



TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Odisha LSA

December 2024

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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 Odisha License Service Area (LSA) during the month of December, 2024 under the supervision of TRAI Regional Office (RO), Hyderabad. Details of routes/areas covered during the IDT are as given below:

Sl. No	Drive test route	Type of route	Distance covered (Kms)/ Locations	From date	To date
1	Bhubaneswar	City	335.5	10-Dec-2024	12-Dec-2024
2	Bhubaneswar	City (Inter-operator calling)	20.3	13-Dec-2024	13-Dec-2024
3	Bhubaneswar	Hotspot	08 Locations	11-Dec-2024	13-Dec-2024
4	Bhubaneswar	Walk Test	10.8	11-Dec-2024	13-Dec-2024

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 tests per the legends shown on the map.

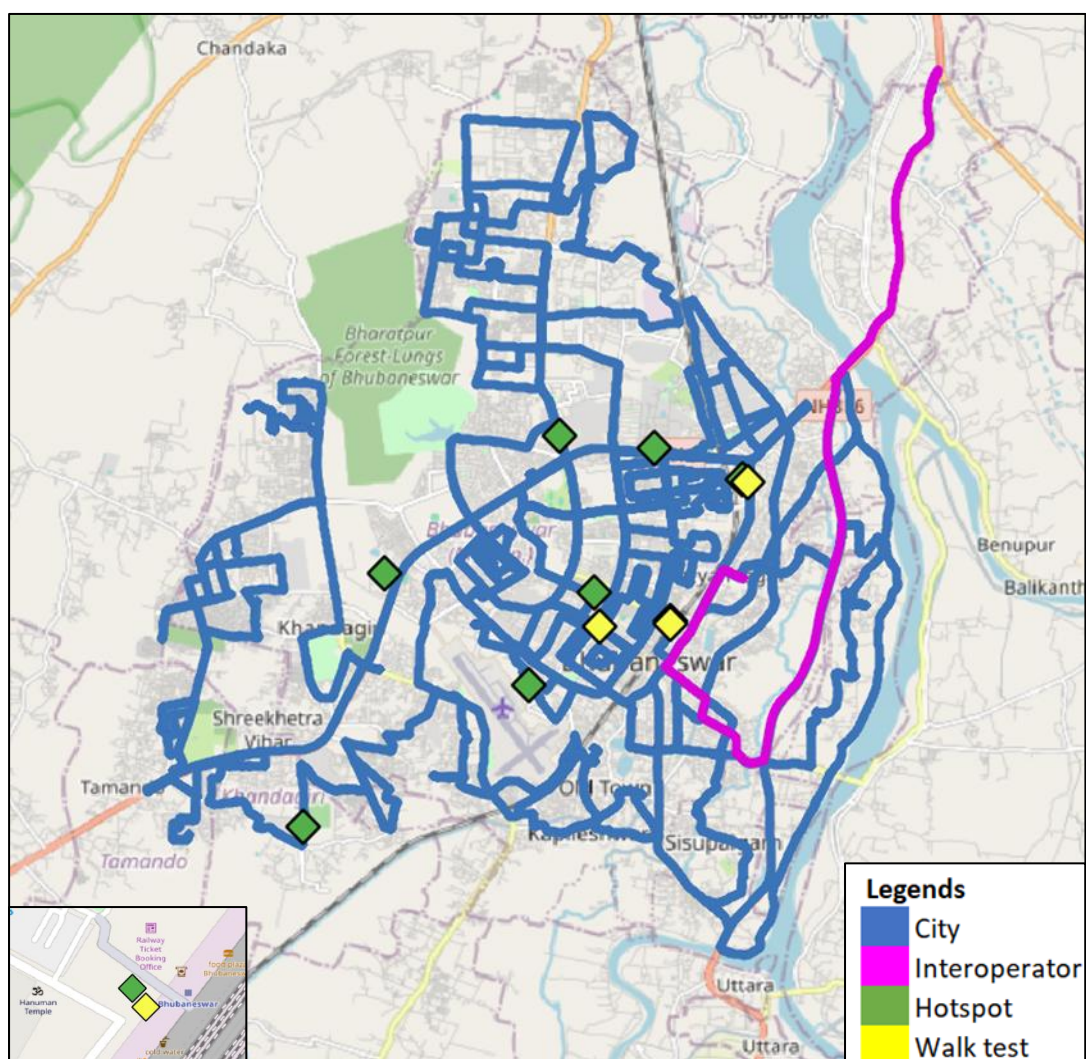


Figure-1: Drive test routes

2.3 Summary of areas covered

a) City- Khandagiri, Rajiv Nagar, Sisupalgarh, Kapileshwar, Satya Nagar, Mancheswar etc.

b) Hotspot-

1. Bhubaneswar Airport
2. Bhubaneswar Railway Station
3. Bhubaneswar Secretariat
4. Esplanade One Mall
5. Paul Heights Hotel
6. Barmunda Bus Stand
7. AIIMS Hospital
8. Utkal University

c) Walk Test-

1. AG Square
2. Durga Mandap
3. Bhubaneswar Railway Station

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	900,1800,2300
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	1800

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

QoS Performance Analysis- Odisha 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 December-2024 covering city, hotspot & 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	530	533	530
Call Setup Success Rate %	99.43	99.62	99.43
Drop Call Rate %	0.19	2.07	0.00
Call Setup Time-Average (Second)	4.69	3.00	4.39
Handover Success Rate %	99.01%	98.46%	98.41%

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

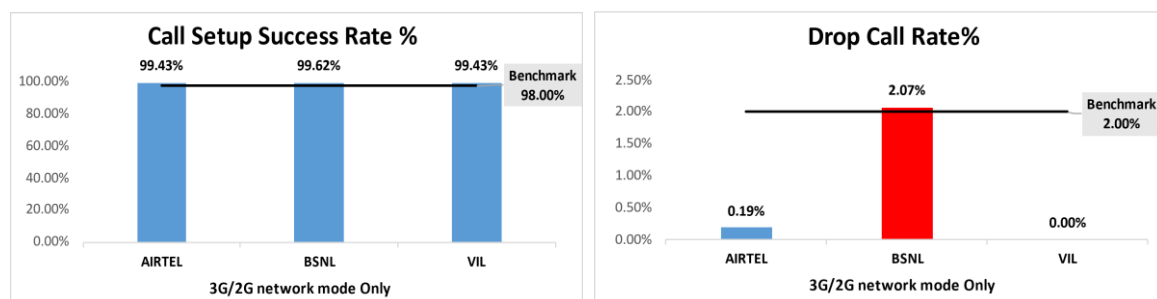


Figure-2: Call setup success rate and drop call rate performance.

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	171	NA
2G	729	420	555

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	719	1095	735	719
Call Setup Success Rate %	99.44	51.51	99.32	100.00
Drop Call Rate %	0.14	1.77	0.96	0.00
Call Setup Time-Average (Second)	0.51	2.78	0.60	0.50
Handover Success Rate %	100.00%	98.78%	100.00%	100.00%

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

Note-

- Maximum call were failed in BSNL while call were initiated in LTE.

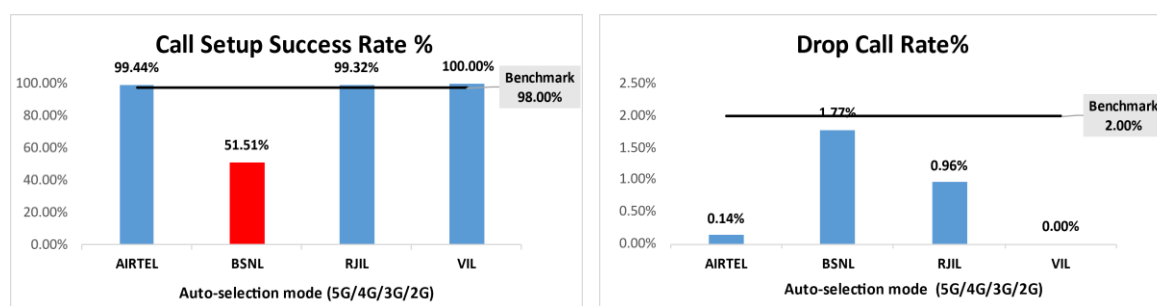


Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	533	557	535	540
Number of silence call for >4 Sec	0	22	7	1
Silence Call Rate %	0.00	3.95	1.31	0.19
Number of silence instances for >4 Sec	0	28	7	1
Number of silence instances for >3 Sec	2	37	13	4
Number of silence instances for >2 sec	13	53	36	29
RTP Jitter (4G & 5G) in ms	5.82	10.60	10.56	4.10
Packet loss Rate Downlink %	0.32	5.19	0.43	0.32
Packet loss Rate Uplink %	0.39	5.31	0.64	0.27

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

Note-

- BSNL has latched 61.13% on LTE technology. Silence call, Jitter and packet loss rate have been taken for that duration only (Volte call).

Number of unique cell id's covered in Voice test- Technology wise				
Technology	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
5G	0	NA	803	NA
4G	1237	323	1424	656
3G	NA	117	NA	NA
2G	5	332	NA	5

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	3170	2526	3145	3218
Speech Quality (Average MOS Score)	4.00	2.69	3.88	4.64
Number of samples with MOS ≥ 4 to <5 (Excellent)	2580	292	2142	3049
Number of samples with MOS ≥ 3 to <4 (Good)	500	677	833	135
Number of samples with MOS ≥ 2 to <3 (Fair)	67	898	115	19
Number of samples with MOS ≥ 1 to <2 (Poor)	23	659	55	15
%age of samples with MOS ≥ 4 to <5 (Excellent)	81.39%	11.56%	68.11%	94.75%
%age of samples with MOS ≥ 3 to <4 (Good)	15.77%	26.80%	26.49%	4.20%
%age of samples with MOS ≥ 2 to <3 (Fair)	2.11%	35.55%	3.66%	0.59%
%age of samples with MOS ≥ 1 to <2 (Poor)	0.73%	26.09%	1.75%	0.47%

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

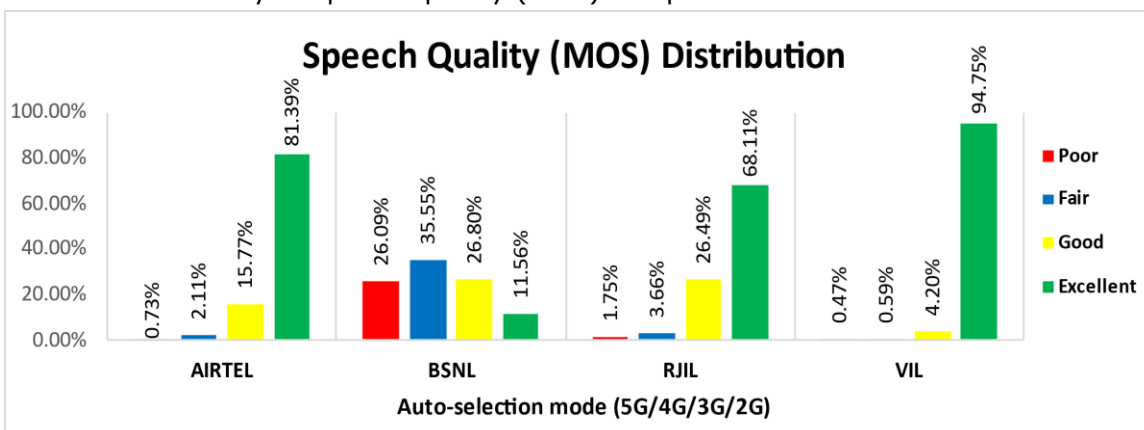


Figure- 4: Distribution of samples in MOS score range.

- (d) Inter-service provider voice call performance:** To check the performance of inter-service provider call setup success rate, total 35 to 47 inter operator calls were attempted. The Call setup success rate and call setup time observation are as below.

Call setup success rate %				
From Service Provider	To Service Provider			
	AIRTEL	BSNL	RJIL	VIL
AIRTEL	NA	100.00	100.00	100.00
BSNL	95.00	NA	97.56	97.14
RJIL	100.00	100.00	NA	100.00
VIL	97.87	97.37	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	4.68	1.75	2.26
BSNL	7.63	NA	3.67	8.09
RJIL	1.93	4.73	NA	1.70
VIL	2.07	3.48	1.99	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	151.65	3.86	236.83	32.99
	80th Percentile	241.85	7.24	368.24	43.22
	20th Percentile	68.87	1.13	73.13	21.52
Upload Throughput (Mbits/s)	Average	30.78	4.27	20.49	18.87
	80th Percentile	49.50	6.44	36.94	29.59
	20th Percentile	10.74	1.63	3.76	9.07
Latency (ms)	50th Percentile	10.40	27.75	14.10	38.10

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

Note-

- Approximately 19% of upload sessions in RJIL are experiencing disconnections within 1 second of server connection, resulting in failed uploads.

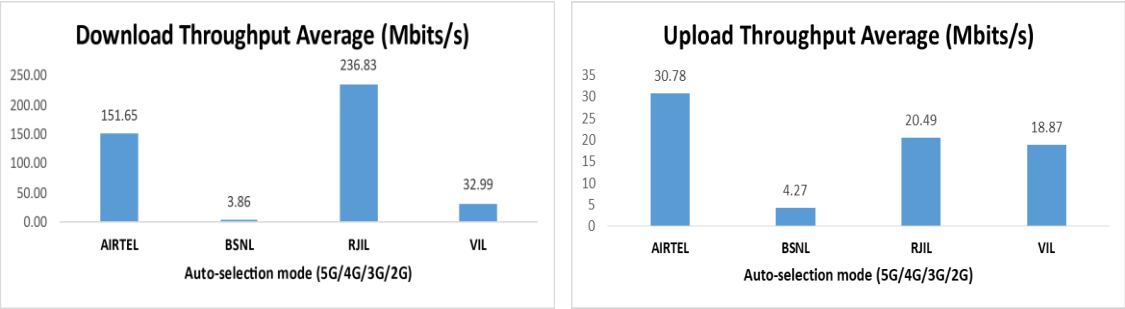


Figure- 5: Download and upload throughput.

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	803	NA
4G	1211	352	59	604
3G	NA	42	NA	NA
2G	0	1	NA	35

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 10th December 2024 to 12th December 2024 in Bhubaneswar. (Refer Table-1)

4.2.1 Drive test route

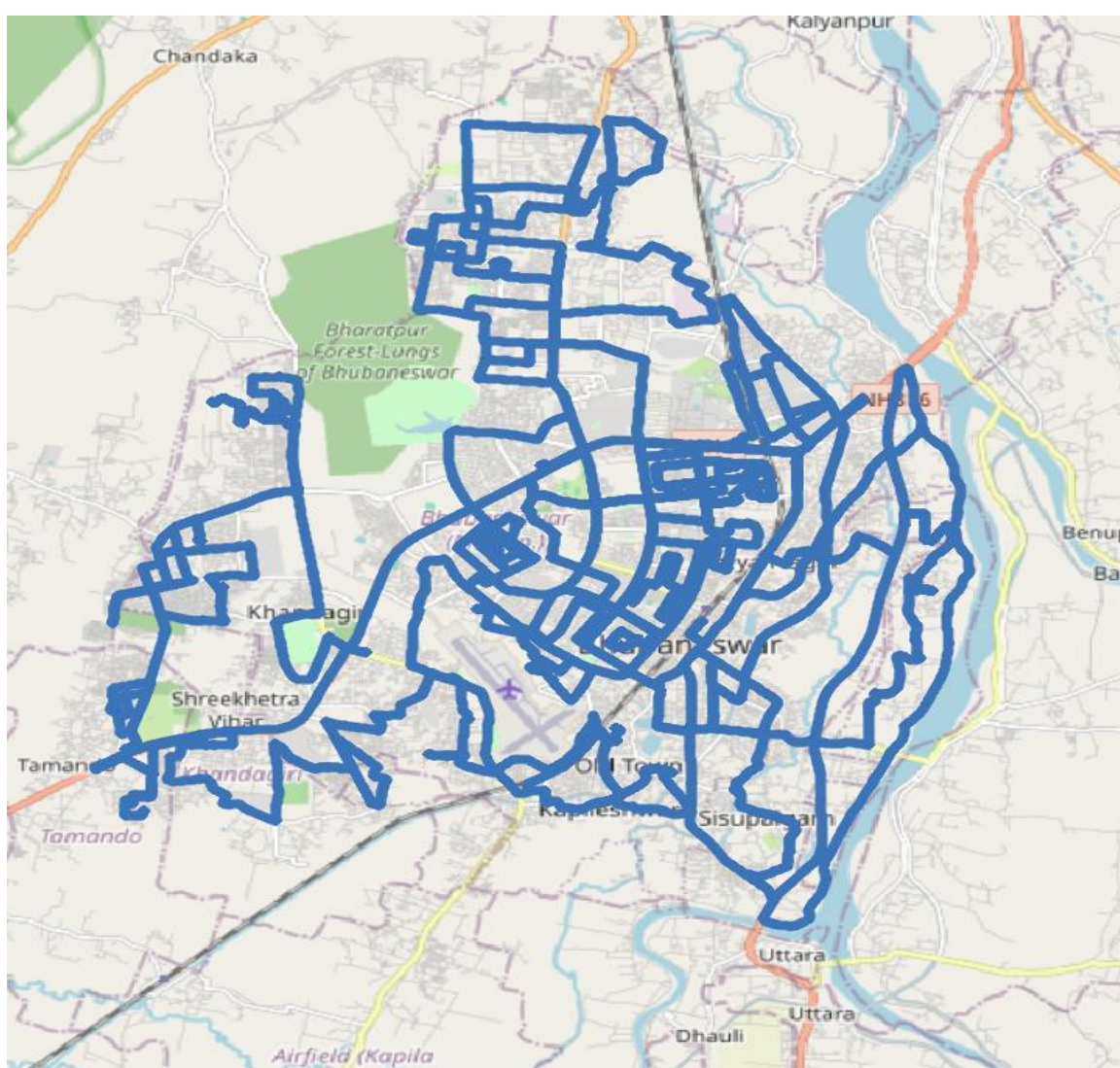


Figure- 6: Drive test routes.

