



TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Himachal Pradesh LSA

June 2026

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1. Introduction

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

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

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

2. Executive Summary (LSA)

2.1 Drive test details

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

S. No	Drive test route	Type of route	Distance covered (KMs)	From date	To date
1	Cities & adjoining area of Shimla and Solan Districts	City	384.8	15-June-2026	18-June-2026
2	Shimla	Inter Operator Calling	1 Location	19-June-2026	19-June-2026
3	Cities & adjoining area of Shimla and Solan Districts	Hotspot	12 Locations	15-June-2026	19-June-2026
4	Shimla	Walk test	4.9	18-June-2026	19-June-2026
5	Solan to Shimla	Highway	35.9	15-June-2026	15-June-2026

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.

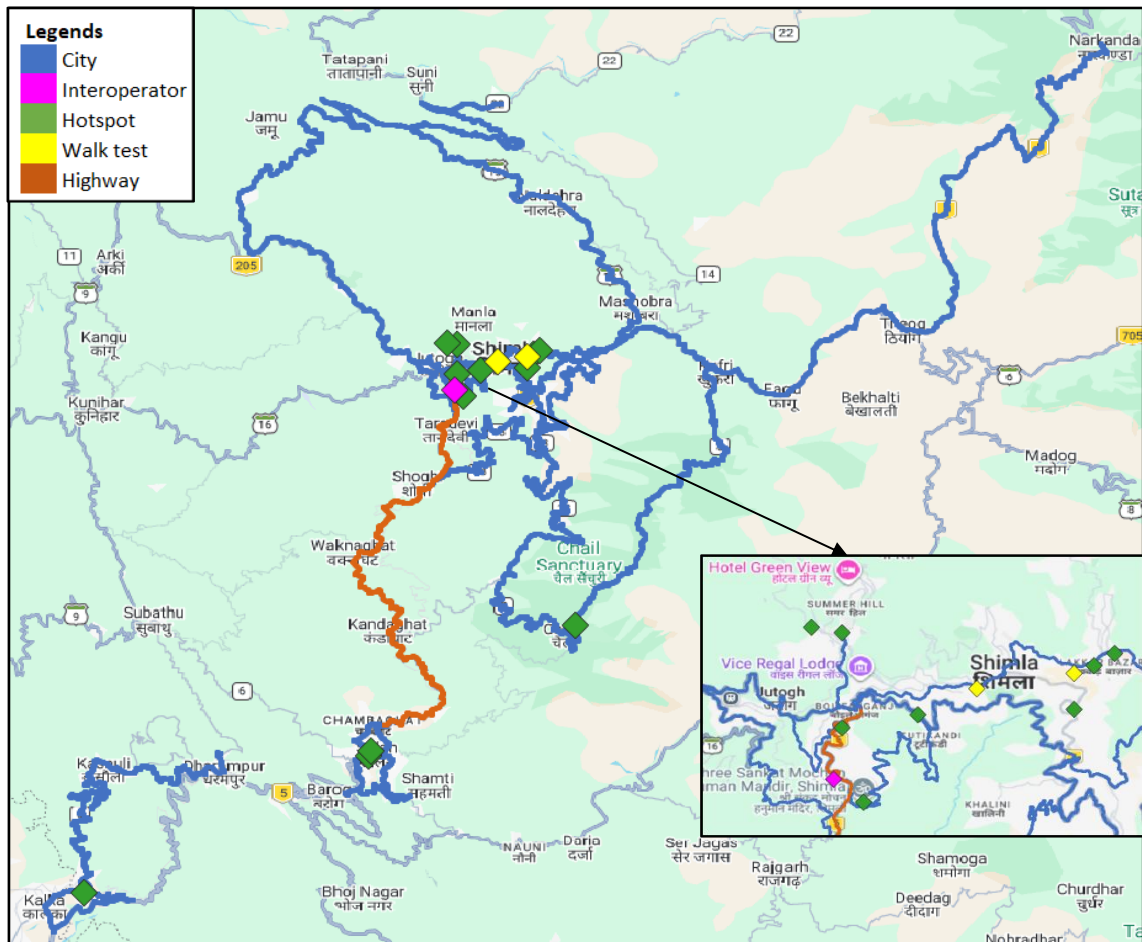


Figure-1: Drive test routes

2.3 Summary of areas covered

a) City

Shimla- Bijli, Panthaghathi, Rajana, Junga, Sadhupul, Chail, Koti, Kufri, Sanjauli, New Shimla, Boileauganj, Bhutwa, Okru, Thog, Chaba, Basantpur, Datar, Mashobra, Fagu, Theog, Chundi, Shillaru and Narkanda etc.

Solan-Sector 6, Sector 3, Tipra, Kalka, Parwanoo, Taksal, Jangeshu waterfall, Garkhal, Dharampur, Deoghat, Chambaghat, Kotla Nala and Sumti etc.

b) Hotspot

1. Civil Hospital Chail
2. DAV School Shimla
3. District Court Shimla
4. District Court Solan
5. ESI Hospital Parwanoo
6. High Court Shimla
7. HP University Shimla
8. IGMCH and Hospital Shimla
9. ISBT Shimla
10. ISBT Solan
11. Shri Sankat Mochan Hanuman Mandir Shimla

12. University Institute of Information Technology Shimla

c) Walk test

1. Mall Road Shimla
2. Shimla Railway Station

d) Highway

Solan to Shimla – Chamabghat, Salogra, Kandaghat, Majhol, Kashmari, Tara Devi and Boileauganj etc.

2.4 Telecom service providers detected frequency bands

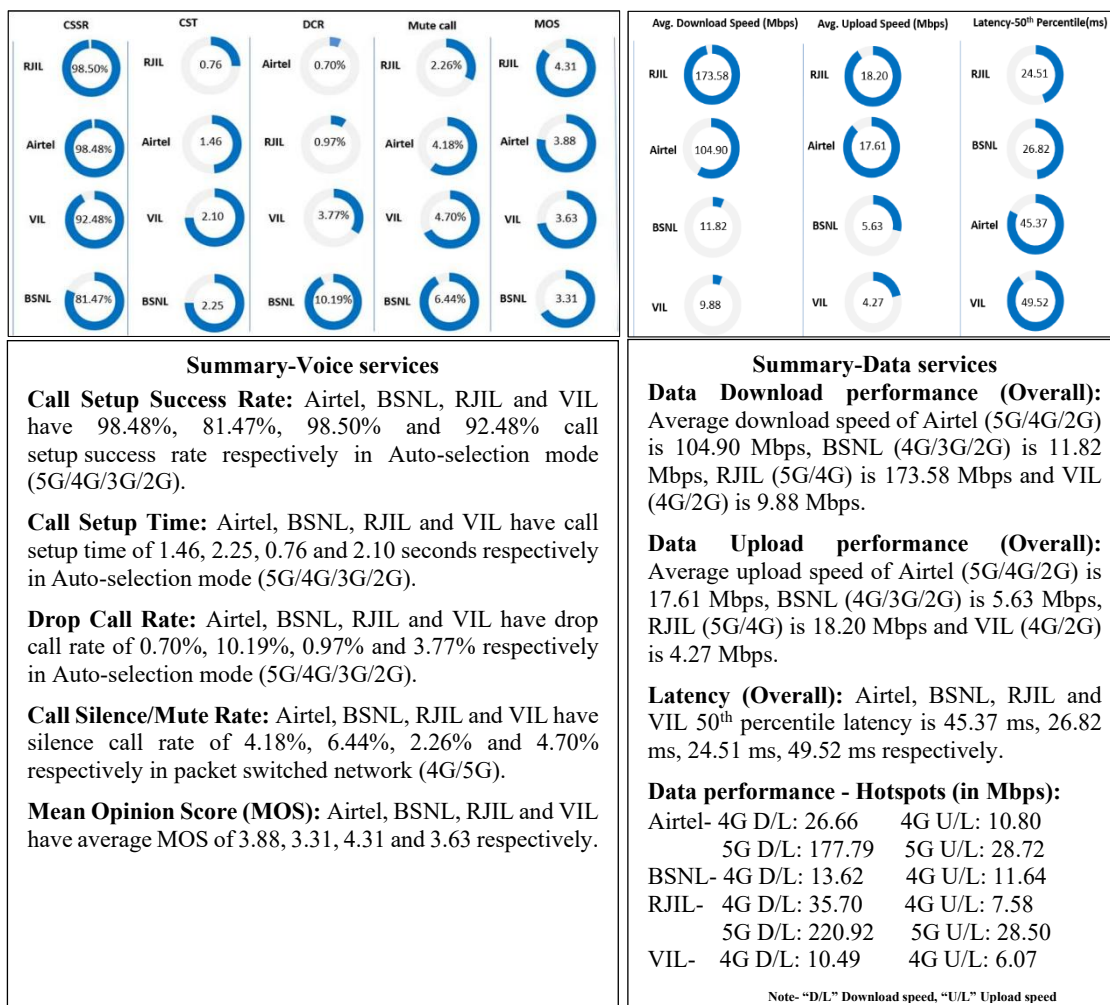
Technologies covered during the IDT and frequency bands in use are summarised in table below:

