only		
	AIRTEL	BSNL	VIL
3G	NA	225	NA
2G	518	42	428

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	BSNL	RJIL	VIL
Call Attempts	551	645	631	626
Call Setup Success Rate %	99.46	98.14	100.00	100.00
Drop Call Rate %	0.00	0.95	0.16	0.00
Call Setup Time-Average (Second)	21.69	4.16	0.65	0.66
Handover Success Rate %	100.00	98.71	99.94	99.94

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

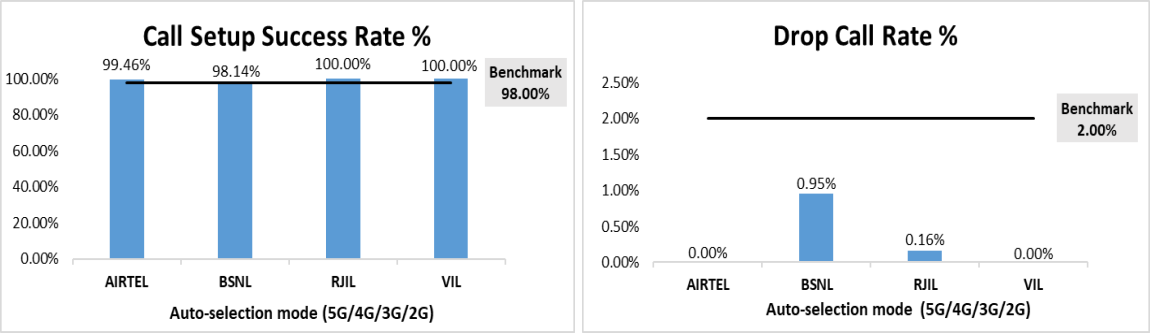


Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	411	494	500	493
Number of silence call for >4 Sec	1	NA	0	6
Silence Call Rate %	0.24%	NA	0.00%	1.22%
Number of silence instances for >4 Sec	1	NA	0	6
Number of silence instances for >3 Sec	4	NA	1	15
Number of silence instances for >2 sec	15	NA	4	50
RTP Jitter (4G & 5G) in ms	4.19	NA	7.41	13.98
Packet loss Rate Downlink %	0.40	NA	0.16	1.08
Packet loss Rate Uplink %	0.42	NA	0.22	1.10

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

Note-
- NA- Due to unavailability of packet switched (VoLTE & VoNR) network in BSNL, 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	BSNL	RJIL	VIL
5G	0	NA	419	NA
4G	1224	245	1628	718
3G	NA	109	NA	NA
2G	0	244	NA	1

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

Note-
- NA- Service provider doesn't provide services on 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 score values means: 5-Excellent, 4-Good, 3-Fair, 2-Poor, 1-Bad.

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls in table-6	2374	2112	2808	2861
Speech Quality (Average MOS Score)	4.01	2.39	3.92	4.33
Number of samples with MOS >=4 to <5 (Excellent)	1975	0	1973	2311
Number of samples with MOS >=3 to <4 (Good)	351	0	705	378
Number of samples with MOS >=2 to <3 (Fair)	19	1881	104	105
Number of samples with MOS >=1 to <2 (Poor)	29	231	26	67
%age of samples with MOS >=4 to <5 (Excellent)	83.19%	0.00%	70.26%	80.78%
%age of samples with MOS >=3 to <4 (Good)	14.79%	0.00%	25.11%	13.21%
%age of samples with MOS >=2 to <3 (Fair)	0.80%	89.06%	3.70%	3.67%
%age of samples with MOS >=1 to <2 (Poor)	1.22%	10.94%	0.93%	2.34%

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

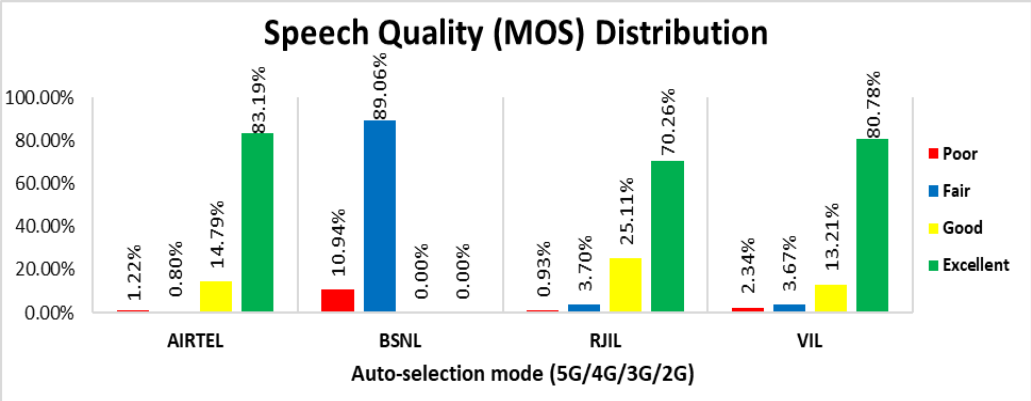


Figure- 4: Distribution of samples in MOS score range.

(d) Inter-service provider voice call performance: To check the performance of inter-service provider call setup success rate, total 29 to 50 inter operator calls were attempted. The Call setup success rate and call setup time observation is as below.

Call Setup Success Rate %				
From Service Provider	To Service Provider			
	AIRTEL	BSNL	RJIL	VIL
AIRTEL	NA	88.66	91.43	96.55
BSNL	100.00	NA	97.50	97.67
RJIL	94.12	90.24	NA	100.00
VIL	100.00	90.70	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	BSNL	RJIL	VIL
AIRTEL	NA	26.53	23.44	21.73
BSNL	3.96	NA	4.49	3.32
RJIL	2.89	6.30	NA	1.66
VIL	4.28	4.72	2.78	NA

Table-10: Call setup time across service providers

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

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	BSNL	RJIL	VIL
Download Throughput (Mbits/s)	Average	130.81	5.05	231.35	46.45
	80th Percentile	207.37	7.50	366.17	74.12
	20th Percentile	45.61	1.14	76.29	15.89
Upload Throughput (Mbits/s)	Average	22.30	4.11	34.28	13.87
	80th Percentile	39.15	6.08	60.68	25.11
	20th Percentile	0.00	1.69	7.49	3.84
Latency (ms)	50th Percentile	21.20	36.95	16.15	29.10

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

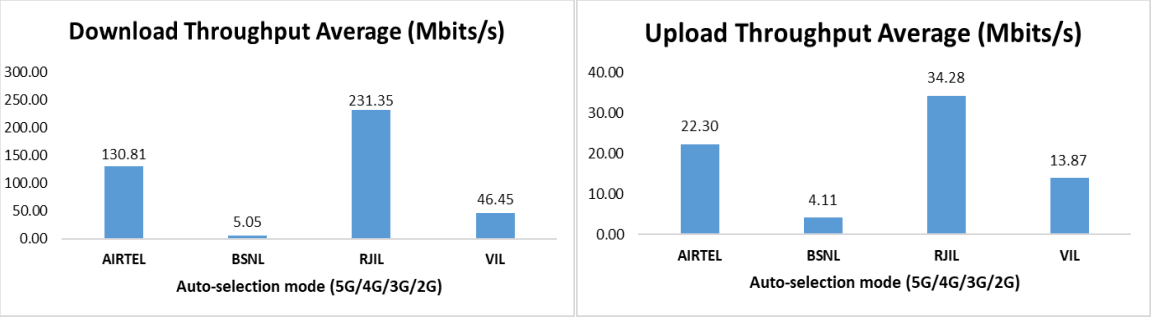


Figure- 5: Download and upload throughput.

Number of unique cell id's covered in Data test- Technology wise				
Technology	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
5G	0	NA	596	NA
4G	1491	258	210	701
3G	NA	84	NA	NA
2G	0	14	NA	5

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.

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, hotspots and walk Test 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 22nd April 2025 to 24th April 2025 in Varanasi. (refer table-1)

4.2.1 Drive test route

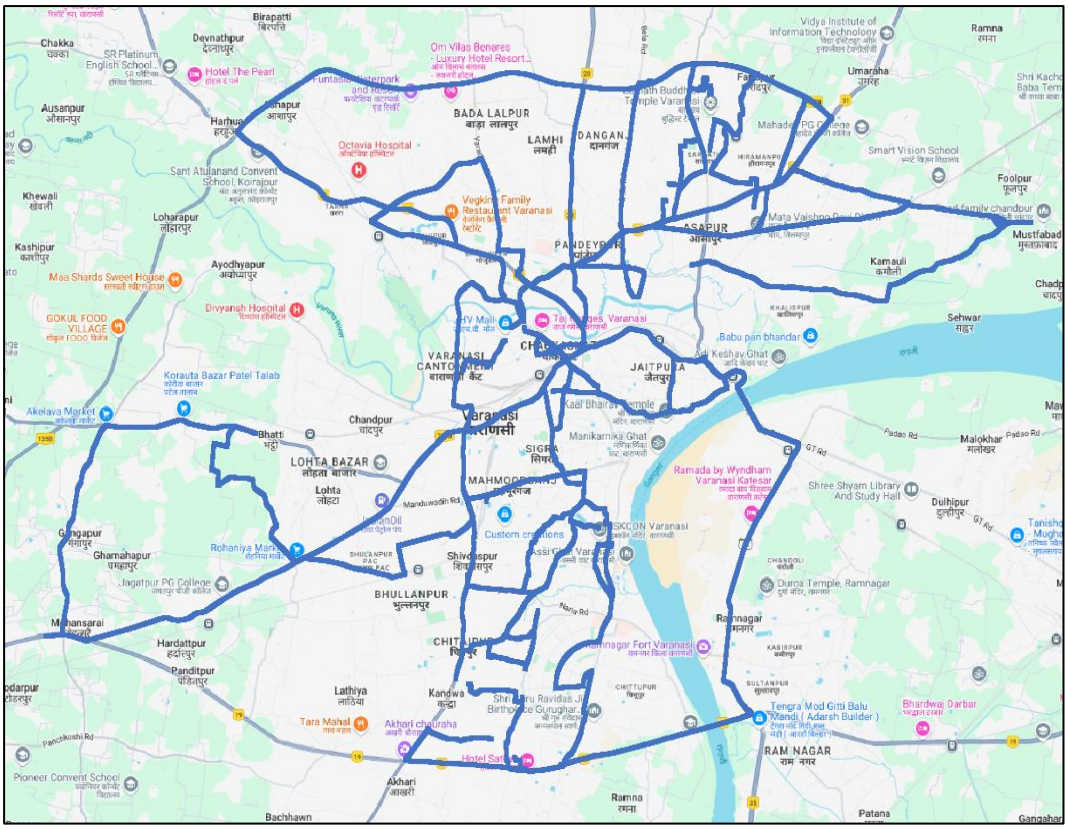


Figure- 6: Drive test routes.

4.2.2 Areas covered

Mohansarai, Bhullanpur PAC, Chitaipur, Mahmoorganj, Jaitpura, Varanasi cantonment, Chaukaghat, Pandaypur, Asapur 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	BSNL	VIL
Call Attempts	434	537	496
Call Setup Success Rate %	99.54	98.14	96.57
Drop Call Rate %	0.00	0.76	0.00
Call Setup Time-Average (Second)	19.67	3.51	4.55
Handover Success Rate %	99.48	99.86	98.02

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

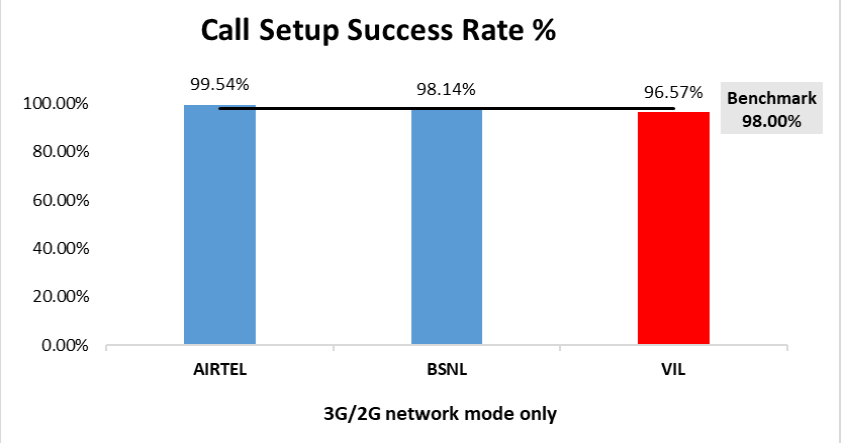


Figure-7: Performance for call setup success rate.

