



TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Karnataka LSA

May 2025

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

S. No.	Drive test route	Type of route	Distance covered (KMs)/ Locations	From date	To date
1	Chikmagaluru	City	308.7	22-May-2025	23-May-2025
2	Chikmagaluru	Hotspot	10 Locations	23-May-2025	24-May-2025
3	Chikmagaluru	Walk Test	6.7	24-May-2025	24-May-2025
4	Chikmagaluru	Inter Operator Calling	1 Location	24-May-2025	24-May-2025
5	Bengaluru to Chikmagaluru	Highway	239.8	21-May-2025	21-May-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, walk test and highway as per the legends shown on the map.

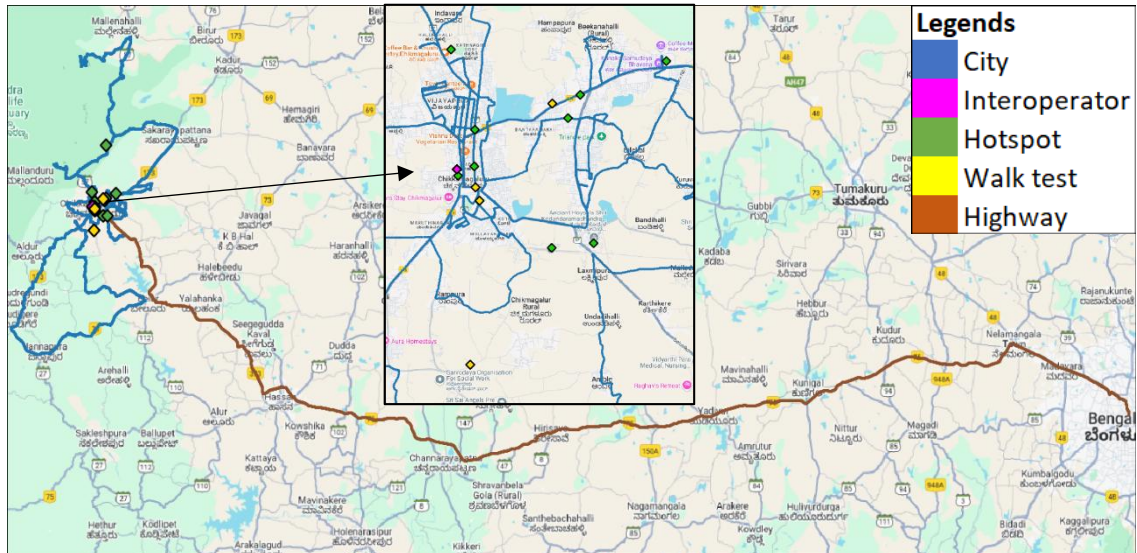


Figure-1: Drive test routes

2.3 Summary of areas covered

a) City- Ballavara, kallattigiri, Athigiri, Kumaragiri, Sakarayapattana, udde Boranahalli, Lakya, Allampura, RK Pete, Belur, Tolalu, Jannapura, Bidarahalli, Bilagola and Balehalli etc.

b) Hotspot

1. Shri Deviramma Temple
2. MG Park
3. Hanumanthappa Circle City Centre
4. Chikmagaluru District Stadium
5. Chikmagaluru Railway Station
6. I.D.S.G Government College, Chikmagaluru
7. Kodandarama Temple
8. KSRTC Bus Stand Area
9. RTO Office Chikmagaluru
10. Shanthi Complex

c) Walk Test

1. A.P.M.C Yard Agricultural Produce Market Committee
2. Chikmagaluru Institute of Medical Science
3. Chikmagaluru Municipal Office Area
4. MG Road

d) Highway- Bengaluru to Chikmagaluru via NH-373 and NH75 passing through Belur, Hassan, Channarayapatna, Hirisave, Kunigal and Madavara.

2.4 Telecom service providers detected frequency bands

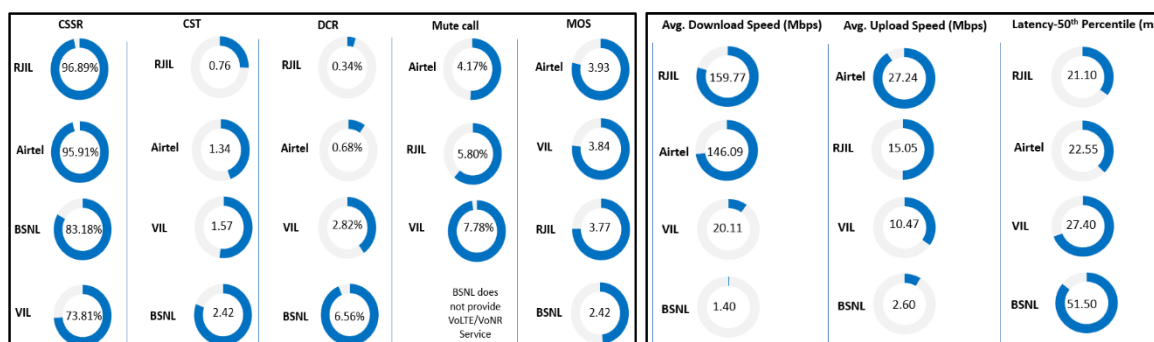
Technologies covered during the IDT and frequency bands in use are summarised in below table.

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

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 milliseconds), DCR: Drop Call Rate (in %) & MOS: Mean Opinion Score.



Summary-Voice services

Call Setup Success Rate: Airtel, BSNL, RJIL and VIL have call setup success rate of 95.91%, 83.18%, 96.89%, and 73.81% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Setup Time: Airtel, BSNL, RJIL & VIL have call setup time of 1.34, 2.42, 0.76 and 1.57 seconds respectively in Auto-selection mode (5G/4G/3G/2G).

Drop Call Rate: Airtel, BSNL, RJIL and VIL have drop call rate of 0.68%, 6.56% 0.34% and 2.82% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Silence/Mute Rate: Airtel, RJIL and VIL have silence call rate of 4.17%, 5.80% and 7.78% respectively in packet switched network (4G/5G).

Mean Opinion Score (MOS): Airtel, BSNL, RJIL and VIL have average MOS of 3.93, 2.42, 3.77 and 3.84 respectively.

Summary-Data services

Data Download performance (Overall): Average download speed of Airtel (5G/4G) is 146.09 Mbps, BSNL (4G/3G) is 1.40 Mbps, RJIL (5G/4G) is 159.77 Mbps and VIL (4G/2G) is 20.11 Mbps.

Data Upload performance (Overall): Average upload speed of Airtel (5G/4G) is 27.24 Mbps, BSNL (4G/3G) is 2.60 Mbps, RJIL (5G/4G) is 15.05 Mbps and VIL (4G/2G) is 10.47 Mbps.

Data performance - Hotspots (in Mbps):

Airtel- 4G D/L: 25.70	4G U/L: 13.24
5G D/L: 260.34	5G U/L: 38.00
BSNL- 4G D/L: 1.23	4G U/L: 5.44
RJIL- 4G D/L: 38.16	4G U/L: 6.76
5G D/L: 137.86	5G U/L: 17.77
VIL- 4G D/L: 26.65	4G U/L: 15.86

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

QoS Performance Analysis- Karnataka 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 May-2025 covering city drive, hotspots, walk test and highway. (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	447	458	485
Call Setup Success Rate %	90.16	87.77	70.31
Drop Call Rate %	1.24	6.47	4.99
Call Setup Time-Average (Second)	5.10	4.16	3.80
Handover Success Rate %	98.56	98.91	98.04

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

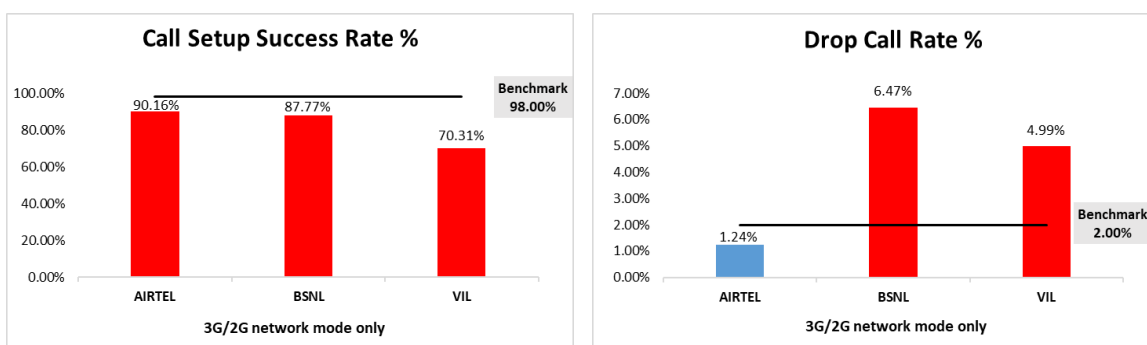


Figure-2: Call setup success rate and drop call rate performance.

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	149	NA
2G	537	203	323

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	611	660	610	672
Call Setup Success Rate %	95.91	83.18	96.89	73.81
Drop Call Rate %	0.68	6.56	0.34	2.82
Call Setup Time-Average (Second)	1.34	2.42	0.76	1.57
Handover Success Rate %	99.78	97.84	99.50	99.38

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

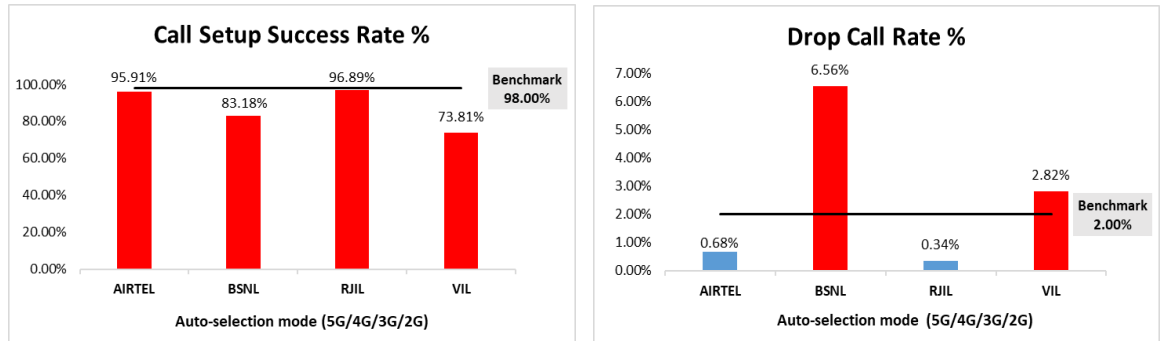


Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	408	511	414	334
Number of silence call for >4 Sec	17	NA	24	26
Silence Call Rate %	4.17	NA	5.80	7.78
Number of silence instances for >4 Sec	28	NA	34	37
Number of silence instances for >3 Sec	42	NA	47	70
Number of silence instances for >2 sec	72	NA	85	90
RTP Jitter (4G & 5G) in ms	4.07	NA	9.11	21.52
Packet loss Rate Downlink %	4.04	NA	1.40	3.76
Packet loss Rate Uplink %	2.16	NA	3.16	2.64

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	276	NA
4G	956	239	1404	438
3G	NA	77	NA	NA
2G	4	169	NA	121

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 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	2767	2010	2772	2099
Speech Quality (Average MOS)	3.93	2.42	3.77	3.84
Number of samples with MOS ≥ 4 to < 5 (Excellent)	2200	0	1881	1371
Number of samples with MOS ≥ 3 to < 4 (Good)	423	317	580	525
Number of samples with MOS ≥ 2 to < 3 (Fair)	60	1280	149	86
Number of samples with MOS ≥ 1 to < 2 (Poor)	84	413	162	117
%age of samples with MOS ≥ 4 to < 5 (Excellent)	79.51%	0.00%	67.86%	65.32%
%age of samples with MOS ≥ 3 to < 4 (Good)	15.29%	15.77%	20.92%	25.01%
%age of samples with MOS ≥ 2 to < 3 (Fair)	2.17%	63.68%	5.38%	4.10%
%age of samples with MOS ≥ 1 to < 2 (Poor)	3.04%	20.55%	5.84%	5.57%

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

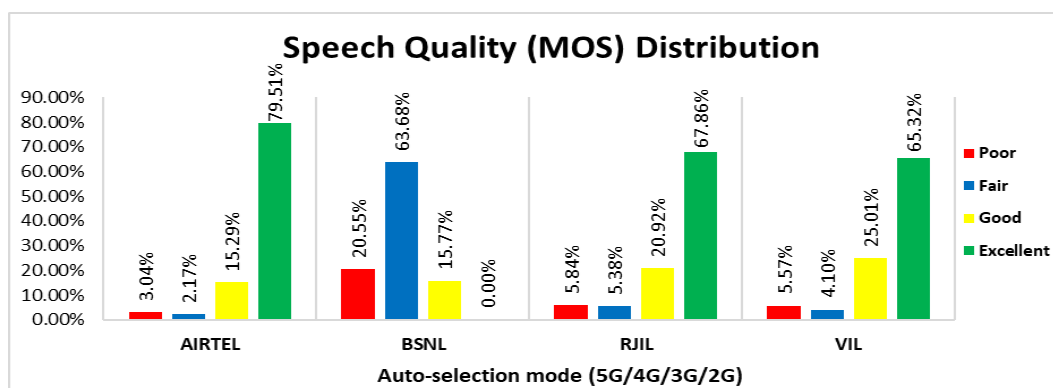


Figure- 4: Distribution of samples in MOS range.

(d) **Inter-service provider voice call performance:** To check the performance of inter-service providers call setup success rate at Hotel Vishwas Residency near KSRTC bus stand, total 33 to 37 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	100.00	100.00	100.00
BSNL	100.00	NA	100.00	100.00
RJIL	100.00	100.00	NA	100.00
VIL	100.00	100.00	100.00	NA

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

Note-

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

Call setup time average (seconds)				
From Service Provider	To Service Provider			
	AIRTEL	BSNL	RJIL	VIL
AIRTEL	NA	4.95	1.81	1.79
BSNL	4.53	NA	4.55	2.44
RJIL	1.96	4.51	NA	1.88
VIL	2.13	2.16	2.06	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	146.09	1.40	159.77	20.11
	80th Percentile	250.73	2.02	282.62	36.80
	20th Percentile	22.00	0.28	3.42	3.68
Upload Throughput (Mbits/s)	Average	27.24	2.60	15.05	10.47
	80th Percentile	50.05	3.41	27.81	18.83
	20th Percentile	2.99	0.94	1.69	2.22
Latency (ms)	50th Percentile	22.55	51.50	21.10	27.40

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

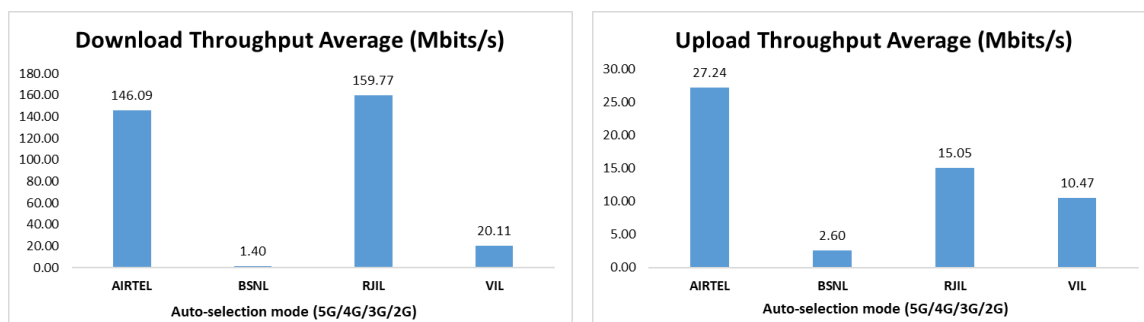


Figure- 5: Download and upload throughput.

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	580	NA
4G	1252	206	584	434
3G	NA	177	NA	NA
2G	9	84	NA	89

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 May 2025 to 23rd May 2025 in Chikmagalur. (refer table-1)

4.2.1 Drive test route

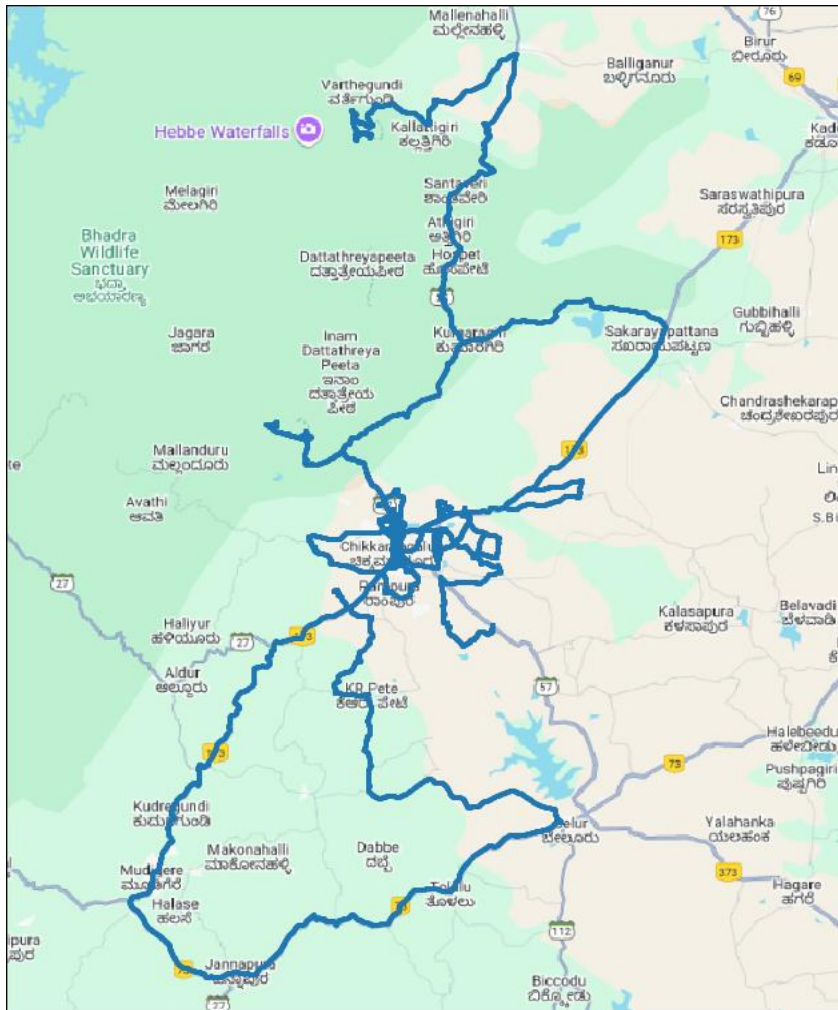


Figure- 6: Drive test routes.