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

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

2.5 Performance against key QoS parameters

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



- The Poor signal strength in auto-selection mode (5G/4G/3G/2G) during **voice** testing has been observed in 7.75%, 17.78%, 4.63% & 24.93% of the **Shimla District IDT route** in case of Airtel, BSNL, RJIL and VIL respectively. {refer **figure- 77 to 80** as per the **Section 6.1** under Para-6 (Annexure)}
- The Poor signal strength in auto-selection mode (5G/4G/3G/2G) during **data** testing has been observed in 23.41%, 20.57%, 19.17% & 29.10% of the **Shimla District IDT route** in case of Airtel, BSNL, RJIL and VIL respectively. {refer **figure- 81 to 84** as per the **Section 6.1** under Para-6 (Annexure)}
- The Poor signal strength in auto-selection mode (5G/4G/3G/2G) during **voice** testing has been observed in 3.82%, 5.55%, 4.00% & 9.23% of the **Solan District IDT route** in case of Airtel, BSNL, RJIL and VIL respectively. {refer **figure- 88 to 91** as per the **Section 6.1** under Para-6 (Annexure)}
- The Poor signal strength in auto-selection mode (5G/4G/3G/2G) during **data** testing has been observed in 8.75%, 4.17%, 11.09% & 10.48% of the **Solan District IDT route** in case of Airtel, BSNL, RJIL and VIL respectively. {refer **figure- 92 to 95** as per the **Section 6.1** under Para-6 (Annexure)}
- The Poor signal strength in auto-selection mode (5G/4G/3G/2G) during **voice** testing has been observed in 2.20%, 14.07%, 0.86% & 14.28% of the **Solan to Shimla Highway IDT route** in case of Airtel, BSNL, RJIL and VIL respectively. {refer **figure- 99 to 102** as per the **Section 6.1** under Para-6 (Annexure)}
- The Poor signal strength in auto-selection mode (5G/4G/3G/2G) during **data** testing has been observed in 14.63%, 19.18%, 9.50% & 17.42% of the **Solan to Shimla Highway IDT route** in case of Airtel, BSNL, RJIL and VIL respectively. {refer **figure- 103 to 106** as per the **Section 6.1** under Para-6 (Annexure)}

QoS Performance Analysis- Himachal Pradesh 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 Himachal Pradesh LSA during the month of June-2026 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	546	564	552
Call Setup Success Rate %	97.62	94.68	94.02
Drop Call Rate %	2.06	5.06	3.28
Call Setup Time-Average (Second)	3.37	4.37	4.54
Handover Success Rate %	97.33	97.94	95.08

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

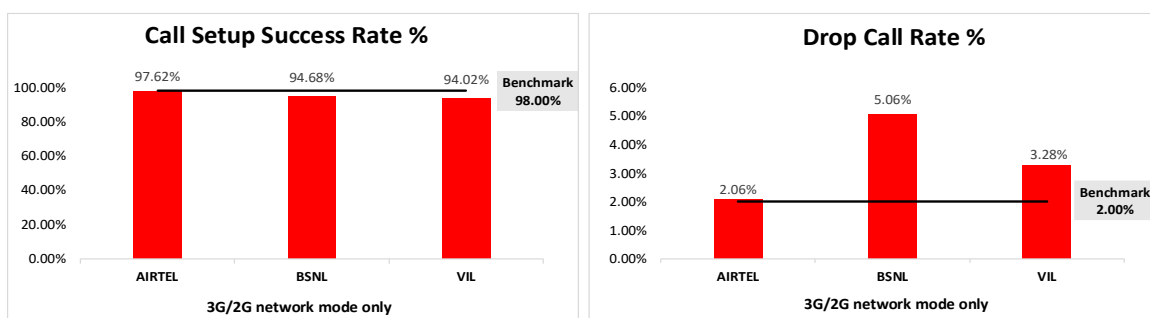


Figure-2: Call setup success rate and drop call rate performance.

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	9	NA
2G	535	314	275

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	726	831	732	745
Call Setup Success Rate %	98.48	81.47	98.50	92.48
Drop Call Rate %	0.70	10.19	0.97	3.77
Call Setup Time-Average (Second)	1.46	2.25	0.76	2.10
Handover Success Rate %	99.91	99.69	99.70	99.77

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

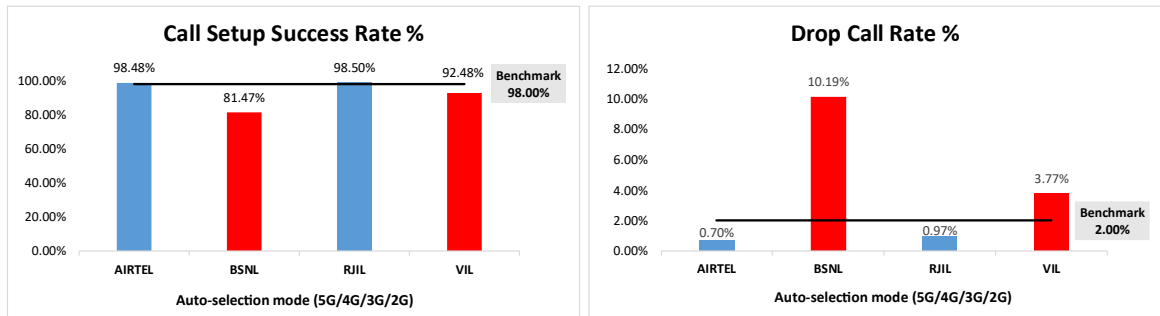


Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	526	450	532	489
Number of silences call for >4 Sec	22	29	12	23
Silence Call Rate %	4.18	6.44	2.26	4.70
Number of silence instances for >4 Sec	29	36	18	37
Number of silence instances for >3 Sec	49	72	23	49
Number of silence instances for >2 sec	105	154	52	111
RTP Jitter (4G & 5G) in ms	3.53	7.61	16.20	17.13
Packet loss Rate Downlink %	1.91	6.92	2.30	3.85
Packet loss Rate Uplink %	1.84	6.22	2.36	3.41

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

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	601	NA
4G	1160	733	868	419
3G	NA	6	NA	NA
2G	9	117	NA	109

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

Note-

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

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

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

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls table-6	3242	2243	3223	2732
Speech Quality (Average MOS)	3.88	3.31	4.31	3.63
Number of samples with MOS ≥ 4 to < 5 (Excellent)	2486	1065	2639	1469
Number of samples with MOS ≥ 3 to < 4 (Good)	536	351	304	826
Number of samples with MOS ≥ 2 to < 3 (Fair)	88	424	99	183
Number of samples with MOS ≥ 1 to < 2 (Poor)	132	403	181	254
%age of samples with MOS ≥ 4 to < 5 (Excellent)	76.68%	47.48%	81.88%	53.77%
%age of samples with MOS ≥ 3 to < 4 (Good)	16.53%	15.65%	9.43%	30.23%
%age of samples with MOS ≥ 2 to < 3 (Fair)	2.71%	18.90%	3.07%	6.70%
%age of samples with MOS ≥ 1 to < 2 (Poor)	4.07%	17.97%	5.62%	9.30%

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

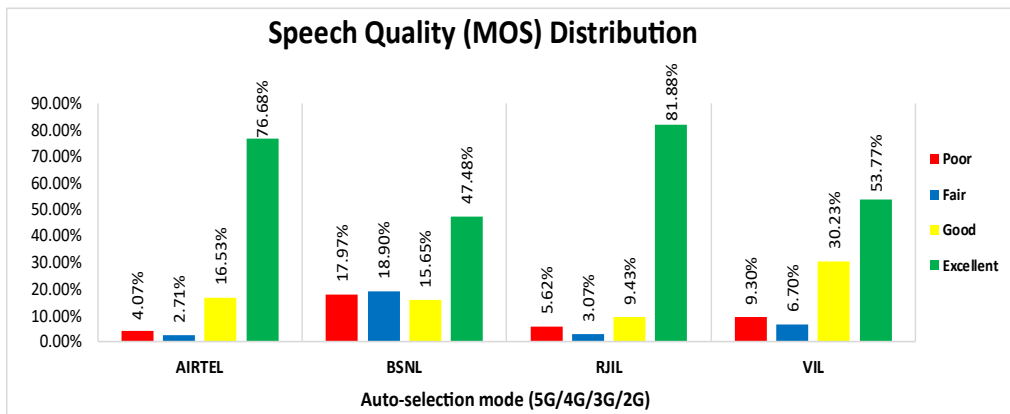


Figure- 4: Distribution of samples in MOS range.