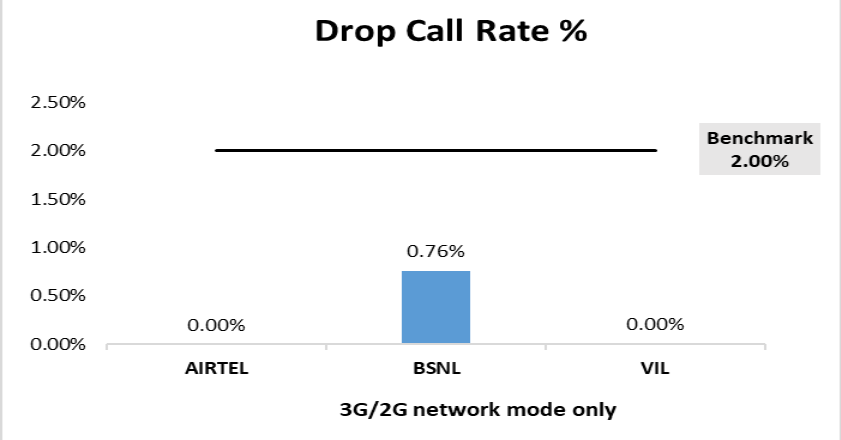


Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	92.84%	NA
2G	99.98%	7.13%	99.65%
Limited Service	0.02%	0.03%	0.35%

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

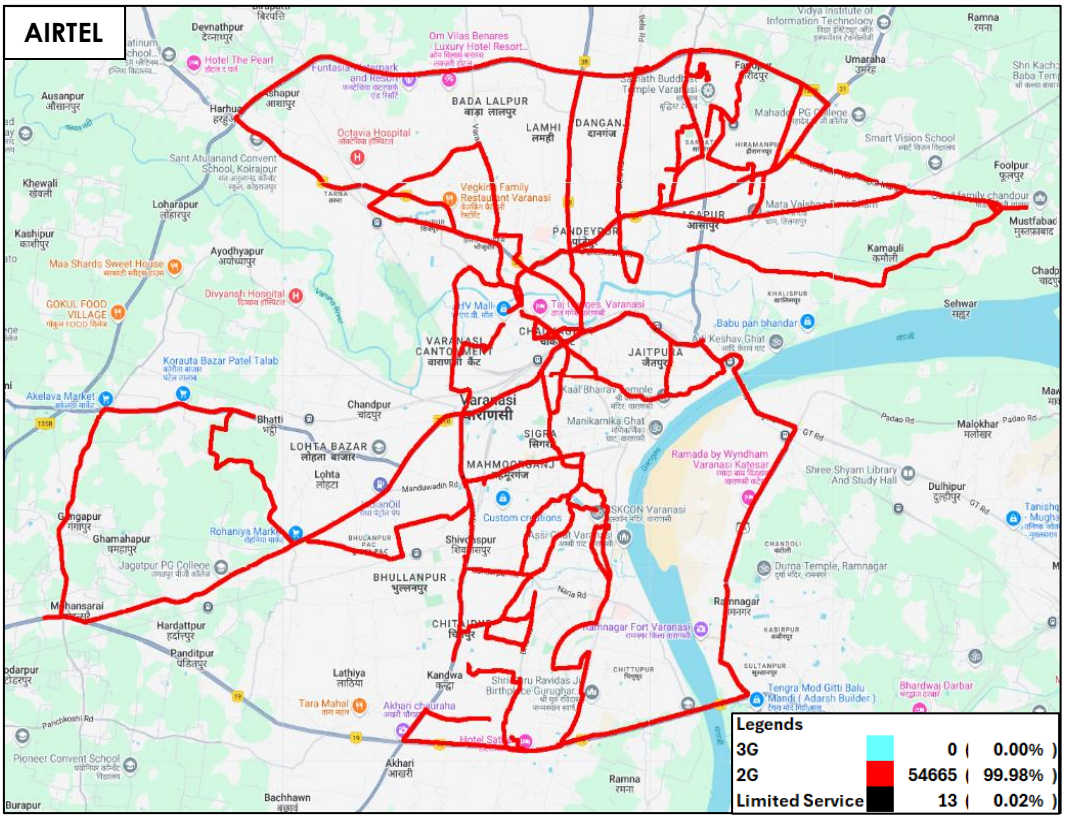


Figure-9: Serving technology plots 3G/2G network mode-AIRTEL

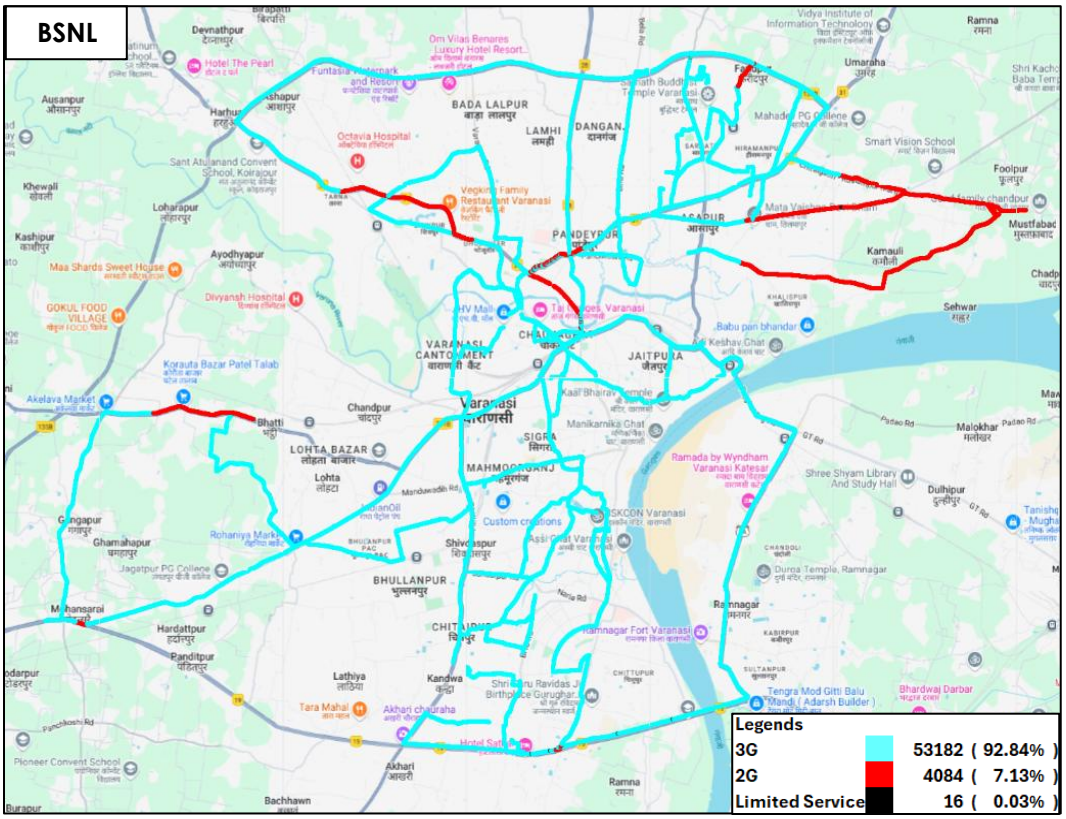


Figure-10: Serving technology plots 3G/2G network mode – BSNL.

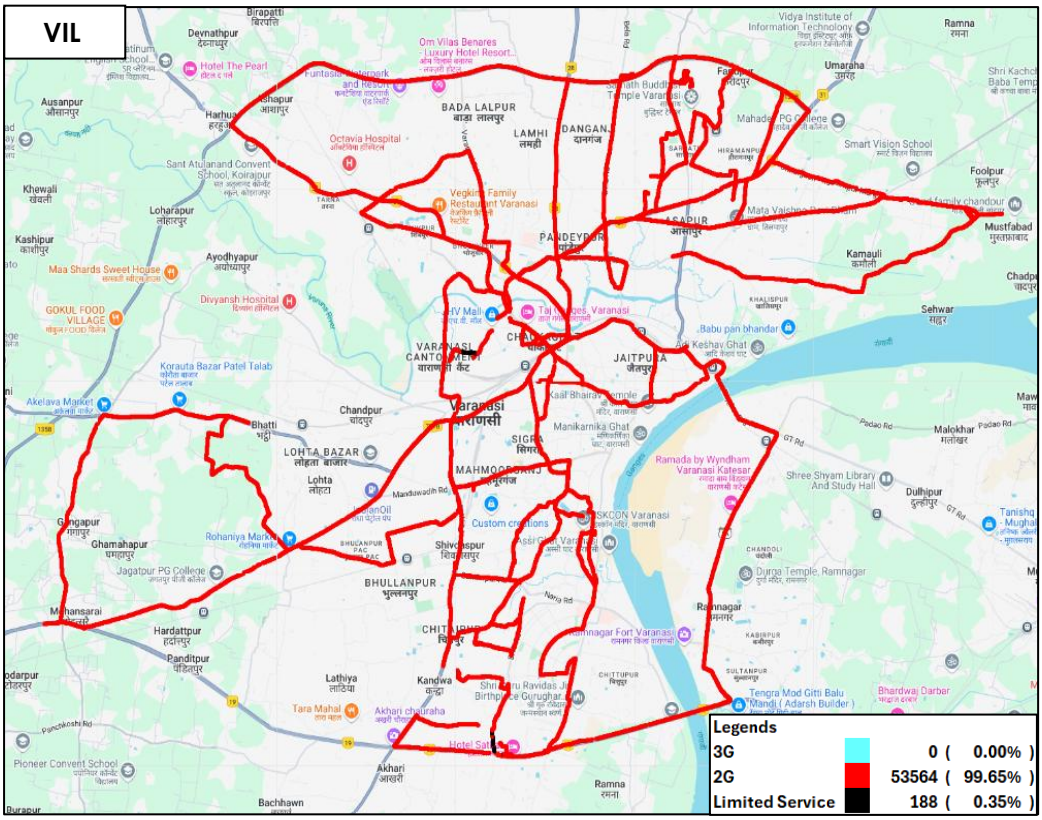


Figure-11: Serving technology plots 3G/2G network mode –VIL.

(c) Network Signal Strength distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (refer figure-25, 26 & 27 for map view)

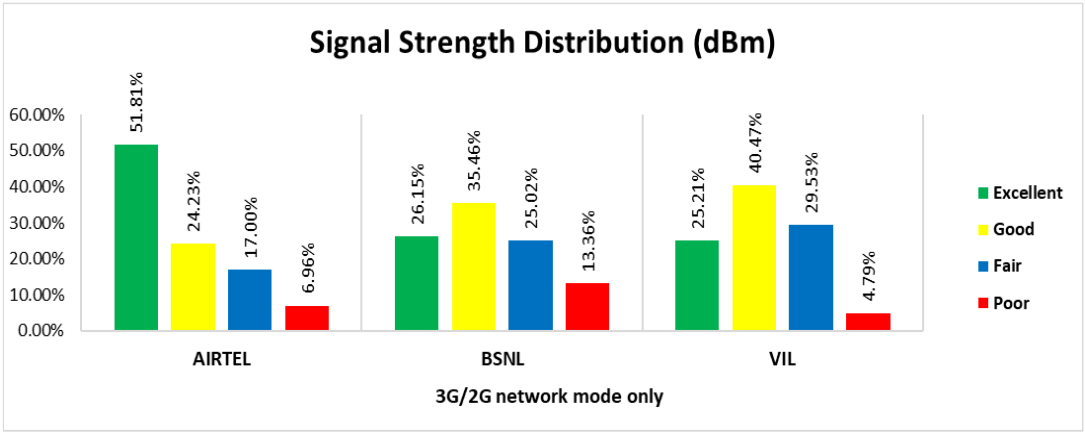


Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 52% of samples falling in the excellent signal strength category.
- BSNL has 26% of samples falling in the excellent signal strength category.
- VIL has 25% 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	BSNL	RJIL	VIL
Call Attempts	444	535	521	516
Call Setup Success Rate %	99.32	98.32	100.00	100.00
Drop Call Rate %	0.00	1.14	0.19	0.00
Call Setup Time Average (Second)	21.80	4.13	0.64	0.66
Handover Success Rate %	100.00	98.61	99.93	99.94

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

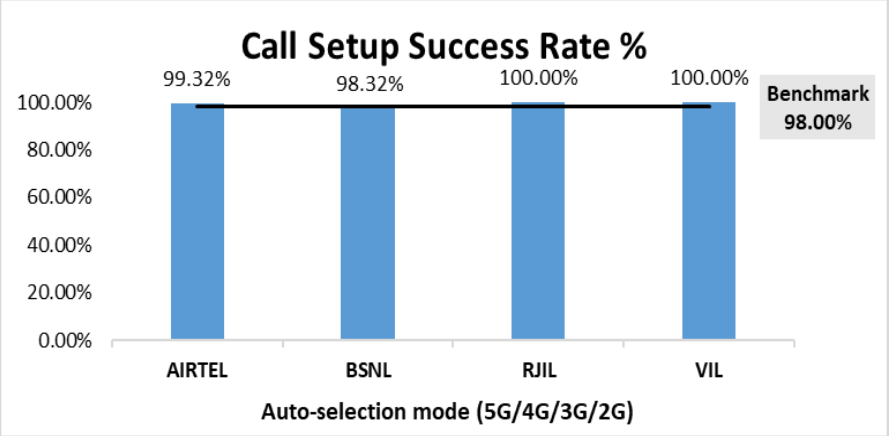


Figure-13: Performance for call setup success rate.