4.2.2 Areas covered

Khandagiri, Rajiv Nagar, Sisupalgarh, Kapileshwar, Satya Nagar, Mancheswar 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	530	533	530
Call Setup Success Rate %	99.43	99.62	99.43
Drop Call Rate%	0.19	2.07	0.00
Call Setup Time-Average (Second)	4.69	3.00	4.39
Handover Success Rate %	99.01%	98.46%	98.41%

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

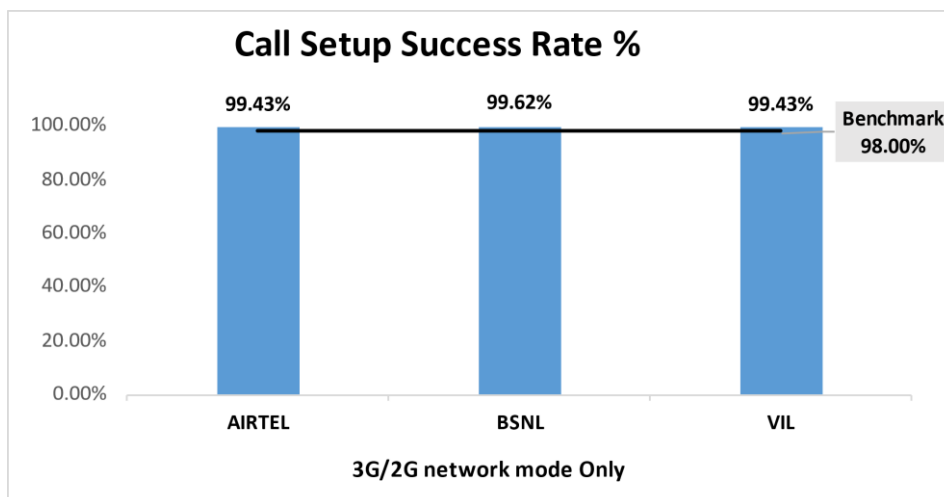


Figure-7: Performance for call setup success rate.

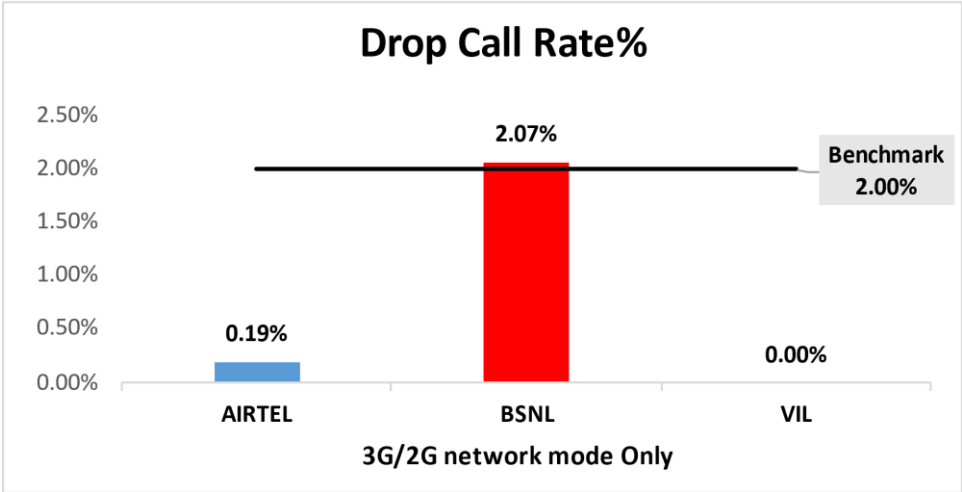


Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	8.17%	NA
2G	100.00%	91.83%	99.99%
Limited Service	0.00%	0.00%	0.01%

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

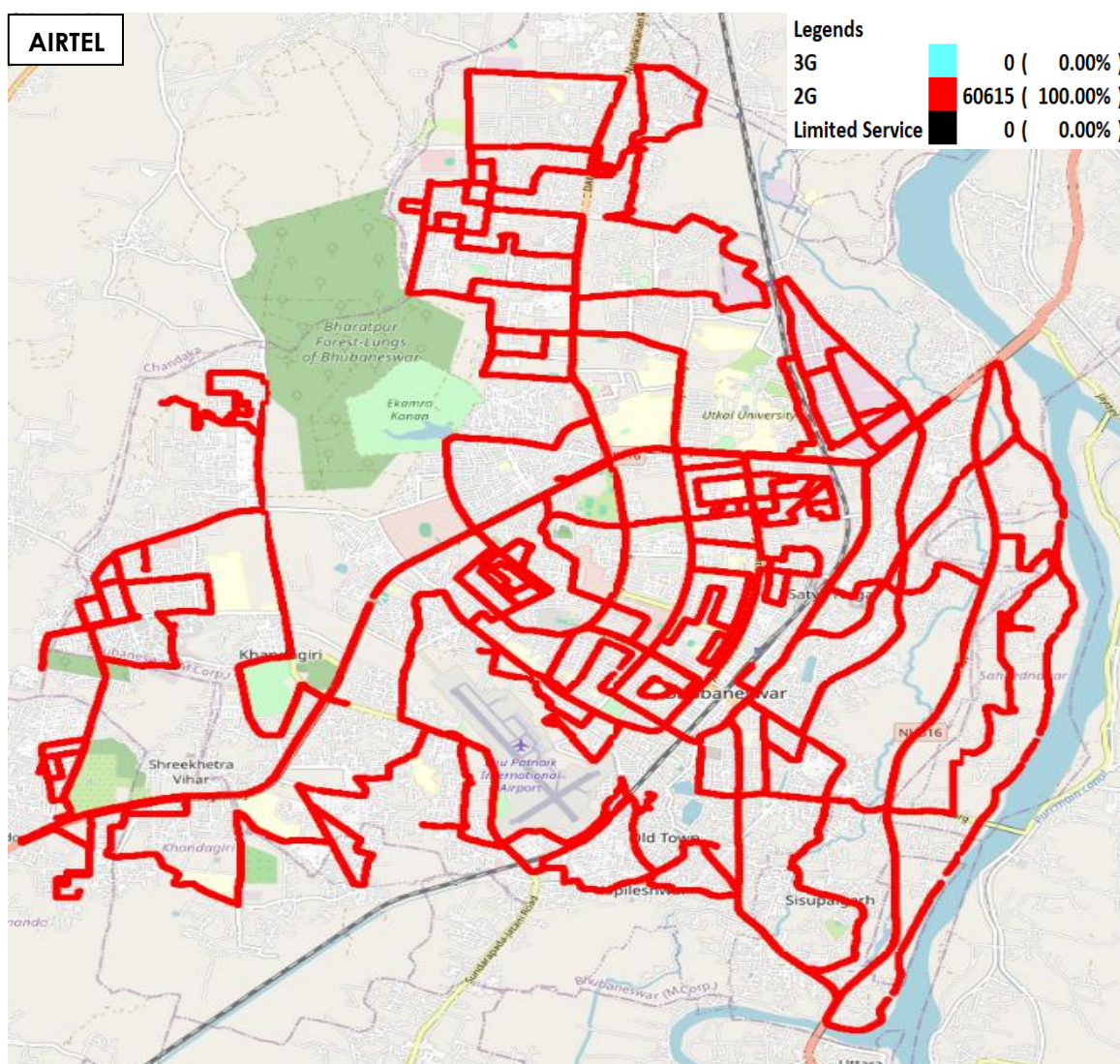


Figure-9: Serving technology plots 3G/2G network mode – AIRTEL.

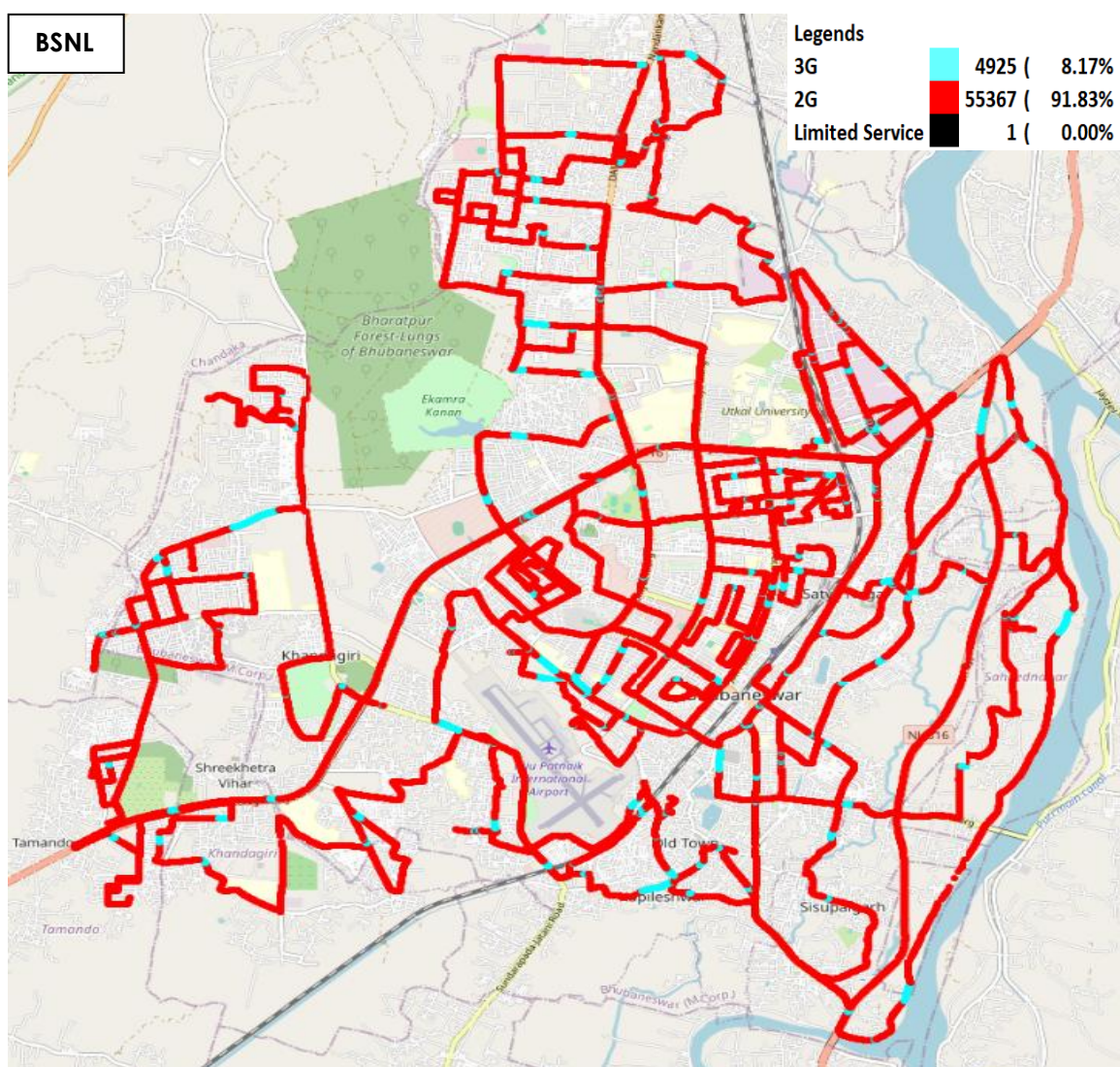


Figure-10: Serving technology plots 3G/2G network mode – BSNL.

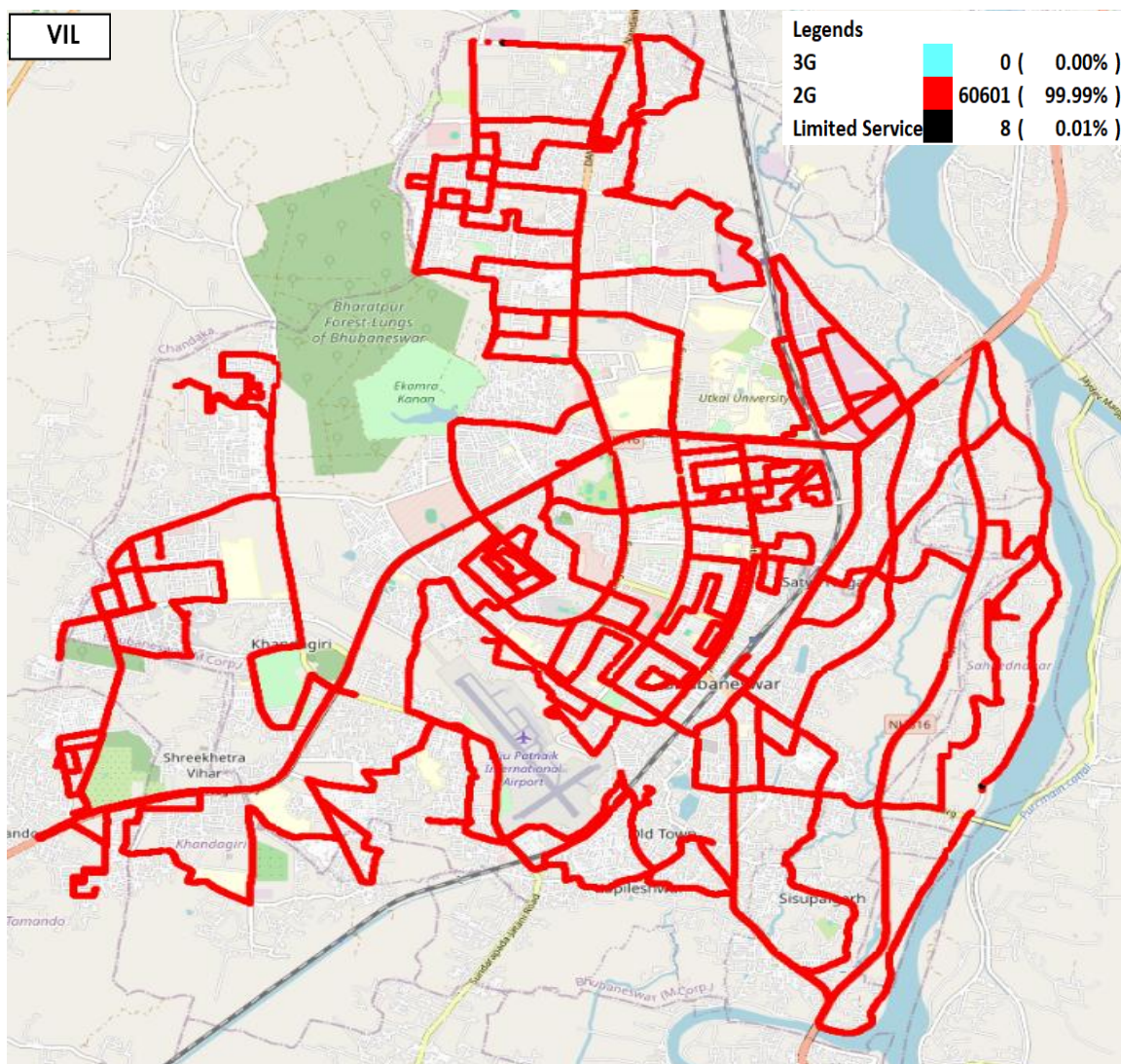


Figure-11: Serving technology plots 3G/2G network mode –VIL.