(d) Inter-service provider voice call performance: To check the performance of inter-service providers call setup success rate, total 12 to 14 inter operator calls were attempted at one location which is Patrakar Vihar, Chakker Court Complex Rd, Bagh, Shimla. 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	100.00	NA	100.00	100.00
RJIL	100.00	91.67	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	4.80	1.78	3.12
BSNL	2.77	NA	3.67	2.32
RJIL	2.26	4.68	NA	2.11
VIL	2.96	6.71	2.18	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	104.90	11.82	173.58	9.88
	80th Percentile	174.39	17.78	285.93	15.65
	20th Percentile	16.25	4.86	33.99	2.61
Upload Throughput (Mbits/s)	Average	17.61	5.63	18.20	4.27
	80th Percentile	32.85	9.61	32.30	6.95
	20th Percentile	2.31	1.62	2.56	1.29
Latency (ms)	50th Percentile	45.37	26.82	24.51	49.52

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

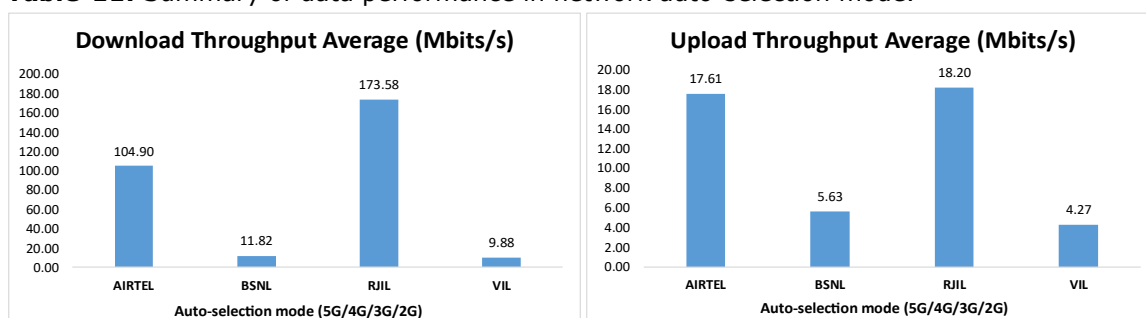


Figure- 5: Download and Upload throughput.

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	658	NA
4G	1329	819	588	446
3G	NA	9	NA	NA
2G	9	51	NA	72

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

Note-

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

Detailed QoS Performance Analysis

4. Detailed QoS performance analysis

4.1 Overview

This section covers analysis on performance of various categories of drives like city, hotspots, walktest and highway 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 15th June 2026 to 18th June 2026 in Cities & adjoining area of Shimla and Solan Districts. (Refer Table-1)

4.2.1 Shimla District

4.2.1.1 Drive test route

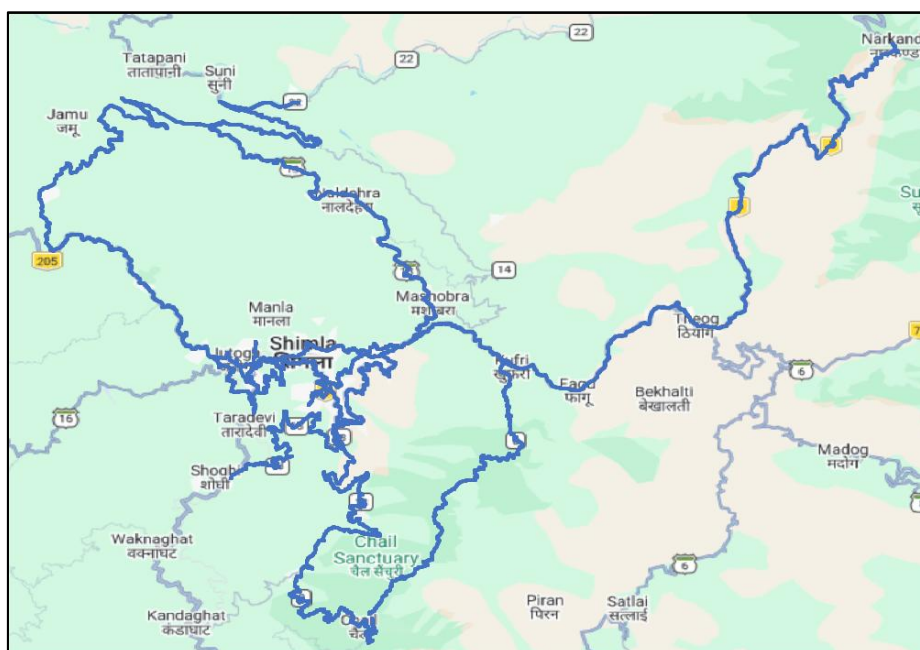


Figure- 6: Drive test routes

4.2.1.2 Areas covered

Bijli, Panthaghati, Rajana, Junga, Sadhupul, Chail, Koti, Kufri, Sanjauli, New Shimla, Boileauganj, Bhutwa, Okru, Thog, Chaba, Basantpur, Datyar, Mashobra, Fagu, Theog, Chundi, Shillaru and Narkanda etc.

4.2.1.3 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	405	420	411
Call Setup Success Rate %	98.77	94.76	94.65
Drop Call Rate %	2.00	4.27	3.34
Call Setup Time-Average (Second)	3.39	4.75	4.38
Handover Success Rate %	97.34	97.50	94.38

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

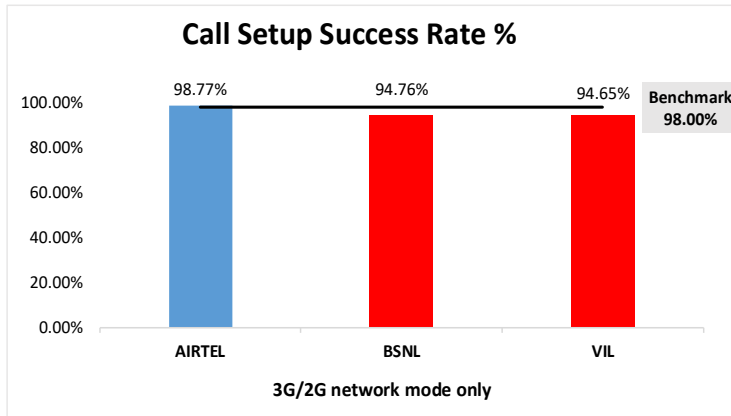


Figure-7: Performance for call setup success rate.

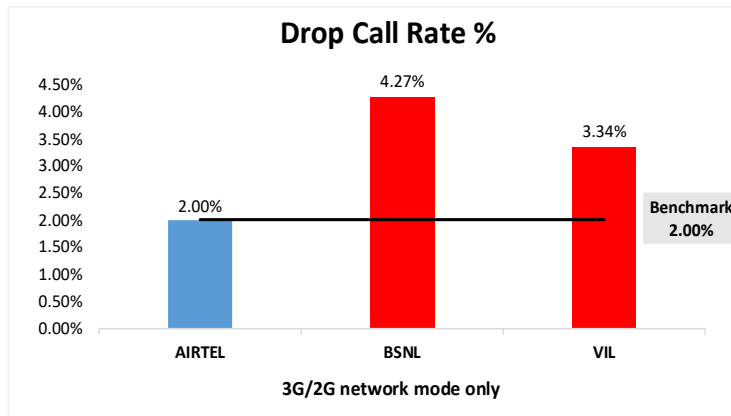


Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	3.31%	NA
2G	99.93%	95.80%	99.11%
Limited Service	0.07%	0.90%	0.89%