4.2.2 Areas covered

Ballavara, kallattigiri, Athigiri, Kumaragiri, Sakarayapattana, udde Boranahalli, Lakya, Allampura, RK Pete, Belur, Tolalu, Jannapura, Bidarahalli, Bilagola and Balehalli 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	356	363	389
Call Setup Success Rate %	89.04	87.05	64.78
Drop Call Rate %	0.95	5.70	3.57
Call Setup Time-Average (Second)	5.02	4.22	3.72
Handover Success Rate %	99.45	98.75	98.85

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

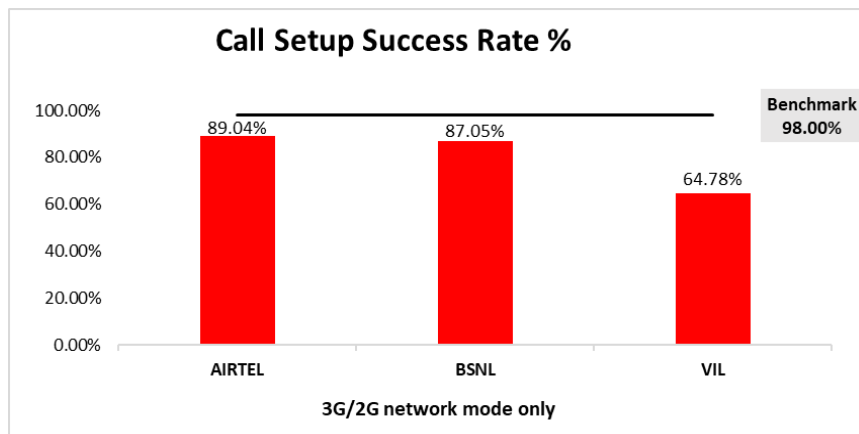


Figure-7: Performance for call setup success rate.

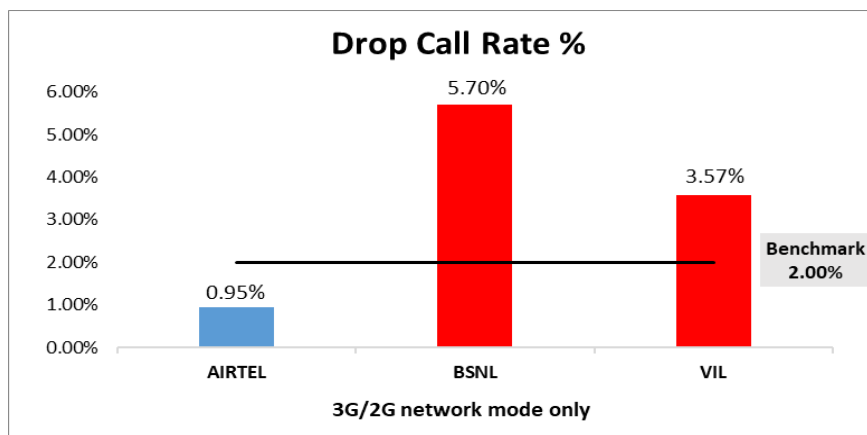


Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	34.00%	NA
2G	97.93%	62.72%	90.72%
Limited Service	2.07%	3.28%	9.28%

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

Note-

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

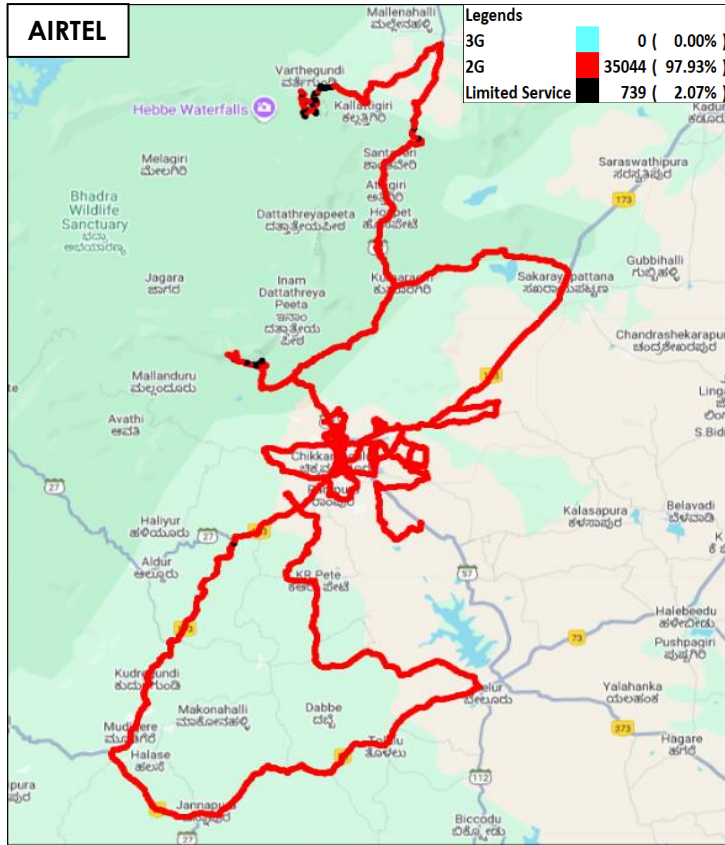


Figure-9: Serving technology plots 3G/2G network mode – AIRTEL.

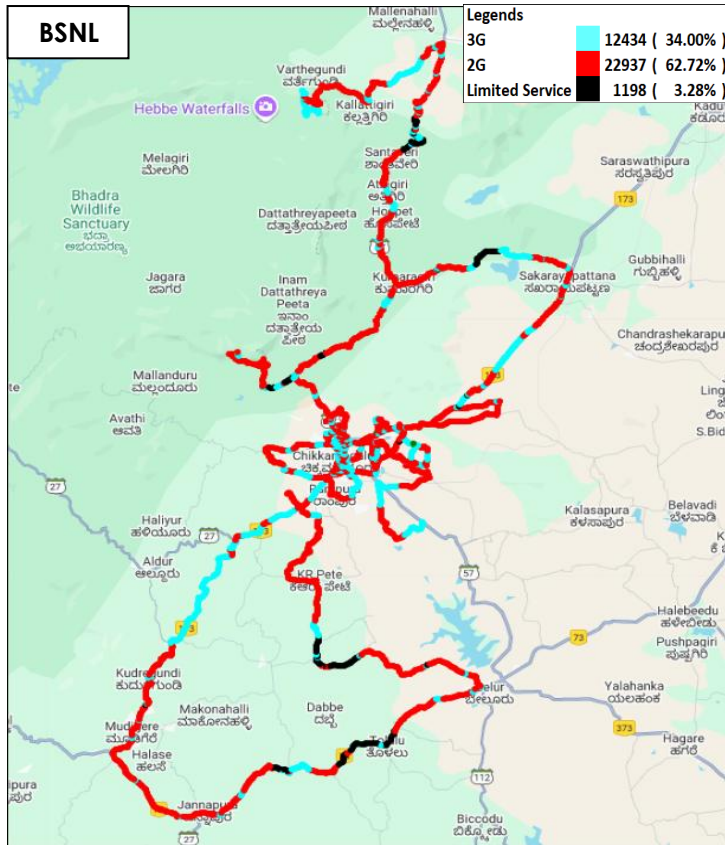


Figure-10: Serving technology plots 3G/2G network mode – BSNL.

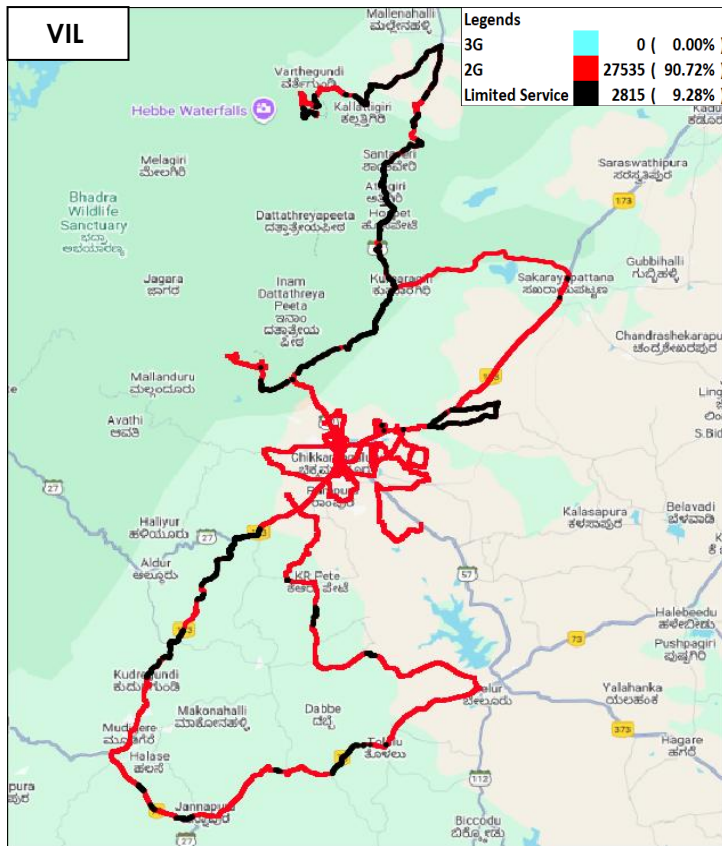


Figure-11: Serving technology plots 3G/2G network mode –VIL.

(c) Network Signal Strength distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (refer figure-42, 43 & 44 for map view)

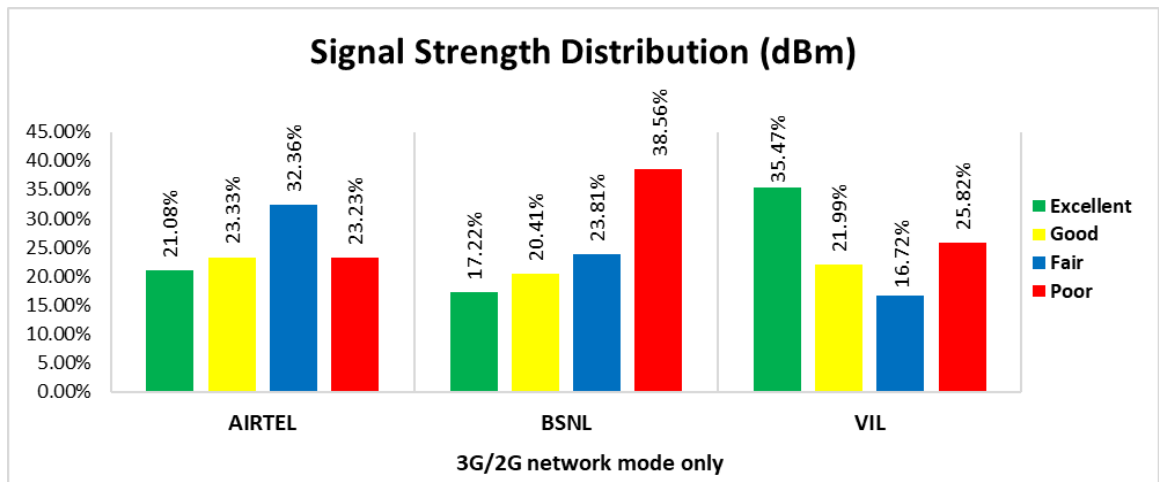


Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 21% of samples falling in the excellent signal strength category.
- BSNL has 17% of samples falling in the excellent signal strength category.
- VIL has 35% 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	366	392	364	424
Call Setup Success Rate %	93.17	78.83	94.78	61.08
Drop Call Rate %	1.17	7.12	0.58	4.63
Call Setup Time Average (Second)	1.48	2.84	0.90	1.89
Handover Success Rate %	99.74	98.27	99.58	98.98

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

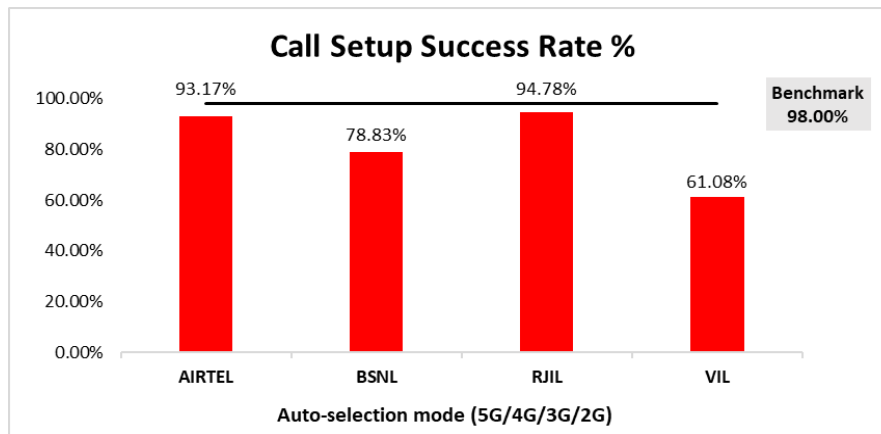


Figure-13: Performance for call setup success rate.

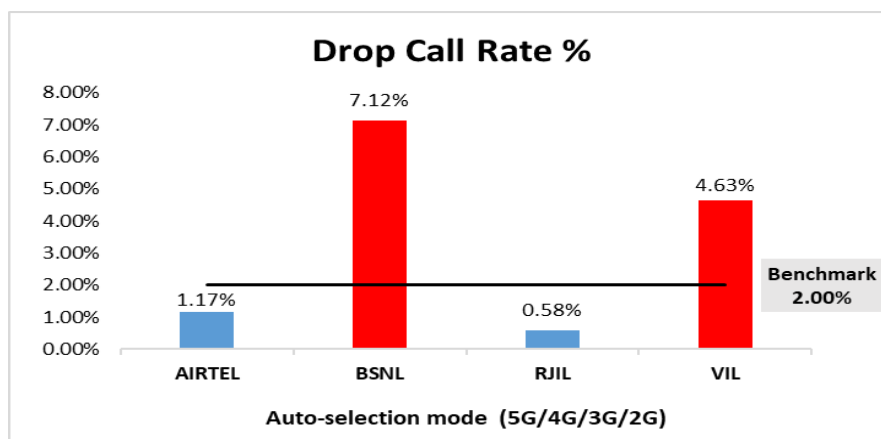


Figure-14: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	332	376	338	247
Number of silence call for >4 Sec	16	NA	24	17
Silence Call Rate %	4.82	NA	7.10	6.88
Number of silence instances for >4 Sec	26	NA	34	23
Number of silence instances for >3 Sec	39	NA	46	35
Number of silence instances for >2 sec	58	NA	78	42
RTP Jitter (4G & 5G) in ms	4.56	NA	9.59	13.65
Packet loss Rate Downlink %	4.78	NA	1.68	3.23
Packet loss Rate Uplink %	2.53	NA	3.62	2.87

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 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	1822	1278	1839	1241
Speech Quality (Average MOS)	3.90	2.43	3.73	3.87
Number of samples with MOS ≥ 4 to < 5 (Excellent)	1415	0	1240	828
Number of samples with MOS ≥ 3 to < 4 (Good)	293	178	374	306
Number of samples with MOS ≥ 2 to < 3 (Fair)	44	870	92	48
Number of samples with MOS ≥ 1 to < 2 (Poor)	70	230	133	59
%age of samples with MOS ≥ 4 to < 5 (Excellent)	77.66%	0.00%	67.43%	66.72%
%age of samples with MOS ≥ 3 to < 4 (Good)	16.08%	13.93%	20.34%	24.66%
%age of samples with MOS ≥ 2 to < 3 (Fair)	2.41%	68.08%	5.00%	3.87%
%age of samples with MOS ≥ 1 to < 2 (Poor)	3.84%	18.00%	7.23%	4.75%

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

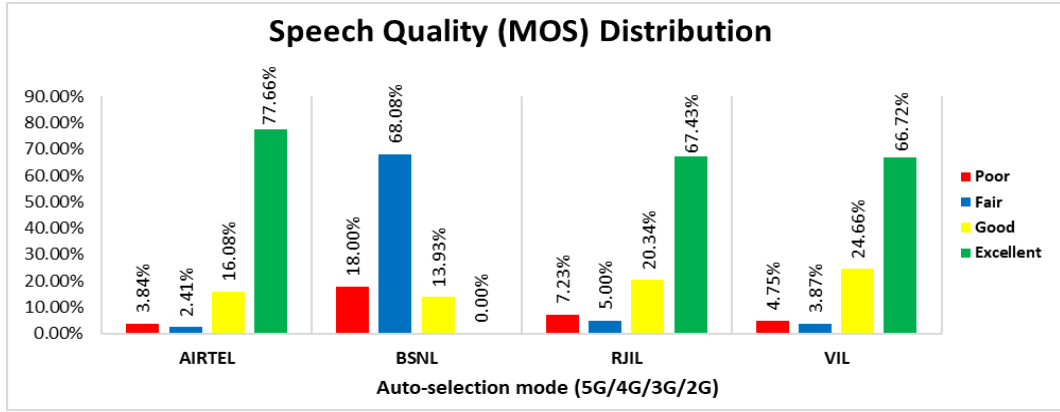


Figure-15: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	1.78%	NA	7.34%	NA
4G	95.05%	42.36%	90.47%	68.61%
3G	NA	13.60%	NA	NA
2G	0.35%	39.21%	NA	16.86%
Limited Service	2.82%	4.83%	2.19%	14.53%

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

Note-

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

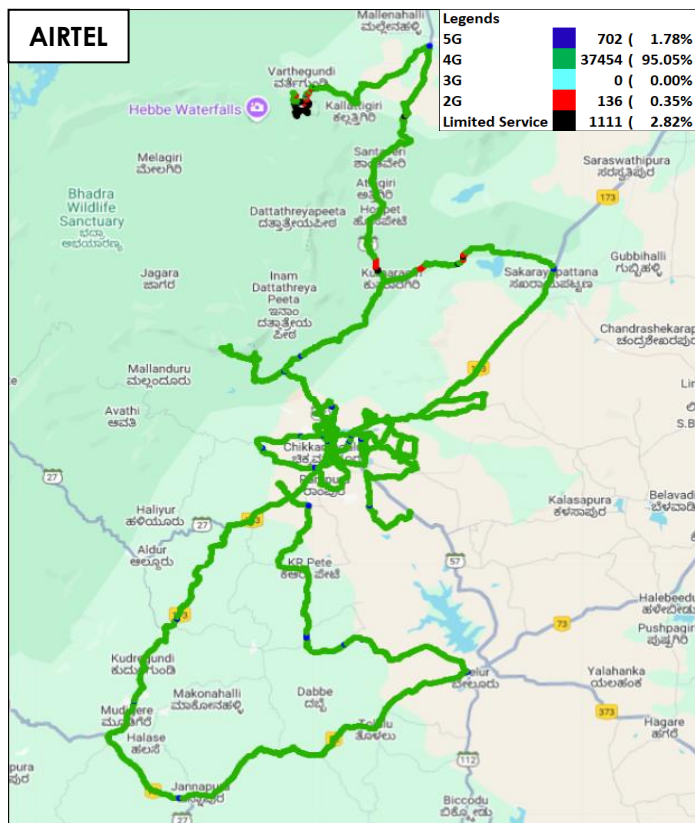


Figure-16: Serving technology plots in auto-selection mode (5G/4G/3G/2G) –AIRTEL.