(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)

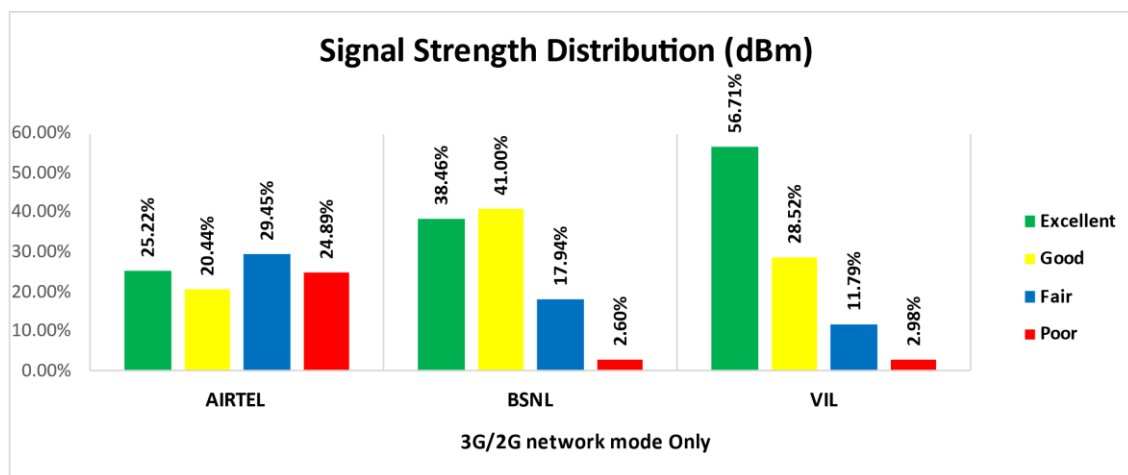


Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

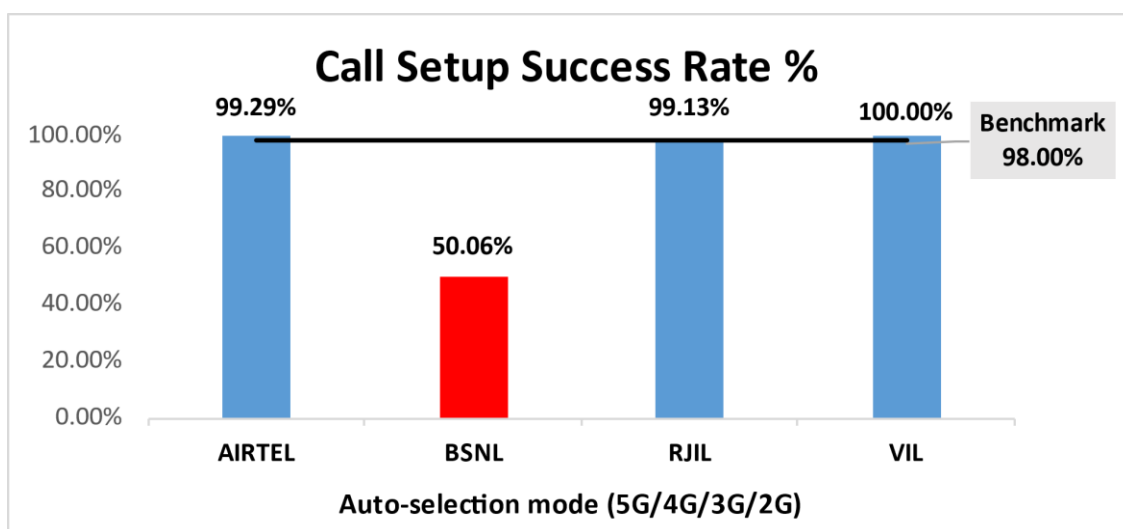
- Airtel has 25% of samples falling in the excellent signal strength category.
- BSNL has 38% of samples falling in the excellent signal strength category.
- VIL has 57% of samples falling in the excellent signal strength category.

(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	560	885	575	559
Call Setup Success Rate %	99.29	50.06	99.13	100.00
Drop Call Rate %	0.18	1.81	1.23	0.00
Call Setup Time Average (Second)	0.51	2.89	0.61	0.52
Handover Success Rate %	100.00	98.72	99.98	100.00

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

- Maximum call were failed in BSNL while call were initiated in LTE.

**Figure-13:** Performance for call setup success rate.

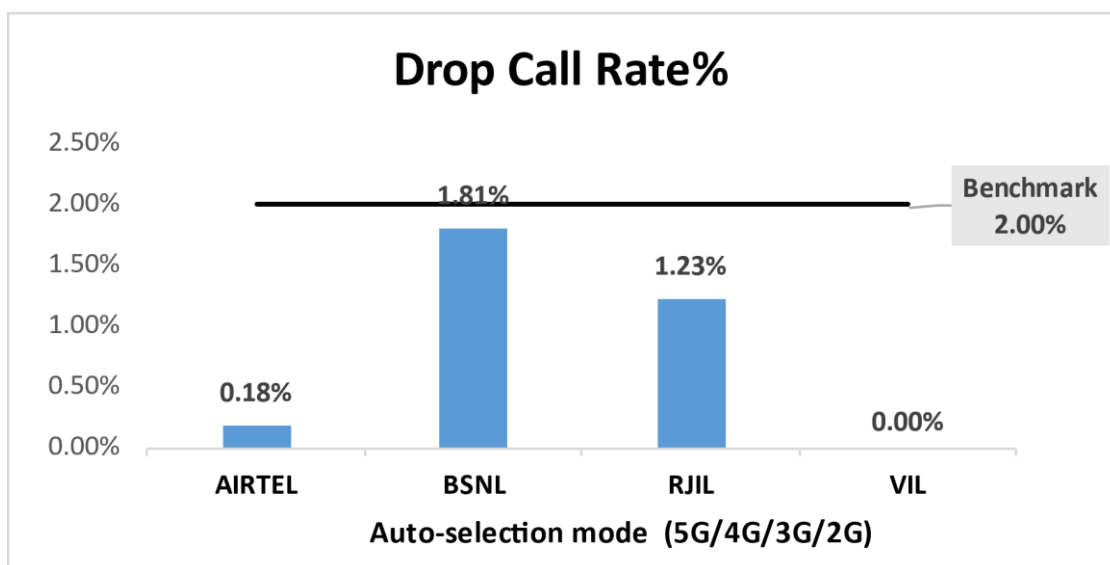


Figure-14: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	533	557	535	540
Number of silence call for >4 Sec	0	22	7	1
Silence Call Rate %	0.00	3.95	1.31	0.19
Number of silence instances for >4 Sec	0	28	7	1
Number of silence instances for >3 Sec	2	37	13	4
Number of silence instances for >2 sec	13	53	36	29
RTP Jitter (4G & 5G) in ms	5.82	10.60	10.56	4.10
Packet loss Rate Downlink %	0.32	5.19	0.43	0.32
Packet loss Rate Uplink %	0.39	5.31	0.64	0.27

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

Note-

- BSNL has latched 61.13% on LTE technology. Silence call, Jitter and packet loss rate have been taken for that duration only (Volte call).

(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	3170	2526	3145	3218
Speech Quality (Average MOS Score)	4.00	2.69	3.88	4.64
Number of samples with MOS ≥ 4 to < 5 (Excellent)	2580	292	2142	3049
Number of samples with MOS ≥ 3 to < 4 (Good)	500	677	833	135
Number of samples with MOS ≥ 2 to < 3 (Fair)	67	898	115	19
Number of samples with MOS ≥ 1 to < 2 (Poor)	23	659	55	15
%age of samples with MOS ≥ 4 to < 5 (Excellent)	81.39%	11.56%	68.11%	94.75%
%age of samples with MOS ≥ 3 to < 4 (Good)	15.77%	26.80%	26.49%	4.20%
%age of samples with MOS ≥ 2 to < 3 (Fair)	2.11%	35.55%	3.66%	0.59%
%age of samples with MOS ≥ 1 to < 2 (Poor)	0.73%	26.09%	1.75%	0.47%

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

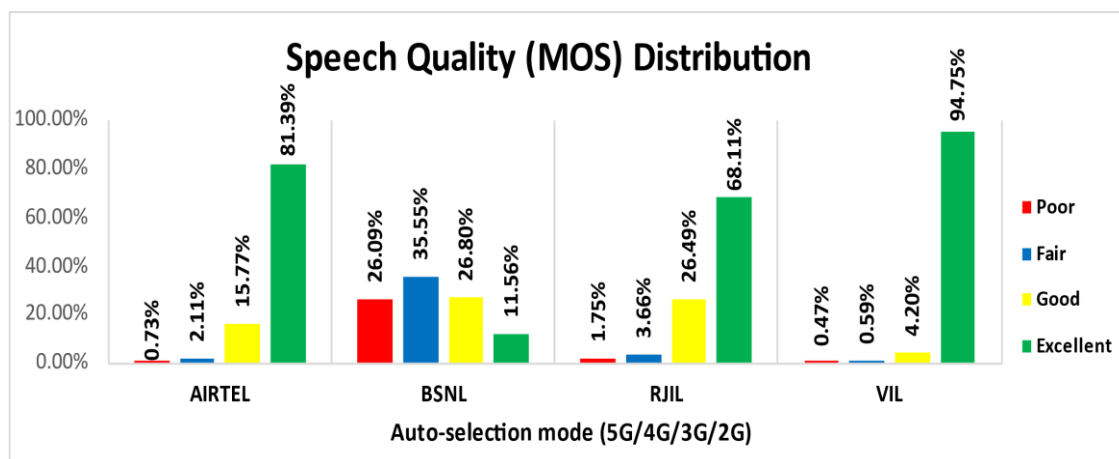


Figure-15: Distribution of samples in MOS score range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	12.29%	NA	42.61%	NA
4G	87.55%	40.95%	57.38%	99.63%
3G	NA	4.66%	NA	NA
2G	0.15%	51.76%	NA	0.37%
Limited Service	0.00%	2.64%	0.02%	0.00%

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

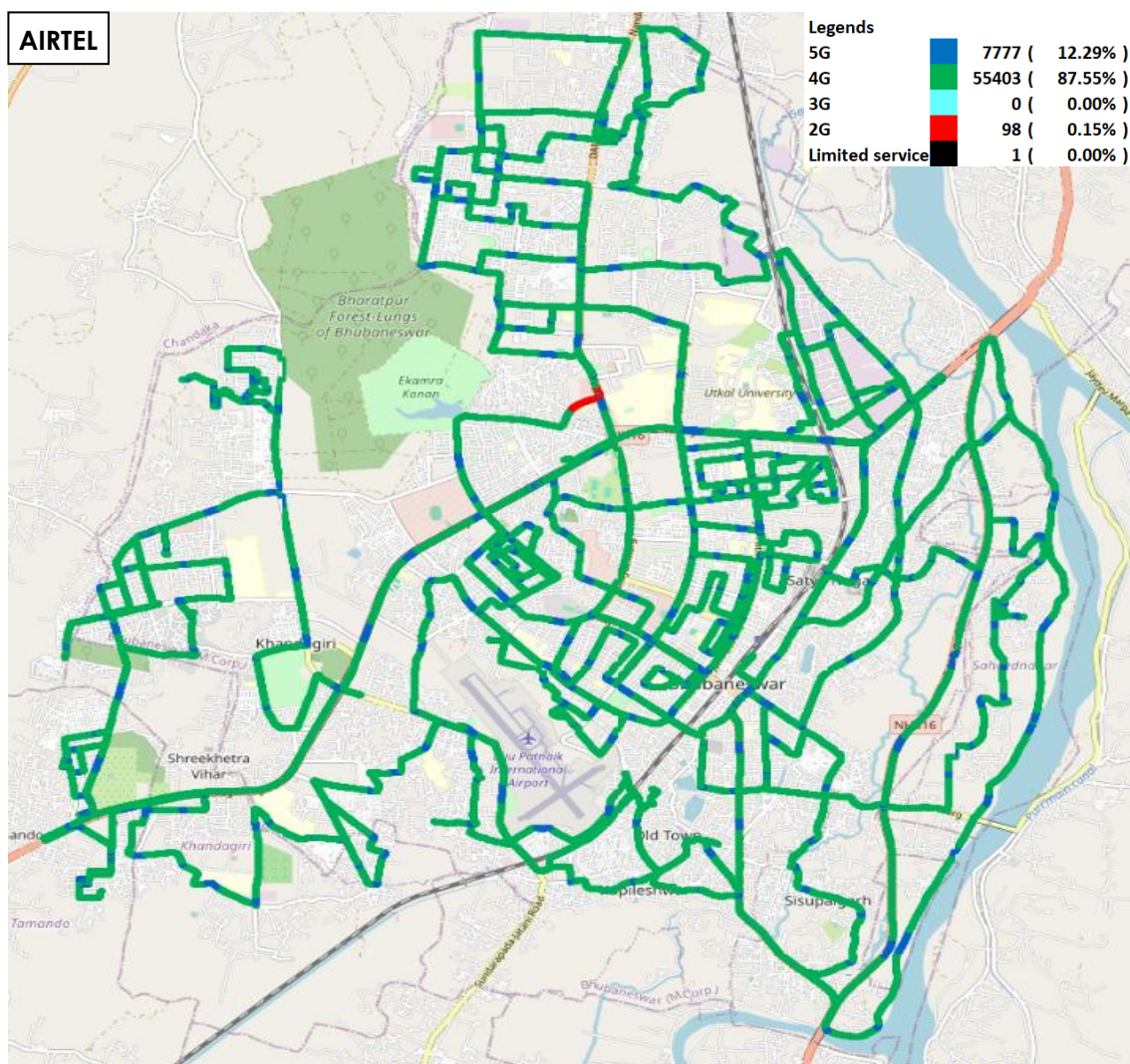


Figure-16: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-AIRTEL

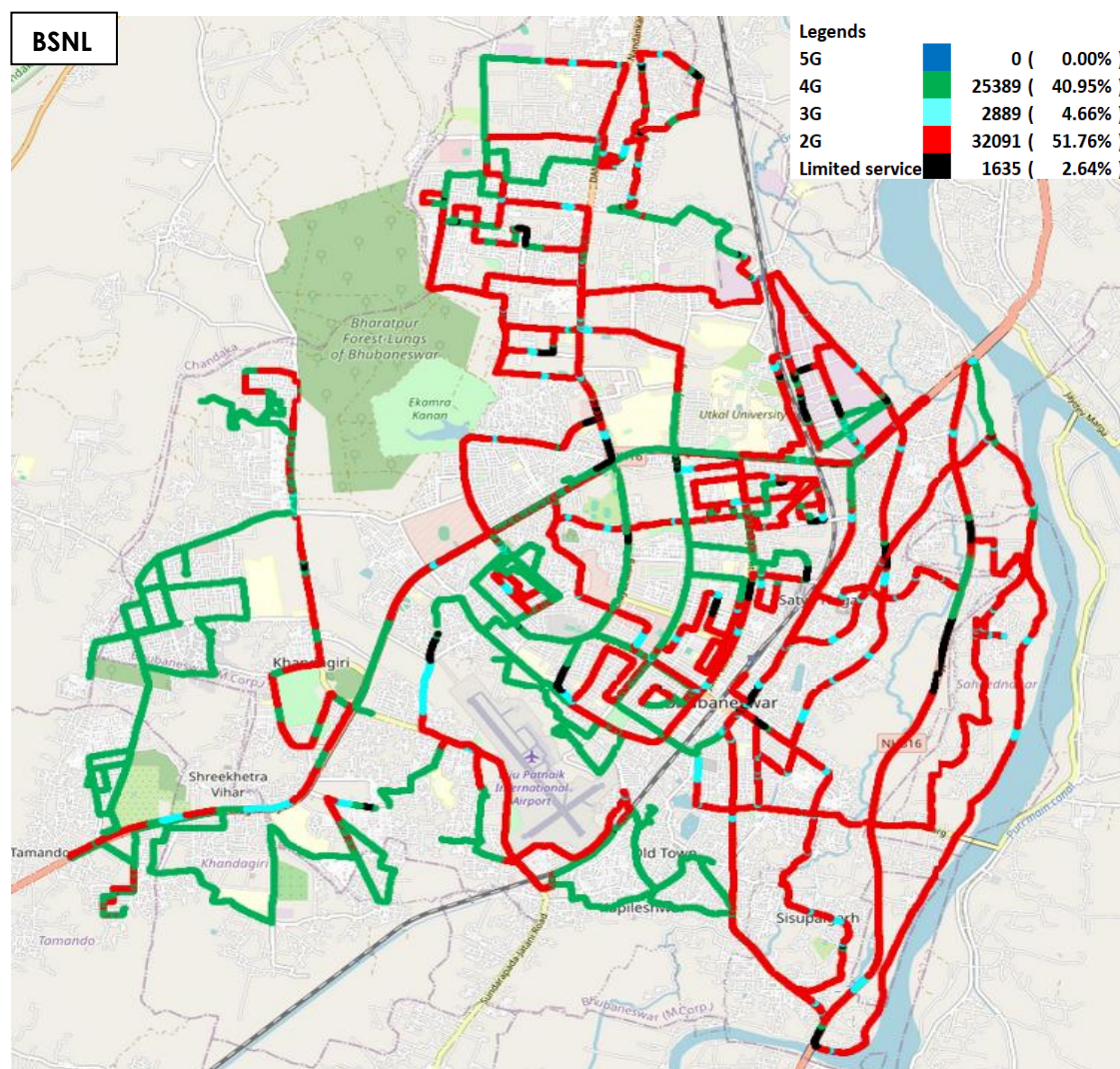


Figure-17: Serving technology plots in auto-selection mode (5G/4G/3G/2G) -BSNL.