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

Note-

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

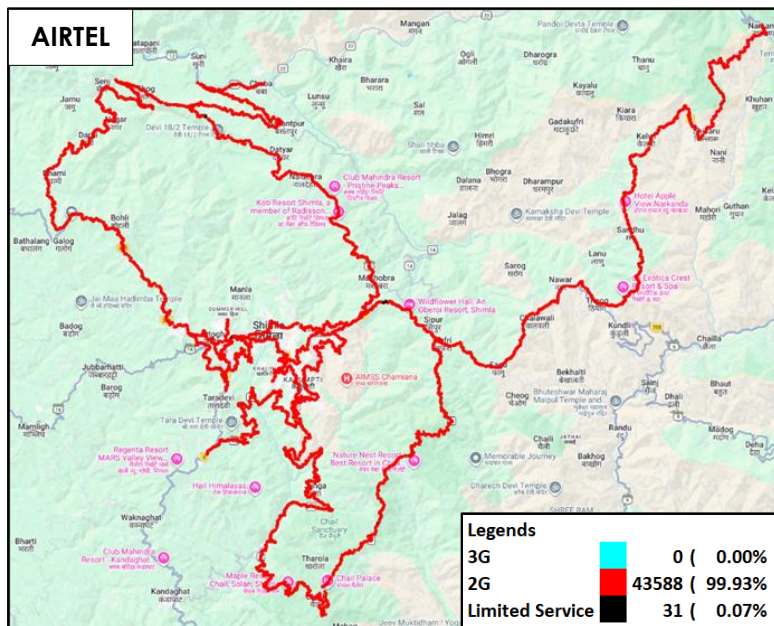


Figure-9: Serving technology plots 3G/2G network mode - AIRTEL

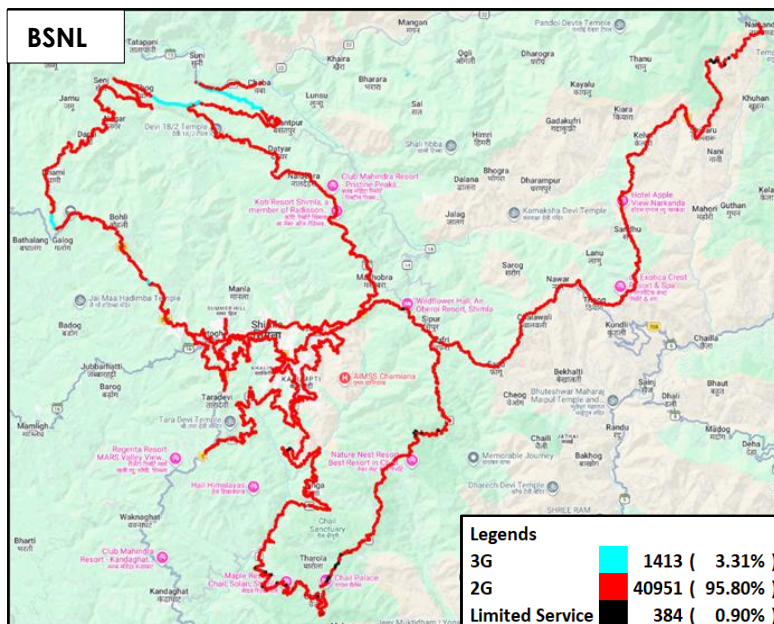


Figure-10: Serving technology plots 3G/2G network mode - BSNL.

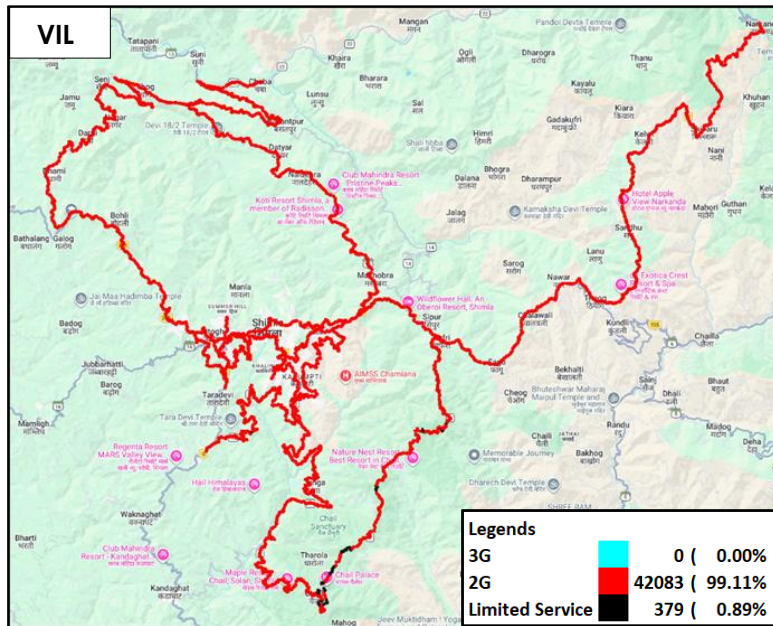


Figure-11: Serving technology plots 3G/2G network mode - VIL.

(c) Network Signal Strength Distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (Refer figure-74, 75 & 76 for map view)

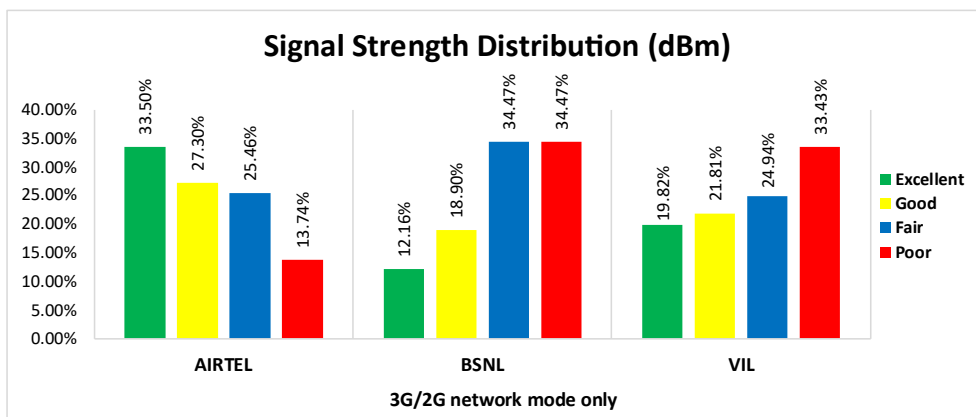


Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 33% of samples falling in the excellent signal strength category.
- BSNL has 12% of samples falling in the excellent signal strength category.
- VIL has 20% 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	414	499	418	437
Call Setup Success Rate %	99.28	77.96	100.00	88.56
Drop Call Rate %	0.24	12.08	0.24	5.17
Call Setup Time Average (Second)	1.51	2.58	0.76	2.44
Handover Success Rate %	99.87	99.62	99.66	99.63

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

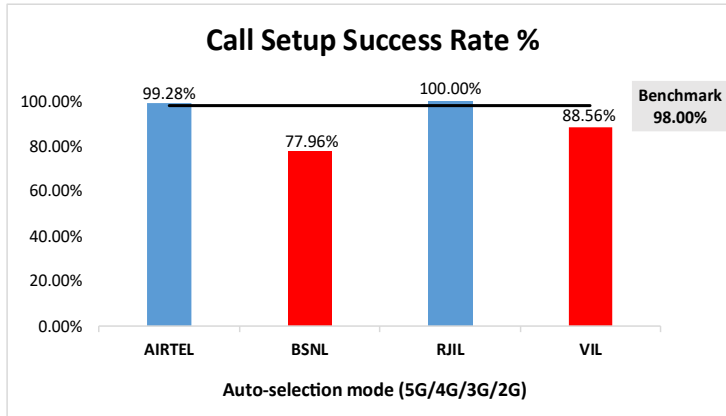


Figure-13: Performance for call setup success rate.

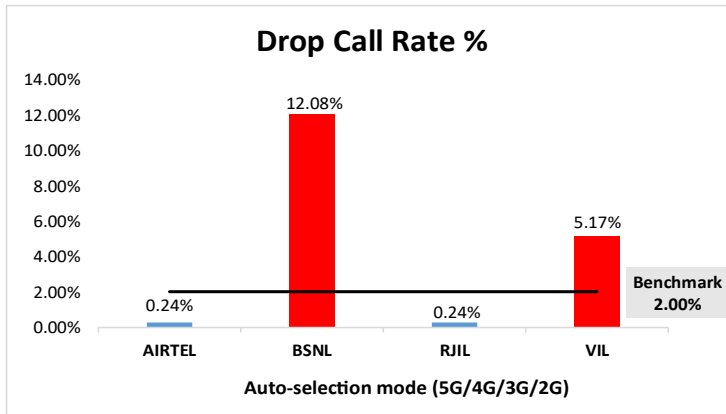


Figure-14: Performance for drop call rate.