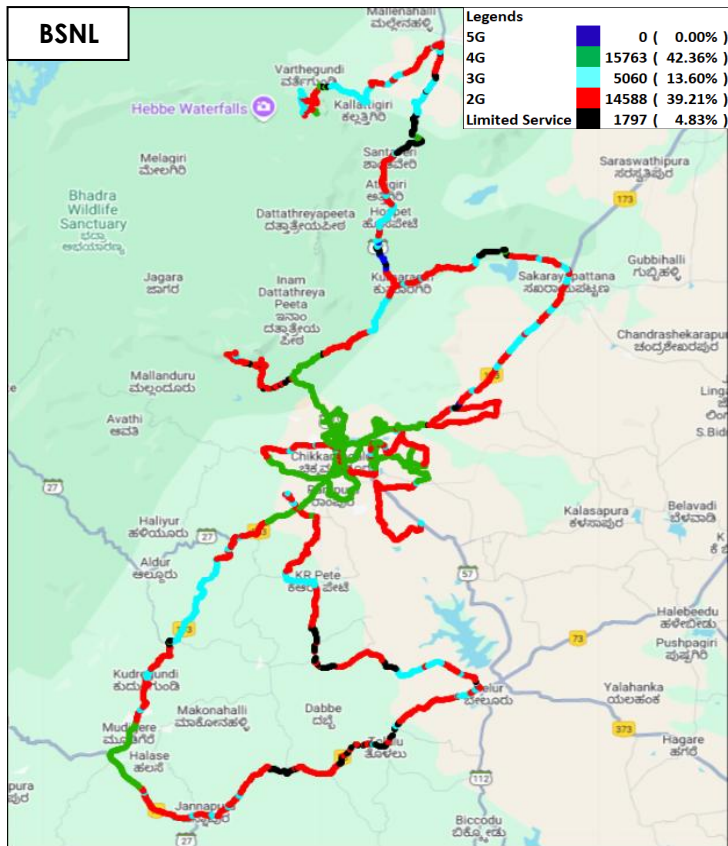


Figure-17: Serving technology plots in auto-selection mode (5G/4G/3G/2G) –BSNL.

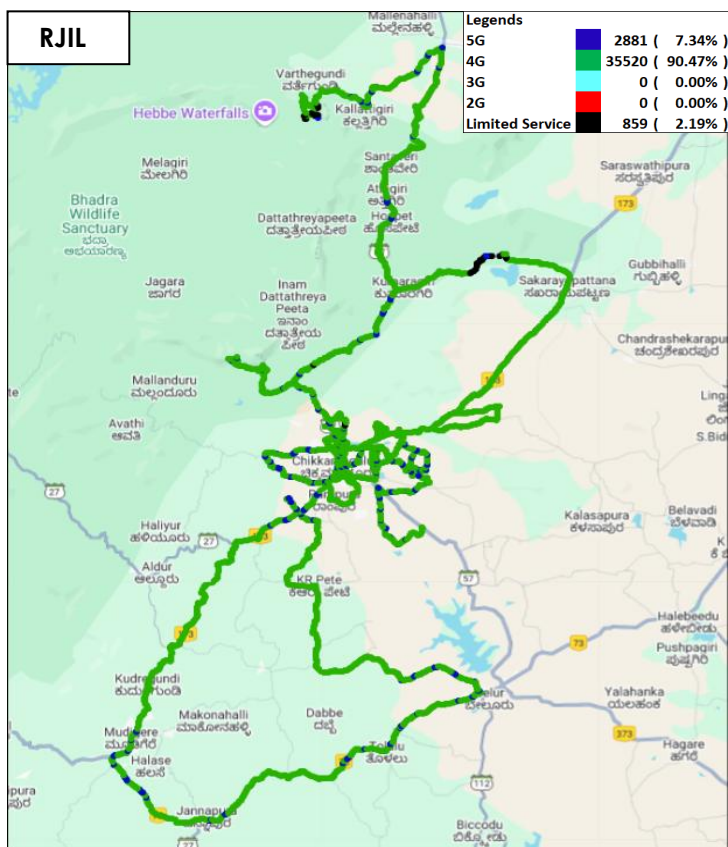


Figure-18: Serving technology plots in auto-selection (5G/4G/3G/2G)- RJIL.

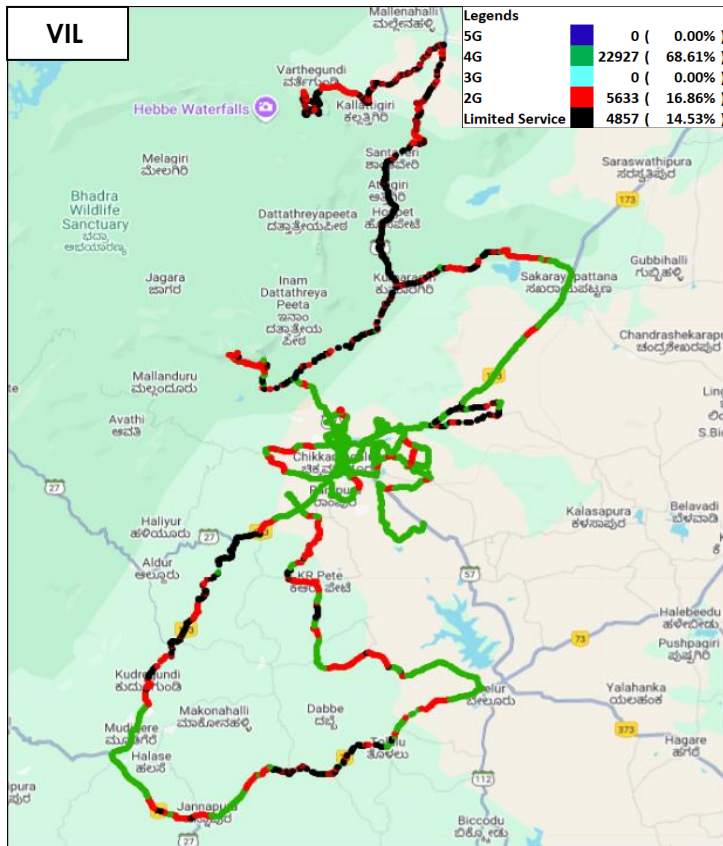


Figure-19: Serving technology plots in auto-selection mode (5G/4G/3G/2G) – VIL.

(g) Network Signal Strength distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G). (refer figure-45, 46, 47 & 48 for map view)

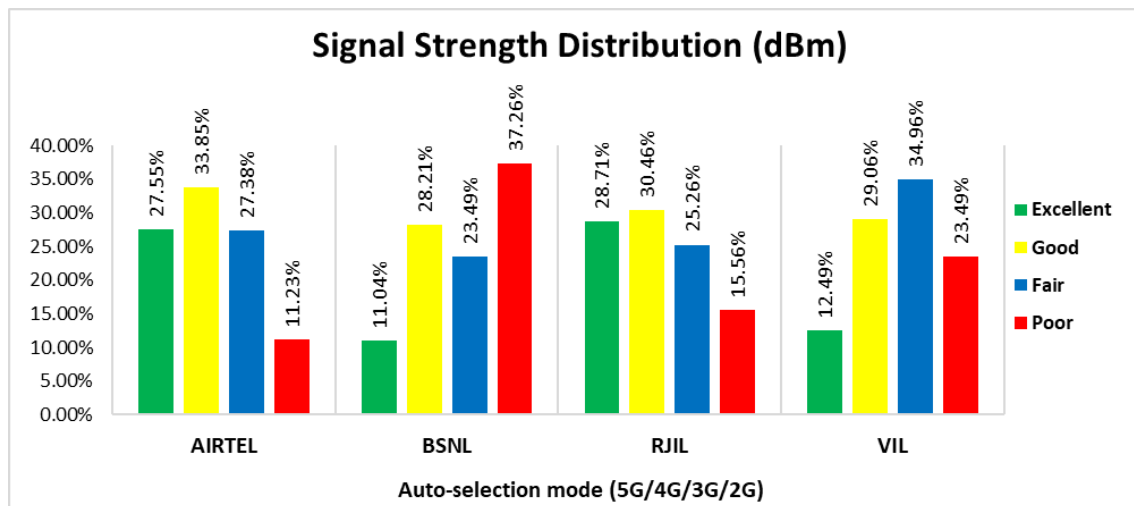


Figure-20: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:

- Airtel has 28% of samples falling in the excellent signal strength category.
- BSNL has 11% of samples falling in the excellent signal strength category.
- RJIL has 29% of samples falling in the excellent signal strength category.
- VIL has 12% 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	145.39	1.17	134.22	17.56
	80th Percentile	249.57	1.69	235.36	30.87
	20th Percentile	15.53	0.30	1.42	3.28
Upload Throughput (Mbits/s)	Average	24.73	2.37	12.78	8.08
	80th Percentile	47.60	2.97	22.66	12.72
	20th Percentile	2.05	0.92	1.29	1.94
Latency (ms)	50th Percentile	22.90	53.00	22.70	28.20

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

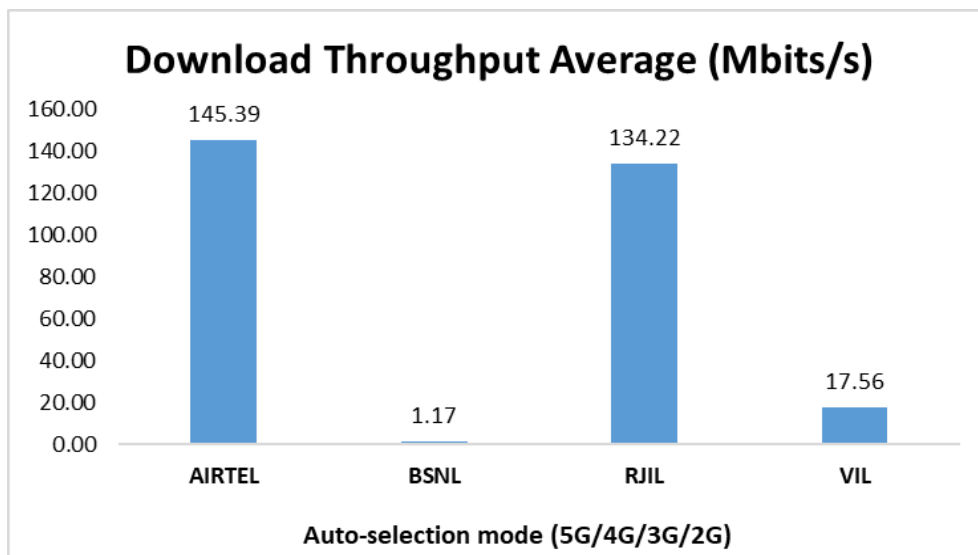


Figure- 21: Download throughput.

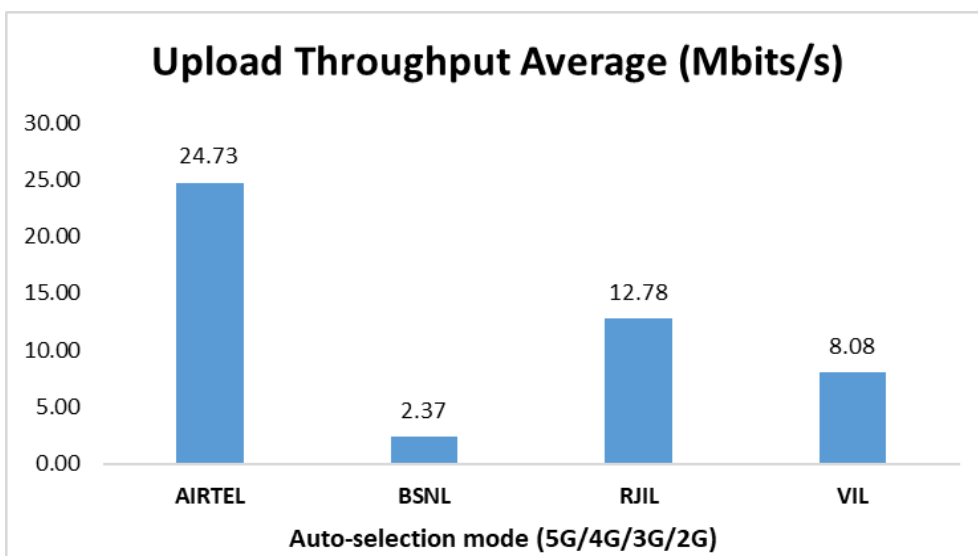


Figure- 22: Upload throughput

4.3 Hotspots

Hotspot testing has been done from 23rd May 2025 to 24th May 2025. Ten locations have been tested in the city.

4.3.1 Locations

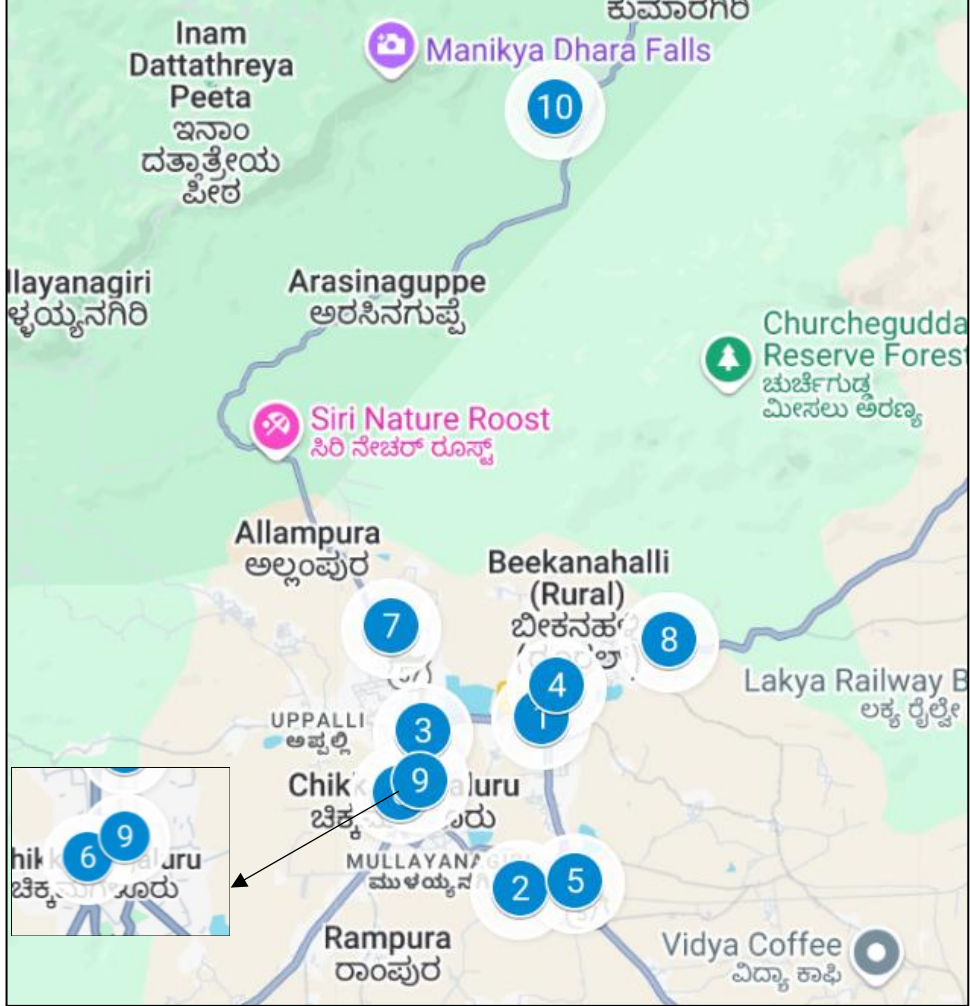


Figure- 23: Hotspot locations

4.3.2 Hotspot covered

1. Shri Deviramma Temple
2. MG Park
3. Hanumanthappa Circle City Centre
4. Chikmagalur District Stadium
5. Chikmagalur Railway Station
6. I.D.S.G Government College, Chikmagalur
7. Kodandarama Temple
8. Ksrtc Bus Stand Area
9. RTO Office Chikmagalur
10. Shanthi Complex

4.3.3 Voice performance

Overall Voice Performance				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	100	100	100	100
Call Setup Success Rate %	100.00	100.00	100.00	90.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	1.17	0.92	0.52	0.90

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

Chikmagaluru District Stadium				
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)	1.09	0.75	0.51	0.86

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

Chikmagaluru 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)	1.19	0.59	0.48	0.89

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

Hanumanthappa Circle City 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)	1.10	0.64	0.47	0.90

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

I.D.S.G Government College, Chikmagaluru				
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)	1.46	1.20	0.50	0.86

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

Kodandarama Temple				
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)	1.09	0.80	0.48	0.91

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

KSRTC Bus Stand Area				
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)	1.20	0.58	0.48	0.86

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

MG Park				
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)	1.13	0.67	0.54	0.84

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

RTO Office Chikmagaluru				
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)	1.08	0.96	0.71	1.09

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

Shanthi Complex				
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)	1.28	0.60	0.53	0.88

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

Shri Deviramma Temple				
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	0.00
Drop Call Rate %	0.00	0.00	0.00	-
Call Setup Time-Average (Sec)	1.10	2.45	0.53	-