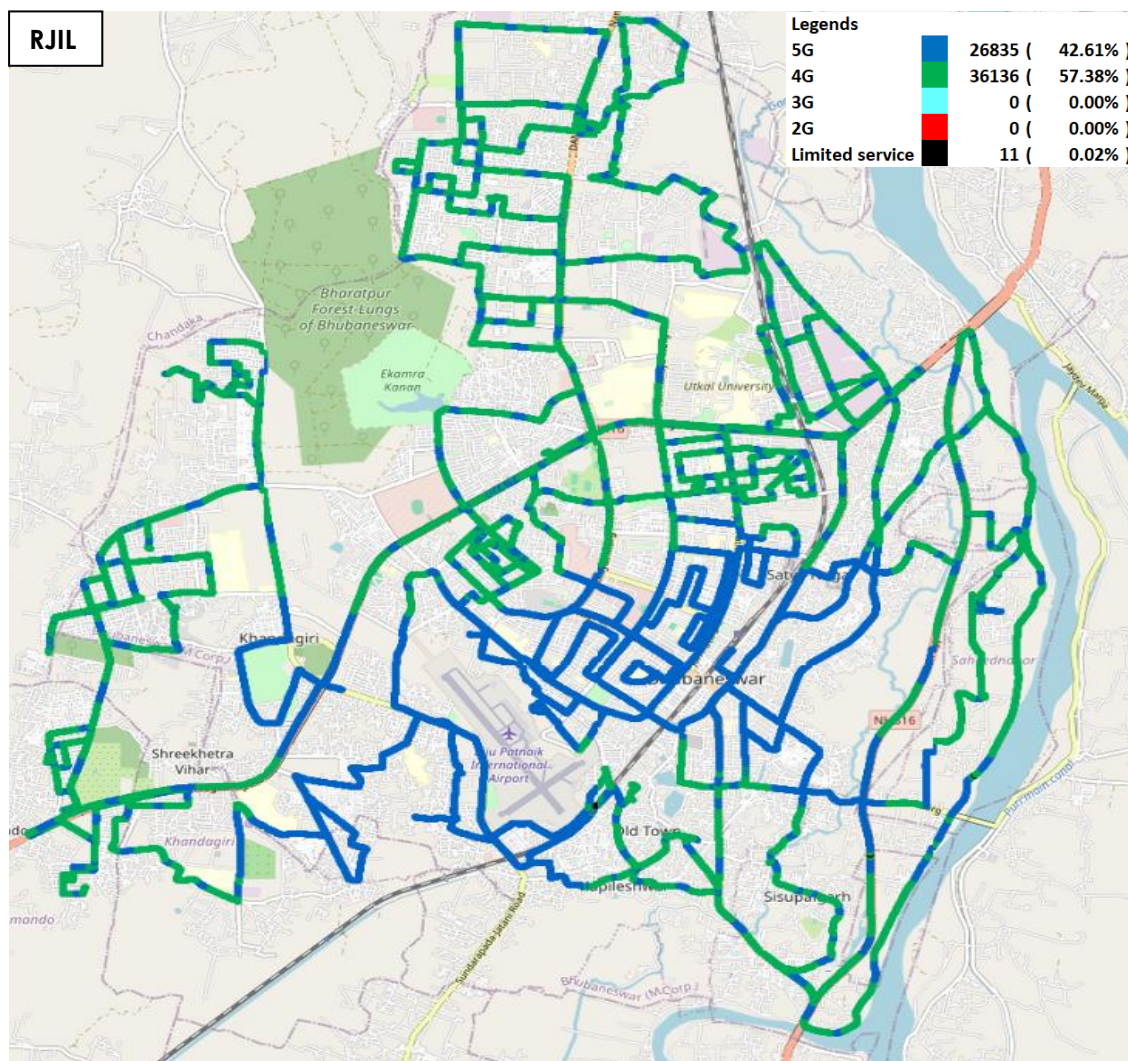


Figure-18: Serving technology plots in auto-selection mode (5G/4G/3G/2G)- RJIL.

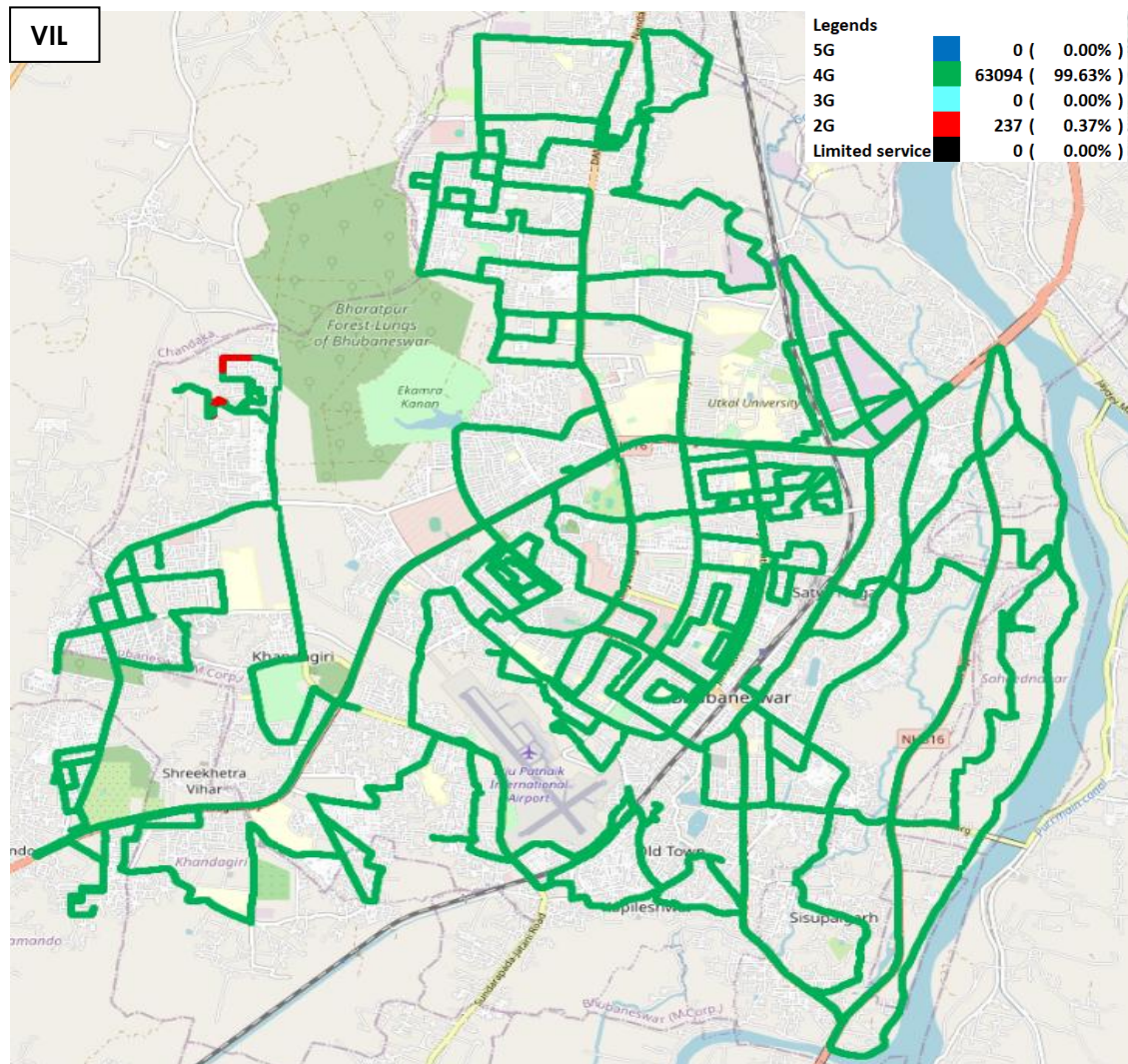


Figure-19: Serving technology plots in auto-selection mode (5G/4G/3G/2G) – VIL.

(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)

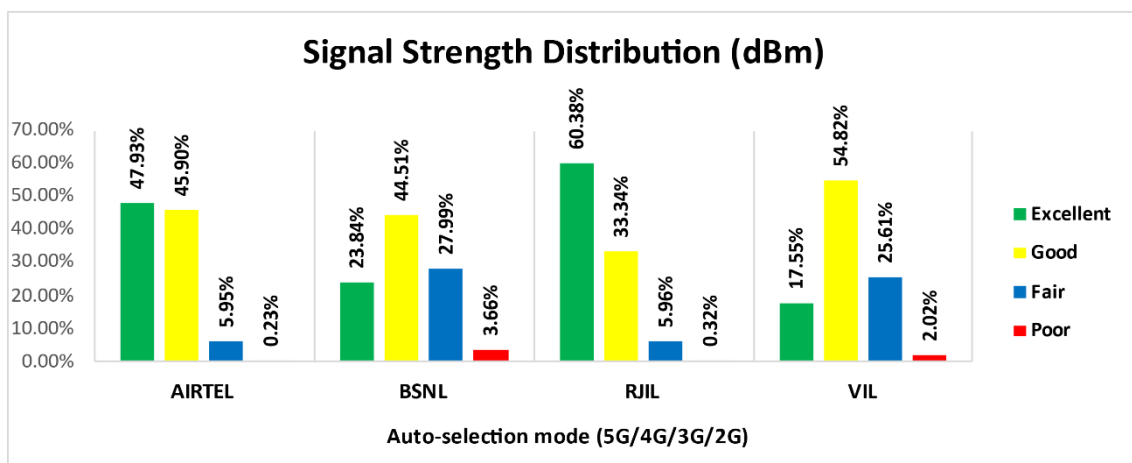


Figure-20: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:

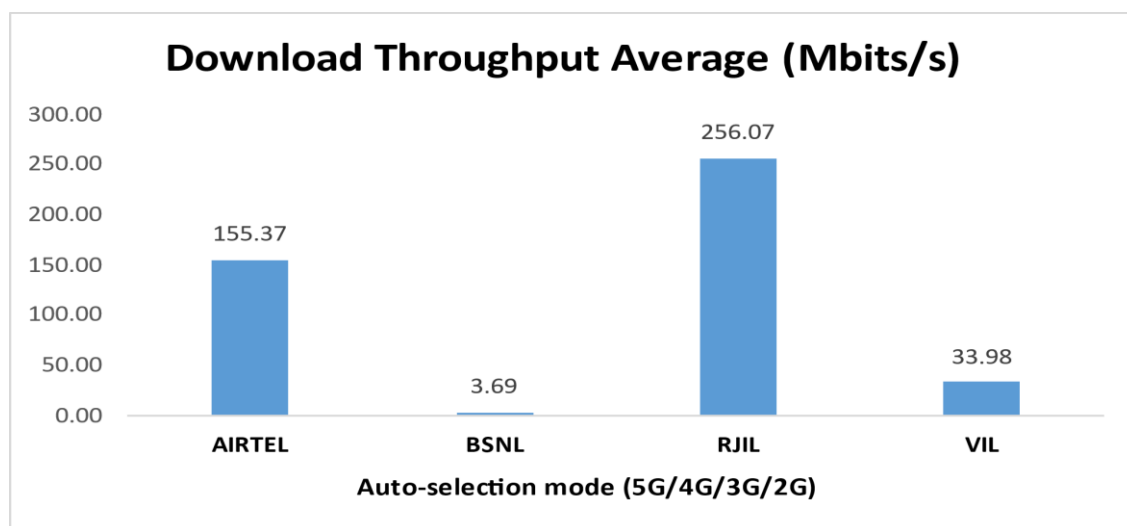
- Airtel has 48% of samples falling in the excellent signal strength category.
- BSNL has 24% of samples falling in the excellent signal strength category.
- RJIL has 60% of samples falling in the excellent signal strength category.
- VIL has 18% of samples falling in the excellent signal strength category.

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	155.37	3.69	256.07	33.98
	80th Percentile	247.98	7.07	386.54	44.80
	20th Percentile	70.61	1.06	103.29	21.61
Upload Throughput (Mbits/s)	Average	30.17	3.95	22.35	18.37
	80th Percentile	48.16	5.47	39.38	28.60
	20th Percentile	10.96	1.61	5.16	8.99
Latency (ms)	50th Percentile	10.35	28.65	12.85	38.65

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

- Approximately 23% of upload sessions in RJIL are experiencing disconnections within 1 second of server connection, resulting in failed uploads.

**Figure- 21:** Download throughput.

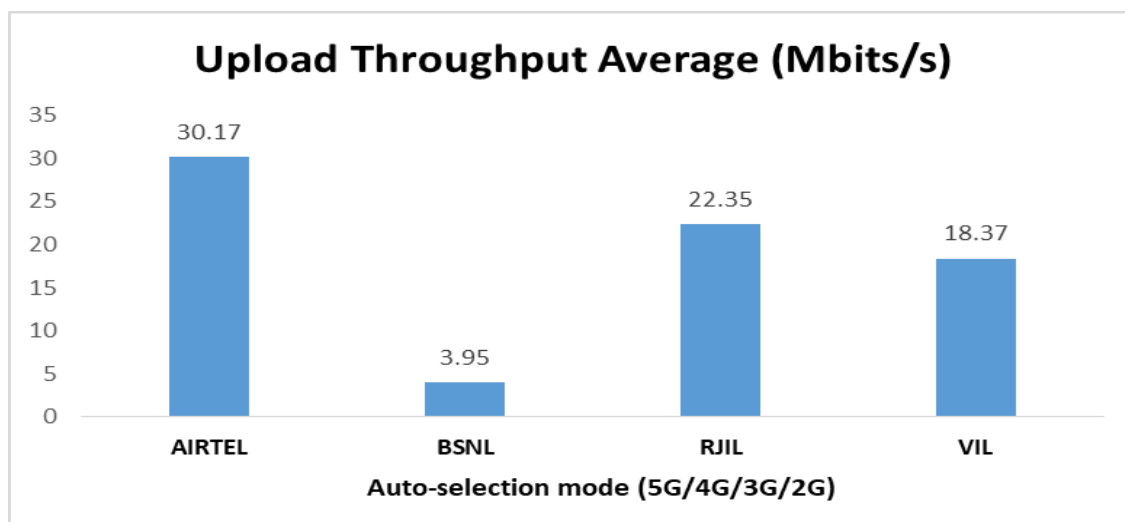


Figure- 22: Upload throughput.