Parameter	Service Provider Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	396	326	400	359
Number of silences call for >4 Sec	15	22	6	17
Silence Call Rate %	3.79	6.75	1.5	4.74
Number of silence instances for >4 Sec	19	27	7	30
Number of silence instances for >3 Sec	35	50	11	41
Number of silence instances for >2 sec	82	113	34	81
RTP Jitter (4G & 5G) in ms	3.63	7.16	16.45	16.52
Packet loss Rate Downlink %	1.95	7.22	2.02	4.27
Packet loss Rate Uplink %	1.73	6.62	2.26	3.55

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

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

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

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls in table-16	2337	1588	2322	1889
Speech Quality (Average MOS)	3.87	3.24	4.29	3.68
Number of samples with MOS ≥ 4 to < 5 (Excellent)	1775	704	1881	1058
Number of samples with MOS ≥ 3 to < 4 (Good)	401	255	221	575
Number of samples with MOS ≥ 2 to < 3 (Fair)	61	327	79	96
Number of samples with MOS ≥ 1 to < 2 (Poor)	100	302	141	160
%age of samples with MOS ≥ 4 to < 5 (Excellent)	75.95%	44.33%	81.01%	56.01%
%age of samples with MOS ≥ 3 to < 4 (Good)	17.16%	16.06%	9.52%	30.44%
%age of samples with MOS ≥ 2 to < 3 (Fair)	2.61%	20.59%	3.40%	5.08%
%age of samples with MOS ≥ 1 to < 2 (Poor)	4.28%	19.02%	6.07%	8.47%

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

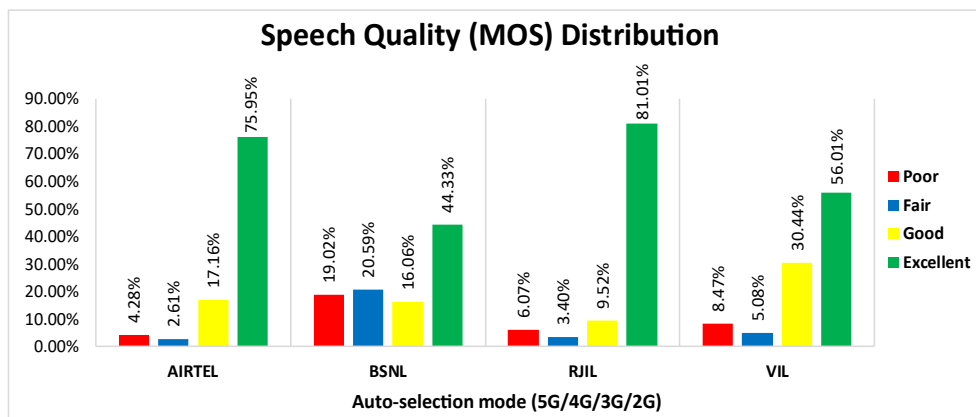


Figure-15: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	1.32%	NA	62.08%	NA
4G	97.37%	82.18%	37.89%	76.42%
3G	NA	3.83%	NA	NA
2G	1.23%	13.02%	NA	21.94%
Limited Service	0.09%	0.97%	0.02%	1.64%

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

Note-

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

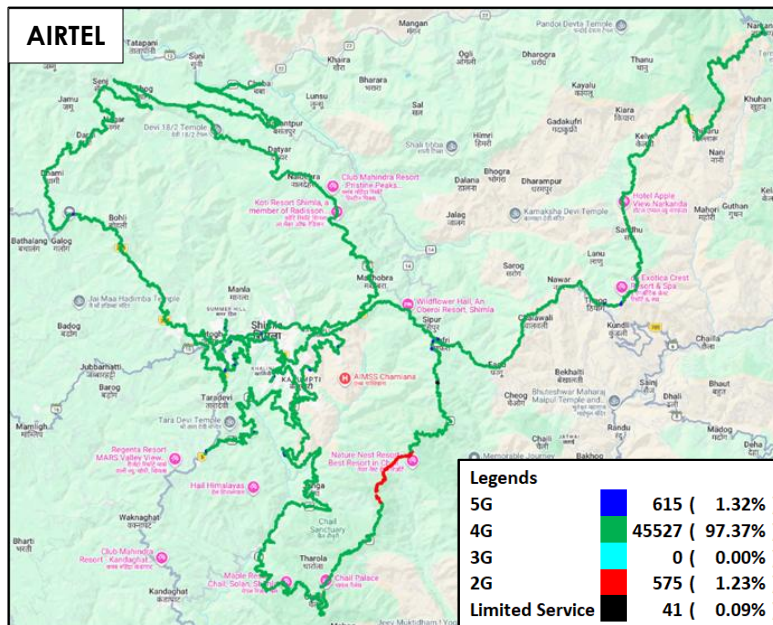


Figure-16: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

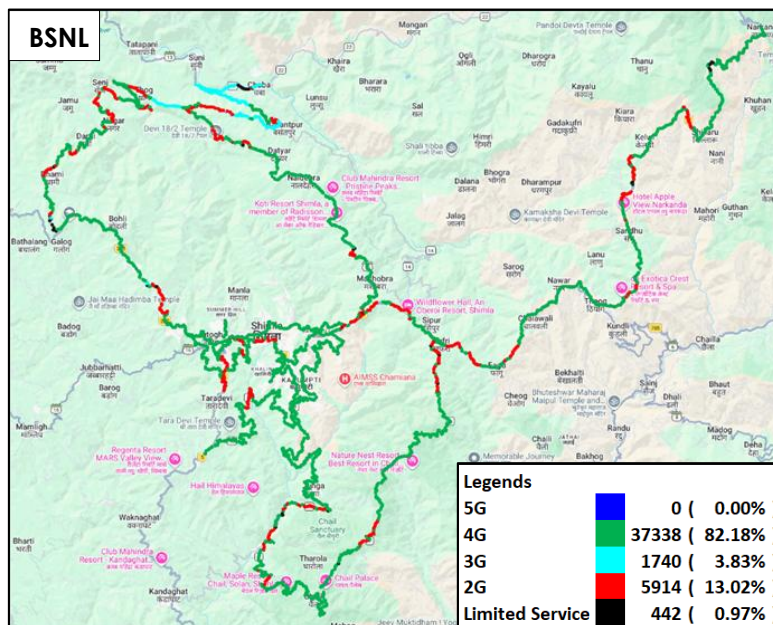


Figure-17: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - BSNL.

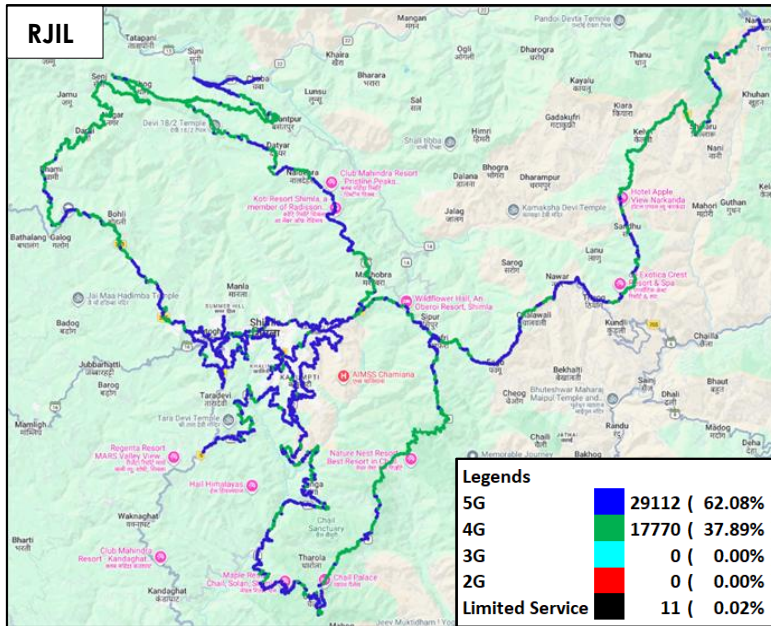


Figure-18: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

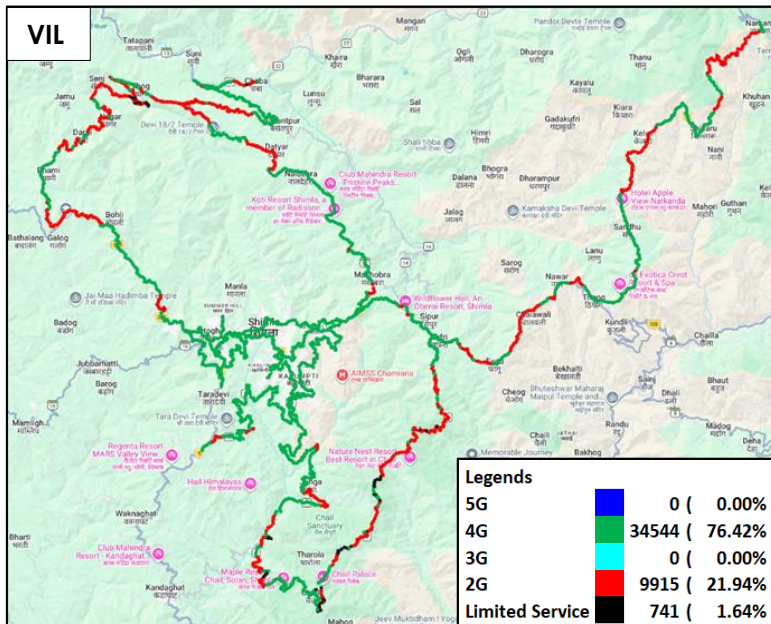


Figure-19: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - VIL.