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

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

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)	248.47	1.48	201.08	19.34
Download Throughput 80th Percentile (Mbit/s)	347.27	2.26	328.01	33.64
Download Throughput 20th Percentile (Mbit/s)	149.04	0.89	7.85	7.92
Download Session Setup Success Rate %	100.00	96.00	84.00	90.00
Upload Throughput Average (Mbits/s)	24.03	2.98	20.22	8.60
Upload Throughput 80th Percentile (Mbit/s)	33.31	4.03	34.82	10.99
Upload Throughput 20th Percentile (Mbit/s)	13.61	1.85	2.45	2.64
Upload Session Setup Success Rate %	100.00	94.00	98.00	90.00
Web Browsing Delay (Second)	2.50	2.22	1.89	2.76
Youtube Initial Buffer Delay (Second)	1.46	1.44	0.72	1.68
Latency (ms)-50th Percentile	22.15	50.50	20.00	28.00
Jitter (ms)	13.92	35.82	73.95	7.81
Packet Loss Rate%	2.69	4.20	10.83	0.52
Packet Loss Rate- 90th percentile	6.17	7.11	36.18	1.12

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

Chikmagalur District Stadium				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	473.40	1.10	143.33	12.14
Download Session Setup Success Rate %	100.00	100.00	80.00	100.00
Upload Throughput Average (Mbits/s)	57.92	2.03	8.72	8.13
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	3.36	1.97	1.44	3.11
Youtube Initial Buffer Delay (Second)	3.13	1.21	0.74	2.68
Latency (ms)-50th Percentile	18.73	50.50	23.38	37.55
Jitter (ms)	7.15	7.96	13.31	9.80
Packet Loss Rate%	0.10	13.50	0.20	0.30

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

Chikmagaluru Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	211.23	2.14	220.55	5.95
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	26.32	3.85	78.92	2.44
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	1.36	2.31	1.27	3.62
Youtube Initial Buffer Delay (Second)	0.74	1.05	0.54	1.45
Latency (ms)-50th Percentile	27.75	43.45	13.10	23.95
Jitter (ms)	6.18	4.28	5.64	17.63
Packet Loss Rate%	0.10	5.50	0.00	0.70

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

Hanumanthappa Circle City Centre				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	147.75	0.84	331.29	19.66
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	20.31	3.22	26.83	6.73
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	1.83	2.11	1.60	1.79
Youtube Initial Buffer Delay (Second)	1.91	1.17	0.59	2.20
Latency (ms)-50th Percentile	28.70	55.00	16.55	25.65
Jitter (ms)	56.07	9.11	4.62	5.21
Packet Loss Rate%	21.20	0.30	0.00	0.00

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

I.D.S.G Government College, Chikmagaluru				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	384.13	0.39	221.00	12.95
Download Session Setup Success Rate %	100.00	60.00	100.00	100.00
Upload Throughput Average (Mbits/s)	24.10	1.99	16.38	9.75
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	2.86	2.20	1.93	2.79
Youtube Initial Buffer Delay (Second)	0.64	1.82	0.71	0.67
Latency (ms)-50th Percentile	19.00	55.00	20.05	40.70
Jitter (ms)	4.69	10.69	12.30	5.02
Packet Loss Rate%	0.10	1.90	0.70	1.10

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

Kodandarama Temple				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	325.52	1.40	584.71	5.01
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	20.67	2.51	53.06	1.47
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.64	1.84	1.35	4.29
Youtube Initial Buffer Delay (Second)	2.51	1.18	0.52	3.62
Latency (ms)-50th Percentile	18.80	48.10	14.60	28.45
Jitter (ms)	3.73	10.14	3.52	12.59
Packet Loss Rate%	0.00	2.50	0.10	1.20

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

KSRTC Bus Stand Area				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	216.64	2.12	109.43	13.23
Download Session Setup Success Rate %	100.00	100.00	20.00	100.00
Upload Throughput Average (Mbits/s)	10.12	3.24	2.42	7.71
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	3.71	1.60	1.62	2.97
Youtube Initial Buffer Delay (Second)	1.93	1.40	1.10	0.77
Latency (ms)-50th Percentile	20.05	53.00	26.25	22.63
Jitter (ms)	11.23	11.11	40.97	7.45
Packet Loss Rate%	0.20	4.70	7.80	0.70

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

MG Park				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	262.72	1.23	160.64	37.16
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	15.40	4.69	5.78	11.95
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	1.35	1.95	1.39	1.70
Youtube Initial Buffer Delay (Second)	0.61	1.12	0.65	1.11
Latency (ms)-50th Percentile	21.30	53.50	17.20	33.60
Jitter (ms)	16.94	20.39	13.05	6.99
Packet Loss Rate%	0.10	6.40	0.80	0.60

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

RTO Office Chikmagaluru				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	52.02	0.75	3.09	36.10
Download Session Setup Success Rate %	100.00	100.00	80.00	100.00
Upload Throughput Average (Mbits/s)	4.45	2.71	1.94	4.36
Upload Session Setup Success Rate %	100.00	80.00	80.00	100.00
Web Browsing Delay (Second)	1.81	1.76	4.31	2.13
Youtube Initial Buffer Delay (Second)	0.90	1.55	2.56	2.00
Latency (ms)-50th Percentile	26.00	54.50	39.70	24.10
Jitter (ms)	9.74	7.98	541.25	3.65
Packet Loss Rate%	0.50	1.20	33.00	0.10

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

Shanthi Complex				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	154.19	3.25	52.70	31.83
Download Session Setup Success Rate %	100.00	100.00	60.00	100.00
Upload Throughput Average (Mbits/s)	37.36	4.28	3.22	24.84
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	4.48	2.15	1.41	2.67
Youtube Initial Buffer Delay (Second)	1.61	2.36	0.75	1.74
Latency (ms)-50th Percentile	22.18	51.00	27.25	26.40
Jitter (ms)	21.03	10.77	13.65	1.97
Packet Loss Rate%	4.50	0.30	0.90	0.00

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

Shri Deviramma Temple				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	257.12	1.11	0.25	-
Download Session Setup Success Rate %	100.00	100.00	100.00	0.00
Upload Throughput Average (Mbits/s)	23.64	0.87	1.25	-
Upload Session Setup Success Rate %	100.00	100.00	100.00	0.00
Web Browsing Delay (Second)	1.85	5.06	6.32	-
Youtube Initial Buffer Delay (Second)	0.73	-	-	-
Latency (ms)-50th Percentile	22.25	44.65	120.00	-
Jitter (ms)	2.76	258.96	101.46	-
Packet Loss Rate%	0.10	5.70	64.80	-

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

Note- "-"Download, Upload, YouTube & Ping 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)	260.34	-	137.86	-
	Upload Throughput Average (Mbits/s)	38.00	-	17.77	-
4G	Download Throughput Average (Mbits/s)	25.70	1.23	38.16	26.65
	Upload Throughput Average (Mbits/s)	13.24	5.44	6.76	15.86

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

Note- “-”Respective technology was not observed during the test.

Chikmagaluru District Stadium					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	524.21	-	167.63	-
	Upload Throughput Average (Mbits/s)	50.51	-	9.69	-
4G	Download Throughput Average (Mbits/s)	27.52	1.13	16.93	12.33
	Upload Throughput Average (Mbits/s)	11.00	1.84	4.42	13.10

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

Note- “-”Respective technology was not observed during the test.

Chikmagaluru Railway Station					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	201.45	-	200.54	-
	Upload Throughput Average (Mbits/s)	40.66	-	41.84	-
4G	Download Throughput Average (Mbits/s)	6.95	1.38	116.92	6.80
	Upload Throughput Average (Mbits/s)	8.43	4.41	11.93	3.58

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

Note- “-”Respective technology was not observed during the test.

Hanumanthappa Circle City Centre					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	60.85	-	375.03	-
	Upload Throughput Average (Mbits/s)	33.55	-	39.05	-
4G	Download Throughput Average (Mbits/s)	18.29	1.08	53.99	33.78
	Upload Throughput Average (Mbits/s)	15.63	9.32	17.14	24.66

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

Note- “-”Respective technology was not observed during the test.

I.D.S.G Government College, Chikmagaluru					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	374.88	-	183.95	-
	Upload Throughput Average (Mbits/s)	41.19	-	26.52	-
4G	Download Throughput Average (Mbits/s)	13.51	0.60	28.33	24.64
	Upload Throughput Average (Mbits/s)	7.56	3.96	7.33	17.17

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

Note- “-”Respective technology was not observed during the test.

Kodandarama Temple					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	419.12	-	50.04	-
	Upload Throughput Average (Mbits/s)	35.61	-	36.00	-
4G	Download Throughput Average (Mbits/s)	50.28	0.62	85.01	14.18
	Upload Throughput Average (Mbits/s)	16.51	4.86	6.75	3.93

Table-47: Summary of 5G only & 4G only data download & upload speed.

Note- “-”Respective technology was not observed during the test.

KSRTC Bus Stand Area					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	205.02	-	76.86	-
	Upload Throughput Average (Mbits/s)	20.33	-	3.18	-
4G	Download Throughput Average (Mbits/s)	16.07	1.77	4.25	19.03
	Upload Throughput Average (Mbits/s)	11.20	7.76	1.56	12.96

Table-48: Summary of 5G only & 4G only data download & upload speed.

Note- “-”Respective technology was not observed during the test.

MG Park					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	160.77	-	134.04	-
	Upload Throughput Average (Mbits/s)	38.22	-	5.24	-
4G	Download Throughput Average (Mbits/s)	10.16	0.74	37.46	53.14
	Upload Throughput Average (Mbits/s)	18.67	4.96	7.88	23.25

Table-49: Summary of 5G only & 4G only data download & upload speed.

Note- “-”Respective technology was not observed during the test.

RTO Office Chikmagaluru					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	-	-	0.41	-
	Upload Throughput Average (Mbits/s)	-	-	0.77	-
4G	Download Throughput Average (Mbits/s)	34.23	0.76	16.22	28.32
	Upload Throughput Average (Mbits/s)	4.05	3.14	7.01	7.79

Table-50: Summary of 5G only & 4G only data download & upload speed.

Note- “-”Respective technology was not observed during the test.

Shanthi Complex					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	120.20	-	70.99	-
	Upload Throughput Average (Mbits/s)	44.70	-	4.71	-
4G	Download Throughput Average (Mbits/s)	17.52	2.68	2.24	47.61
	Upload Throughput Average (Mbits/s)	7.01	7.80	2.20	36.33

Table-51: Summary of 5G only & 4G only data download & upload speed.

Note- “-”Respective technology was not observed during the test.

Shri Deviramma Temple					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	-	-	35.82	-
	Upload Throughput Average (Mbits/s)	-	-	7.28	-
4G	Download Throughput Average (Mbits/s)	62.44	-	12.78	-
	Upload Throughput Average (Mbits/s)	32.35	-	1.39	-

Table-52: 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 May 2025. Four locations have been tested in the city.

4.4.1 Drive test route

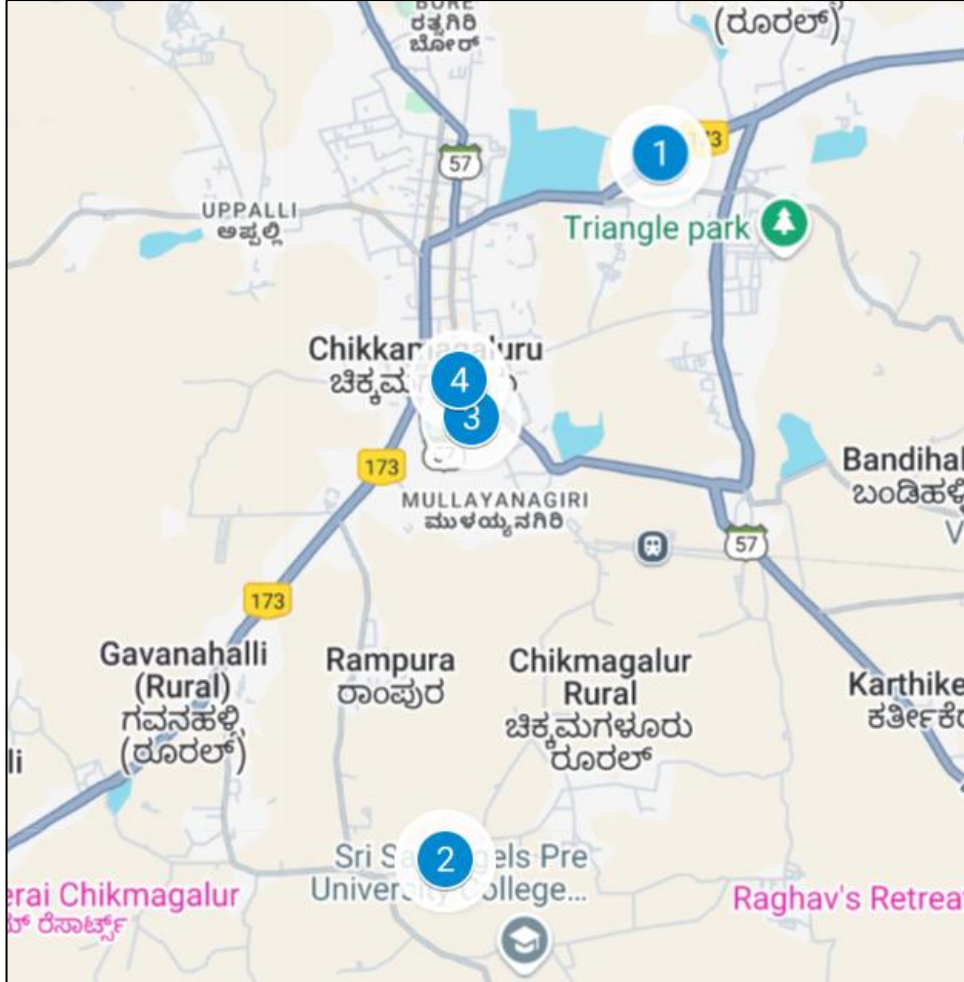


Figure-24: Walk Test location.

4.4.2 Walk Test Covered

1. A.P.M.C Yard Agricultural Produce Market Committee
2. Chikmagaluru Institute of Medical Science
3. Chikmagaluru Municipal Office Area
4. MG Road

4.4.3 Voice performance

A.P.M.C. Yard Agricultural Produce Market Committee				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	12	13	12	12
Call Setup Success Rate %	100.00	84.62	100.00	100.00
Drop Call Rate %	0.00	9.09	0.00	0.00
Call Setup Time-Average (Second)	0.99	1.87	0.57	0.81

Table-53: Summary of voice call performance in network auto-selection mode 5G/4G/3G/2G).

Chikmagalur Institute of Medical Sciences				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	10	20	10	10
Call Setup Success Rate %	100.00	35.00	100.00	100.00
Drop Call Rate %	0.00	28.57	0.00	0.00
Call Setup Time-Average (Second)	1.06	4.99	0.54	2.15

Table-54: Summary of voice call performance in network auto-selection mode 5G/4G/3G/2G).

Chikmagalur Municipal Office Area				
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 (Second)	1.01	0.64	0.53	1.01

Table-55: Summary of voice call performance in network auto-selection mode 5G/4G/3G/2G).

MG Road				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	22	22	22	22
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)	1.02	0.72	0.5	0.91

Table-56: 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)

A.P.M.C. Yard Agricultural Produce Market Committee				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	342.55	0.38	65.64	15.92
Download Session Setup Success Rate %	100.00	100.00	92.31	100.00
Upload Throughput Average (Mbits/s)	72.95	1.91	4.72	27.01
Upload Session Setup Success Rate %	100.00	86.67	100.00	100.00
Latency (ms) - 50th Percentile	-	50.00	34.73	23.78

Table-57: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Note- "- "Ping tests were failed.

Chikmagalur Institute of Medical Sciences				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	204.63	0.38	67.99	8.78
Download Session Setup Success Rate %	100.00	66.67	80.00	100.00
Upload Throughput Average (Mbits/s)	42.41	3.56	8.67	3.48
Upload Session Setup Success Rate %	100.00	75.00	80.00	100.00
Latency (ms) - 50th Percentile	-	46.78	165.25	25.85

Table-58: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Note- "- "Ping tests were failed.

Chikmagaluru Municipal Office Area				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	51.34	0.56	279.72	10.79
Download Session Setup Success Rate %	100.00	78.57	45.45	100.00
Upload Throughput Average (Mbits/s)	6.14	2.52	21.88	6.91
Upload Session Setup Success Rate %	100.00	76.92	90.91	100.00
Latency (ms) - 50th Percentile	-	53.00	18.58	22.95

Table-59: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Note- "-"-Ping tests were failed.

MG Road				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	133.83	0.74	98.49	44.55
Download Session Setup Success Rate %	100.00	75.86	60.87	100.00
Upload Throughput Average (Mbits/s)	72.64	2.50	11.32	30.43
Upload Session Setup Success Rate %	100.00	86.21	100.00	100.00
Latency (ms) - 50th Percentile	23.00	46.13	28.30	25.90

Table-60: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

4.5 Highway

Drive test has been conducted on 21st May 2025 covering one highway route. (Refer Table-1)

4.5.1 Drive test route

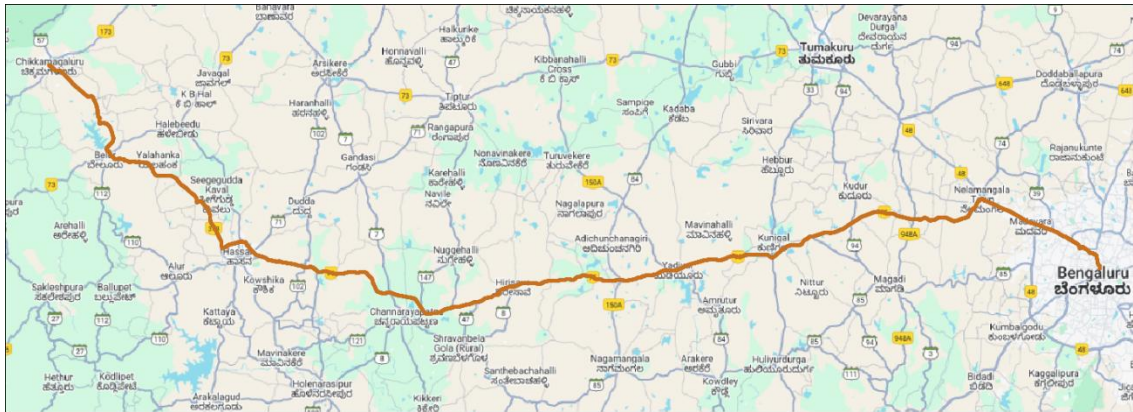


Figure-25: Drive test route highway

4.5.2 Routes Covered

Bengaluru to Chikmagalur via NH-373 and NH75 passing through Belur, Hassan, Channarayana, Hirisave, Kunigal and Madavara.