4.3 Hotspots

Hotspot testing has been done on 11th December 2024 to 13th December 2024. Eight locations have been tested in the city.

4.3.1 Locations

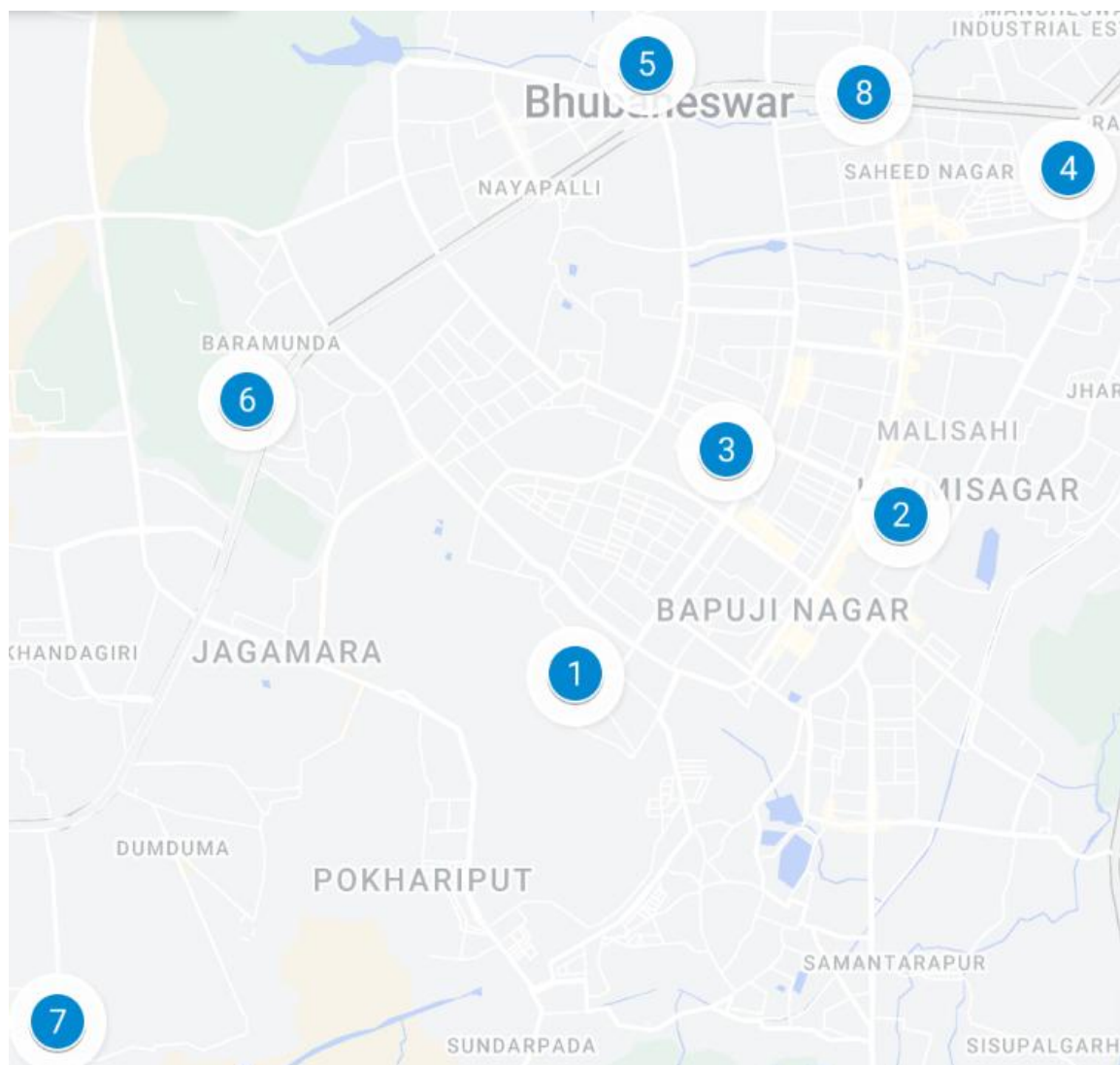


Figure- 23: Hotspot locations.

4.3.2 Hotspot covered

1. Bhubaneswar Airport
2. Bhubaneswar Railway Station
3. Bhubaneswar Secretariat
4. Esplanade One Mall
5. Paul Heights Hotel
6. Barmunda Bus Stand
7. AIIMS Hospital
8. Utkal University

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	1.30	0.00	0.00
Call Setup Time-Average (Sec)	0.41	2.48	0.56	0.47

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

Bhubaneswar 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)	0.66	1.80	0.53	0.48

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

Bhubaneswar Railway Station				
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)	0.31	5.27	0.54	0.48

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

Bhubaneswar Secretariat				
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)	0.66	2.10	0.59	0.43

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

Esplanade One Mall				
Parameters	Service Provider			
	Auto 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)	0.33	1.62	0.53	0.45

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

Paul Heights Hotel				
Parameters	Service Provider			
	Auto 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)	0.33	1.86	0.59	0.46

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

Barmunda Bus Stand				
Parameters	Service Provider			
	Auto 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)	0.32	2.53	0.50	0.51

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

AIIMS Hospital				
Parameters	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	70.00	100.00	100.00
Drop Call Rate %	0.00	14.29	0.00	0.00
Call Setup Time-Average (Sec)	0.30	2.86	0.58	0.54

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

Utkal University				
Parameters	Service Provider			
	Auto 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)	0.34	1.90	0.60	0.42

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

4.3.4 Data performance

Overall Data Performance				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	156.09	4.87	121.90	31.23
Download Throughput 80th Percentile (Mbit/s)	193.56	8.75	231.71	37.69
Download Throughput 20th Percentile (Mbit/s)	105.14	2.09	29.49	27.20
Download Session Setup Success Rate %	100.00	95.12	95.00	97.50
Upload Throughput Average (Mbits/s)	37.37	6.39	10.70	24.80
Upload Throughput 80th Percentile (Mbit/s)	73.81	14.10	20.66	34.99
Upload Throughput 20th Percentile (Mbit/s)	9.12	1.21	2.69	15.76
Upload Session Setup Success Rate %	100.00	92.68	100.00	97.50
Web Browsing Delay (Second)	2.53	3.56	3.75	2.96
Youtube Initial Buffer Delay (Second)	0.75	1.65	1.12	0.91
Latency (ms)- 50th Percentile	9.75	26.90	15.75	36.50
Jitter (ms)	9.63	27.28	159.73	6.04
Packet Loss Rate %	0.09	20.08	8.29	0.63

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

Bhubaneswar Airport				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	166.78	0.07	59.53	33.88
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	9.01	0.54	2.81	18.13
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.40	3.64	2.48	3.12
Youtube Initial Buffer Delay (Second)	0.84	2.39	0.78	1.27
Latency (ms)- 50th Percentile	13.00	579.00	13.83	36.80
Jitter (ms)	16.26	158.11	320.67	3.57
Packet Loss Rate %	0.00	91.80	7.30	0.20

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

Bhubaneswar Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	120.41	9.90	41.91	35.33
Download Session Setup Success Rate %	100.00	100.00	60.00	100.00
Upload Throughput Average (Mbits/s)	47.60	14.53	1.96	25.24
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.31	3.06	6.44	2.78
Youtube Initial Buffer Delay (Second)	0.91	1.88	-	0.71
Latency (ms)- 50th Percentile	12.40	23.55	31.10	35.55
Jitter (ms)	5.73	4.07	29.24	3.00
Packet Loss Rate %	0.00	0.20	5.80	0.40

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

Note-

- Youtube tests failed at this location for RJIL.

Bhubaneswar Secretariat				
Parameters	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	110.81	3.77	65.00	34.70
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	40.67	1.20	13.77	31.22
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.49	3.85	3.38	2.77
Youtube Initial Buffer Delay (Second)	0.75	3.25	1.12	0.56
Latency (ms)- 50th Percentile	8.75	27.65	25.98	37.05
Jitter (ms)	5.05	4.86	18.10	15.38
Packet Loss Rate %	0.00	0.00	0.90	1.00

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

Esplanade One Mall				
Parameters	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average(Mbits/s)	139.35	8.67	264.04	37.49
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	77.77	14.74	18.76	34.59
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.38	2.61	2.34	2.61
Youtube Initial Buffer Delay (Second)	0.68	0.80	0.62	0.97
Latency (ms)- 50th Percentile	7.95	24.63	10.80	38.00
Jitter (ms)	1.94	3.85	3.33	2.77
Packet Loss Rate %	0.00	0.00	0.00	0.80

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

Paul Heights Hotel				
Parameters	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average(Mbits/s)	185.13	2.61	206.28	39.09
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	25.39	8.01	34.90	35.09
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.51	3.62	2.48	2.60
Youtube Initial Buffer Delay (Second)	0.75	1.02	0.64	0.66
Latency (ms)- 50th Percentile	8.15	27.80	14.80	35.25
Jitter (ms)	7.59	4.06	5.82	3.32
Packet Loss Rate %	0.20	0.70	0.00	0.70

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

Barmunda Bus Stand				
Parameters	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	305.39	2.18	0.46	26.13
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	69.93	5.04	5.80	34.21
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.45	4.98	13.08	3.75
Youtube Initial Buffer Delay (Second)	0.57	1.34	10.14	0.71
Latency (ms)- 50th Percentile	7.30	24.35	16.65	32.75
Jitter (ms)	2.28	12.04	39.34	12.51
Packet Loss Rate %	0.00	4.00	5.50	0.80

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

AIIMS Hospital				
Parameters	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	82.24	5.49	141.12	7.18
Download Session Setup Success Rate %	100.00	60.00	100.00	100.00
Upload Throughput Average (Mbits/s)	21.98	2.17	3.02	3.40
Upload Session Setup Success Rate %	100.00	40.00	100.00	100.00
Web Browsing Delay (Second)	2.89	2.80	2.35	2.90
Youtube Initial Buffer Delay (Second)	0.77	1.21	0.74	1.40
Latency (ms)- 50th Percentile	14.45	29.15	29.85	39.90
Jitter (ms)	21.43	16.79	695.46	4.75
Packet Loss Rate %	0.20	63.60	33.10	0.70

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

Utkal University				
Parameters	Service Provider			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	138.63	7.46	164.85	37.26
Download Session Setup Success Rate %	100.00	100.00	100.00	80.00
Upload Throughput Average (Mbits/s)	6.59	2.33	4.55	14.47
Upload Session Setup Success Rate %	100.00	100.00	100.00	80.00
Web Browsing Delay (Second)	2.83	3.60	2.63	3.13
Youtube Initial Buffer Delay (Second)	0.73	1.70	0.81	0.97
Latency (ms)- 50th Percentile	10.70	24.83	14.13	37.50
Jitter (ms)	16.74	7.11	165.93	3.07
Packet Loss Rate %	0.30	0.30	13.70	0.40

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

4.4 Walk Test

Walk test testing has been done on 11th December 2024 & 13th December 2024. Three locations have been tested in the city.

4.4.1 Walk test location map



Figure- 24: Walk Test locations.

4.4.2 Walk Test covered

1. AG Square
2. Durga Mandap
3. Bhubaneswar Railway Station

4.4.3 Voice performance

AG Square				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	18	18	18	18
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate%	0.00	5.56	0.00	0.00
Call Setup Time-Average (Sec)	0.50	2.47	0.57	0.44

Table-38: Summary of voice call performance in network auto-selection mode (5G/4G/3G/2G).

Durga Mandap				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	25	25	25	25
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)	0.45	1.96	0.55	0.42

Table-39: Summary of voice call performance of in network auto-selection mode(5G/4G/3G/2G).

Bhubaneswar Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	36	87	37	37
Call Setup Success Rate %	100.00	1.15	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	0.83	4.76	0.57	0.46

Table-40: Summary of voice call performance in network auto-selection mode (5G/4G/3G/2G).

Note-

- Out of 87, 86 calls were failed in BSNL while call were initiated in LTE.

4.4.4 Data performance

AG Square				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	64.39	3.45	240.76	30.08
Download Session Setup Success Rate %	100.00	100.00	68.42	100.00
Upload Throughput Average (Mbits/s)	20.59	4.12	20.15	19.39
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Latency (ms)- 50th Percentile	18.63	21.65	16.15	41.85

Table-41: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Durga Mandap				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	174.06	2.89	160.04	30.15
Download Session Setup Success Rate %	100.00	89.66	73.08	100.00
Upload Throughput Average (Mbits/s)	46.63	4.40	17.86	30.90
Upload Session Setup Success Rate %	100.00	96.43	100.00	100.00
Latency (ms)- 50th Percentile	9.95	23.58	15.70	41.50

Table-42: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Bhubaneswar Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	109.48	6.88	17.84	20.92
Download Session Setup Success Rate %	100.00	100.00	42.86	100.00
Upload Throughput Average (Mbits/s)	29.91	7.97	5.55	12.93
Upload Session Setup Success Rate %	100.00	100.00	85.71	100.00
Latency (ms)- 50th Percentile	14.60	24.15	96.00	38.85

Table-43: 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:

- Airtel, BSNL and VIL have 99.43%, 99.62% and 99.43% call setup success rate respectively in 3G/2G network mode. (refer Table-3)
- Airtel, BSNL, RJIL and VIL have 99.44%, 51.51%, 99.32% and 100.00% call setup success rate respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5).
- Airtel and RJIL have 100% call setup success rate while calling on peer service provider's network, while remaining service providers have block call rate for inter-operator calls. (refer table-9)

2. Call Setup Time:

- Airtel has taken comparatively longer time (4.69 second) to establish the voice call, whereas BSNL and VIL call setup time is 3.00 & 4.39 seconds respectively in 3G/2G network mode. (refer table-3)
- BSNL has taken comparatively longer time (2.78 second) to establish the voice call, whereas Airtel, RJIL and VIL call setup time is 0.51, 0.60 & 0.50 seconds respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)

3. Call Silence/Mute Rate: In packet switched network (4G/5G), BSNL, RJIL, VIL and Airtel have 3.95%, 1.31%, 0.19% and 0.00% silence call rate respectively. Further BSNL has higher RTP packet loss rate in downlink (5.19%) compared to RJIL (0.43%), Airtel (0.32%) and VIL (0.32%). In uplink the RTP packet loss rate is higher for BSNL (5.31%) compared to RJIL (0.64%), Airtel (0.39%) and VIL (0.27%). (refer table-6)

4. Call Drop Rate:

a) Airtel, BSNL and VIL have 0.19%, 2.07% and 0.00% drop call rate respectively in 3G/2G network mode. (refer table-3)

b) Overall Airtel, BSNL, RJIL, VIL call drop rate is 0.14%, 1.77%, 0.96% and 0.00% are within the benchmark of 2%. (refer table-5)

5.2 Overall Data

1. Data download and upload performance (Dynamic i.e. while moving) :

a) BSNL (3.86 Mbps) and VIL (32.99 Mbps) being on 3G & 4G as top technology, have comparatively lower data speeds respectively. While Airtel and RJIL have average download speed of 151.65 Mbps and 236.83 Mbps respectively. (refer table-11)

b) BSNL (4.27 Mbps) and VIL (18.87 Mbps) being on 3G & 4G as top technology, have comparatively lower data speeds respectively. While Airtel and RJIL have average upload speed of 30.78 Mbps and 20.49 Mbps respectively. (refer table-11)

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

a) Airtel, BSNL, RJIL and VIL have download speed i.e. 156.09 Mbps, 4.87 Mbps, 121.90 Mbps and 31.23 Mbps. (refer table-29)

b) Airtel, BSNL, RJIL and VIL have upload speed i.e. 37.37 Mbps, 6.39 Mbps, 10.70 Mbps and 24.80 Mbps. (refer table-29)

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

a) Airtel, BSNL, RJIL and VIL have download session setup success rate i.e. 100.00%, 95.12%, 95.00% and 97.50%. (refer table-29)

b) Airtel, BSNL, RJIL and VIL have Upload session setup success rate i.e. 100.00%, 92.68%, 100.00% and 97.50%. (refer table-29)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 99.43% call setup success rate and 0.19% call drop rate have been observed in 3G/2G network mode. Performance is well within the benchmark of 98.00% and 2.00% respectively for LSA and City drive. (refer table-3 and table-13)
- 99.44% call setup success rate and 0.14% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for LSA drive. (refer table-5)
- 99.29% call setup success rate and 0.18% drop call rate have been observed for 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 for auto-selection mode (5G/4G/3G/2G) for all Hotspot locations. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for all walk test locations. (refer table-38, 39 and 40)