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) voice. (Refer figure-77, 78, 79 & 80 for map view)

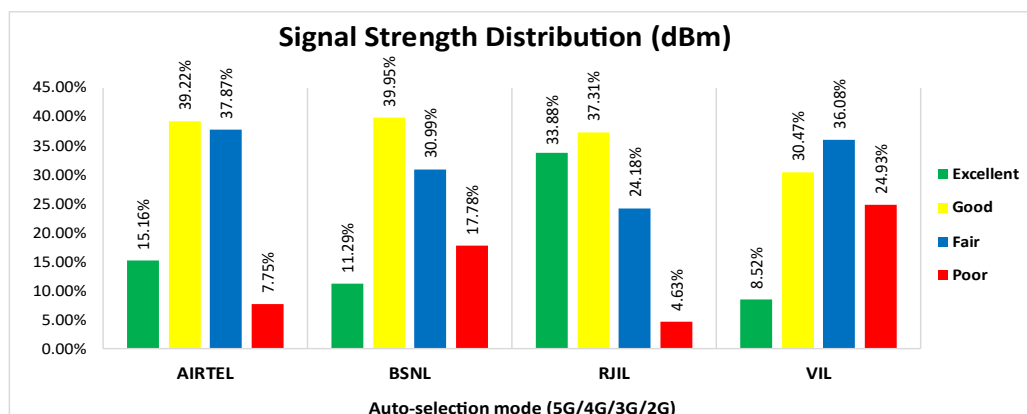


Figure-20: Signal strength distribution auto-selection mode (5G/4G/3G/2G) voice.

Observations:

- Airtel has 15% of samples falling in the excellent signal strength category.
- BSNL has 11% of samples falling in the excellent signal strength category.
- RJIL has 34% of samples falling in the excellent signal strength category.
- VIL has 9% of samples falling in the excellent signal strength category.

4.2.1.4 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	83.09	10.99	163.01	10.30
	80th Percentile	155.37	17.08	276.86	17.06
	20th Percentile	12.47	3.63	18.14	2.24
Upload Throughput (Mbits/s)	Average	13.90	4.81	15.43	3.32
	80th Percentile	22.72	8.38	28.11	5.29
	20th Percentile	1.79	1.41	1.65	1.15
Latency (ms)	50th Percentile	47.04	28.48	25.67	51.83

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

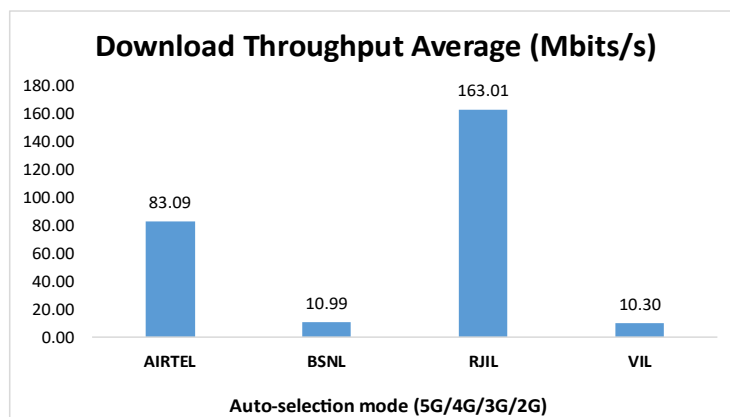


Figure- 21: Download throughput.

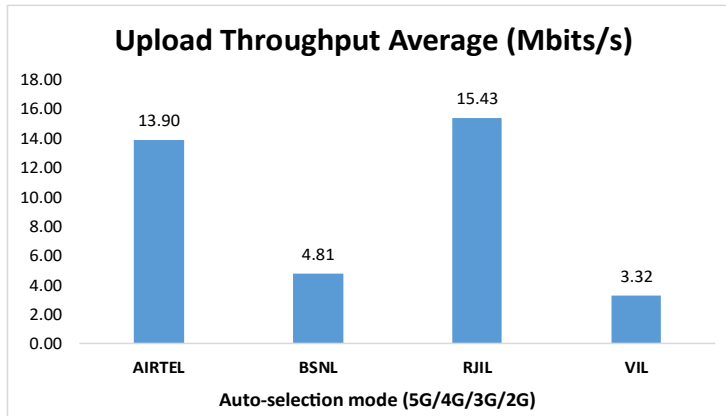


Figure- 22: Upload throughput.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	45.01%	NA	71.89%	NA
4G	53.72%	94.22%	28.03%	86.59%
3G	NA	1.48%	NA	NA
2G	0.04%	1.19%	NA	11.19%
Limited Service	1.23%	3.11%	0.08%	2.22%

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

Note-

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

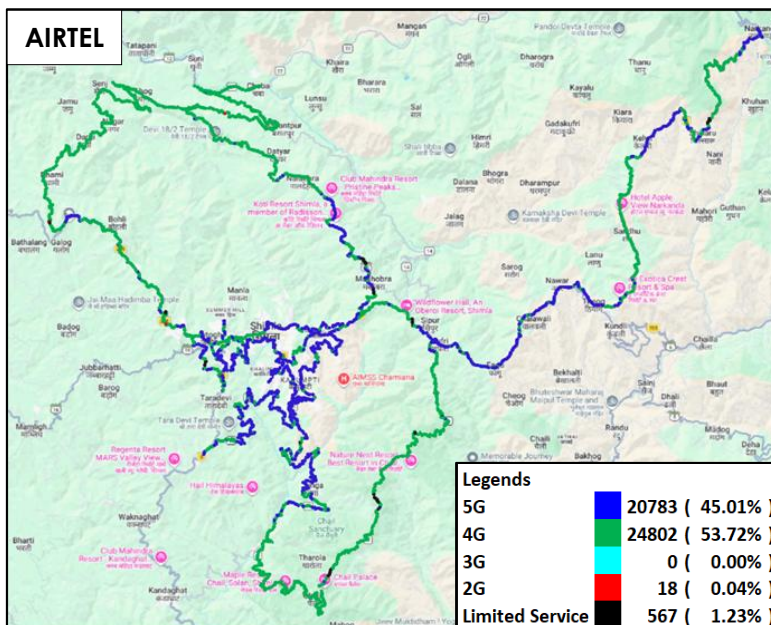


Figure-23: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

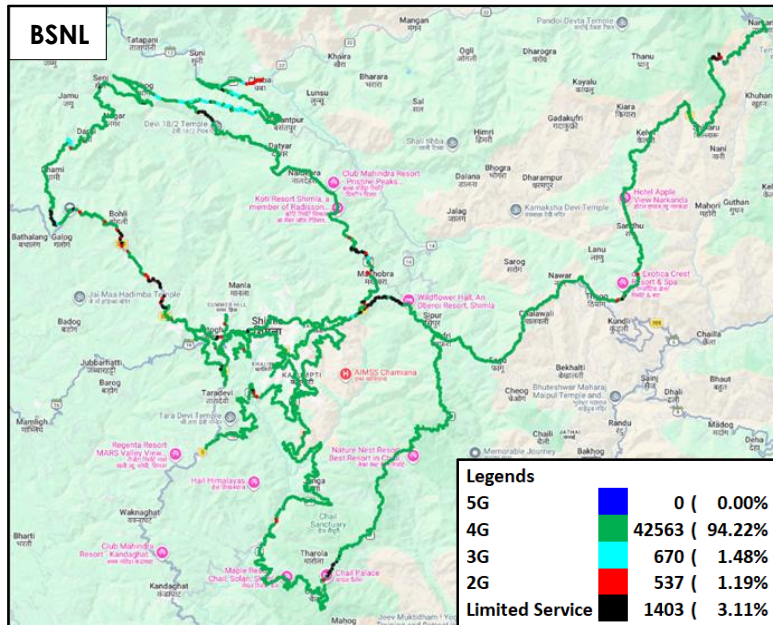


Figure-24: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - BSNL.

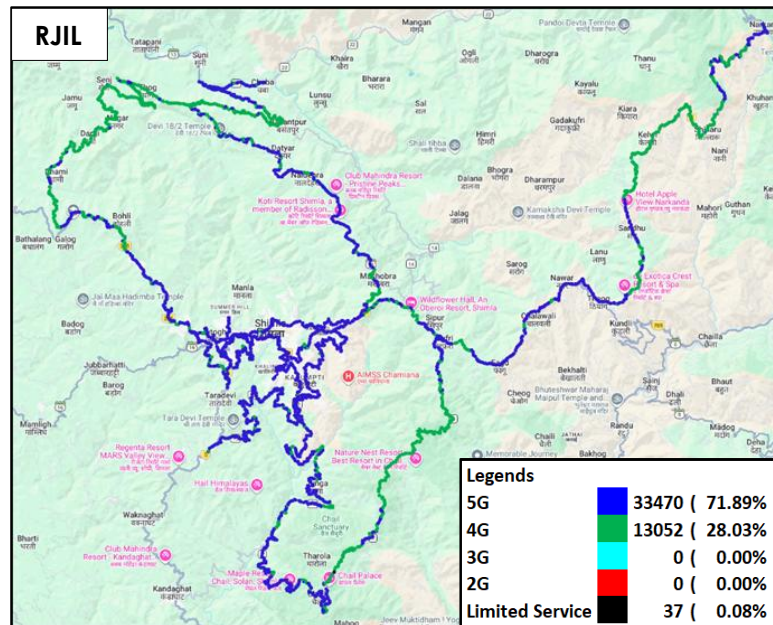


Figure-25: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - RJIL.