4.5.3 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	91	95	96
Call Setup Success Rate %	94.51	90.53	92.71
Drop Call Rate %	2.33	9.30	8.99
Call Setup Time-Average (Second)	5.41	3.94	4.05
Handover Success Rate %	97.39	99.15	97.33

Table-61: Summary of voice call performance in 3G/2G network mode only.

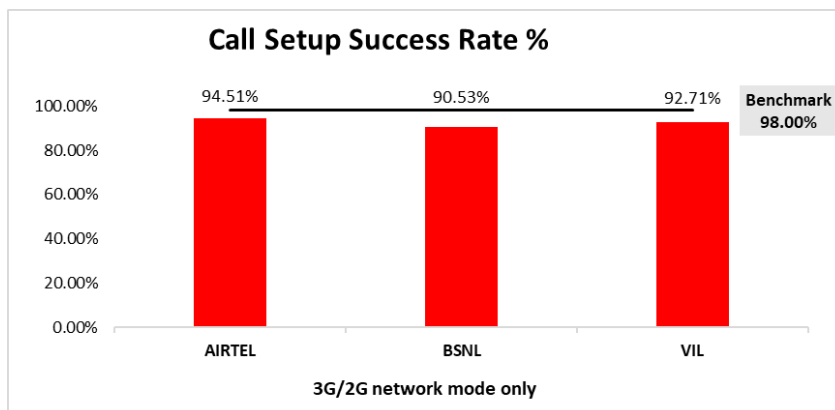


Figure-26: Performance for call setup success rate.

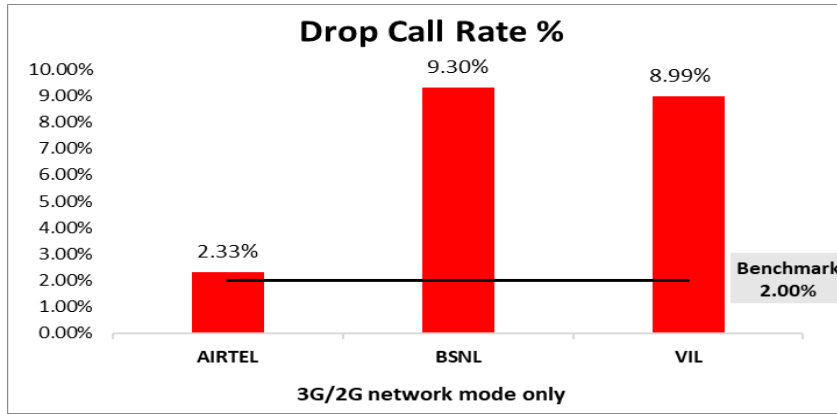


Figure-27: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	42.78%	NA
2G	99.94%	55.60%	100.00%
Limited Service	0.06%	1.62%	0.00%

Table-62: Time spent on technology during drive test 3G/2G network mode only.

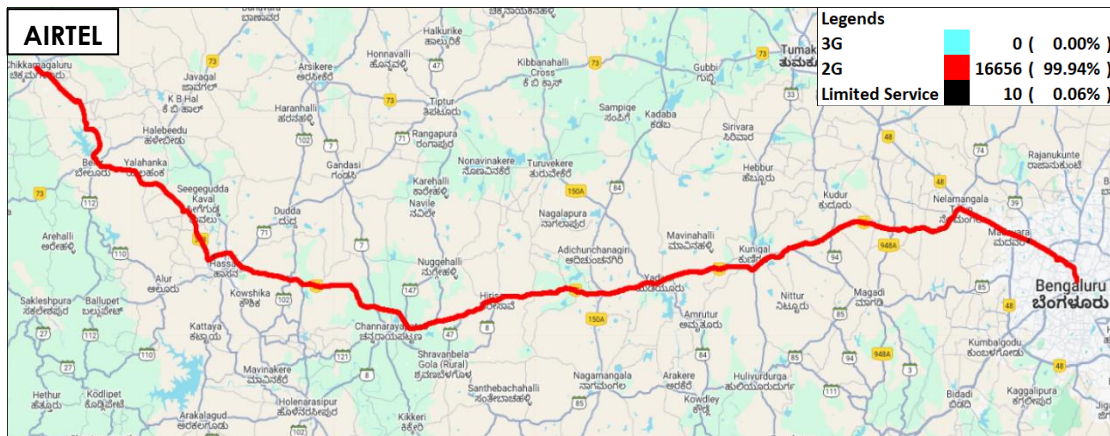


Figure-28: Serving technology plots 3G/2G network mode-AIRTEL

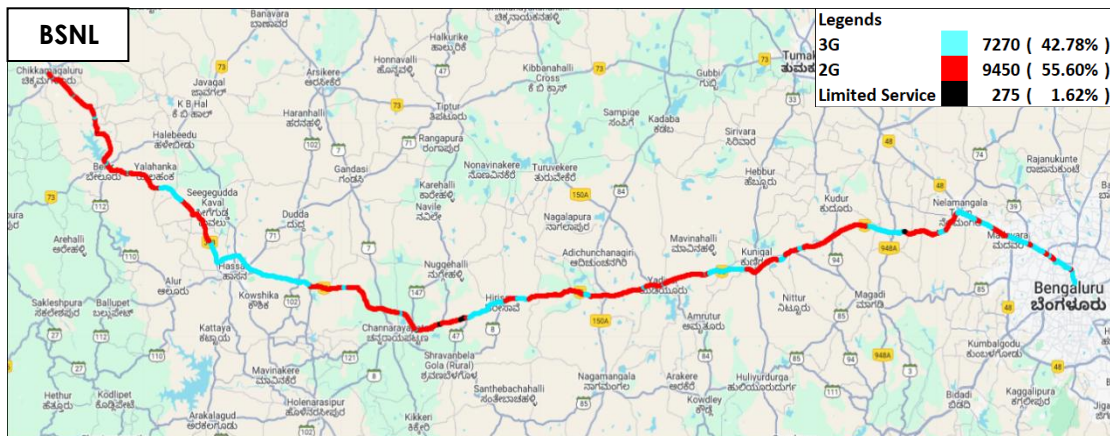


Figure-29: Serving technology plots 3G/2G network mode – BSNL.

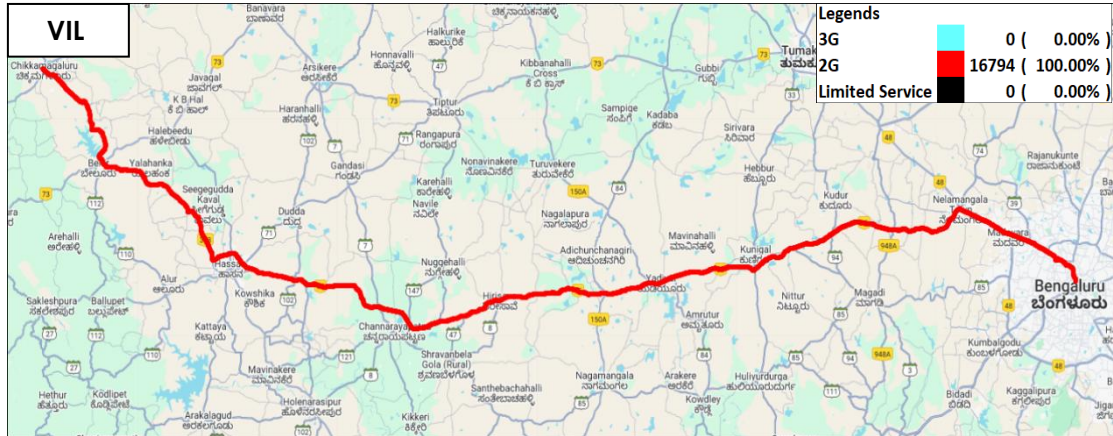


Figure-30: Serving technology plots 3G/2G network mode –VIL.

(c) Network Signal Strength distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (refer figure-49, 50 & 51 for map view)

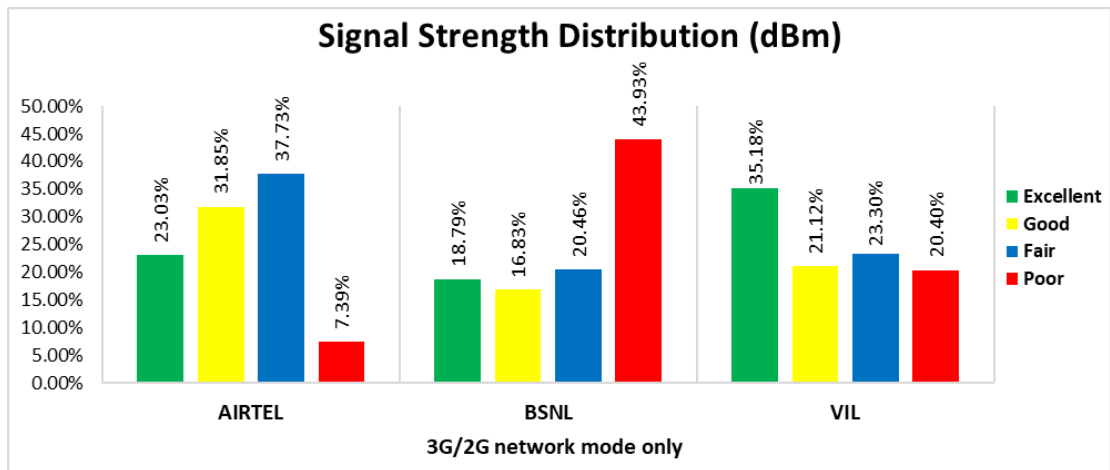


Figure-31: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 23% of samples falling in the excellent signal strength category.
- BSNL has 19% of samples falling in the excellent signal strength category.
- VIL has 35% 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	91	103	92	94
Call Setup Success Rate %	100.00	86.41	100.00	98.94
Drop Call Rate %	0.00	12.36	0.00	2.15
Call Setup Time Average (Second)	1.15	3.11	0.64	1.56
Handover Success Rate %	99.87	96.28	99.35	100.00

Table-63: Summary of voice call performance in network auto-selection mode.

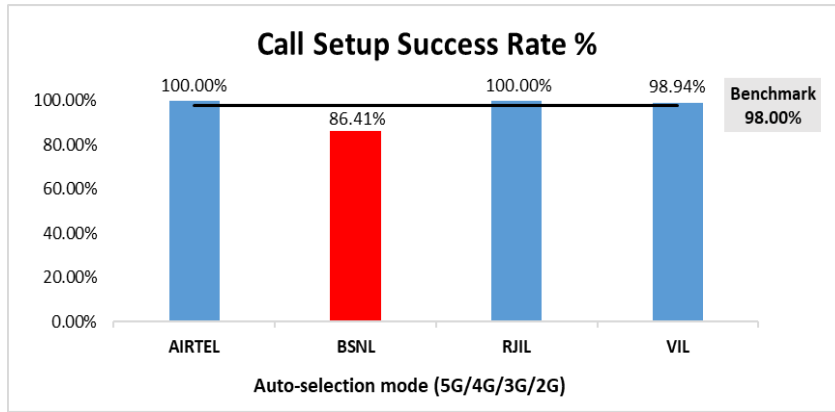


Figure-32: Performance for call setup success rate.

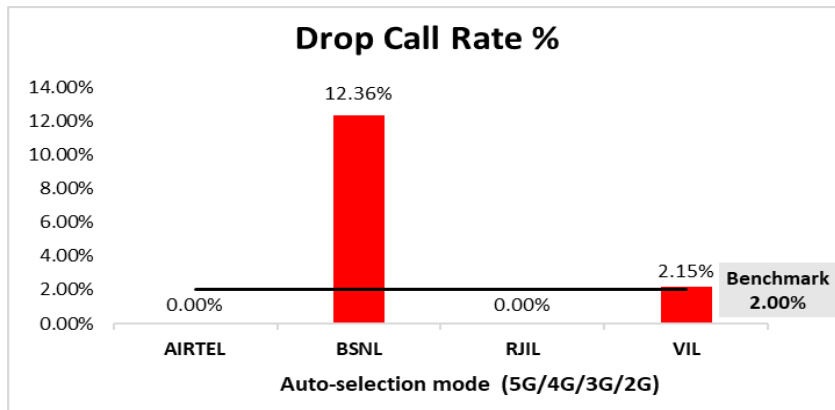


Figure-33: Performance for drop call rate.

Parameter	Service Provider Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	76	135	76	87
Number of silence call for >4 Sec	1	NA	0	9
Silence Call Rate %	1.32	NA	0.00	10.34
Number of silence instances for >4 Sec	2	NA	0	14
Number of silence instances for >3 Sec	3	NA	1	35
Number of silence instances for >2 sec	14	NA	7	48
RTP Jitter (4G & 5G) in ms	3.03	NA	8.10	33.89
Packet loss Rate Downlink %	0.56	NA	0.40	5.24
Packet loss Rate Uplink %	0.61	NA	0.97	1.95

Table-64: 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 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-64	945	732	933	858
Speech Quality (Average MOS)	3.99	2.4	3.83	3.79
Number of samples with MOS ≥ 4 to < 5 (Excellent)	785	0	641	543
Number of samples with MOS ≥ 3 to < 4 (Good)	130	139	206	219
Number of samples with MOS ≥ 2 to < 3 (Fair)	16	410	57	38
Number of samples with MOS ≥ 1 to < 2 (Poor)	14	183	29	58
%age of samples with MOS ≥ 4 to < 5 (Excellent)	83.07%	0.00%	68.70%	63.29%
%age of samples with MOS ≥ 3 to < 4 (Good)	13.76%	18.99%	22.08%	25.52%
%age of samples with MOS ≥ 2 to < 3 (Fair)	1.69%	56.01%	6.11%	4.43%
%age of samples with MOS ≥ 1 to < 2 (Poor)	1.48%	25.00%	3.11%	6.76%

Table-65: Summary of speech quality (MOS) samples.

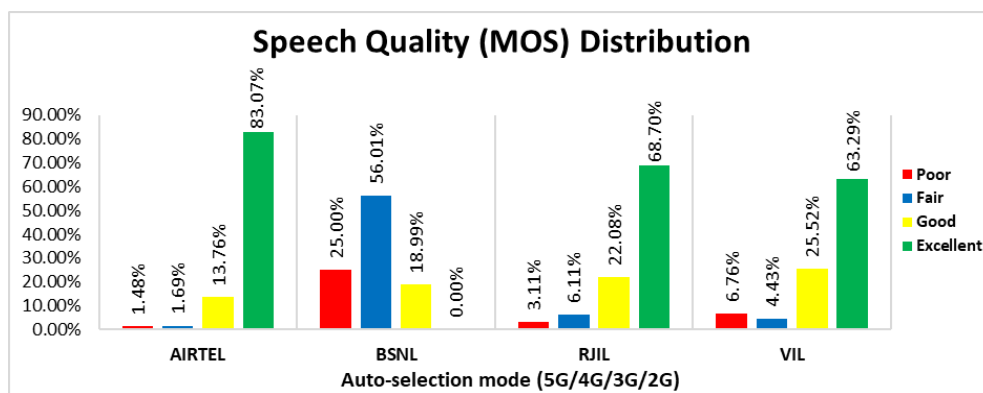


Figure-34: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	0.52%	NA	9.33%	NA
4G	99.48%	38.74%	90.67%	82.07%
3G	NA	9.82%	NA	NA
2G	0.00%	49.53%	NA	17.65%
Limited Service	0.00%	1.91%	0.00%	0.28%

Table-66: Time spent on technology during drive test.

Note-

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

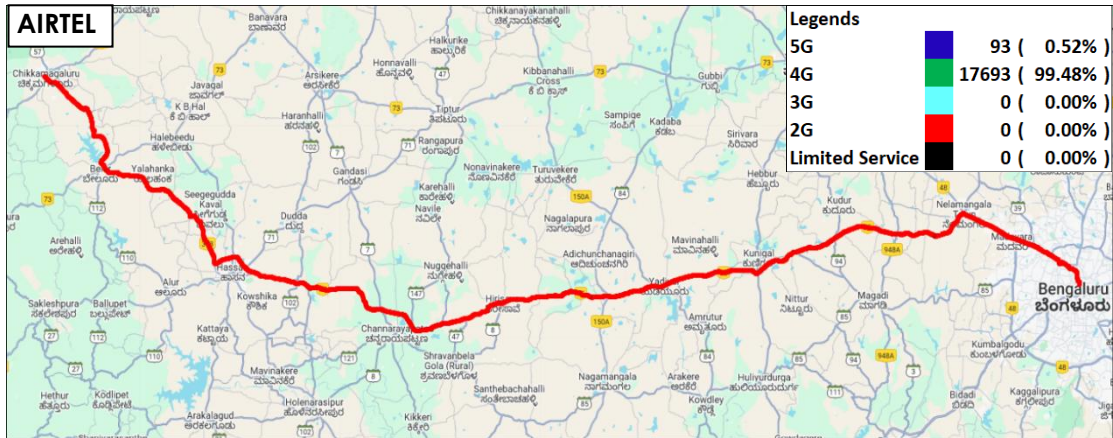


Figure-35: Serving technology plots in auto-selection mode (5G/4G/3G/2G) –AIRTEL.

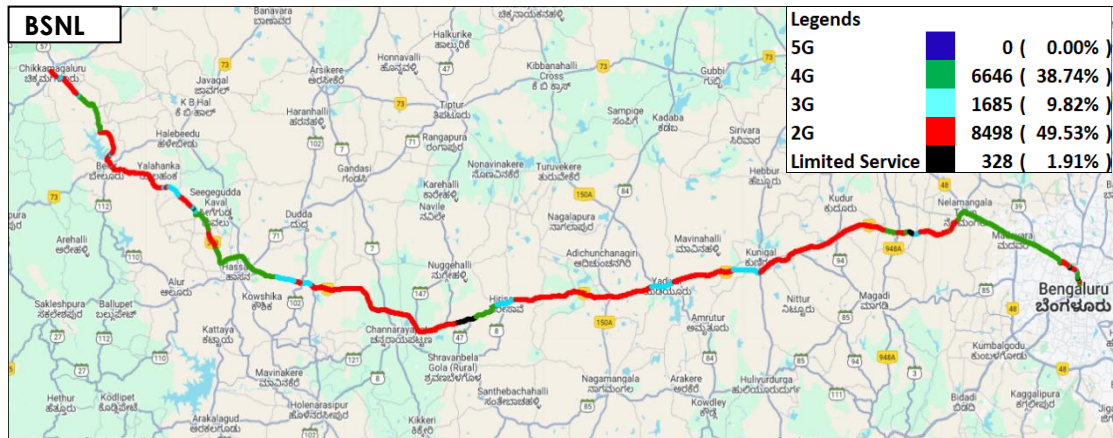


Figure-36: Serving technology plots in auto-selection mode (5G/4G/3G/2G) –BSNL.