Data

- Airtel has 151.65 Mbps average download throughput & 30.78 Mbps average upload throughput across measured routes for LSA. (refer table-11)
- Airtel has 155.37 Mbps average download throughput & 30.17 Mbps average upload throughput across measured routes for city drive. (refer table- 19)
- AIIMS Hospital hotspot has less download speeds (less than 100 Mbps) out of 8 hotspot locations. (refer table -36)
- Bhubaneswar Airport and Utkal University hotspots have less upload speeds (less than 20 Mbps). (refer table -30 and 37)
- AG Square walk test has less download speeds (less than 100 Mbps). (refer table -41)

2. BSNL:

Voice

- 99.62% call setup success rate and 2.07% call drop rate have been observed in 3G/2G network mode, whereas the call setup success rate is within the benchmark of 98.00% and the call drop rate is above the benchmark of 2.00%. (refer table-3 and table-13)
- 51.51% call setup success rate and 1.77% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G), whereas the call setup success rate is below the benchmark of 98.00% and the call drop rate is within the benchmark of 2.00% for LSA. (refer table-5)
- 50.06% call setup success rate and 1.81% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G), whereas the call setup success rate is below the benchmark of 98.00% and the call drop rate is within the benchmark of 2.00% for city drive. (refer table-15)
- 96.25% call setup success rate and 1.30% drop call rate have been observed in overall hotspots, whereas the call setup success rate is below the benchmark of 98.00% and the call drop rate is within the benchmark of 2.00%. (refer table-20).
- AG Square walk test has 100.00% call setup success rate and 5.56% drop call rate has been observed for auto-selection mode (5G/4G/3G/2G) (refer table-38)
- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) at Durga Mandap walk test location. (refer table-39)
- 1.15% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) at Bhubaneswar Railway Station walk test location. (refer table-40)

Data

- BSNL has 3.86 Mbps average download throughput & 4.27 Mbps average upload throughput across measured routes for LSA (refer table-11)

- BSNL has 3.69 Mbps average download throughput & 3.95 Mbps average upload throughput across measured routes for city drive (refer table-19)
- All Hotspots have less download speed (less than 10 Mbps). (refer table- 30, 31, 32, 33, 34, 35, 36 and 37)
- Bhubaneswar Airport and Bhubaneswar Secretariat hotspot have less upload speeds (less than 2 Mbps). (refer table -30 and 32)
- All walk test have less download speed (less than 10 Mbps). (refer table 41, 42 and 43)

3. RJIL:

Voice

- 99.32% call setup success rate and 0.96% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is well within the benchmark of 98.00% and 2.00% respectively for LSA. (refer table-5)
- 99.13% call setup success rate and 1.23% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is well within the benchmark of 98.00% and 2.00% respectively for city drive. (refer table-15)
- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for all Hotspot locations.(refer table-20)
- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for all walk test locations. (refer table-38, 39 and 40)

Data

- RJIL has 236.83 Mbps average download speed & 20.49 Mbps average upload speed across measured routes for LSA. (refer table-11)
- RJIL has 256.07 Mbps average download speed & 22.35 Mbps average upload speed across measured routes for city drive. (refer table-19)
- Bhubaneswar Airport, Bhubaneswar Railway Station, Bhubaneswar Secretariat, Barmunda Bus Stand have less download speed (less than 100 Mbps). (refer table- 30, 31, 32 and 35)
- Bhubaneswar Airport, Bhubaneswar Railway Station, Bhubaneswar Secretariat, Esplanade One Mall, Barmunda Bus Stand, AIIMS Hospital & Utkal University have less upload speed (less than 20 Mbps). (refer table- 30, 31, 32, 33, 35, 36 and 37)
- RJIL's latency, Jitter & Packet loss rate are exceptionally high at AIIMS Hospital hotspot location. (refer table- 36)
- Bhubaneswar Railway Station walk test has less download speed (less than 100 Mbps). (refer table- 43)
- Bhubaneswar Railway Station and Durga Mandap walk test locations have less upload speed (less than 20 Mbps). (refer table-42 and 43)

4. VIL:**Voice**

- 99.43% call setup success rate and 0.00% call drop rate have been observed in 3G/2G network mode. Performance is well within the benchmark of 98.00% and 2.00% respectively for LSA and city drive. (refer table-3 and table- 13)
- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for city drive. (refer table-5 & 15).
- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for all Hotspot locations.(refer table-20)
- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for all walk test locations. (refer table-38, 39 and 40)

Data

- VIL has 32.99 Mbps average download speed & 18.87 Mbps average upload speed across measured routes for LSA. (refer table-11)
- VIL has 33.98 Mbps average download speed & 18.37 Mbps average upload speed across measured routes for city drive. (refer table-19)
- AIIMS Hospital has less download speed (less than 10 Mbps) out of total 8 hotspots. (refer table- 36)

6. Annexure

6.1 Route wise coverage map

6.1.1 City

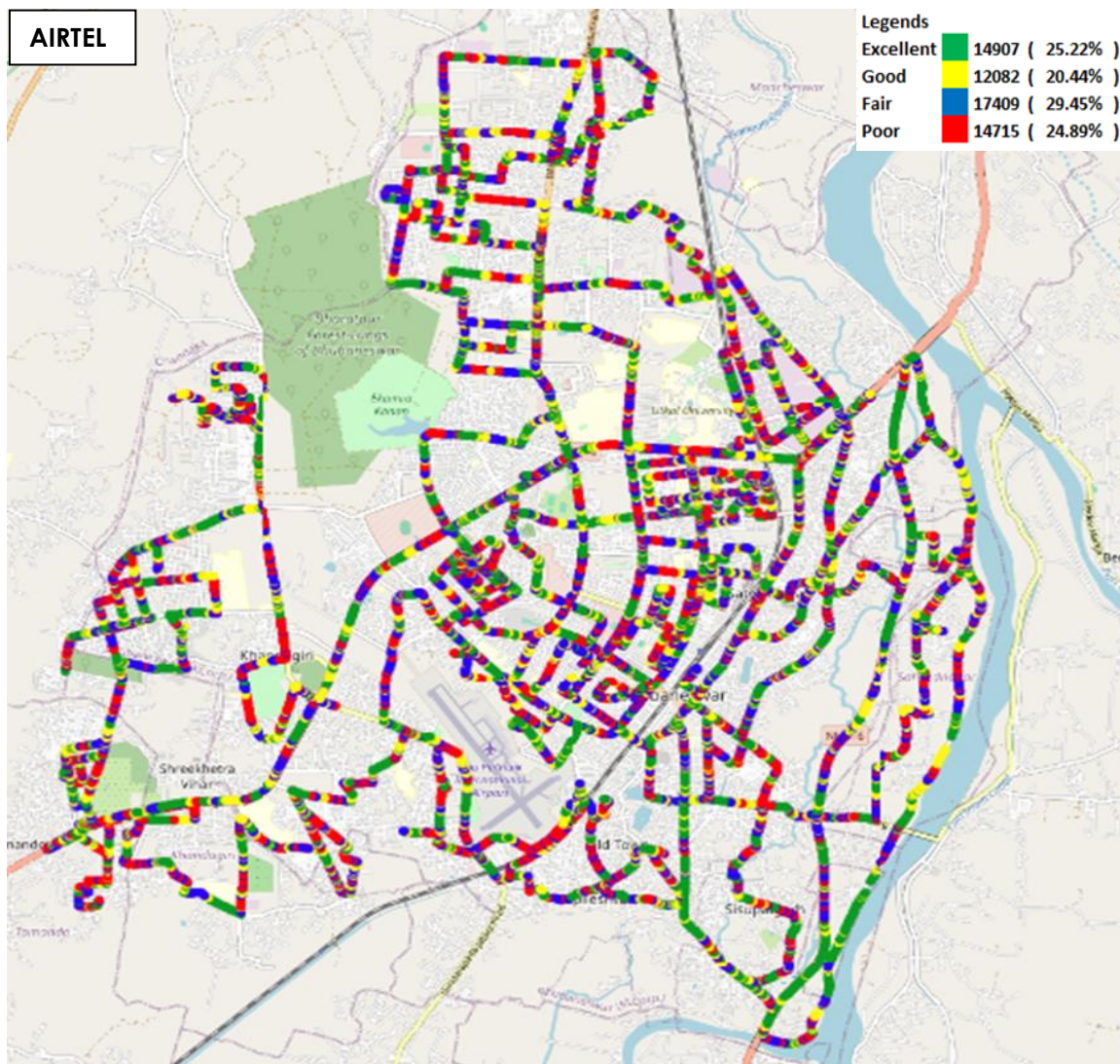


Figure-25: Signal strength 3G/2G network mode – AIRTEL.

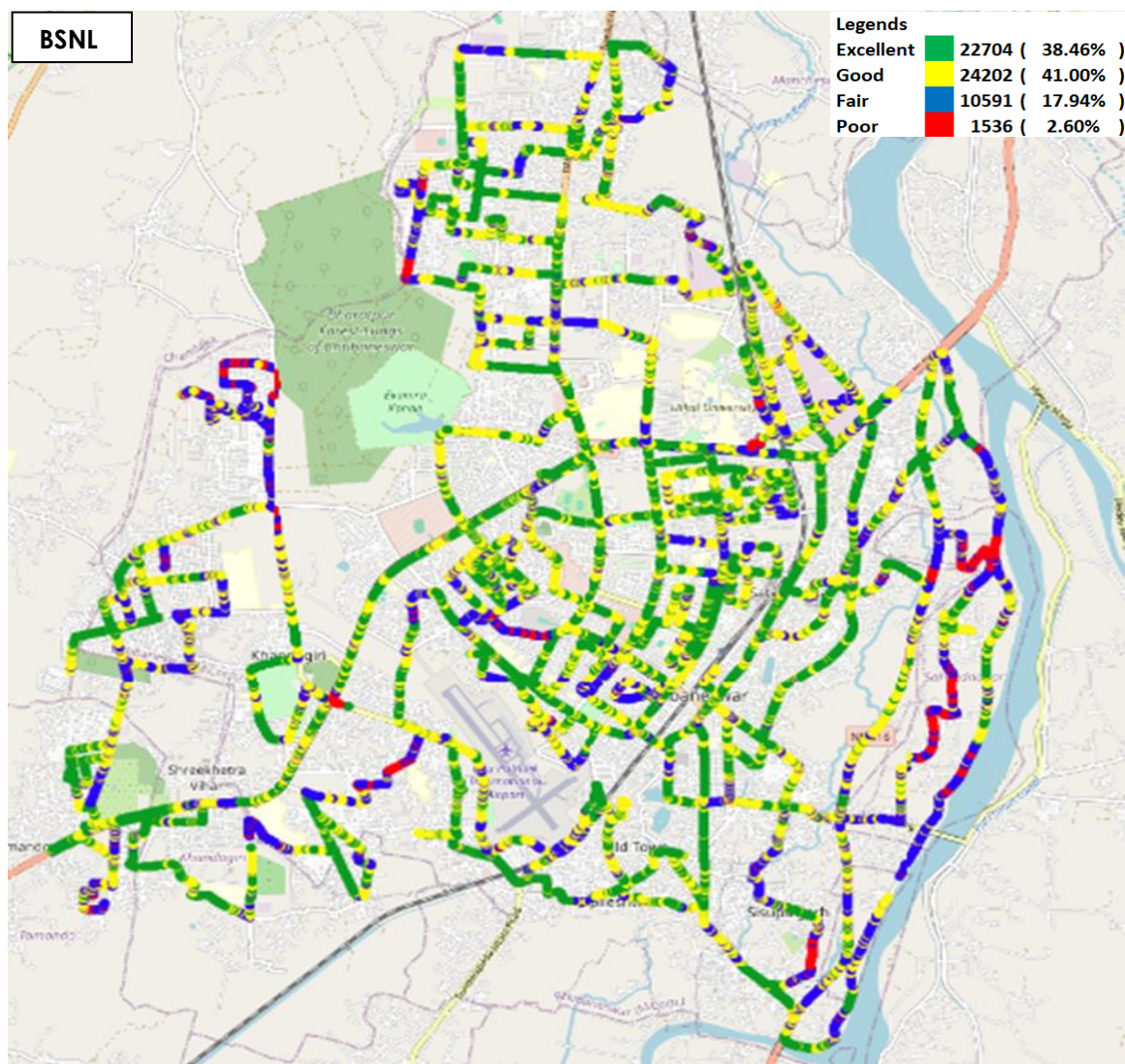


Figure-26: Signal strength 3G/2G network mode – BSNL.

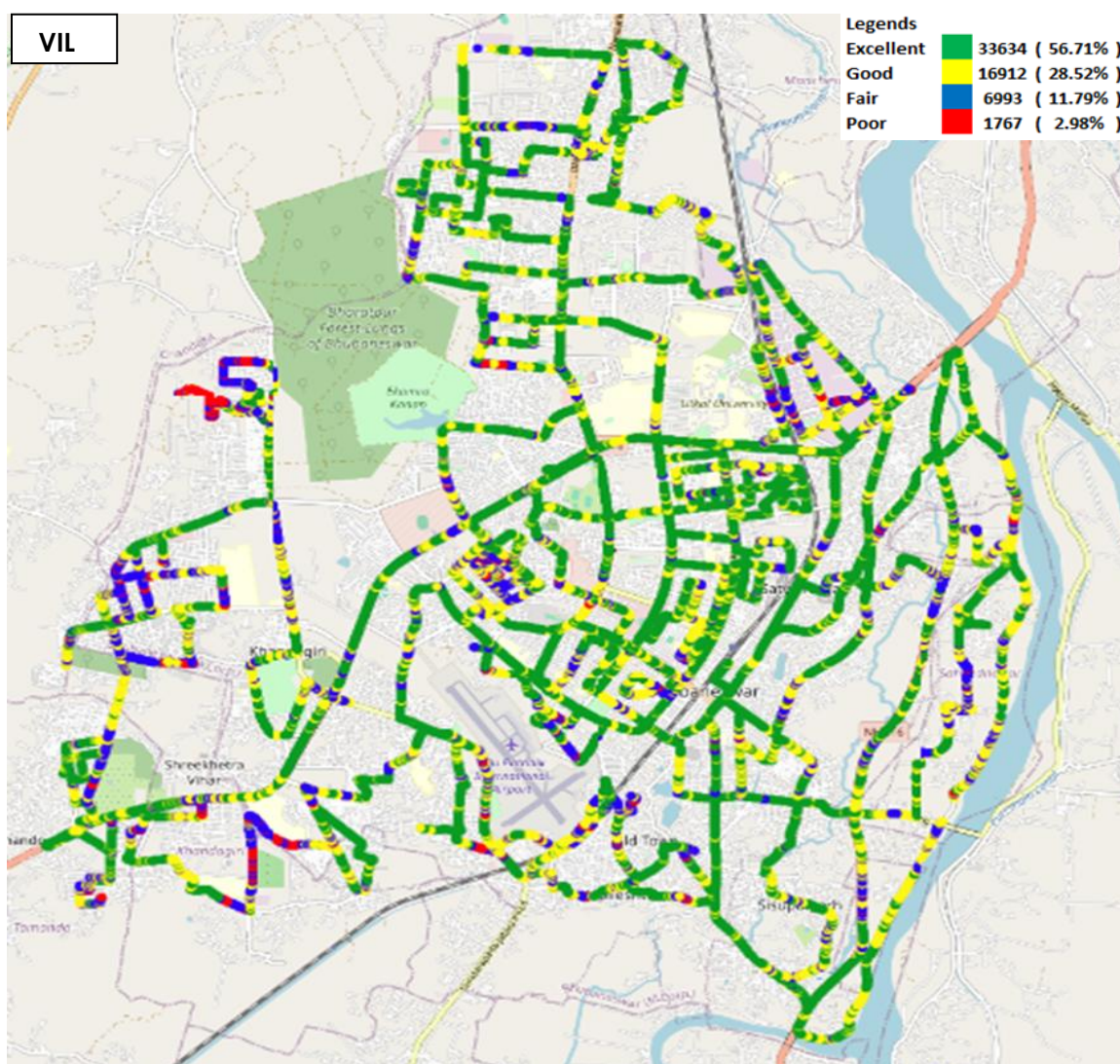


Figure-27: Signal strength 3G/2G network mode – VIL.