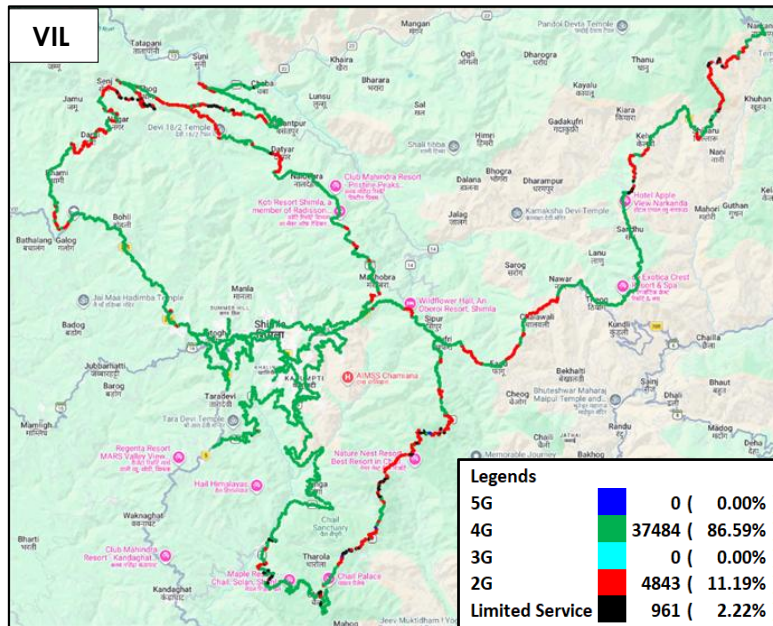


Figure-26: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - VIL.

(c) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) data. (Refer figure-81, 82, 83 & 84 for map view)

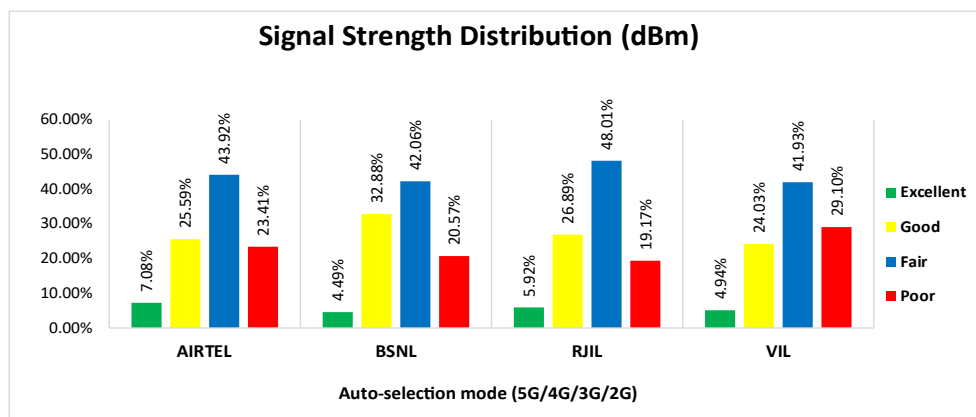


Figure-27: Signal strength distribution auto-selection mode (5G/4G/3G/2G) data.

Observations:

- Airtel has 7% of samples falling in the excellent signal strength category.
- BSNL has 4% of samples falling in the excellent signal strength category.
- RJIL has 6% of samples falling in the excellent signal strength category.
- VIL has 5% of samples falling in the excellent signal strength category.

4.2.2 Solan District

4.2.2.1 Drive test route



Figure- 28: Drive test routes

4.2.2.2 Areas covered

Sector 6, Sector 3, Tipra, Kalka, Parwanoo, Taksal, Jangeshu waterfall, Garkhal, Dharampur, Deoghat, Chambaghat, Kotla Nala and Sumti etc.

4.2.2.3 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	119	120	119
Call Setup Success Rate %	94.12	94.17	91.60
Drop Call Rate %	2.68	4.42	1.83
Call Setup Time-Average (Second)	3.31	2.96	4.91
Handover Success Rate %	97.67	99.45	97.34

Table-21: Summary of voice call performance in 3G/2G network mode only.

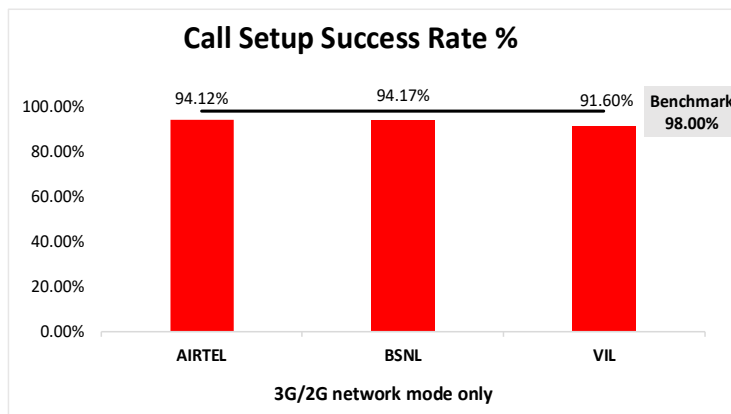


Figure-29: Performance for call setup success rate.

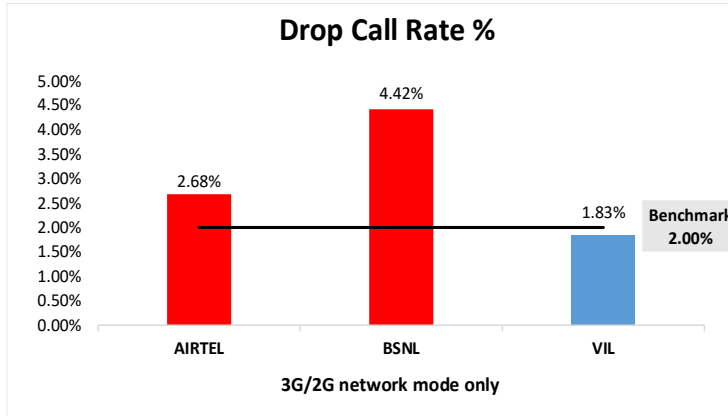


Figure-30: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	6.05%	NA
2G	98.83%	91.12%	98.26%
Limited Service	1.17%	2.82%	1.74%

Table-22: Time spent on technology during drive test 3G/2G network mode.

Note-

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

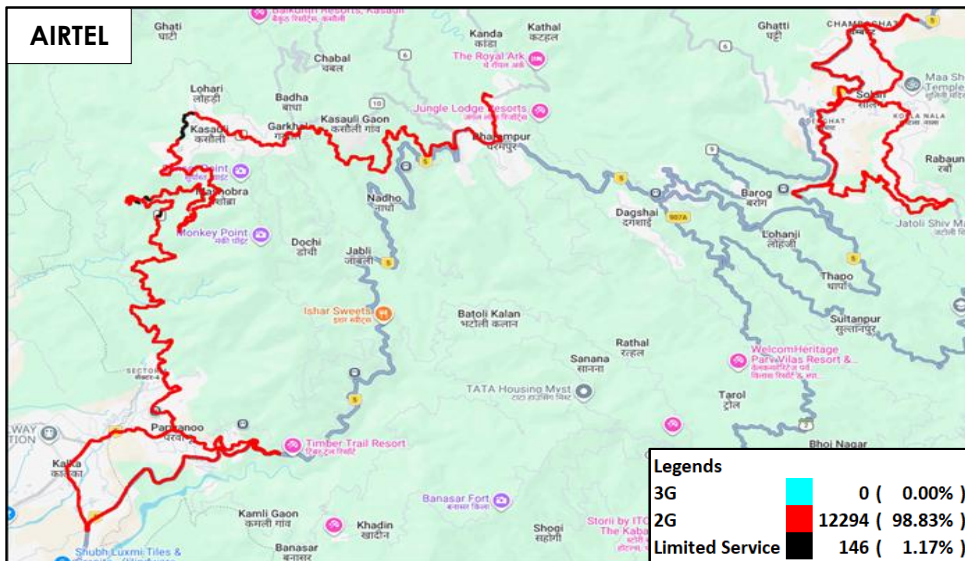


Figure-31: Serving technology plots 3G/2G network mode - AIRTEL.