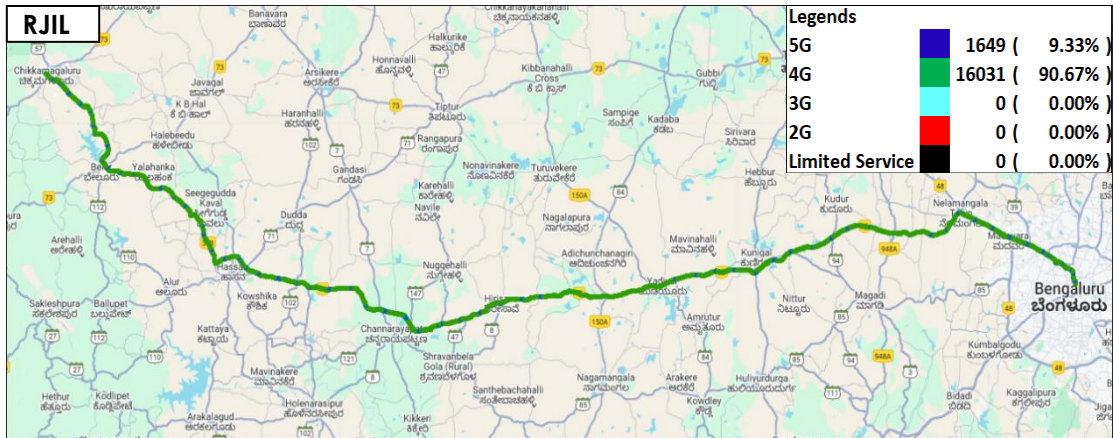


Figure-37: Serving technology plots in auto-selection (5G/4G/3G/2G)- RJIL.

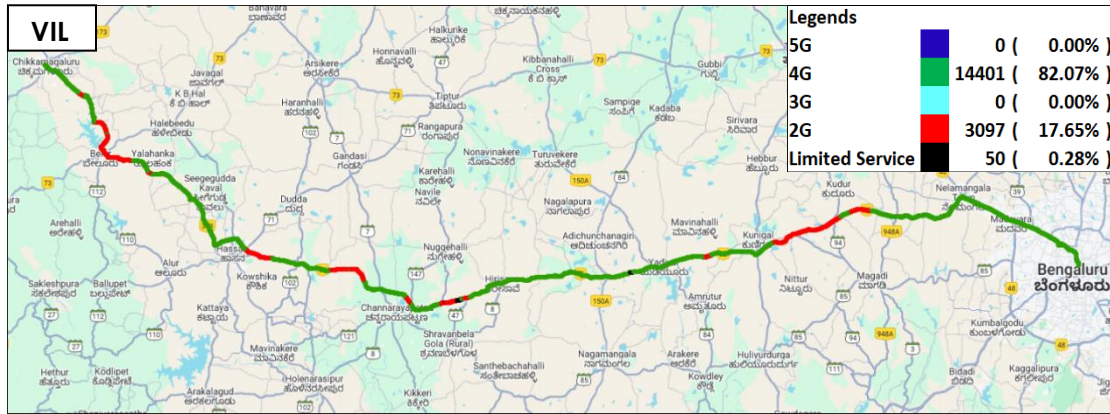


Figure-38: Serving technology plots in auto-selection mode (5G/4G/3G/2G) – VIL.

(g) Network Signal Strength distribution: The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G). (refer figure-52, 53, 54 & 55 for map view)

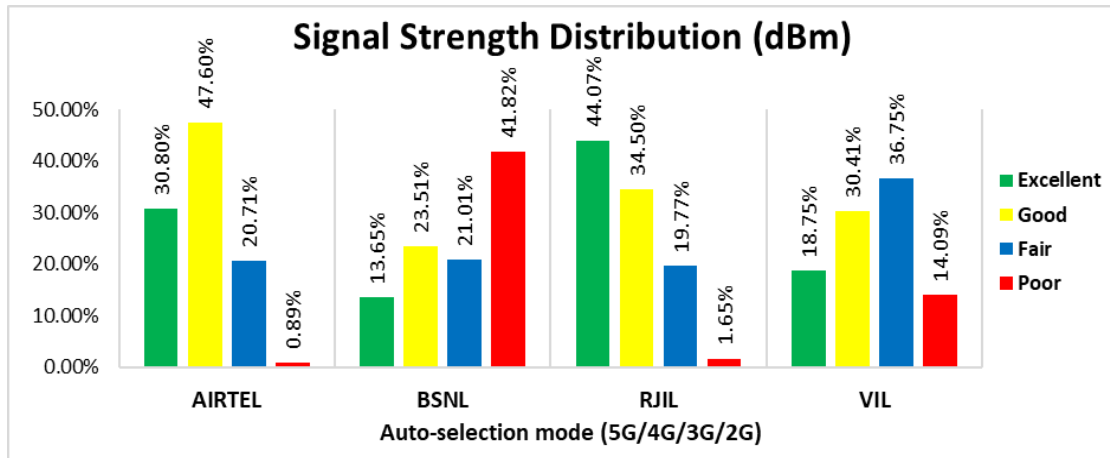


Figure-39: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:

- Airtel has 31% of samples falling in the excellent signal strength category.
- BSNL has 14% of samples falling in the excellent signal strength category.
- RJIL has 44% of samples falling in the excellent signal strength category.
- VIL has 19% of samples falling in the excellent signal strength category.

4.5.4 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 (Mbps/s)	Average	101.69	2.44	219.26	21.99
	80th Percentile	173.51	3.85	417.11	38.65
	20th Percentile	18.78	0.07	14.54	3.36
Upload Throughput (Mbps/s)	Average	23.11	3.01	19.68	10.16
	80th Percentile	43.90	3.23	36.33	19.61
	20th Percentile	3.29	0.14	2.53	1.98
Latency (ms)	50th Percentile	23.10	66.00	19.63	25.80

Table-67: Summary of Data performance in network auto-selection mode.

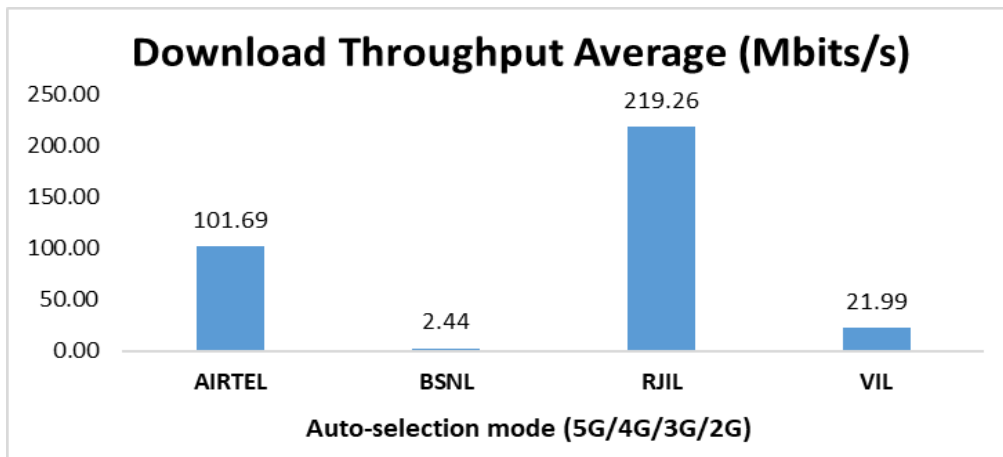


Figure-40: Download throughput.

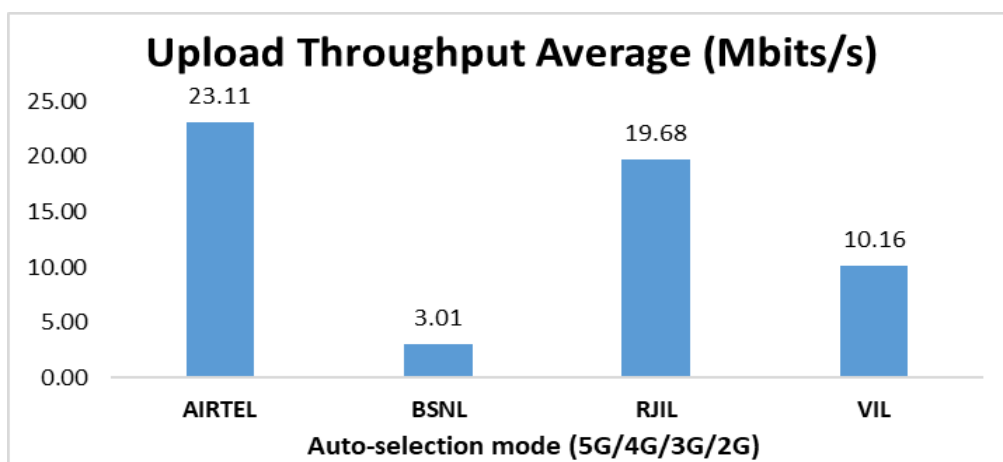


Figure-41: Upload throughput.

5. Voice & Data Key findings

5.1 Overall Voice

1. Call Setup Success Rate:

- a) Airtel, BSNL and VIL have 90.16%, 87.77% and 70.31% call setup success rate respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL and VIL have 95.91%, 83.18%, 96.89% and 73.81% call setup success rate respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)
- c) All operators have 100.00% call setup success rate while calling on peer service provider's network. (refer table-9)

2. Call Setup Time:

- a) Airtel, BSNL and VIL call setup time is 5.10, 4.16 & 3.80 seconds respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL & VIL call setup time is 1.34, 2.42, 0.76 & 1.57 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 1.24%, 6.47% & 4.99% respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL and VIL drop call rate 0.68%, 6.56% 0.34% & 2.82% respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)

4. Call Silence/Mute Rate:

In packet switched network (4G/5G), VIL, RJIL and Airtel have 7.78%, 5.80% & 4.17% silence call rate respectively. Further Airtel has higher RTP packet loss rate in downlink (4.04%) compared to VIL (3.76%) and RJIL (1.40%). In uplink the RTP packet loss rate is higher for RJIL (3.16%) compared to VIL (2.64%) and Airtel (2.16%). (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 146.09 Mbps, 1.40 Mbps, 159.77 Mbps and 20.11 Mbps respectively. (refer table-11)
- b) Airtel, BSNL, RJIL and VIL average upload speeds are 27.24 Mbps, 2.60 Mbps, 15.05 Mbps and 10.47 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 248.47 Mbps, 1.48 Mbps, 201.08 Mbps and 19.34 Mbps respectively. (refer table-31)
- b) Airtel, BSNL, RJIL and VIL average upload speeds are 24.03 Mbps, 2.98 Mbps, 20.22 Mbps and 8.60 Mbps respectively. (refer table-31)

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

- a) Airtel, BSNL, RJIL and VIL have 100.00%, 96.00%, 84.00% and 90.00% download session setup success rate respectively. (refer table-31)
- b) Airtel, BSNL, RJIL and VIL have 100.00%, 94.00%, 98.00% and 90.00% upload session setup success rate respectively. (refer table-31)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 90.16% call setup success rate and 1.24% drop call rate have been observed in 3G/2G network mode for LSA. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-3)
- 95.91% call setup success rate and 0.68% drop call rate have been observed in (5G/4G/3G/2G) network mode for LSA. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-5)
- 89.04% call setup success rate and 0.95% drop call rate have been observed in 3G/2G network mode for city drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-13)
- 93.17% call setup success rate and 1.17% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (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 all walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 53, 54, 55 & 56)
- 94.51% call setup success rate and 2.33% drop call rate have been observed in 3G/2G network mode for highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-61)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for highway drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-63)

Data

- Airtel has average download speed of 146.09 Mbps and average upload speed of 27.24 Mbps for LSA. (refer table-11)
- Airtel has average download speed of 145.39 Mbps and average upload speed of 24.73 Mbps across the measured routes for city drive. (refer table -19)
- RTO Office Chikmagaluru has less download speed (less than 100 Mbps) out of total 10 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-39)
- KSRTC Bus Stand Area, MG Park and RTO Office Chikmagaluru have less Upload speed (less than 20 Mbps) out of total 10 Hotspots in auto-selection mode (5G/4G/3G/2G). (refer table-37, 38 & 39)
- Chikmagaluru Municipal Office Area Walk test location has less download speed (less than 100 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table-59)
- Chikmagaluru Municipal Office Area Walk test location has less upload speed (less than 20 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table- 59)
- Airtel has average download speed of 101.69 Mbps and average upload speed of 23.11 Mbps across the measured routes for highway drive. (refer table -67)

2. BSNL:

Voice

- 87.77% call setup success rate and 6.47% drop call rate have been observed in 3G/2G network mode for LSA. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3)
- 83.18% call setup success rate and 6.56% drop call rate have been observed in (5G/4G/3G/2G) network mode for LSA. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 87.05% call setup success rate and 5.70% drop call rate have been observed in 3G/2G network mode for city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 78.83% call setup success rate and 7.12% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is not meeting 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)
- 84.62% call setup success rate and 9.09% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at A.P.M.C. Yard Agricultural Produce Market Committee Walk test location. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-53)
- 35.00% call setup success rate, and 28.57% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Chikmagaluru Institute of Medical Sciences Walk test location. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-54)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Chikmagaluru Municipal Office Area & MG Road Walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-55 & 56)
- 90.53% call setup success rate and 9.30% drop call rate have been observed in 3G/2G network mode for highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-61)
- 86.41% call setup success rate and 12.36% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-63)

Data

- BSNL has average download speed of 1.40 Mbps and average upload speed of 2.60 Mbps for LSA. (refer table-11)
- BSNL has average download speed of 1.17 Mbps and average upload speed of 2.37 Mbps across the measured routes for city drive. (refer table -19)
- All hotspot locations have less download speed (less than 10 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-32, 33, 34, 35, 36, 37, 38, 39, 40 and 41)
- I.D.S.G Government College-Chikmagaluru and Shri Deviramma Temple have less Upload speed (less than 2 Mbps) out of total 10 hotspot locations in auto-selection mode (5G/4G/3G/2G). (refer table-35 & 41)

- All walk test locations have less download speed (less than 10 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table-57, 58, 59 and 60)
- A.P.M.C. Yard Agricultural Produce Market Committee Walk test location has less upload speed (less than 2 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table- 57)
- BSNL has average download speed of 2.44 Mbps and average upload speed of 3.01 Mbps across the measured routes for highway drive. (refer table -67)

3. RJIL:

Voice

- 96.89% call setup success rate and 0.34% drop call rate have been observed in the auto-selection (5G/4G/3G/2G) mode for LSA. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-5)
- 94.78% call setup success rate and 0.58% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (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 all walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 53, 54, 55 & 56)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for highway drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-63)

Data

- RJIL has average download speed of 159.77 Mbps and average upload speed of 15.05 Mbps for LSA. (refer table-11)
- RJIL has average download speed of 134.22 Mbps and average upload speed of 12.78 Mbps across the measured routes for city drive. (refer table -19)
- RTO Office Chikmagaluru, Shanthi Complex and Shri Deviramma Temple have less download speed (less than 100 Mbps) out of total 10 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-39, 40 & 41)
- Chikmagaluru District Stadium, I.D.S.G Government College- Chikmagaluru, KSRTC Bus Stand Area, MG Park, RTO Office Chikmagaluru, Shanthi Complex and Shri Deviramma Temple have less Upload speed (less than 20 Mbps) out of total 10 Hotspots in auto-selection mode (5G/4G/3G/2G). (refer table-32, 35, 37, 38, 39, 40 & 41)
- A.P.M.C. Yard Agricultural Produce Market Committee, Chikmagaluru Institute of Medical Sciences and MG Road Walk test locations have less download speed (less than 100 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table-57, 58 and 60)
- A.P.M.C. Yard Agricultural Produce Market Committee, Chikmagaluru Institute of Medical Sciences and MG Road Walk test locations have less upload speed (less than 20 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table-57, 58 & 60)

- RJIL has average download speed of 219.26 Mbps and average upload speed of 19.68 Mbps across the measured routes for highway drive. (refer table -67)

4. VIL:

Voice

- 70.31% call setup success rate and 4.99% drop call rate have been observed in 3G/2G network mode for LSA. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3)
- 73.81% call setup success rate and 2.82% drop call rate have been observed in (5G/4G/3G/2G) network mode for LSA. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 64.78% call setup success rate and 3.57% drop call rate have been observed in 3G/2G network mode for city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 61.08% call setup success rate and 4.63% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-15)
- 90.00% 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 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 all walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 53, 54, 55 & 56)
- 92.71% call setup success rate and 8.99% drop call rate have been observed in 3G/2G network mode for highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-61)
- 98.94% call setup success rate and 2.15% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for highway drive. Performance is not meeting the benchmark of 2.00% for drop call rate. (refer table-63)

Data

- VIL has average download speed of 20.11 Mbps and average upload speed of 10.47 Mbps for LSA. (refer table-11)
- VIL has average download speed of 17.56 Mbps and average upload speed of 8.08 Mbps across the measured routes for city drive. (refer table -19)
- Chikmagalur Railway Station, Kodandarama Temple and Shri Deviramma Temple have less download speed (less than 10 Mbps) out of total 10 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-33, 36 & 41)
- Kodandarama Temple and Shri Deviramma Temple have less upload speed (less than 2 Mbps) out of total 10 Hotspots in auto-selection mode (5G/4G/3G/2G). (refer table-36 & 41)
- Chikmagalur Institute of Medical Sciences Walk test location has less download speed (less than 10 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table-58)
- VIL has average download speed of 21.99 Mbps and average upload speed of 10.16 Mbps across the measured routes for highway drive. (refer table -67)

6. Annexure

6.1 Route wise coverage map

6.1.1 City

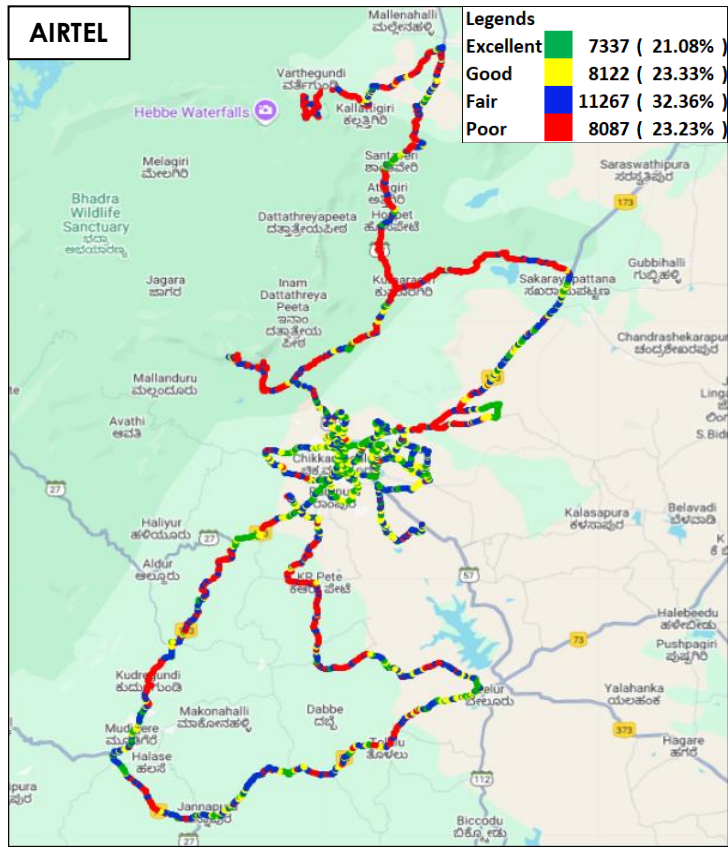


Figure-42: Signal strength 3G/2G network mode – AIRTEL.