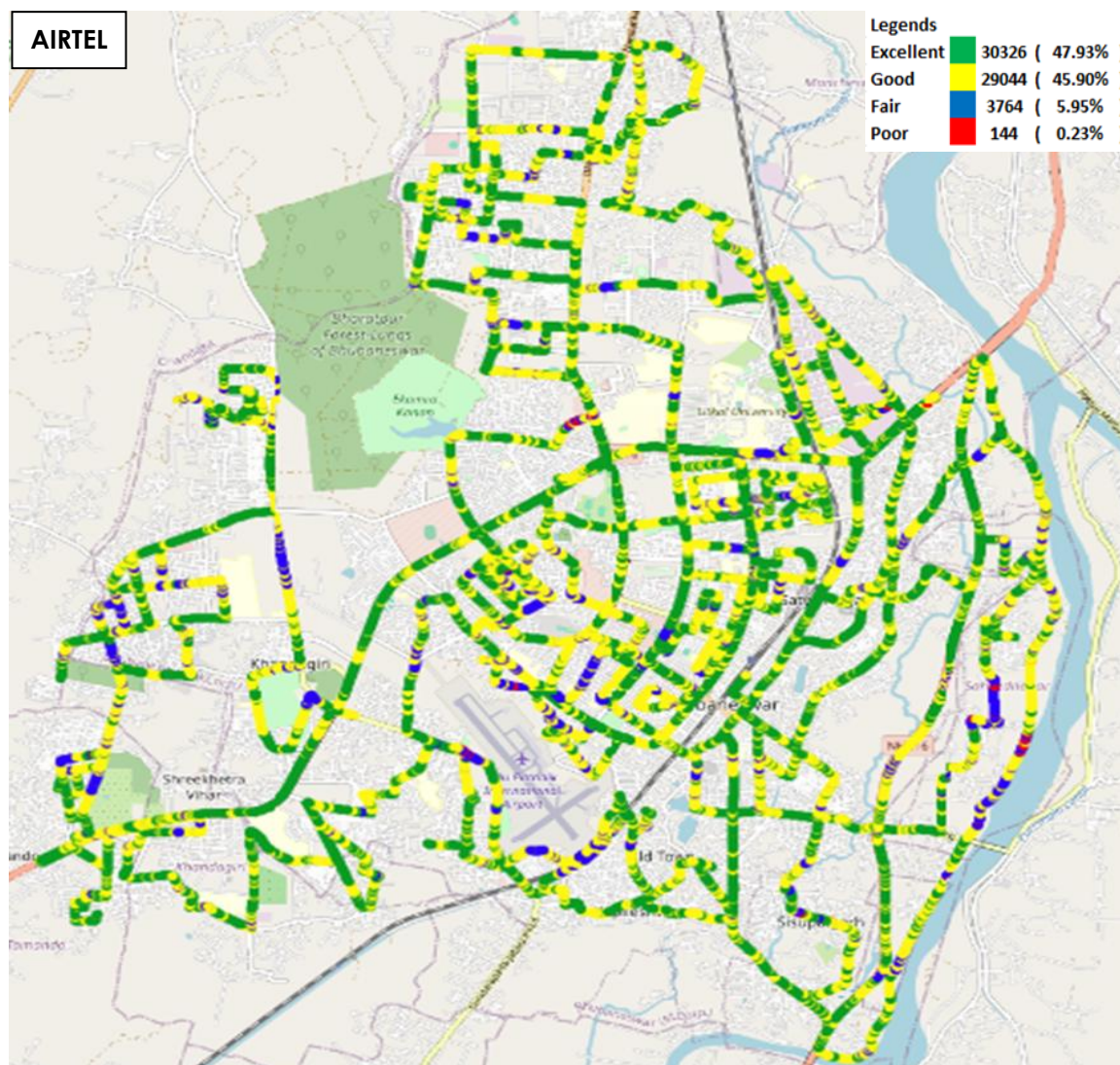


Figure-28: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL.

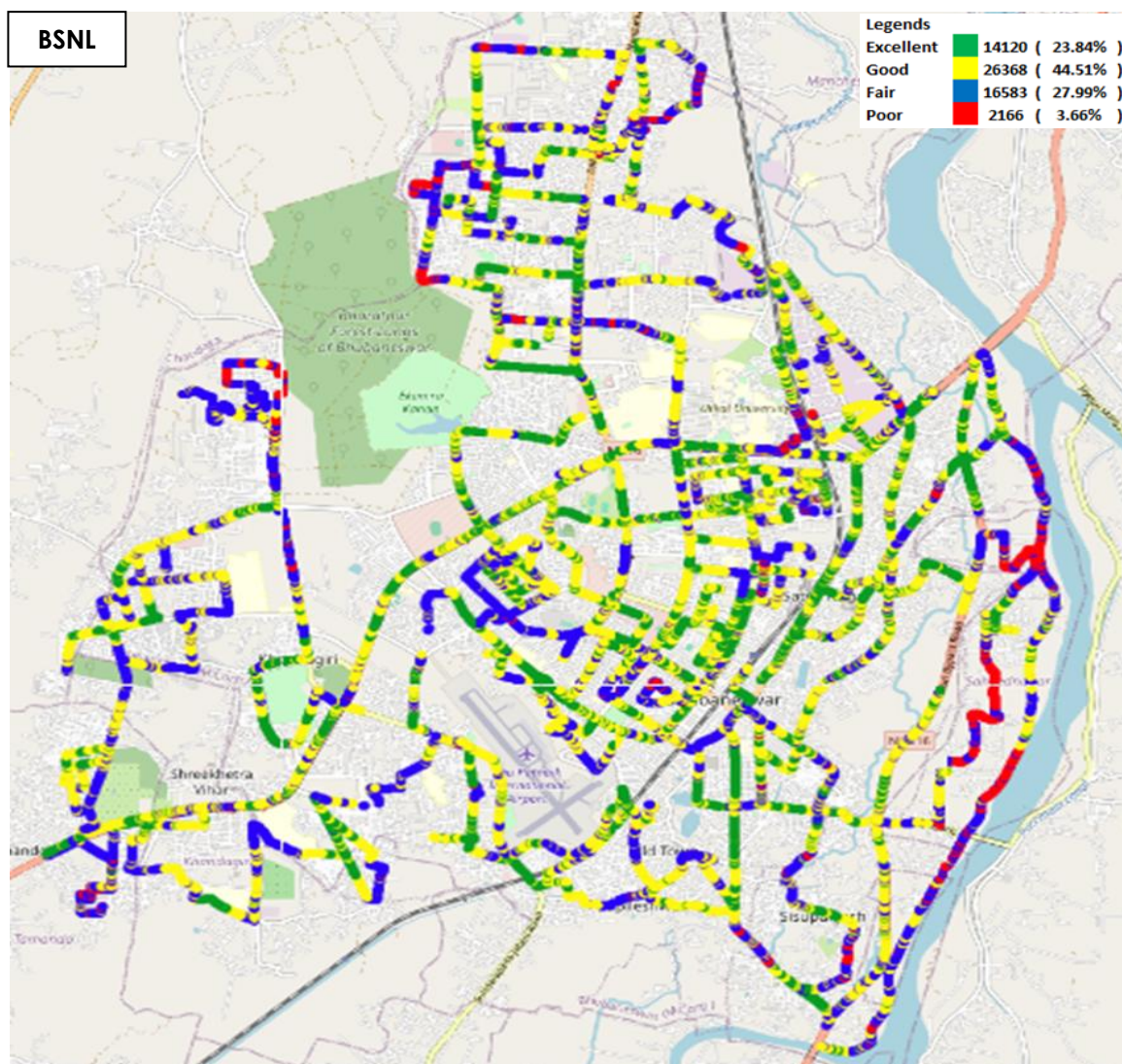


Figure-29: Signal strength auto-selection mode 5G/4G/3G/2G – BSNL.

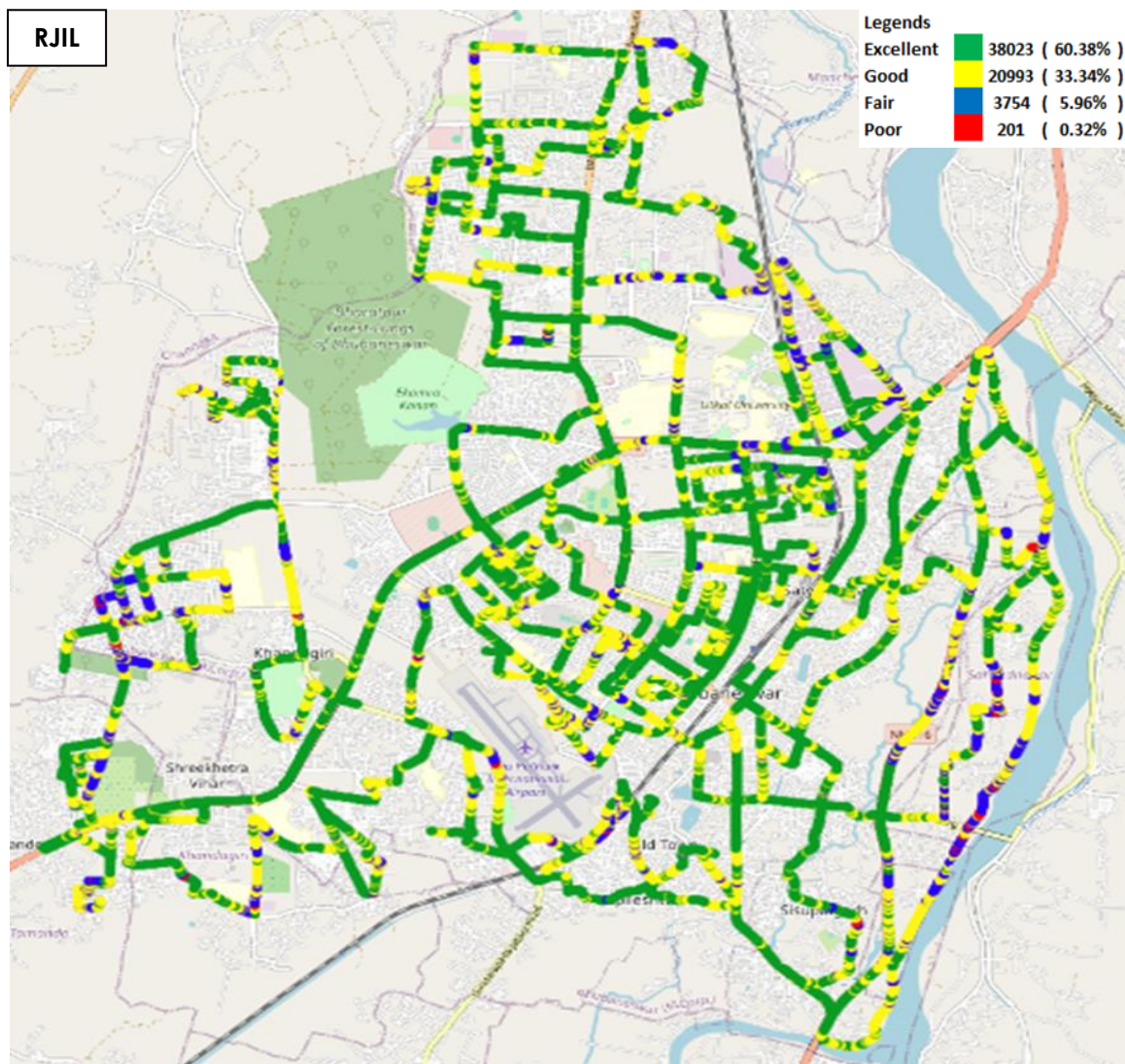


Figure-30: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL.

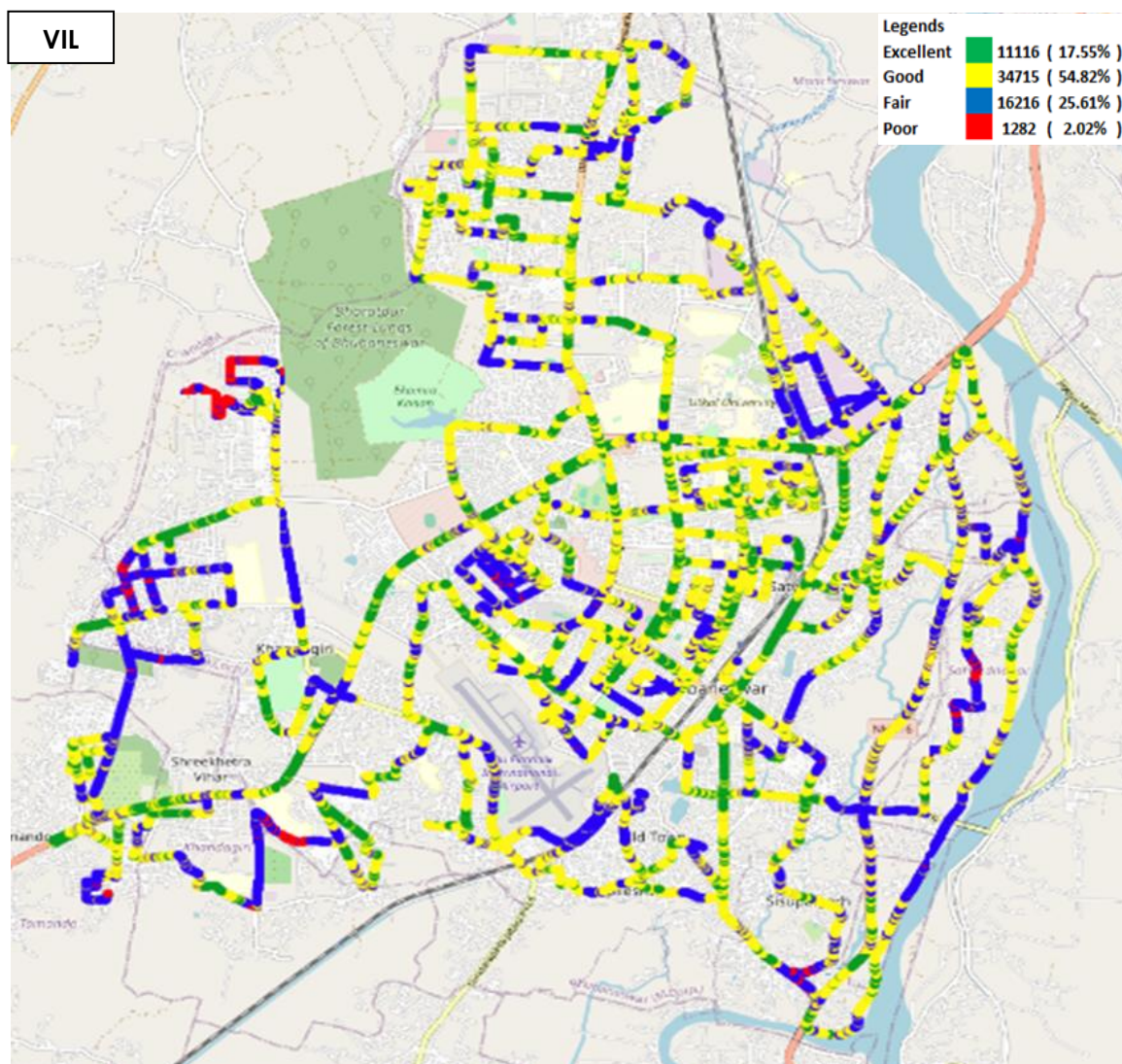


Figure-31: Signal strength auto-selection mode 5G/4G/3G/2G – VIL.

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	<ul style="list-style-type: none"> • 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-44: Voice test detail.