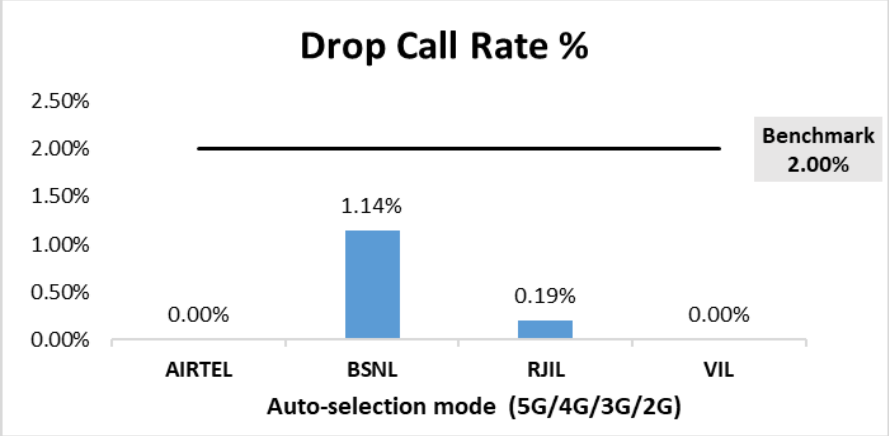


Figure-14: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	411	494	500	493
Number of silence call for >4 Sec	1	NA	0	6
Silence Call Rate %	0.24	NA	0.00	1.22
Number of silence instances for >4 Sec	1	NA	0	6
Number of silence instances for >3 Sec	4	NA	1	15
Number of silence instances for >2 sec	15	NA	4	50
RTP Jitter (4G & 5G) in ms	4.19	NA	7.41	13.98
Packet loss Rate Downlink %	0.40	NA	0.16	1.08
Packet loss Rate Uplink %	0.42	NA	0.22	1.10

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 BSNL, silence instances are not captured.

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

Mean opinion score indicate 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 score values means: 5-Excellent, 4-Good, 3-Fair, 2-Poor, 1-Bad.

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls in table-16	2374	2112	2808	2861
Speech Quality (Average MOS Score)	4.01	2.39	3.92	4.33
Number of samples with MOS >=4 to <5 (Excellent)	1975	0	1973	2311
Number of samples with MOS >=3 to <4 (Good)	351	0	705	378
Number of samples with MOS >=2 to <3 (Fair)	19	1881	104	105
Number of samples with MOS >=1 to <2 (Poor)	29	231	26	67
%age of samples with MOS >=4 to <5 (Excellent)	83.19%	0.00%	70.26%	80.78%
%age of samples with MOS >=3 to <4 (Good)	14.79%	0.00%	25.11%	13.21%
%age of samples with MOS >=2 to <3 (Fair)	0.80%	89.06%	3.70%	3.67%
%age of samples with MOS >=1 to <2 (Poor)	1.22%	10.94%	0.93%	2.34%

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

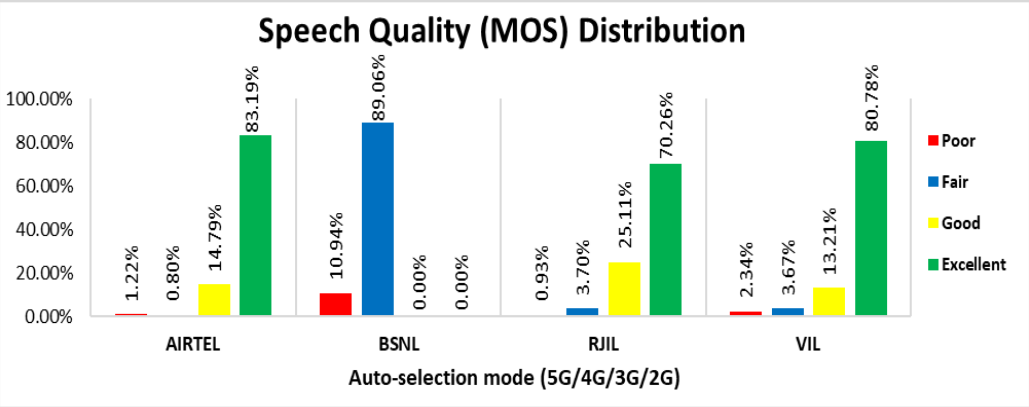


Figure-15: Distribution of samples in MOS score range.

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

Technology	Service Provider			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	6.85%	NA	16.31%	NA
4G	93.15%	12.92%	83.69%	100.00%
3G	NA	36.28%	NA	NA
2G	0.00%	50.65%	NA	0.00%
Limited Service	0.00%	0.14%	0.00%	0.00%

Table-18: Time spent on technology during drive test.

Note-

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

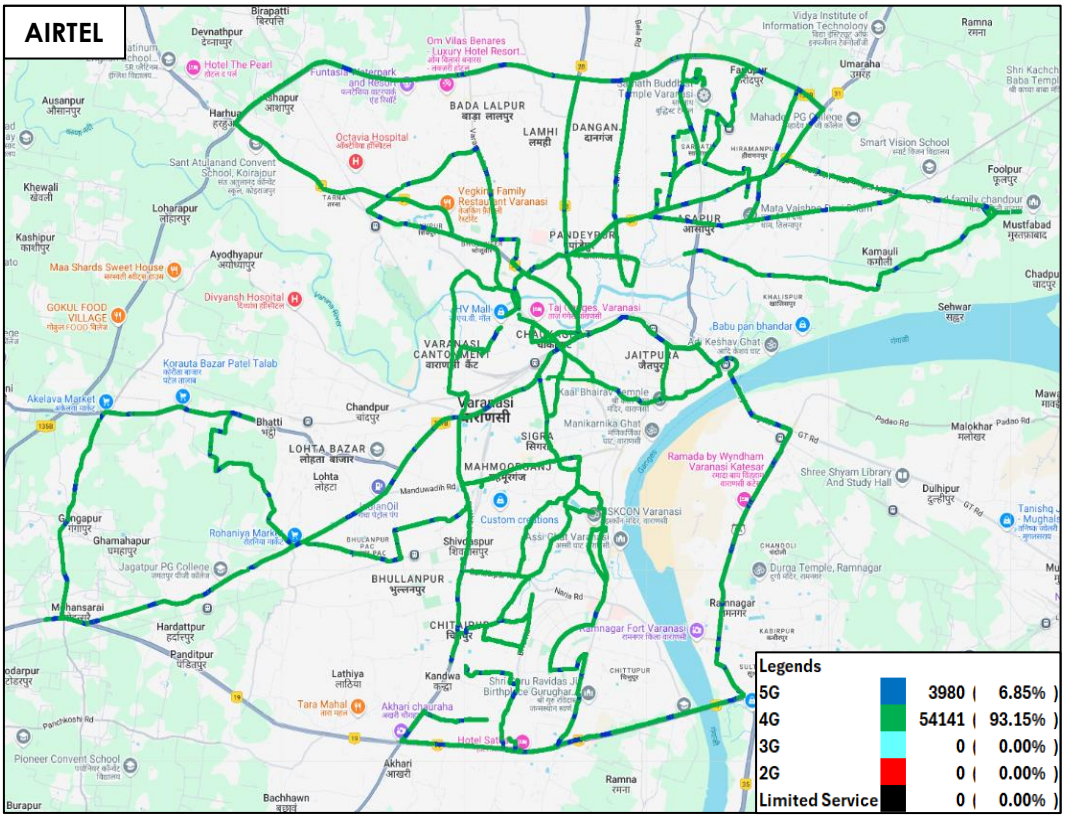


Figure-16: Serving technology plots in auto-selection mode (5G/4G/3G/2G) –AIRTEL.

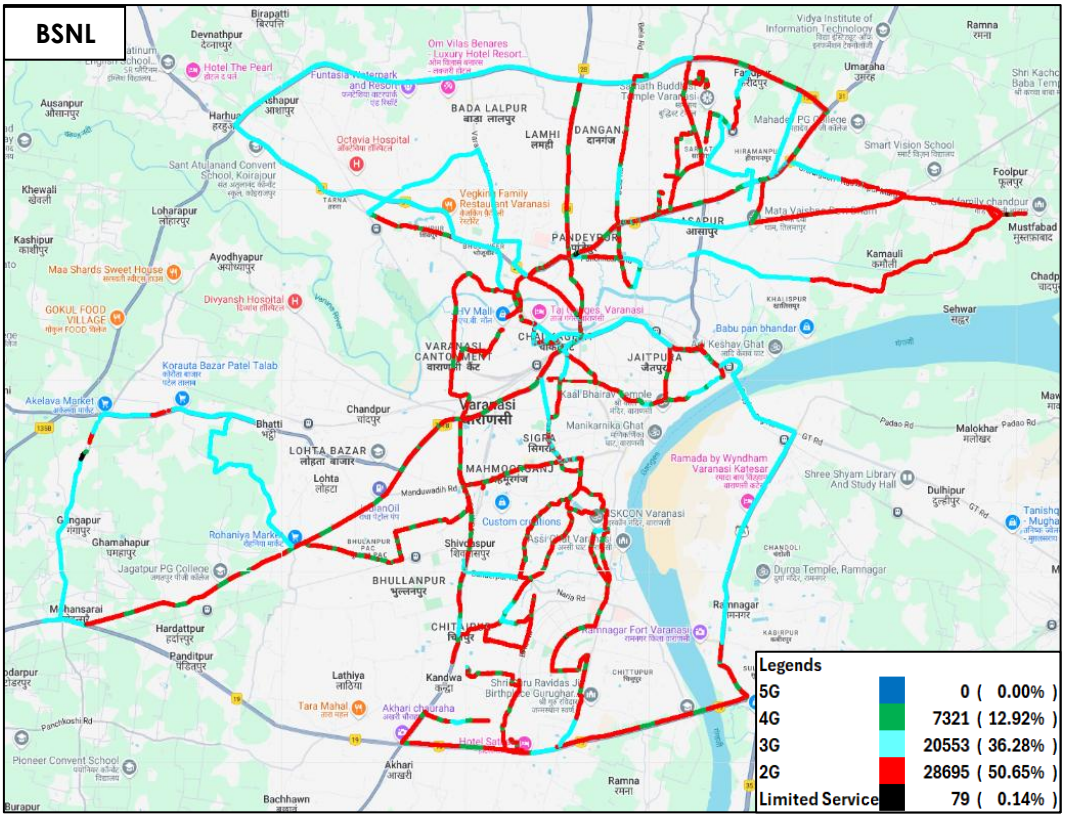


Figure-17: Serving technology plots in auto-selection mode (5G/4G/3G/2G) –BSNL.

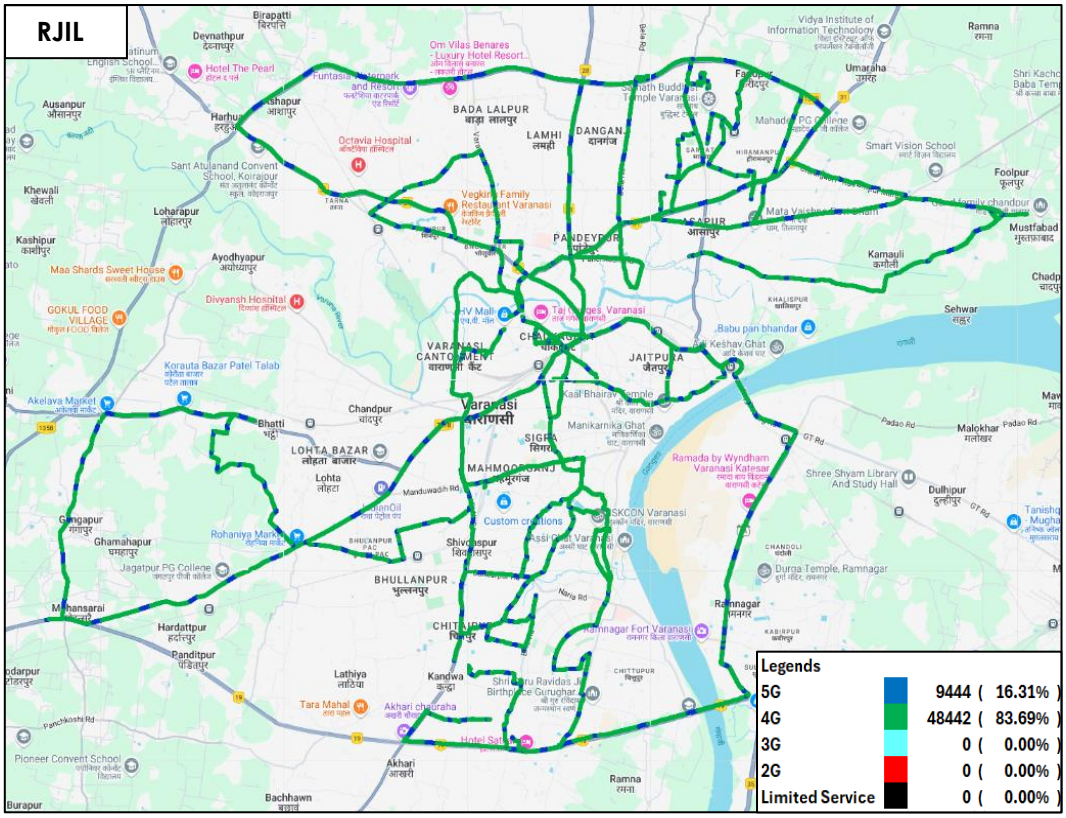


Figure-18: Serving technology plots in auto-selection (5G/4G/3G/2G)- RJIL.