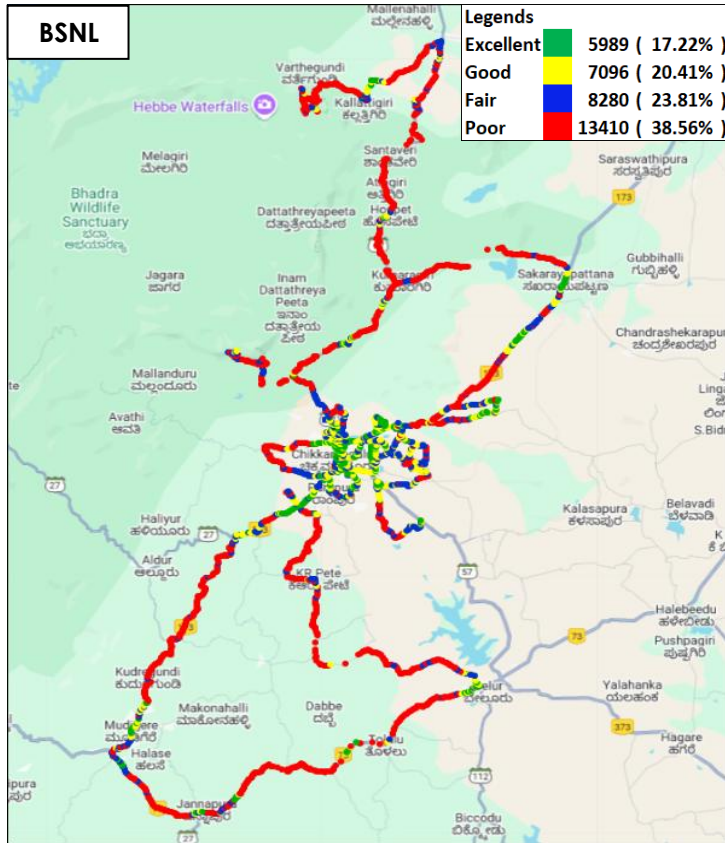


Figure-43: Signal strength 3G/2G network mode – BSNL.

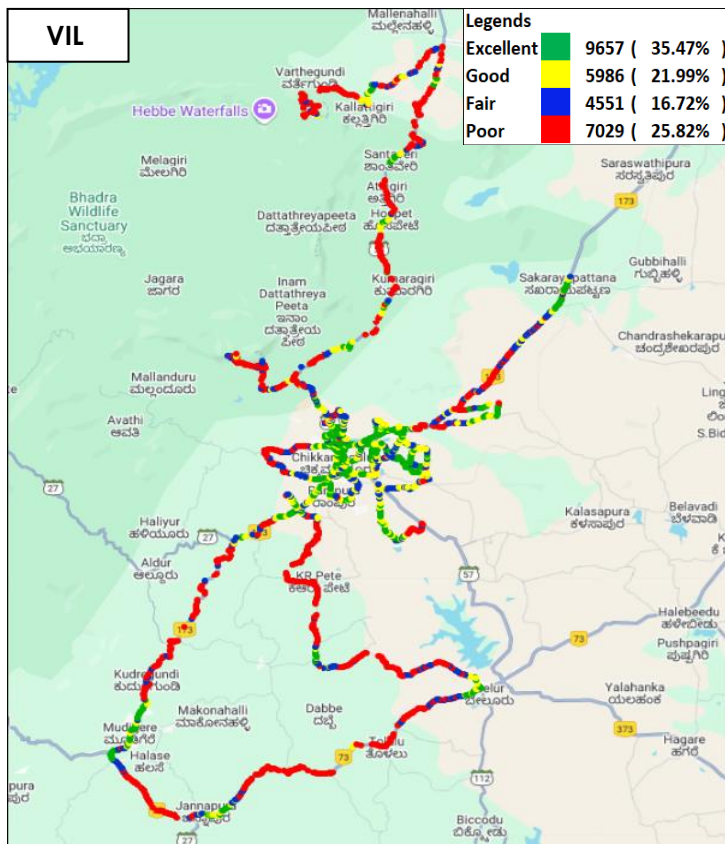


Figure-44: Signal strength 3G/2G network mode – VIL.

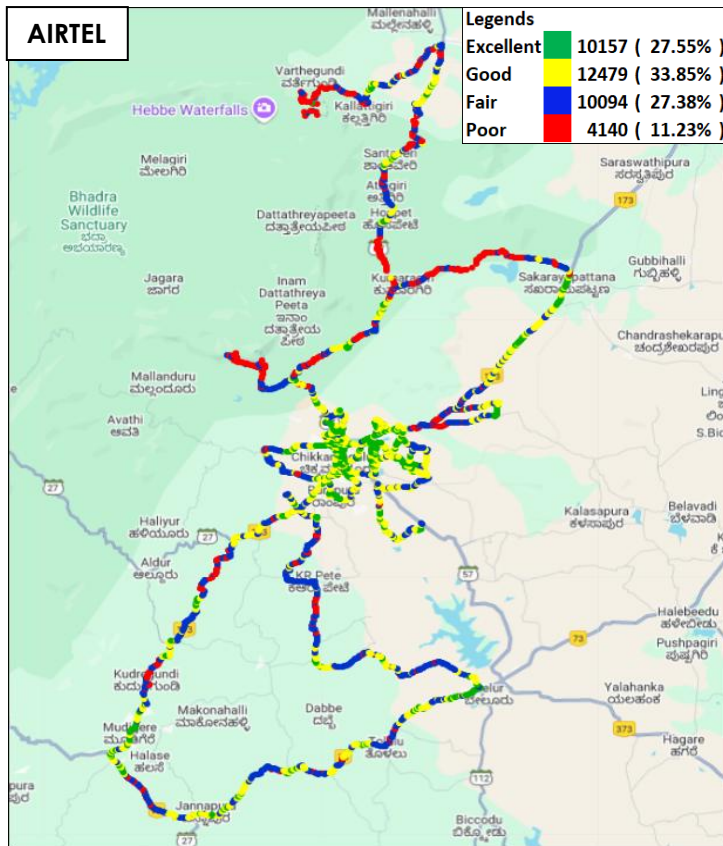


Figure-45: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL.

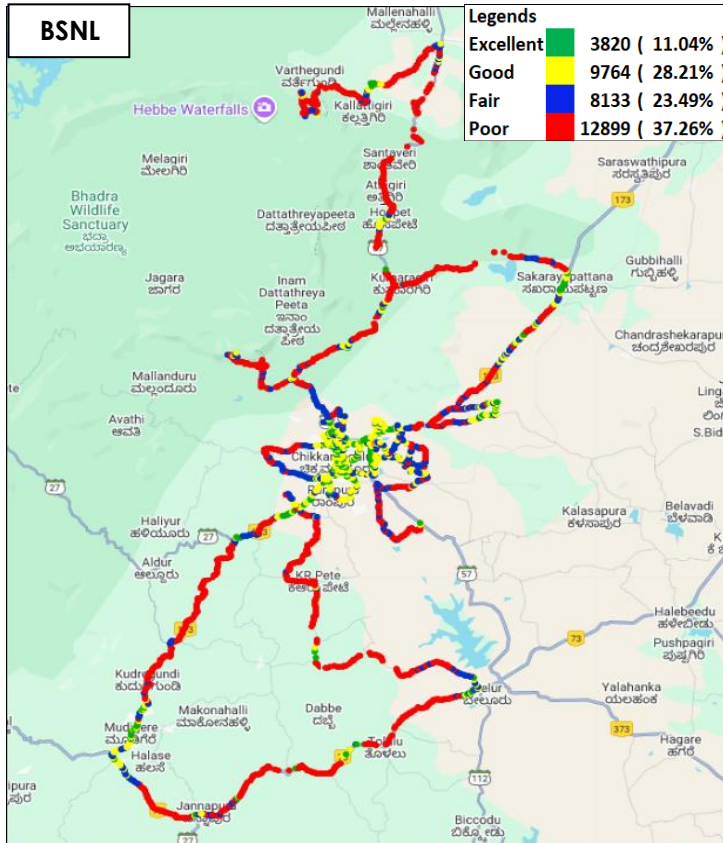


Figure-46: Signal strength auto-selection mode 5G/4G/3G/2G – BSNL.

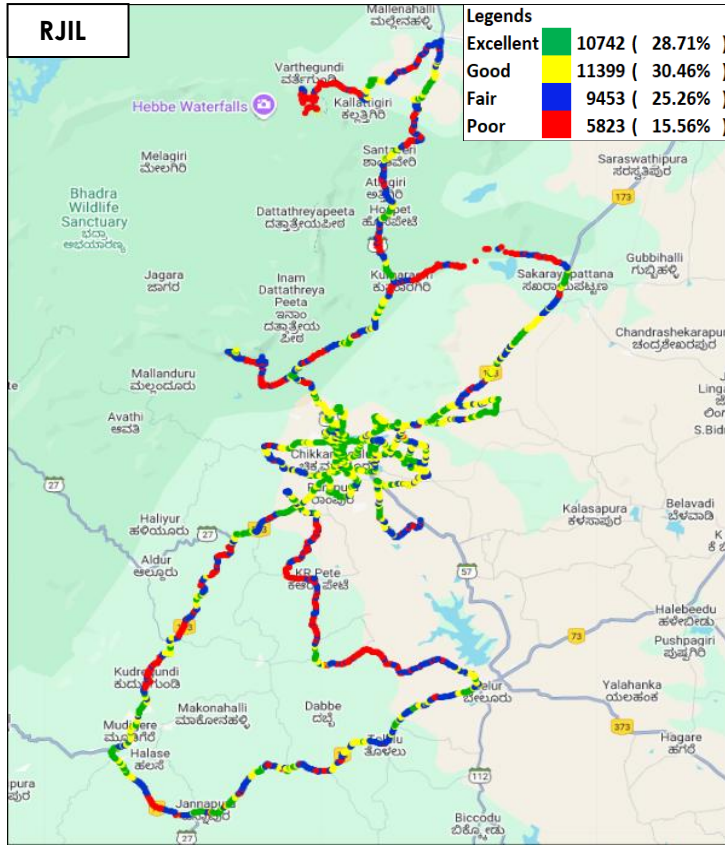


Figure-47: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL.

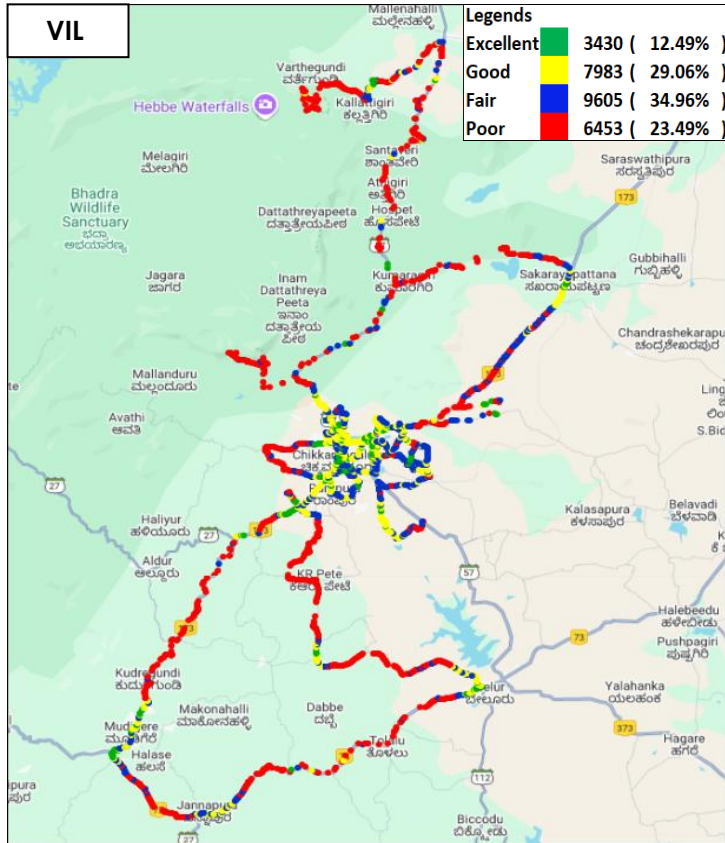


Figure-48: Signal strength auto-selection mode 5G/4G/3G/2G – VIL.

6.1.2 Highway

i) Bengaluru to Chikmagalur

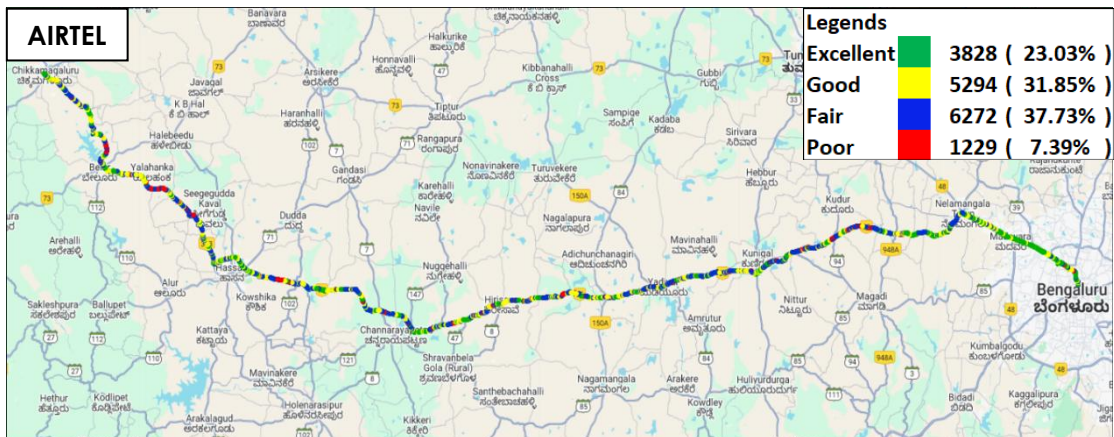


Figure-49: Signal strength 3G/2G network mode – AIRTEL.

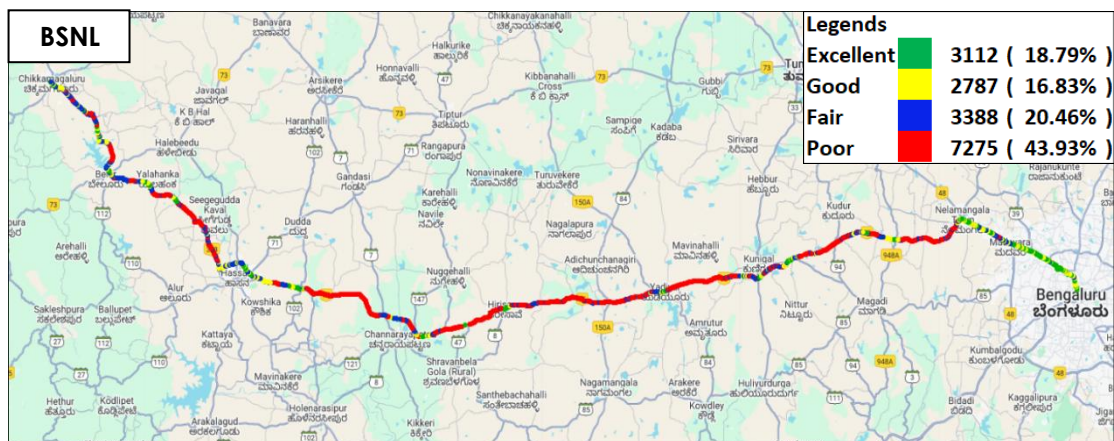


Figure-50: Signal strength 3G/2G network mode – BSNL.