Note-

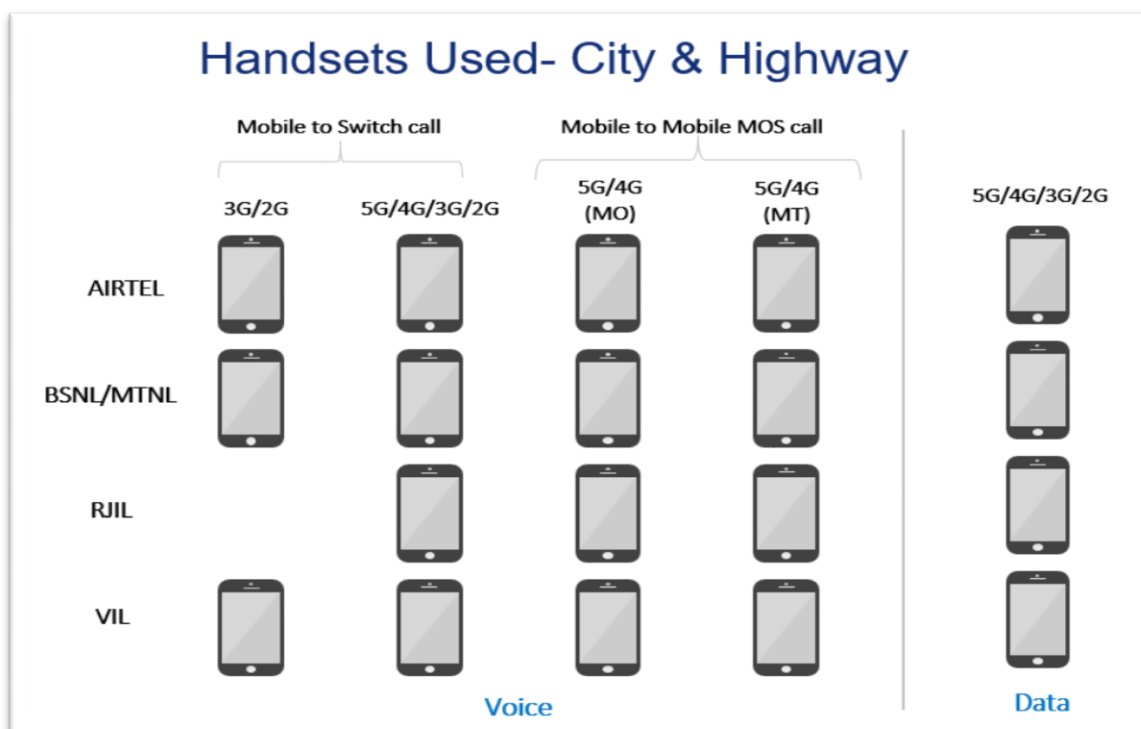
- There is 15 sec wait time after locking and before starting first call in 3G/2G call.
- 10 calls to be made at each Hotspot location.
- Minimum 10 Calls to be made during the walk test. Call count will be increased based on walk test distance.
- Speech quality (MOS) has been measured only in city drive & highway by making Mobile to Mobile call.
- 180 Sec calls were made only in highway & railway route drive.
- 5G/4G/3G/2G auto mode MOS call were made in BSNL as BSNL don't have VoLTE & VoNR network availability.
- All values are taken up to two decimal places with round off.

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.amazon.in , www.facebook.com , www.google.co.in) 20 sec timeout (only at Hotspot)
Ping		25 count- Dynamic 1000 count- Hotspot Payload- 42 bytes in all drive

Table-45: Data test detail.**Note-**

- 5 Data iteration 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

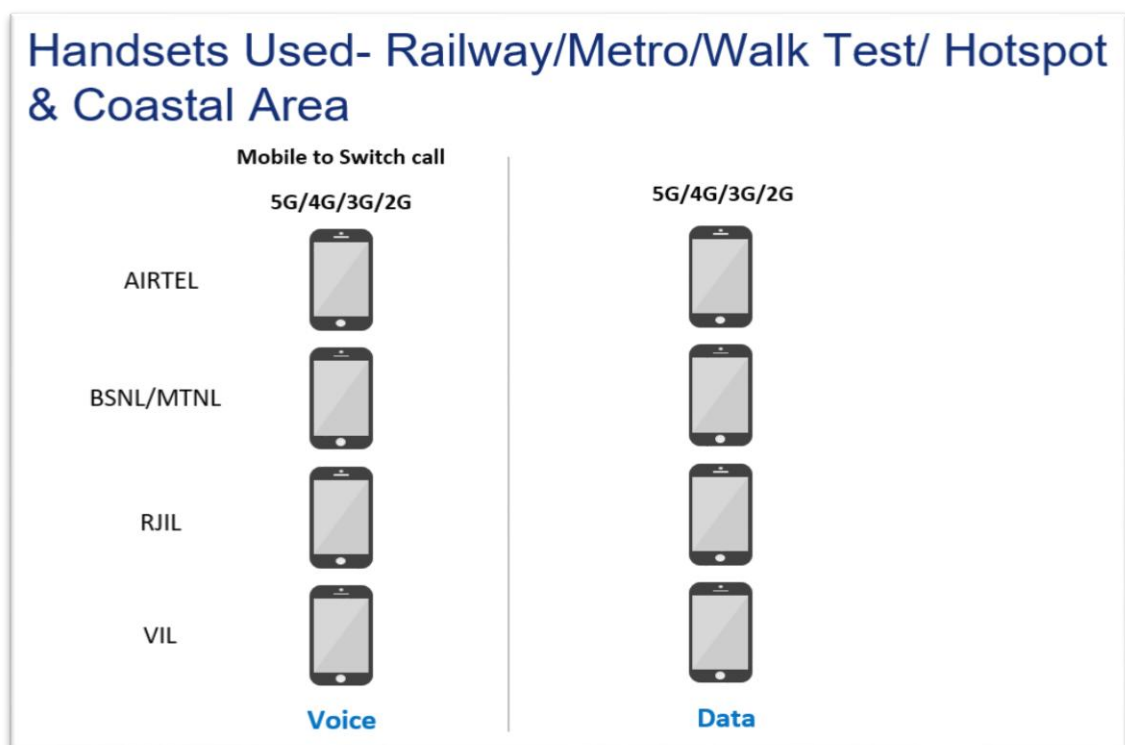


Figure-33: Number of handsets used in railway/metro/walktest/hotspot & coastal area.

7.1.2 Drive test Methodology

(a) Dynamic voice testing (on the move)

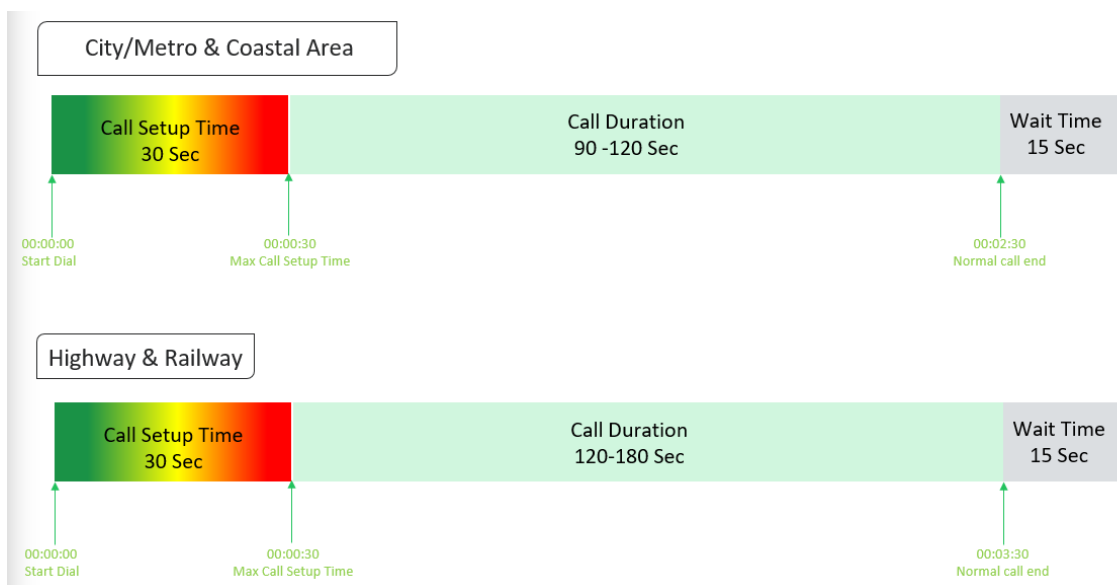


Figure-34: Voice test script for city/railway/metro/highway & coastal area.

- 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

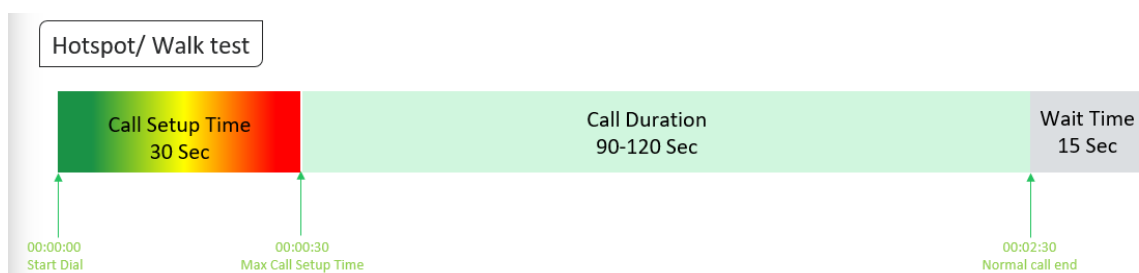


Figure-35: Voice test script for walktest/hotspot

- 10 calls were 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

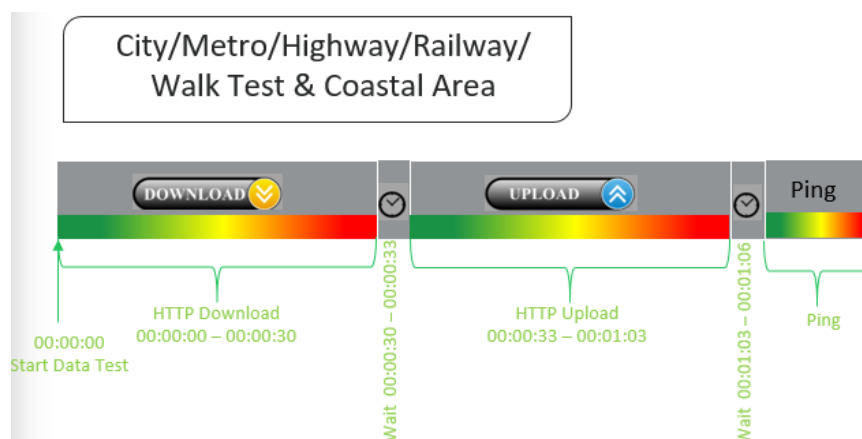


Figure-36: Data test script used in city/metro/railway/highway/walk test & coastal area.

(d) Static Data(internet) testing

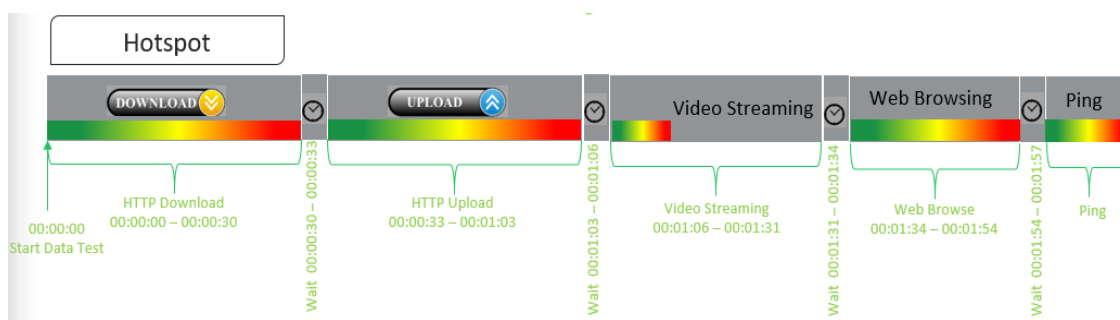


Figure-37: Data test script used at hotspot.

- 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	<p>(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:</p> <ol style="list-style-type: none"> Call attempt is made The signaling channel is allocated The call is routed to the outwards path of the terminating network An alert signal is received by caller in the form of ring back tone, busy tone, or an announcement. <p>CSSR = (Total Call Established/ Total Call Attempt) *100</p> <p>As per QoS Regulation 2024 benchmark value is >=98%</p>
Call Drop Rate	<p>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</p> <p>Call Drop Rate = (Total Call Drop/Total Call Established) *100</p> <p>As per QoS Regulation 2024 benchmark value is <=2%</p>
Call Setup Time	<p>Time taken from call initiate to call alerting/ringing.</p> <p>Call Setup Time = T2- T1</p> <p>T2- Ringing (VoLTE/VoNR) & Alerting (for WCDMA & GSM), T1- Invite (VoLTE/VoNR) & CM Service Request (for WCDMA & GSM)</p>
Voice Quality (MOS)	<p>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;</p> <p>Excellent: MOS ≥ 4 and < 5 Good : MOS ≥ 3 and < 4 Fair : MOS ≥ 2 and < 3 Poor : MOS ≥ 1 and < 2</p>
Handover Success Rate	<p>Handover Success Rate = Count of successful handovers (All Technology Handover combined) / Total count of Handover Attempt (All Technology Handover combined) *100</p> <p>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.</p>
Silence Call -	<p>A call which has ≥ 4 sec continuous RTP gap is considered as a Silence Call.</p> <p>Silence call rate = (count of silence call / Total calls established) *100</p>

	If a call observes multiple silence count >=4 sec in a particular established call it has been taken as one silent event.																																		
Jitter	<p>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:</p> <p>D(i,j) = (Rj - Ri) - (Sj - Si)</p> <p>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</p> <p>J(i) = J(i-1) + (D(i-1,i) - J(i-1))/16 or 8</p>																																		
Downlink Packet Drop Rate	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)																																		
Uplink Packet Drop Rate	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).																																		
Signal Strength	<p>Signal strength is the signal power level received by the wireless user.</p> <table><tr><th rowspan="2">Parameter Name</th><th rowspan="2">Technology</th><th colspan="4">Signal Strength (dBm)</th></tr><tr><th>Excellent</th><th>Good</th><th>Fair</th><th>Poor</th></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>	Parameter Name	Technology	Signal Strength (dBm)				Excellent	Good	Fair	Poor	Rx Level	GSM	0 to ≥ -65	<-65 to ≥ -75	<-75 to ≥ -85	<-85 to min	RSCP	WCDMA	0 to ≥ -70	<-70 to ≥ -80	<-80 to ≥ -90	<-90 to min	RSRP	LTE	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min	SS_RSRP	NR	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min
Parameter Name	Technology			Signal Strength (dBm)																															
		Excellent	Good	Fair	Poor																														
Rx Level	GSM	0 to ≥ -65	<-65 to ≥ -75	<-75 to ≥ -85	<-85 to min																														
RSCP	WCDMA	0 to ≥ -70	<-70 to ≥ -80	<-80 to ≥ -90	<-90 to min																														
RSRP	LTE	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min																														
SS_RSRP	NR	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min																														

Table-46: Network performance parameter and definition voice.

7.2.2 Network Performance Parameters Data tests

Parameter Name	Definition
Download Speed (Mbps)	<p>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.</p> <p>Download Speed = Total bytes transferred during download / Total time for transfer</p> <ul style="list-style-type: none"> 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)	<p>The upload speed is the data transmission rate that is achieved for uploading a test file from a test device to a test server.</p> <p>Upload Speed = Total bytes transferred during upload / Total time for transfer.</p>

	<ul style="list-style-type: none"> 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	<p>Web browsing test is used to measure performance in terms of opening a web/HTTP page.</p> <p>Time taken to open the web page successfully is considered as web browsing delay/web page download time.</p>
Video Streaming Delay	The Video streaming delay is time taken from start of video transfer to First video frame displayed in player.
Latency	<p>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.</p> <p>The Latency is measured in milliseconds (ms).</p> <p>To calculate the one-way latency we just do half of the round-trip time. 50th percentile of one way latency has been reported.</p>
Jitter	<p>Measure of variation in time in arrival of packets from a source to destination</p> <p>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</p> <p>$IPDV(i) = D(i) - D(i-1)$ then Stdvs of IPDV is considered as jitter.</p>
Packet Loss Rate	<p>Number of packets lost out of total packet transferred during test. Packet loss rate = (Total packet lost / Total packet sent) *100</p> <p>* Packet delay (using ping) >90 ms considered as packet loss and included in packet loss rate.</p> <p>* Packet loss rate is calculated based on ICMP</p>

Table-47: Network performance parameter and definition Data.