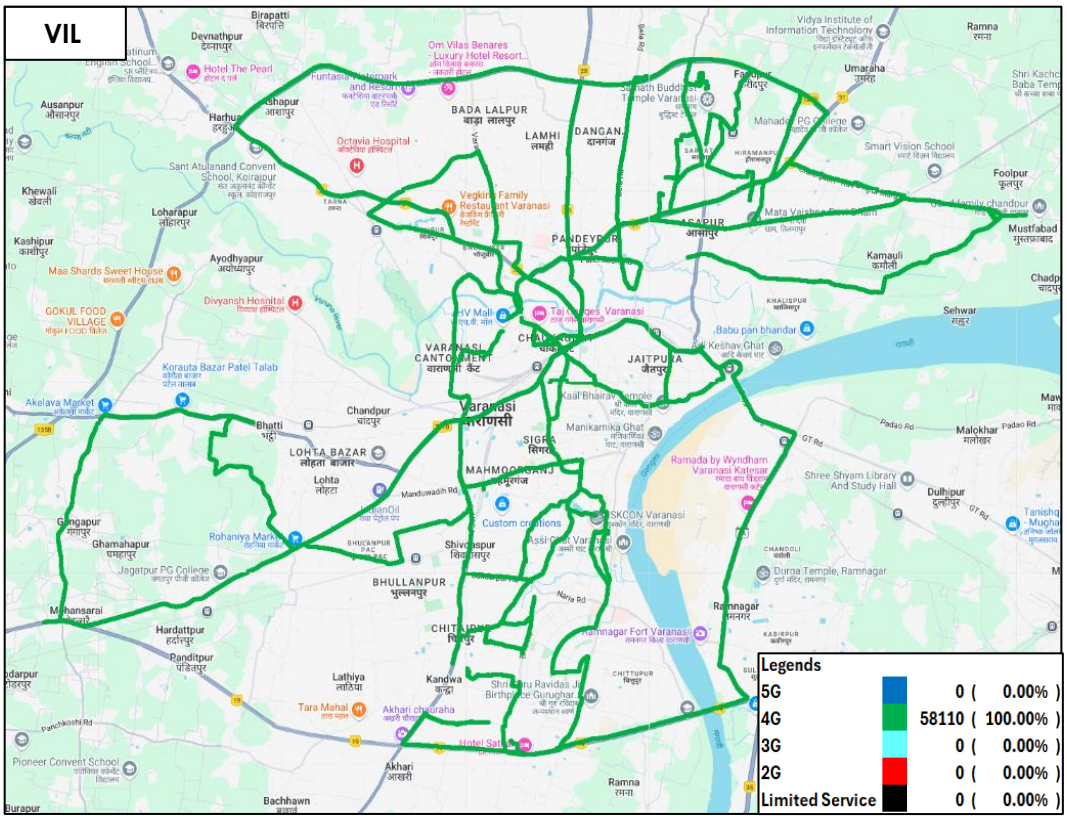


Figure-19: Serving technology plots in auto-selection mode (5G/4G/3G/2G) – VIL.

(g) Network Signal Strength distribution: The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G). (refer figure-28, 29, 30 & 31 for map view)

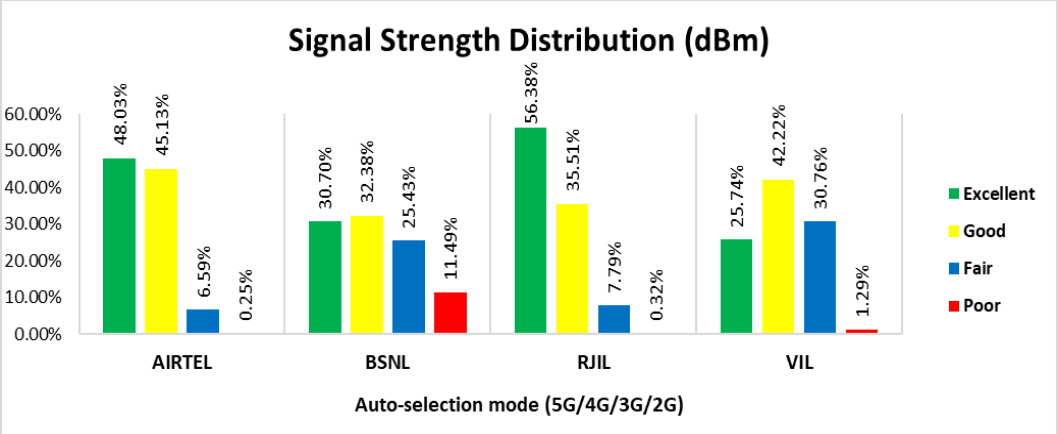


Figure-20: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:

- Airtel has 48% of samples falling in the excellent signal strength category.
- BSNL has 31% of samples falling in the excellent signal strength category.
- RJIL has 56% of samples falling in the excellent signal strength category.
- VIL has 26% of samples falling in the excellent signal strength category.

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	BSNL	RJIL	VIL
Download Throughput (Mbits/s)	Average	137.26	4.99	237.99	48.33
	80th Percentile	213.61	7.38	377.34	74.55
	20th Percentile	50.53	1.13	90.93	18.27
Upload Throughput (Mbits/s)	Average	22.93	3.99	35.15	13.94
	80th Percentile	40.99	5.23	61.55	24.68
	20th Percentile	0.00	1.68	8.00	3.84
Latency (ms)	50th Percentile	19.40	38.75	15.60	29.00

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

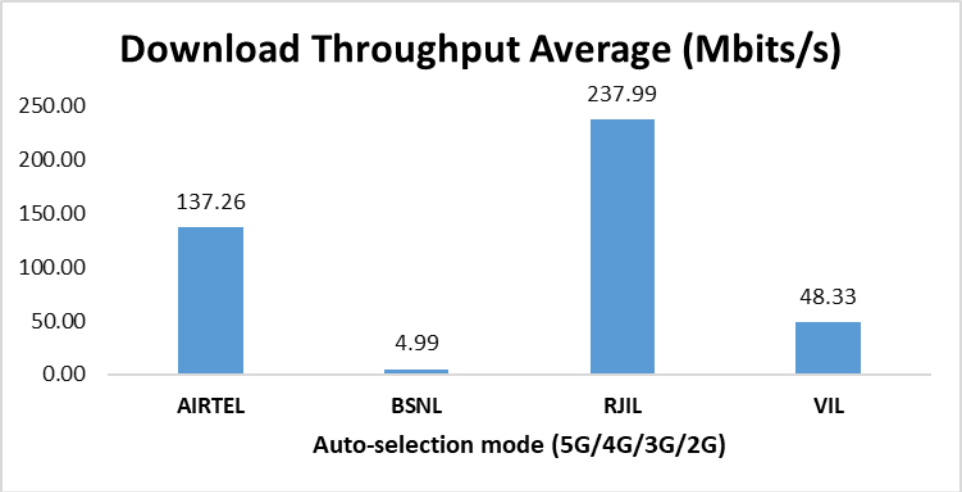


Figure- 21: Download throughput.

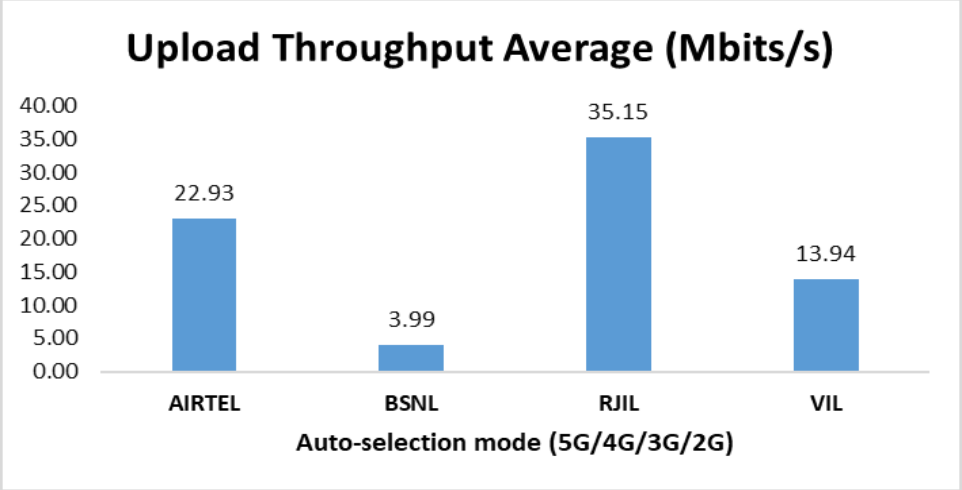


Figure- 22: Upload throughput.

4.3 Hotspots

Hotspot testing has been done on 25th April 2025. Eight locations have been tested in the city.

4.3.1 Locations

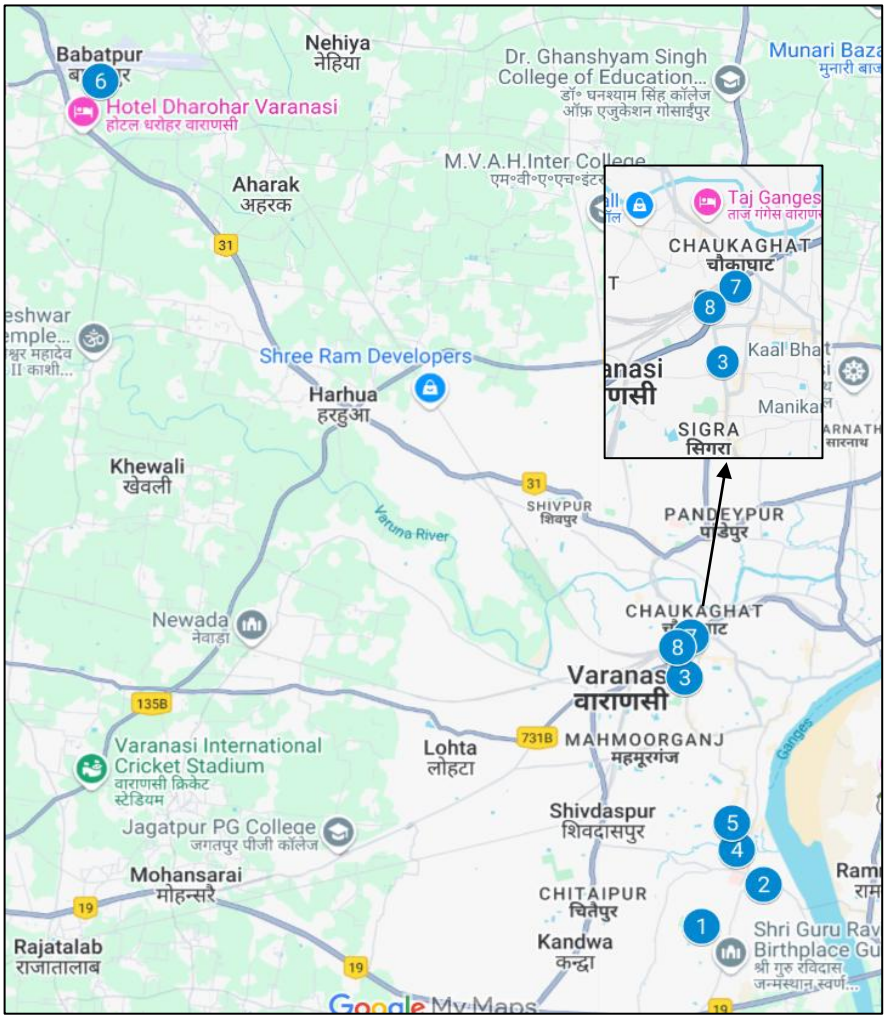


Figure- 23: Hotspot locations

4.3.2 Hotspot covered

1. BHU
2. BHU Trauma Centre
3. Kashi Vidhyapeeth
4. Sankatmochan Mandir
5. Shree Durga Mata Mandir
6. Varanasi Airport
7. Varanasi Bus Stand
8. Varanasi Junction

4.3.3 Voice performance

Overall Voice Performance				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	80	80	80	80
Call Setup Success Rate %	100.00	96.25	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	20.84	4.65	0.55	0.69

Table-20: Overall summary of voice call performance in network auto-selection mode (5G/4G/3G/2G).