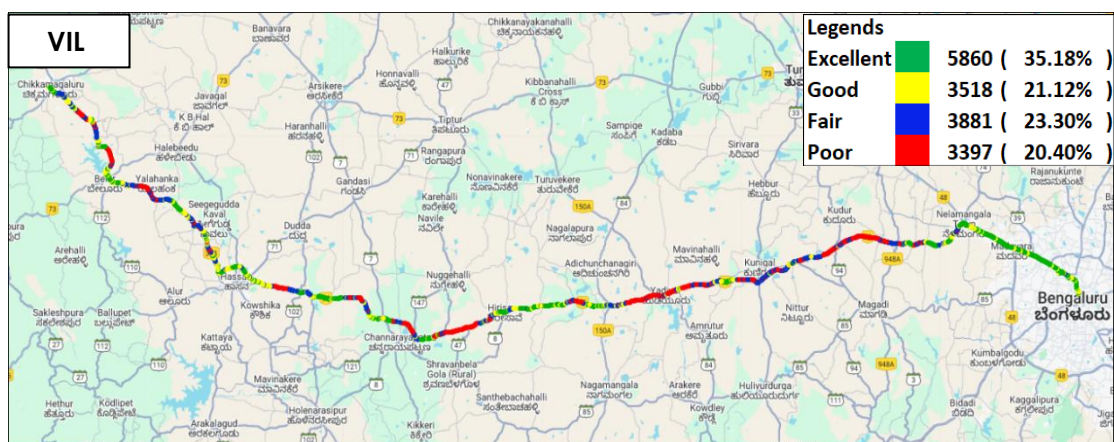


Figure-51: Signal strength 3G/2G network mode – VIL

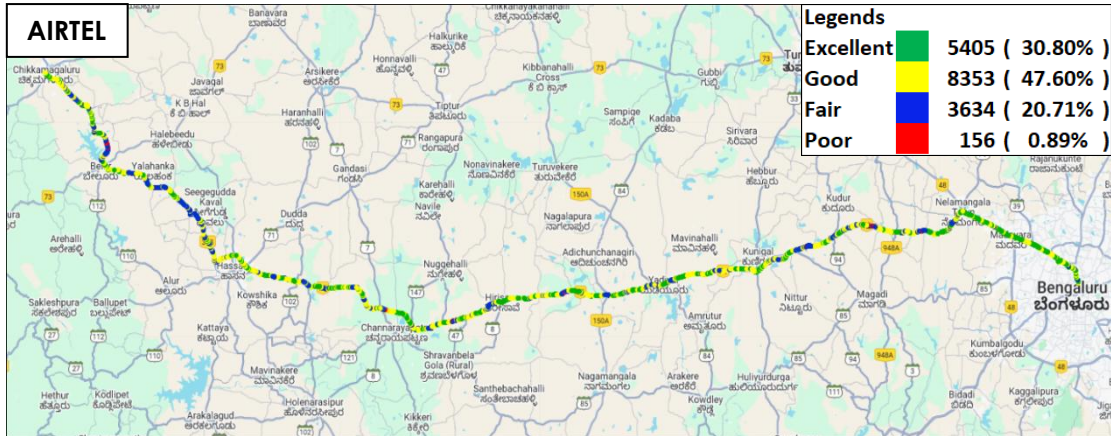


Figure-52: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL.

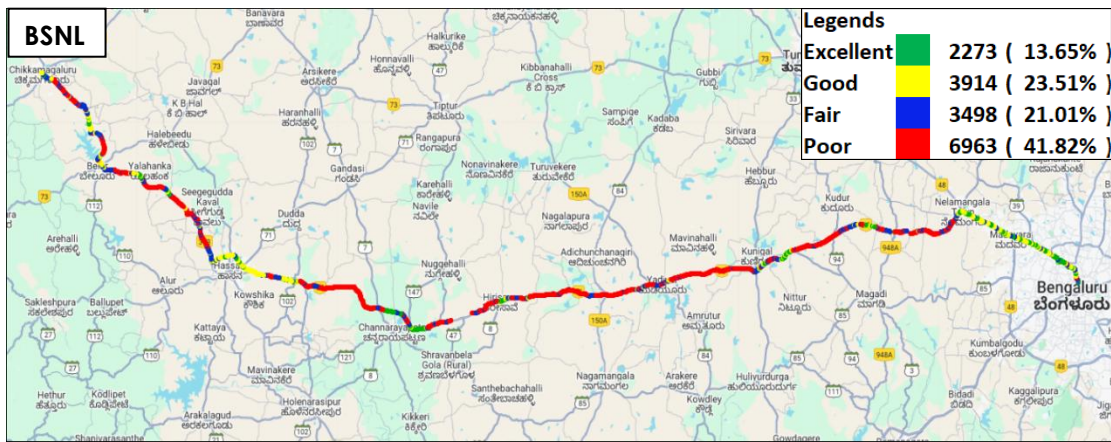


Figure-53: Signal strength auto-selection mode 5G/4G/3G/2G – BSNL.

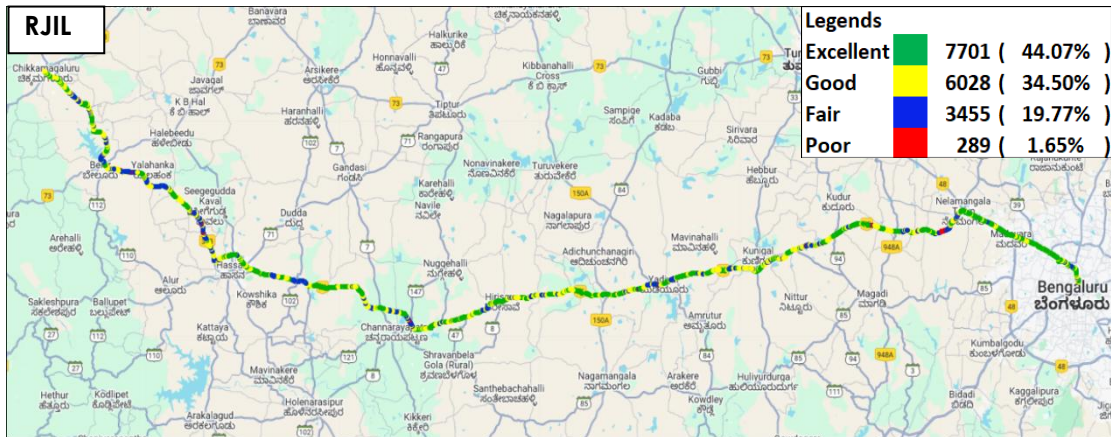


Figure-54: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL.

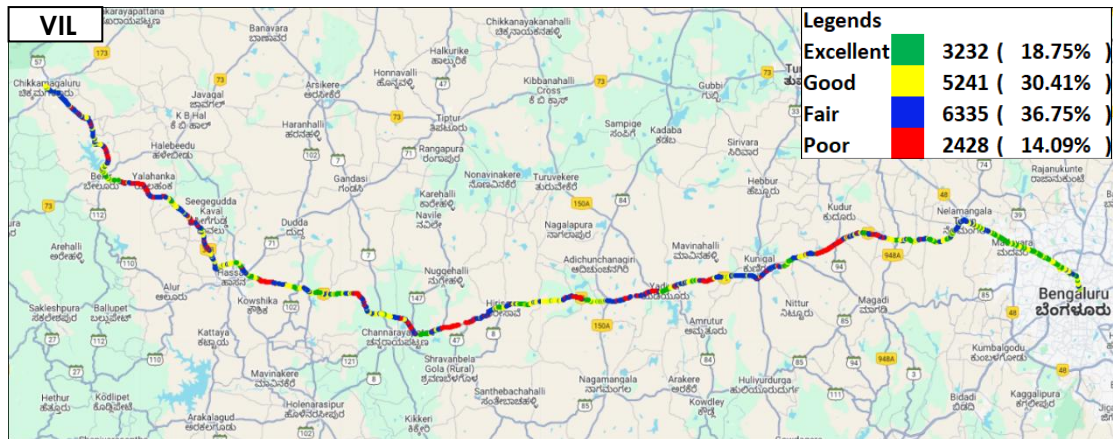


Figure-55: Signal strength auto-selection mode 5G/4G/3G/2G – VIL.

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/ 180 Sec
Wait/ Guard Time		15 Sec

Table-68: 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.ircctc.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
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Table-69: 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.

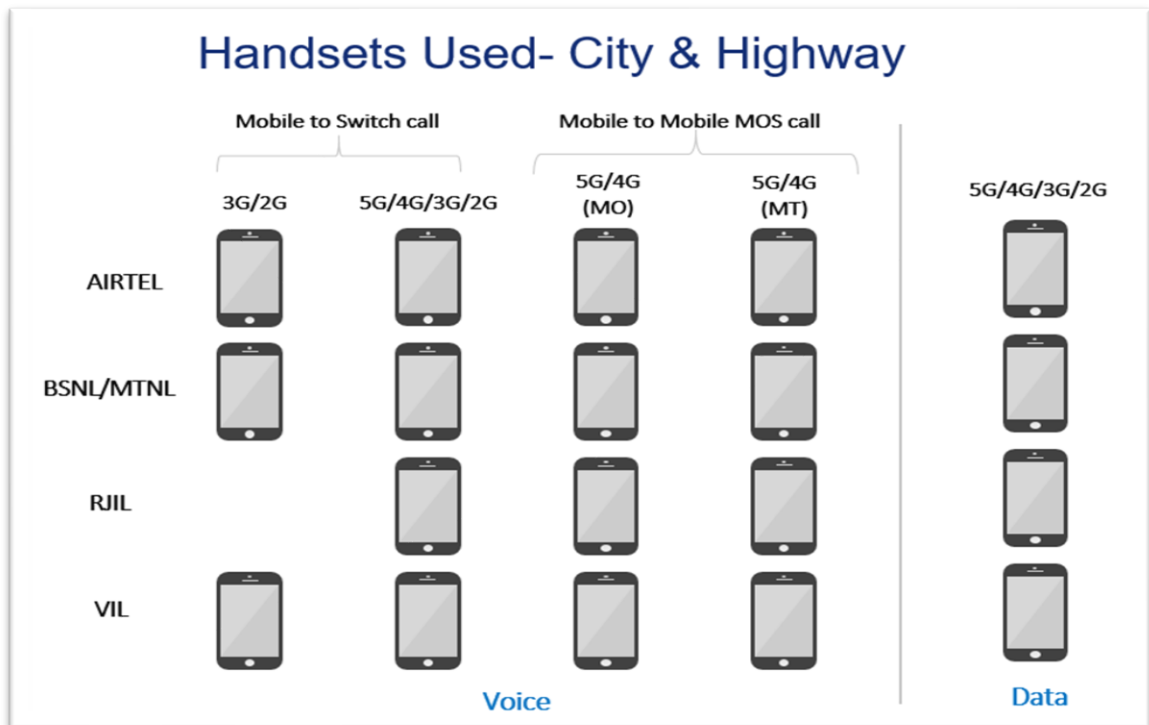


Figure-56: Number of handsets used in city & highway drive

MO: Mobile originating

MT: Mobile terminating

Handsets Used- Railway/Metro/Walk Test/ Hotspot & Coastal Area

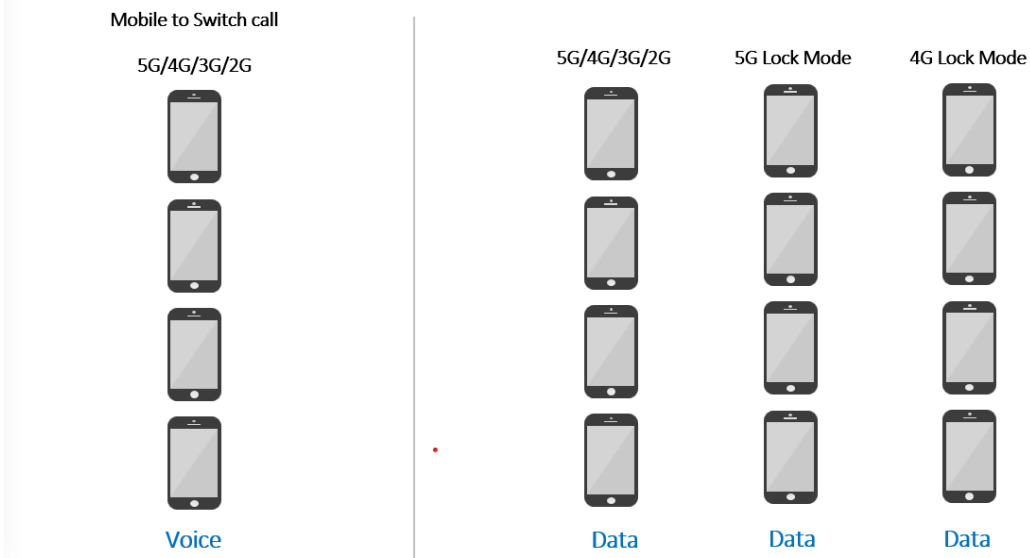


Figure-57: Number of handsets used in railway/metro/walktest/hotspot & coastal area

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

7.1.2 Drive test Methodology

(a) Dynamic voice testing (on the move)

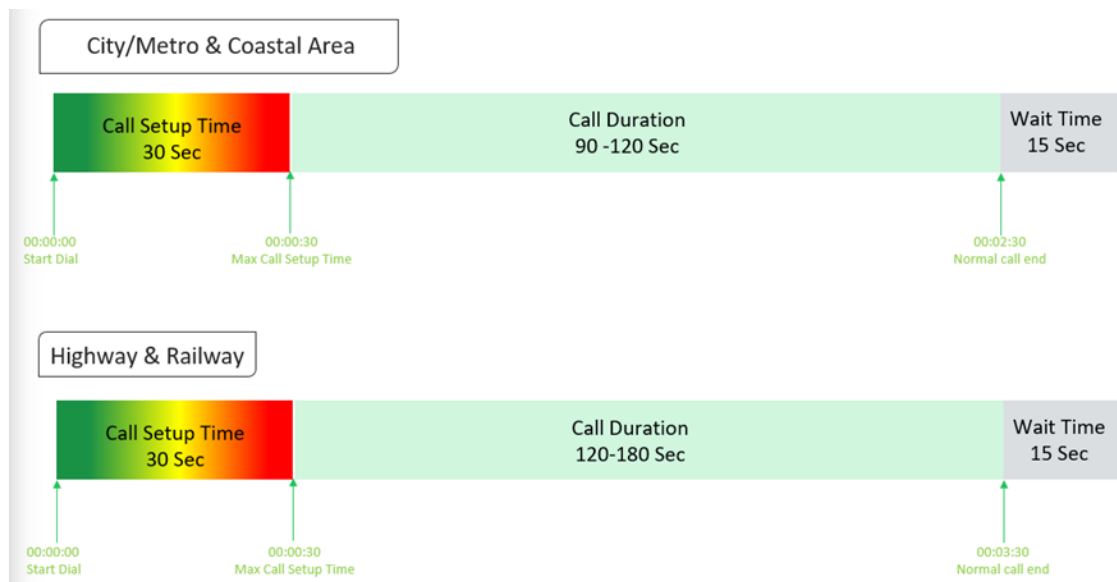


Figure-58: Voice test script for city/railway/metro/highway & coastal area

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

(b) Hotspot voice testing



Figure-59: Voice test script for walktest/hotspot

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

(c) Dynamic Data (internet) test

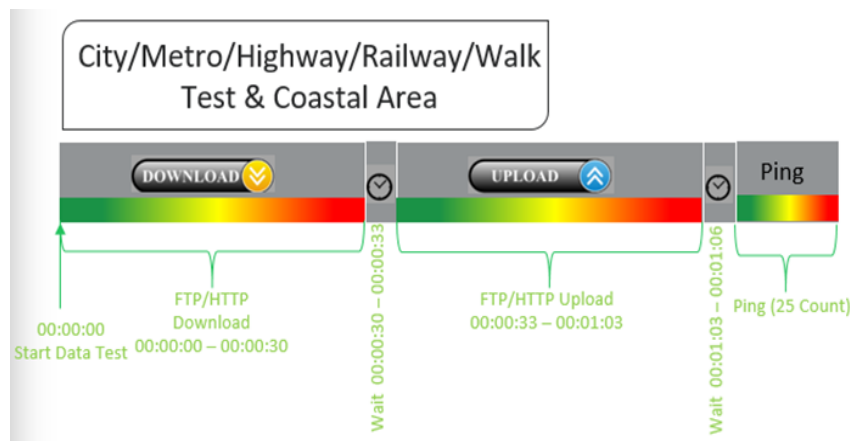


Figure-60: Data test script used in city/metro/railway/highway/walk test & coastal area

(d) Static Data(internet) testing

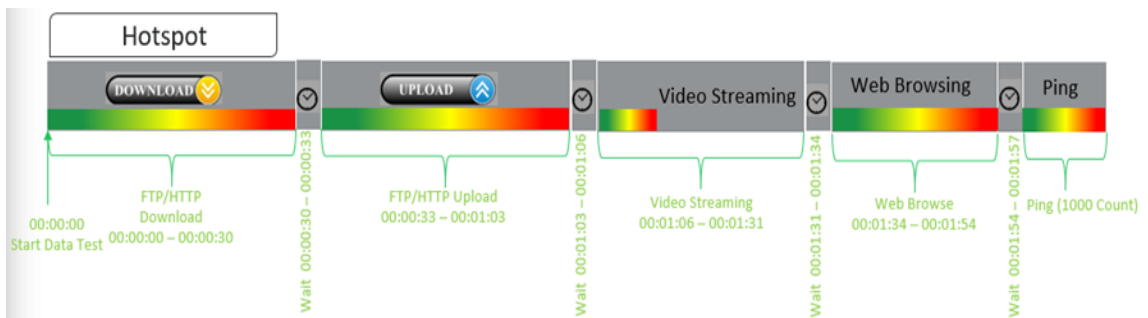


Figure-61: Data test script used at hotspot

- 5 Data iteration done at each hotspot location.
- Min. 5 iteration made during the walk test.
- Web browsing duration mentioned above is for one web site only.
- 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> <ul style="list-style-type: none"> (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. <p>CSSR = (Total Call Established/ Total Call Attempt) *100</p> <p>As per QoS Regulation 2024 benchmark value is >=98%</p>
Drop Call Rate	<p>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</p> <p>Drop Call Rate = (Total Drop Call/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> <p>If a call observes multiple silence count ≥ 4 sec in a particular established call it has been taken as one silent event.</p>

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 S_i is the RTP timestamp from packet i, and R_i 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> $D(i,j) = (R_j - R_i) - (S_j - S_i)$ <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> $J(i) = J(i-1) + (D(i-1,i) - J(i-1))/16 \text{ or } 8$																																		
Downlink Packet Drop Rate	<p>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.</p> <p>This KPI is calculated from MOS call for packet call only (VoNR/VoLTE)</p>																																		
Uplink Packet Drop Rate	<p>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).</p>																																		
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-70: 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	<p>(total download session established (successfully connected to server)/ total download session attempt) *100.</p> <p>This KPI has been calculated for Hotspot only.</p>

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> <p>* 90th percentile for Packet loss rate has been reported in overall Hotspot performance summary.</p>

Table-71: 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: 2025.06.12
10:30:12 +05'30'