BHU				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	90.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	22.31	6.82	0.51	0.58

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

BHU Trauma Centre				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	22.08	4.10	0.54	0.70

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

Kashi Vidhyapeeth				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	90.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	22.1	4.31	0.65	0.66

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

Sankatmochan Mandir				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	22.01	3.50	0.48	0.66

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

Shree Durga Mata Mandir				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	22.05	3.46	0.54	0.61

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

Varanasi Airport				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	11.83	6.31	0.54	1.11

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

Varanasi Bus Stand				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	22.11	3.64	0.60	0.56

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

Varanasi Junction				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	90.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	22.19	5.28	0.54	0.66

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	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	103.49	5.91	211.37	43.24
Download Throughput 80th Percentile (Mbit/s)	127.45	10.13	311.53	75.64
Download Throughput 20th Percentile (Mbit/s)	54.96	1.29	63.90	15.33
Download Session Setup Success Rate %	100.00	85.00	97.50	97.50
Upload Throughput Average (Mbits/s)	21.74	3.97	31.04	16.50
Upload Throughput 80th Percentile (Mbit/s)	32.69	6.49	50.57	32.03
Upload Throughput 20th Percentile (Mbit/s)	8.14	1.65	9.34	2.05
Upload Session Setup Success Rate %	100.00	82.50	100.00	97.50
Web Browsing Delay (Second)	1.91	3.04	1.89	1.63
Youtube Initial Buffer Delay (Second)	1.26	2.55	0.92	0.99
Latency (ms)-50th Percentile	24.75	35.50	16.70	29.15
Jitter (ms)	7.26	30.70	25.29	7.45
Packet Loss Rate%	0.25	19.44	4.13	0.63
Packet Loss Rate- 90th percentile	0.56	51.00	9.81	1.15

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

BHU				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	89.77	9.53	77.35	22.41
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	4.37	4.98	2.33	3.16
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	1.71	1.88	3.10	1.57
Youtube Initial Buffer Delay (Second)	1.35	1.25	3.22	1.16
Latency (ms)-50th Percentile	27.95	33.65	18.10	26.75
Jitter (ms)	7.48	11.07	5.11	8.01
Packet Loss Rate%	0.20	1.60	0.10	0.40

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

BHU Trauma Centre				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	89.21	3.89	231.12	105.88
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	7.67	3.89	33.11	24.53
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	1.61	3.72	1.06	1.15
Youtube Initial Buffer Delay (Second)	0.75	8.50	0.62	0.90
Latency (ms)-50th Percentile	35.00	-	13.95	28.10
Jitter (ms)	10.41	-	3.79	2.93
Packet Loss Rate%	0.50	100.00	0.30	0.40

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

Note- "-" Ping tests were failed.

Kashi Vidhyapeeth				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	105.19	2.51	206.34	15.85
Download Session Setup Success Rate %	100.00	100.00	80.00	100.00
Upload Throughput Average (Mbits/s)	30.13	1.64	21.81	32.23
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	1.65	4.05	2.17	1.53
Youtube Initial Buffer Delay (Second)	0.96	2.50	0.61	0.63
Latency (ms)-50th Percentile	18.25	37.95	20.60	29.45
Jitter (ms)	4.86	10.65	180.27	3.41
Packet Loss Rate%	0.30	7.50	32.00	0.00

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

Sankatmochan Mandir				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	259.51	2.96	550.44	44.62
Download Session Setup Success Rate %	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	39.77	1.58	79.17	4.26
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	1.45	3.37	1.39	1.48
Youtube Initial Buffer Delay (Second)	0.71	1.35	0.71	0.86
Latency (ms)-50th Percentile	19.38	37.15	16.65	26.75
Jitter (ms)	6.03	17.90	3.80	3.33
Packet Loss Rate%	0.00	2.90	0.00	0.10

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

Shree Durga Mata Mandir				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	20.71	6.11	229.83	76.85
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	21.11	6.42	23.79	32.71
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.45	1.76	1.48	1.43
Youtube Initial Buffer Delay (Second)	1.86	1.36	0.71	0.64
Latency (ms)-50th Percentile	20.10	32.60	14.90	29.25
Jitter (ms)	6.01	5.25	12.17	4.29
Packet Loss Rate%	0.00	1.10	0.20	0.70

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

Varanasi Airport				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	88.29	15.29	56.44	24.13
Download Session Setup Success Rate %	100.00	100.00	100.00	80.00
Upload Throughput Average (Mbits/s)	25.83	6.42	24.64	2.24
Upload Session Setup Success Rate %	100.00	100.00	100.00	80.00
Web Browsing Delay (Second)	1.63	1.78	1.35	2.11
Youtube Initial Buffer Delay (Second)	0.79	1.18	0.69	1.60
Latency (ms)-50th Percentile	31.85	36.10	19.40	36.20
Jitter (ms)	11.88	14.02	8.84	22.86
Packet Loss Rate%	0.70	1.10	0.30	2.20

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

Varanasi Bus Stand				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	67.15	0.48	78.59	5.33
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	11.03	1.98	11.47	2.24
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	3.29	5.11	2.89	2.32
Youtube Initial Buffer Delay (Second)	3.04	-	0.94	1.83
Latency (ms)-50th Percentile	34.50	37.05	16.40	31.40
Jitter (ms)	6.56	131.78	10.16	10.55
Packet Loss Rate%	0.20	11.30	0.10	0.50

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

Note- "-" Youtube tests were failed.

Varanasi Junction				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	108.10	-	259.85	47.00
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	34.03	-	52.01	27.79
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	1.49	1.26	1.86	1.45
Youtube Initial Buffer Delay (Second)	0.61	-	0.75	0.68
Latency (ms)-50th Percentile	34.38	32.55	16.33	28.45
Jitter (ms)	4.86	18.87	5.10	4.21
Packet Loss Rate%	0.10	30.00	0.00	0.70

Table-37: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Note- "-" Download, Upload and Youtube tests were failed.

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

Overall Data Performance					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	89.33	-	163.13	-
	Upload Throughput Average (Mbits/s)	13.46	-	32.71	-
4G	Download Throughput Average (Mbits/s)	63.07	6.42	40.17	29.49
	Upload Throughput Average (Mbits/s)	6.68	4.83	10.43	9.17

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

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

BHU					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	56.17	-	55.35	-
	Upload Throughput Average (Mbits/s)	3.38	-	7.53	-
4G	Download Throughput Average (Mbits/s)	35.33	6.95	18.20	22.97
	Upload Throughput Average (Mbits/s)	3.10	3.12	1.54	2.97

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

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

BHU Trauma Centre					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	76.71	-	256.53	-
	Upload Throughput Average (Mbits/s)	10.41	-	33.86	-
4G	Download Throughput Average (Mbits/s)	78.50	8.41	31.94	44.68
	Upload Throughput Average (Mbits/s)	8.72	4.22	4.37	19.16

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

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

Kashi Vidhyapeeth					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	-	-	114.34	-
	Upload Throughput Average (Mbits/s)	-	-	11.38	-
4G	Download Throughput Average (Mbits/s)	86.20	2.05	31.24	13.56
	Upload Throughput Average (Mbits/s)	4.18	1.65	15.66	7.50

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

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

Sankatmochan Mandir					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	275.58	-	425.47	-
	Upload Throughput Average (Mbits/s)	42.53	-	80.73	-
4G	Download Throughput Average (Mbits/s)	80.23	2.42	81.42	46.44
	Upload Throughput Average (Mbits/s)	10.40	1.83	10.42	2.55

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

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

Shree Durga Mata Mandir					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	-	-	168.95	-
	Upload Throughput Average (Mbits/s)	-	-	29.46	-
4G	Download Throughput Average (Mbits/s)	56.63	6.45	32.59	45.09
	Upload Throughput Average (Mbits/s)	7.48	6.22	6.68	13.66

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

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

Varanasi Airport					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	79.62	-	49.88	-
	Upload Throughput Average (Mbits/s)	8.05	-	29.03	-
4G	Download Throughput Average (Mbits/s)	92.68	10.38	87.00	24.47
	Upload Throughput Average (Mbits/s)	1.01	5.29	16.40	1.93

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

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

Varanasi Bus Stand					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	78.89	-	72.03	-
	Upload Throughput Average (Mbits/s)	12.95	-	19.94	-
4G	Download Throughput Average (Mbits/s)	62.04	-	18.54	2.92
	Upload Throughput Average (Mbits/s)	11.32	-	6.80	1.81

Table-45: Summary of 5G only & 4G only data download & upload speed.

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

Varanasi Junction					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	101.12	-	162.48	-
	Upload Throughput Average (Mbits/s)	28.25	-	49.78	-
4G	Download Throughput Average (Mbits/s)	12.95	8.72	20.43	35.76
	Upload Throughput Average (Mbits/s)	7.25	12.97	21.55	23.79

Table-46: Summary of 5G only & 4G only data download & upload speed.

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

4.4 Walk Test

Walk Test has been conducted on 24th April 2025 and 25th April. Two location have been tested in the city.

4.4.1 Drive test route

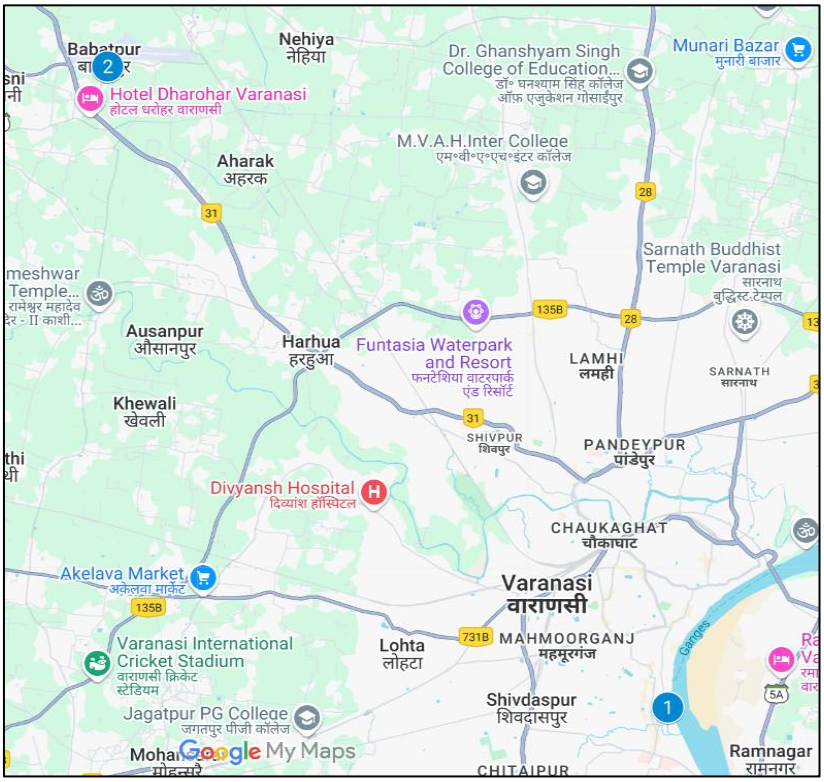


Figure-24: Walk Test location.

4.4.2 Walk Test Covered

- Assi Ghat
- Varanasi Airport

4.4.3 Voice Performance

Assi Ghat				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	20	24	23	23
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	22.45	3.34	0.80	0.68

Table-47: Summary of voice call performance in network auto-selection mode (5G/4G/3G/2G).

Varanasi Airport				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	7	6	7	7
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	22.02	3.66	2.07	0.73

Table-48: Summary of voice call performance in network auto-selection mode (5G/4G/3G/2G).

4.4.4 Data Performance

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

Assi Ghat				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	23.20	5.82	145.95	12.29
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	13.19	8.14	25.70	10.37
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Latency (ms) - 50th Percentile	21.35	33.00	21.65	32.85

Table-49: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Varanasi Airport				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	107.64	3.40	125.79	36.59
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	7.69	2.43	15.13	6.32
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Latency (ms) - 50th Percentile	26.60	36.15	16.73	25.95

Table-50: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

5. Voice & Data Key findings

5.1 Overall Voice

1. Call Setup Success Rate:

a) Airtel, BSNL and VIL have 99.54%, 98.14% and 96.57% call setup success rate respectively in 3G/2G network mode. (refer table-3)

b) Airtel, BSNL, RJIL and VIL have 99.46%, 98.14%, 100.00% and 100.00% call setup success rate respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)

c) None of the operator have 100% call setup success rate while calling on peer service provider's network for inter-operator calls. (refer table-9)

2. Call Setup Time:

a) Airtel, BSNL and VIL call setup time is 19.67, 3.51 & 4.55 seconds respectively in 3G/2G network mode. (refer table-3)

b) Airtel, BSNL, RJIL & VIL call setup time is 21.69, 4.16, 0.65 & 0.66 seconds respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)

3. Drop Call Rate:

a) Airtel, BSNL and VIL drop call rate 0.00%, 0.76% & 0.00% respectively in 3G/2G network mode. (refer table-3)

b) Airtel, BSNL, RJIL and VIL drop call rate 0.00%, 0.95% 0.16% & 0.00% respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)

4. Call Silence/Mute Rate: In packet switched network (4G/5G) VIL, Airtel and RJIL have 1.22%, 0.24% & 0.00% silence call rate respectively. Further VIL has higher RTP packet loss rate in downlink (1.08%) compared to Airtel (0.40%) and RJIL (0.16%). In uplink the RTP packet loss rate is higher for VIL (1.10%) compared to Airtel (0.42%) and RJIL (0.22%). (refer table-6)

5.2 Overall Data

1. Data download and upload performance (Overall i.e. LSA):

a) Airtel, BSNL, RJIL and VIL average download speeds are 130.81 Mbps, 5.05 Mbps, 231.35 Mbps and 46.45 Mbps respectively. (refer table-11)

b) Airtel, BSNL, RJIL and VIL average upload speeds are 22.30 Mbps, 4.11 Mbps, 34.28 Mbps and 13.87 Mbps respectively. (refer table-11)

2. Data download and upload performance (static i.e. while stationary):

a) Airtel, BSNL, RJIL and VIL average download speeds are 103.49 Mbps, 5.91 Mbps, 211.37 Mbps and 43.24 Mbps respectively. (refer table-29)

b) Airtel, BSNL, RJIL and VIL average upload speeds are 21.74 Mbps, 3.97 Mbps, 31.04 Mbps and 16.50 Mbps respectively. (refer table-29)

3. Data session setup success rate (static i.e. while stationary):

a) Airtel, BSNL, RJIL and VIL have 100.00%, 85.00%, 97.50% and 97.50% download session setup success rate respectively. (refer table-29)

b) Airtel, BSNL, RJIL and VIL have 100.00%, 82.50%, 100.00% and 97.50% upload session setup success rate respectively. (refer table-29)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 99.54% call setup success rate and 0.00% drop call rate have been observed in 3G/2G network mode for LSA & city drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-3 & 13)

- 99.46% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)

- 99.32% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (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. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-47 & 48)

Data

- Airtel has average download throughput of 130.81 Mbps and average upload throughput of 22.30 Mbps across measured routes for LSA. (refer table-11)

- Airtel has average download throughput of 137.26 Mbps and average upload throughput of 22.93 Mbps across the measured routes for city drive. (refer table -19)

- BHU, BHU Trauma Centre, Shree Durga Mata Mandir, Varanasi Airport and Varanasi Bus Stand have less download speed (less than 100 Mbps) out of total 8 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-30, 31, 34, 35 & 36)

- BHU, BHU Trauma Centre and Varanasi Bus Stand have less Upload speed (less than 20 Mbps) out of total 8 Hotspots in auto-selection mode (5G/4G/3G/2G). (refer table-30, 31 and 36)

- Assi Ghat has less download speed (less than 100 Mbps) out of total 2 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-49)

- Assi Ghat and Varanasi Airport have less upload speed (less than 20 Mbps) in auto-selection mode (5G/4G/3G/2G) at walk test locations. (refer table-49 and 50)

2. BSNL:

Voice

- 98.14% call setup success rate and 0.76% drop call rate have been observed in 3G/2G network mode for LSA & city drive. Performance is well within the benchmark of 98.00% and 2.00% for LSA & city drive. (refer table-3 & 13)

- 98.14% call setup success rate and 0.95% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% and 2.00% for LSA. (refer table-5)

- 98.32% call setup success rate and 1.14% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-15)

- 96.25% 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. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-47 & 48)

Data

- BSNL has 5.05 Mbps average download throughput & 4.11 Mbps average upload throughput across measured routes for LSA. (refer table-11)

- BSNL has 4.99 Mbps average download throughput & 3.99 Mbps average upload throughput across measured routes for city drive. (refer table-19)

- All hotspots have less download speed (less than 10 Mbps) except Varanasi Airport in auto-selection mode (5G/4G/3G/2G) (refer table- 30, 31, 32, 33, 34, 36 and 37)

- Kashi Vidhyapeeth, Sankatmochan Mandir, Varanasi Bus Stand and Varanasi Junction have less upload speed (less than 2 Mbps) out of total 8 Hotspots in auto-selection mode (5G/4G/3G/2G). (refer table-32, 33, 36 and 37)

- Assi Ghat and Varanasi Airport Walk test location have less download speed (less than 10 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-49 & 50)

3. RJIL:

Voice

- 100.00% call setup success rate and 0.16% drop call rate have been observed in the auto-selection mode for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)

- 100.00% call setup success rate and 0.19% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (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. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table–20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-47 & 48)

Data

- RJIL has 231.35 Mbps average download speed & 34.28 Mbps average upload speed across measured routes for LSA. (refer table-11)

- RJIL has 237.99 Mbps average download speed & 35.15 Mbps average upload speed across measured routes for city drive. (refer table-19)

- BHU, Varanasi Airport and Varanasi Bus stand have less download speed (less than 100 Mbps) out of total 8 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-30, 35 and 36)

- BHU and Varanasi Bus stand have less upload speed (less than 20 Mbps) out of total 8 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-30 and 36)

- Varanasi Airport Walk test location has less upload speed (less than 20 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-50)

4. VIL:

Voice

- 96.57% call setup success rate and 0.00% drop call rate have been observed in 3G/2G network mode for LSA & city drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-3 & 13)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (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. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-47 & 48)

Data

- VIL has 46.45 Mbps average download speed & 13.87 Mbps average upload speed across measured routes for LSA. (refer table-11)

- VIL has 48.33 Mbps average download speed & 13.94 Mbps average upload speed across measured routes for city drive. (refer table-19)

- Varanasi Bus Stand have less download speed (less than 10 Mbps) out of total 8 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-36)

6. Annexure

6.1 Route wise coverage map

6.1.1 City

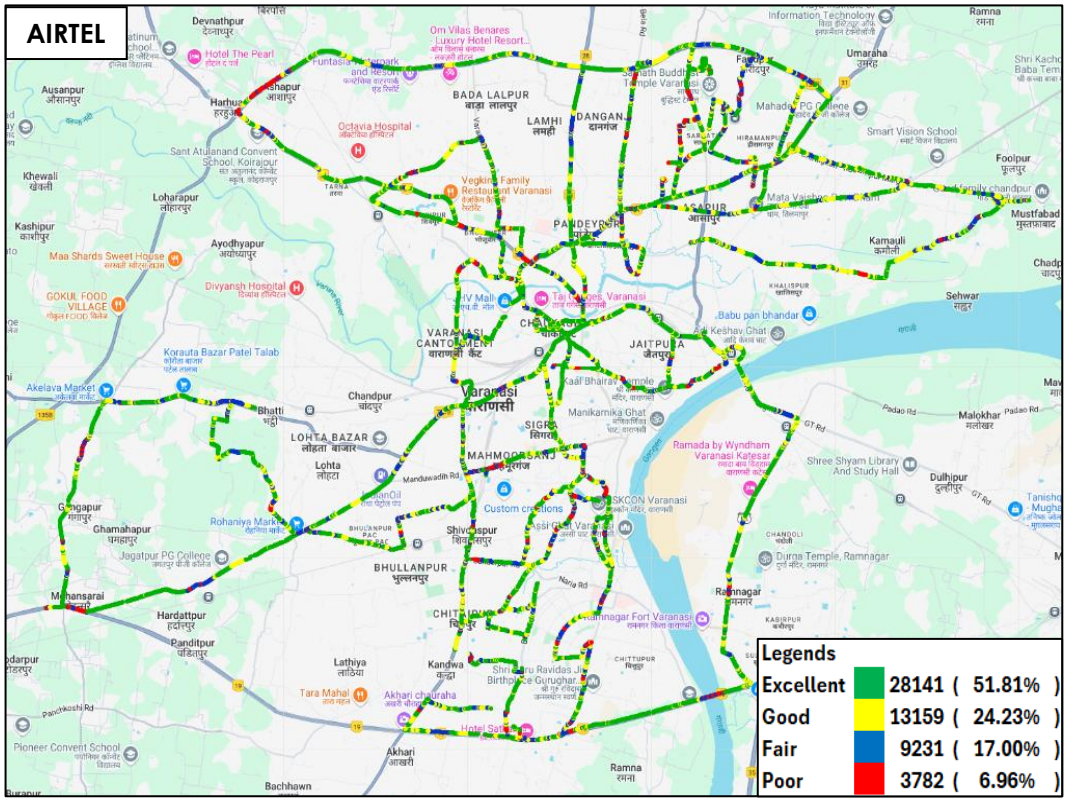


Figure-25: Signal strength 3G/2G network mode – AIRTEL.

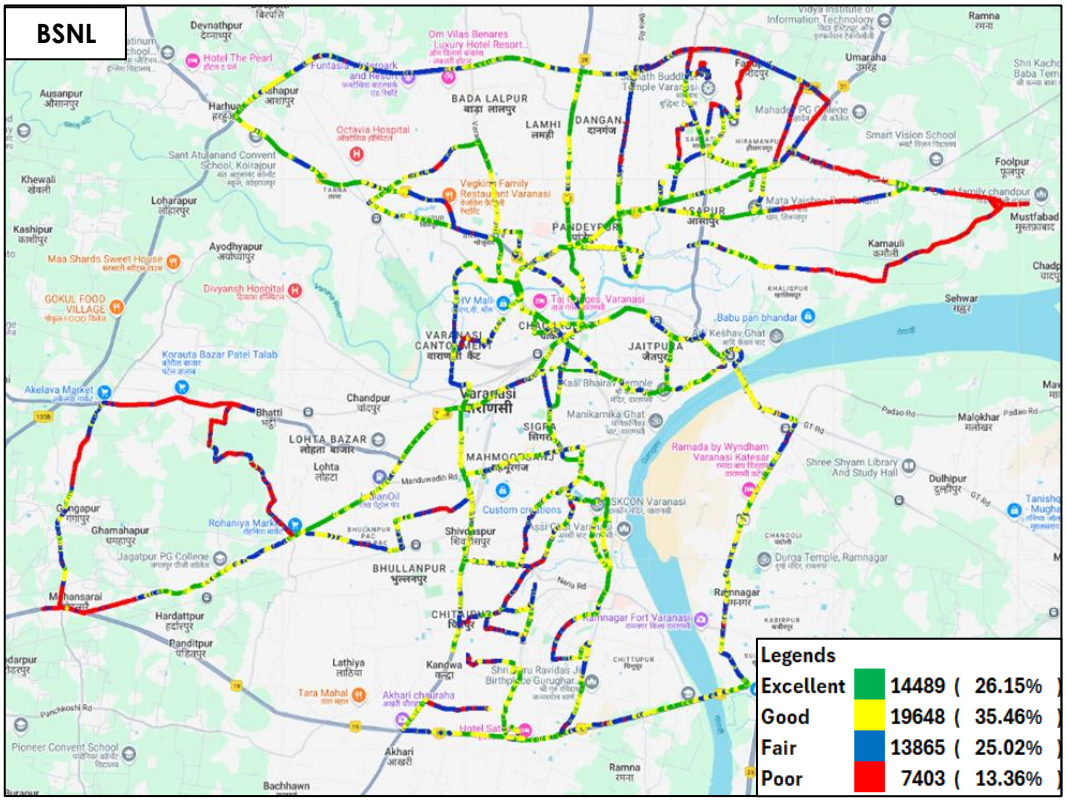


Figure-26: Signal strength 3G/2G network mode – BSNL.

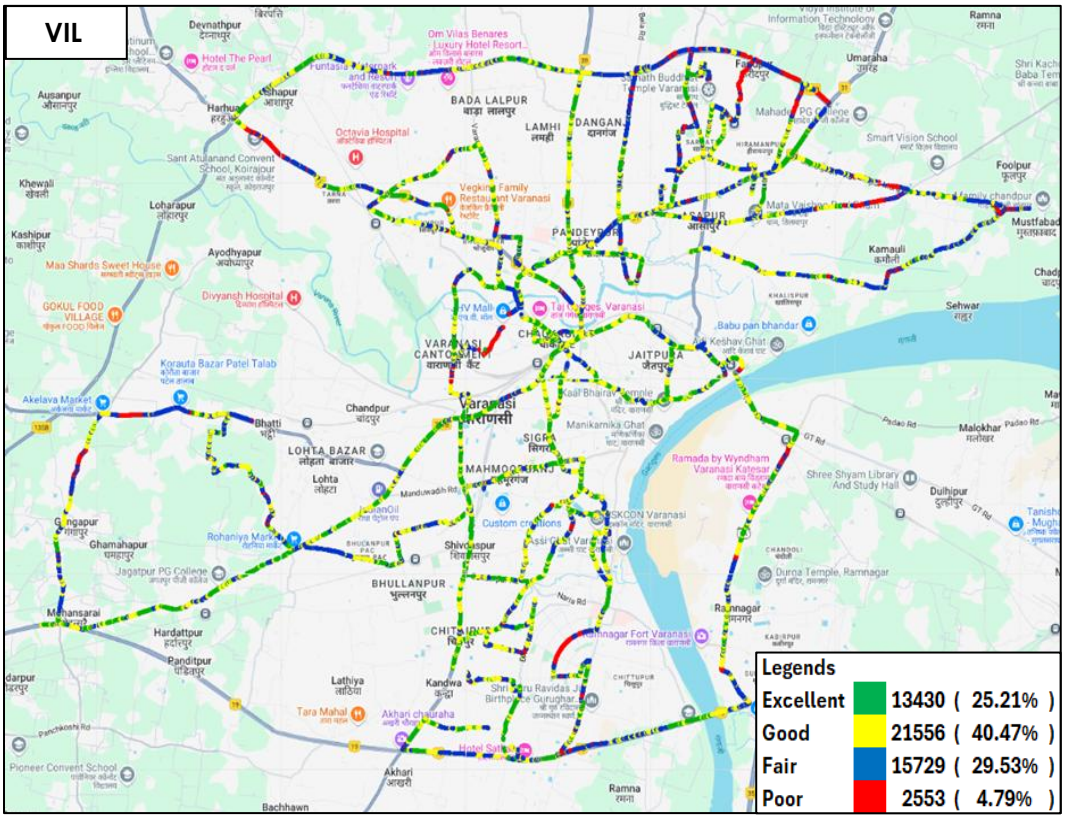


Figure-27: Signal strength 3G/2G network mode – VIL.

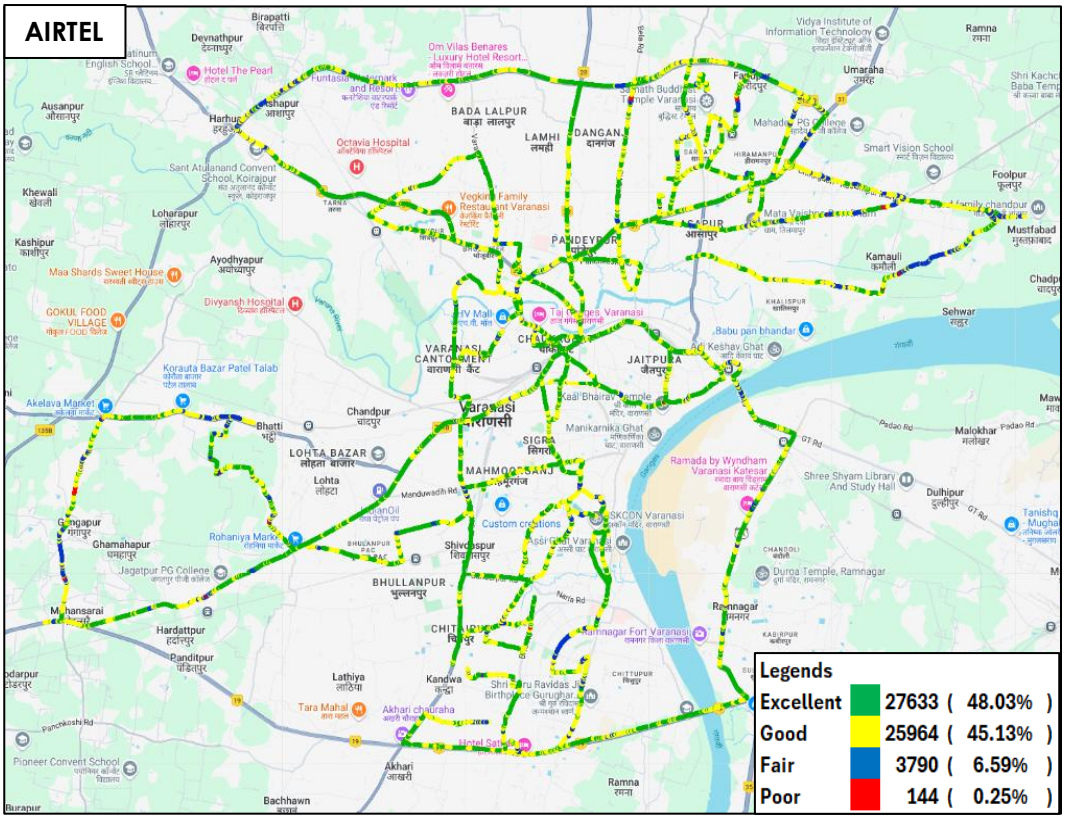


Figure-28: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL.

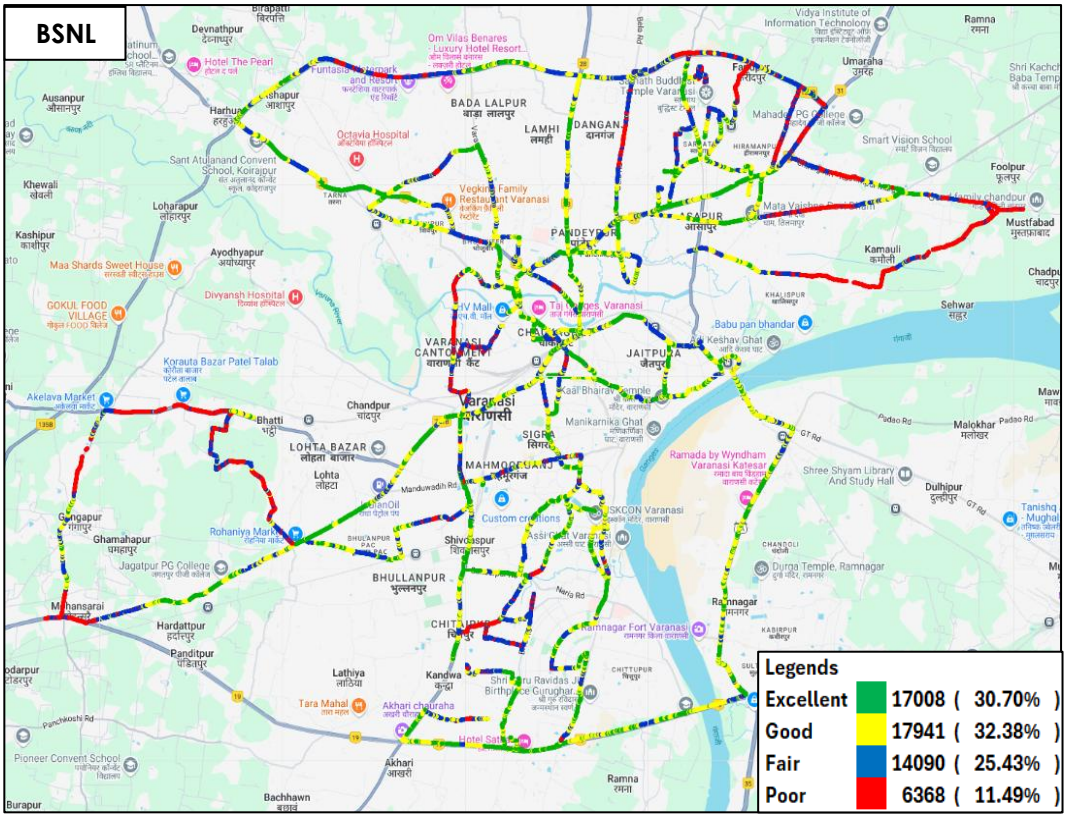


Figure-29: Signal strength auto-selection mode 5G/4G/3G/2G – BSNL.

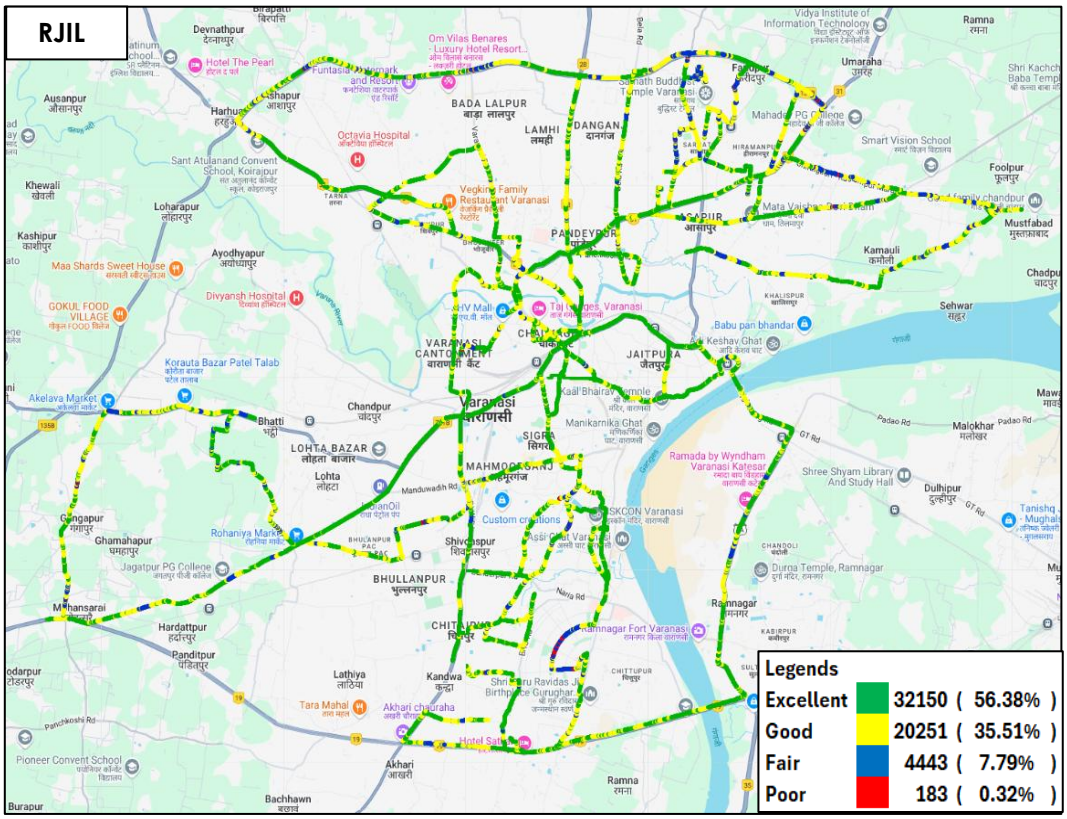


Figure-30: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL.

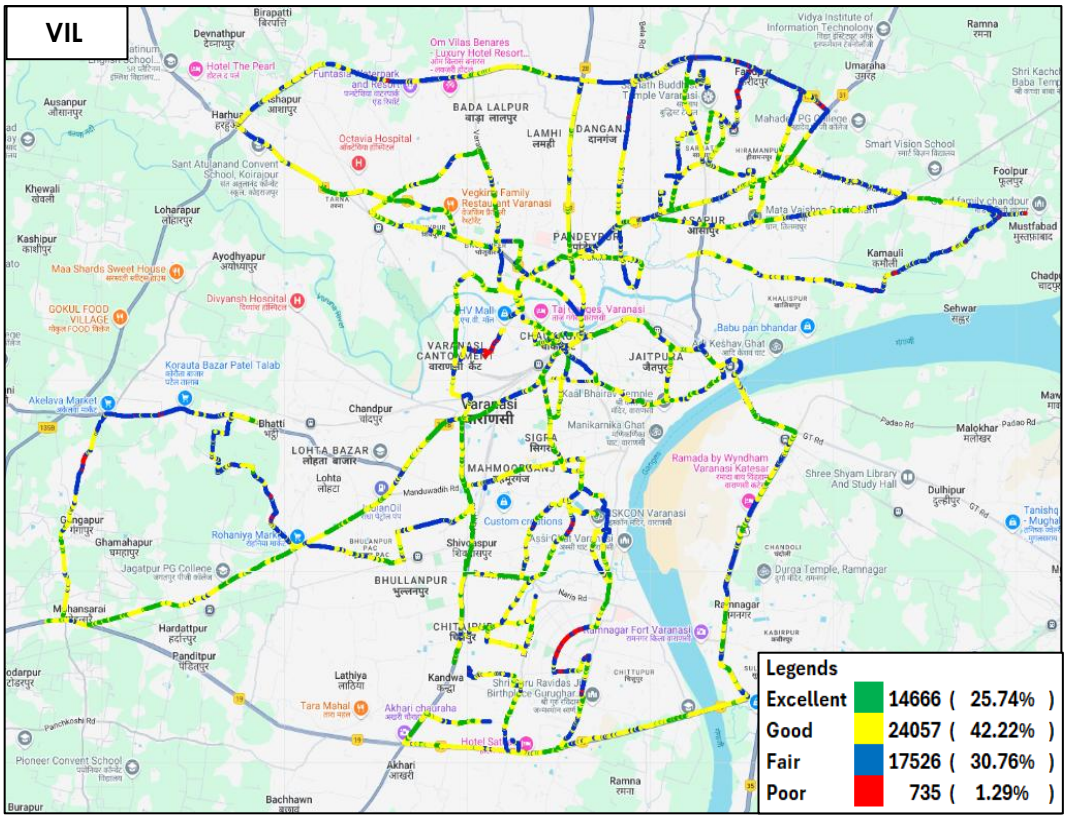


Figure-31: Signal strength auto-selection mode 5G/4G/3G/2G – VIL.

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 Sec
Wait/ Guard Time		15 Sec

Table-51: 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.
- 180 Sec calls were made only in highway & railway route drive.

Data Test		
Test Type	**Technology**	**Detail**
HTTP/FTP Download	5G/4G/3G/2G Auto Mode	500 MB File- 30 Sec Timeout, (Multithread 3- TCP Connection at a time)
HTTP/FTP 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.co.in) 20 sec timeout (only at Hotspot)

Latency		25 count- Dynamic 1000 count- Hotspot Payload- 42 bytes in all drive

Table-52: 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.
- Ping 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.
- Download and upload testing has been done on FTP server for Airtel, BSNL & RJIL. (Airtel, BSNL & RJIL not provided HTTP server)
- VIL download and upload testing is done on HTTP Server.

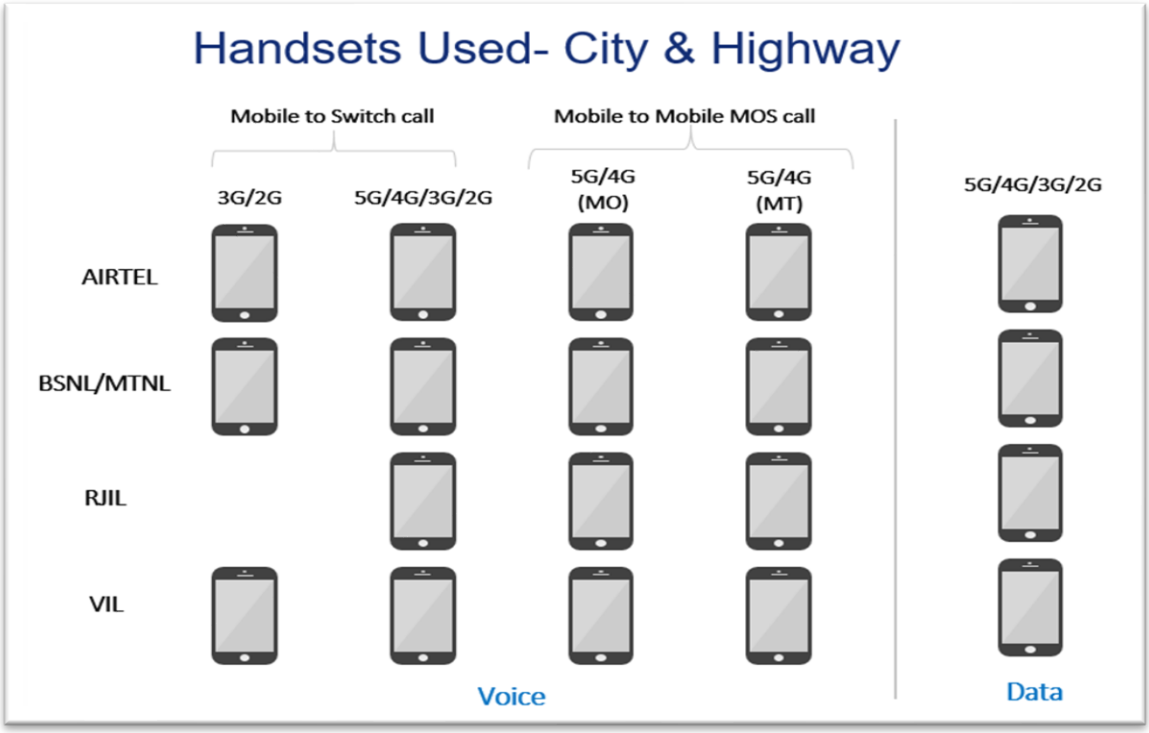


Figure-32: Number of handsets used in city & highway drive

MO: Mobile originating
MT: Mobile terminating

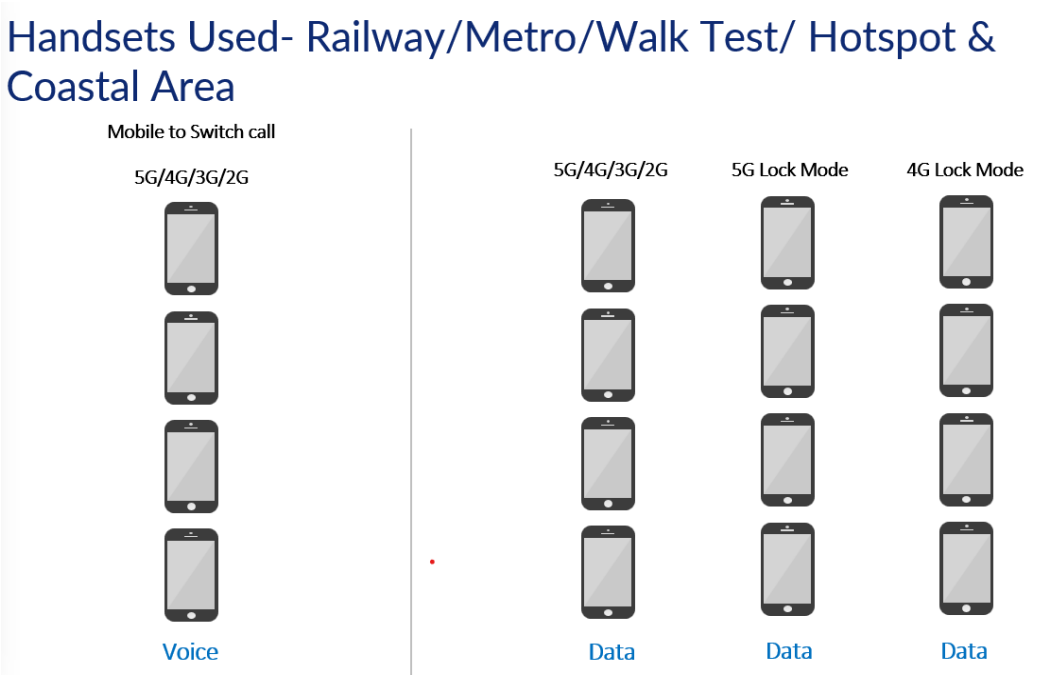


Figure-33: Number of handsets used in railway/metro/walktest/hotspot & coastal area

7.1.2 Drive test Methodology

(a) Dynamic voice testing (on the move)

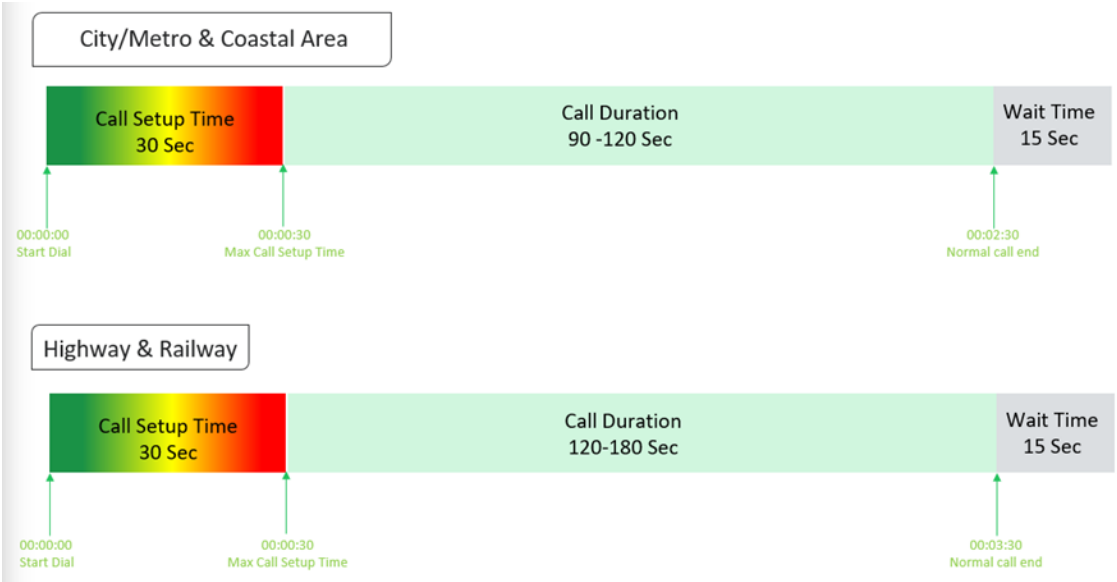


Figure-34: Voice test script for city/railway/metro/highway & coastal area

- 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-35: 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

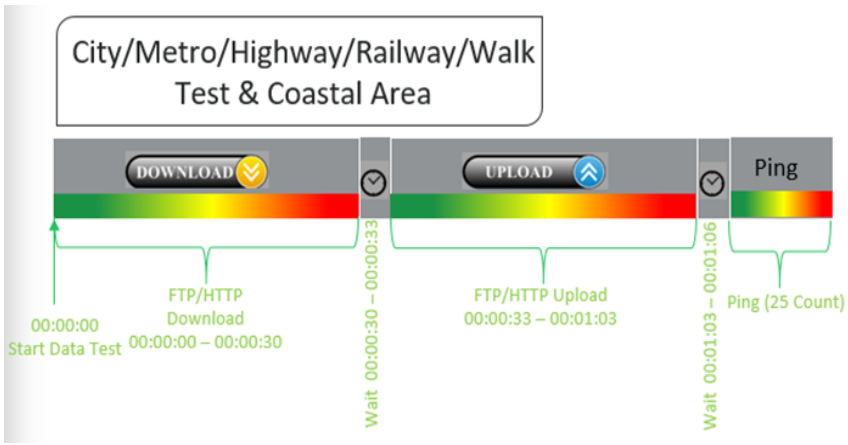


Figure-36: Data test script used in city/metro/railway/highway/walk test & coastal area

(d) Static Data(internet) testing

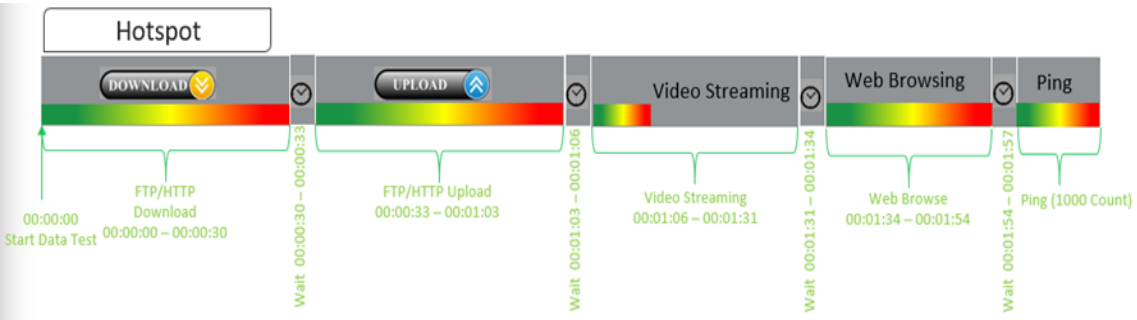


Figure-37: Data test script used at hotspot

- 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.
- Only 1 ping iteration (with 1000 Count) 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	Drop call 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 Drop Call/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-53: 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	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	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	Number of packets lost out of total packet transferred during test. Packet loss rate = (Total packet lost / Total packet sent) *100 * Packet delay (using ping) >90 ms considered as packet loss and included in packet loss rate. * Packet loss rate is calculated based on ICMP * 90th percentile for Packet loss rate has been reported in overall Hotspot performance summary.

Table-54: 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: 2025.05.15 16:03:56 +05'30'