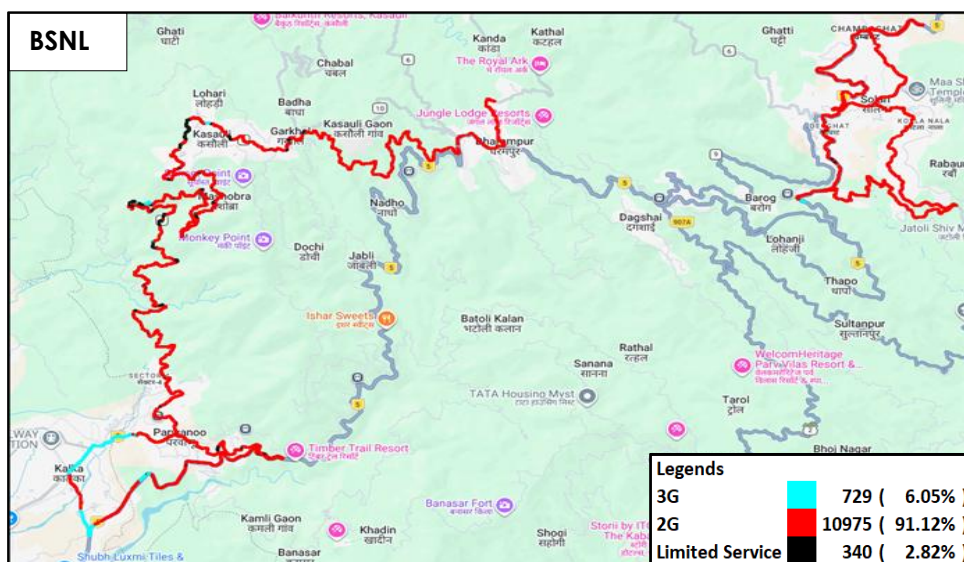


Figure-32: Serving technology plots 3G/2G network mode - BSNL.

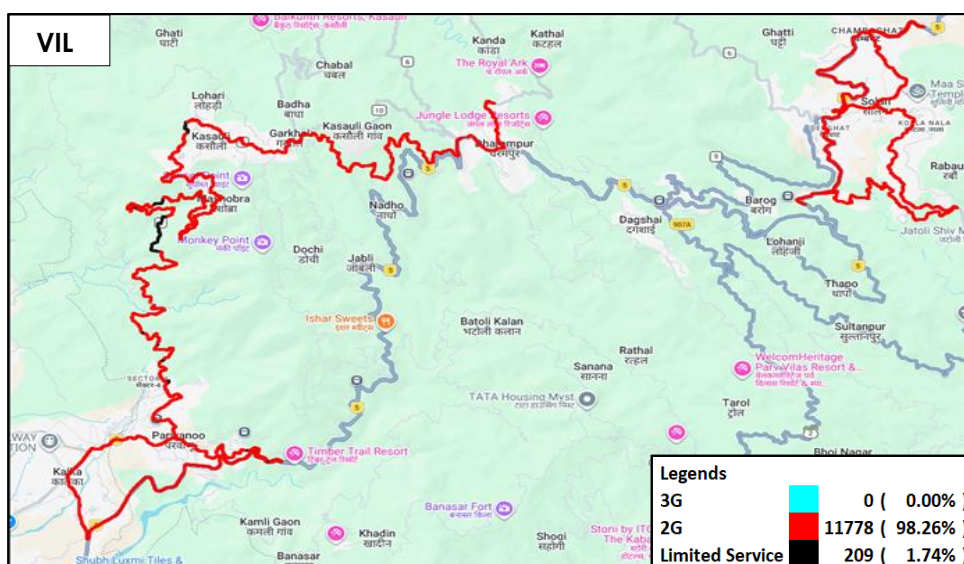


Figure-33: Serving technology plots 3G/2G network mode - VIL.

(c) Network Signal Strength Distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (Refer figure- 85, 86 & 87 for map view)

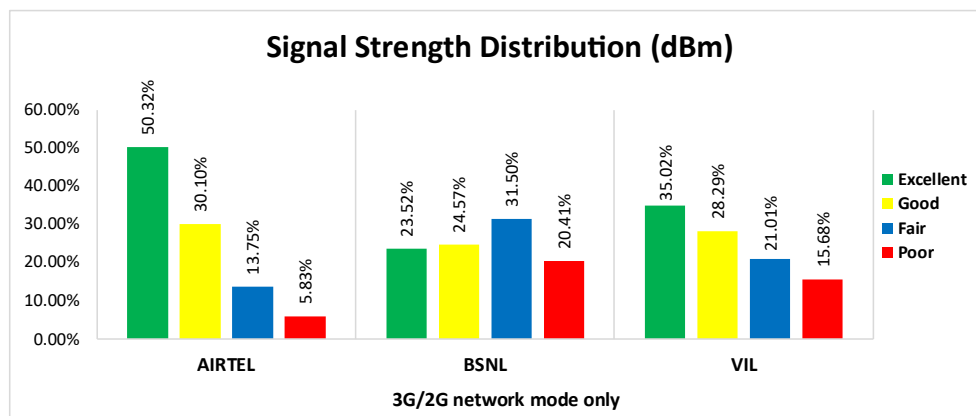


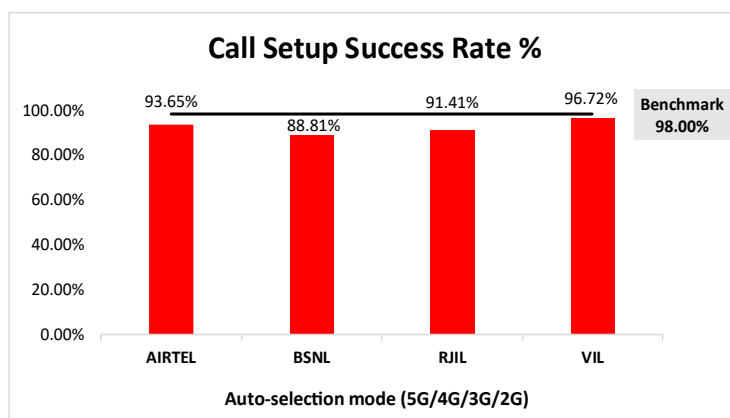
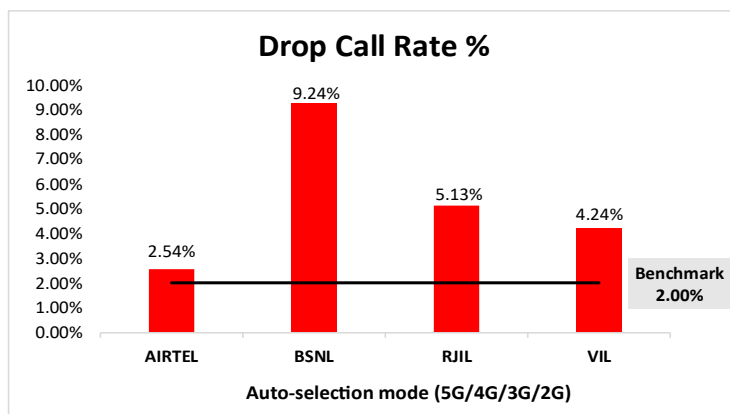
Figure-34: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 50% of samples falling in the excellent signal strength category.
- BSNL has 24% 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	126	134	128	122
Call Setup Success Rate %	93.65	88.81	91.41	96.72
Drop Call Rate %	2.54	9.24	5.13	4.24
Call Setup Time Average (Second)	1.49	1.64	1.02	1.62
Handover Success Rate %	100.00	99.80	99.73	100.00

Table-23: Summary of voice call performance in network auto-selection mode.**Figure-35:** Performance for call setup success rate.**Figure-36:** 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)	109	99	111	107
Number of silences call for >4 Sec	5	5	6	5
Silence Call Rate %	4.59	5.05	5.41	4.67
Number of silence instances for >4 Sec	8	6	11	6
Number of silence instances for >3 Sec	11	15	12	7
Number of silence instances for >2 sec	14	29	17	22
RTP Jitter (4G & 5G) in ms	3.05	9.2	14.91	18.98
Packet loss Rate Downlink %	1.74	5.62	3.5	2.47
Packet loss Rate Uplink %	2.18	5.16	2.94	2.71

Table-24: Summary of silence instances & packet loss rate for mobile to mobile call.

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

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

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls in table-24	633	502	630	587
Speech Quality (Average MOS)	3.93	3.44	4.36	3.75
Number of samples with MOS >=4 to <5 (Excellent)	504	261	532	323
Number of samples with MOS >=3 to <4 (Good)	90	80	55	209
Number of samples with MOS >=2 to <3 (Fair)	22	84	13	23
Number of samples with MOS >=1 to <2 (Poor)	17	77	30	32
%age of samples with MOS >=4 to <5 (Excellent)	79.62%	51.99%	84.44%	55.03%
%age of samples with MOS >=3 to <4 (Good)	14.22%	15.94%	8.73%	35.60%
%age of samples with MOS >=2 to <3 (Fair)	3.48%	16.73%	2.06%	3.92%
%age of samples with MOS >=1 to <2 (Poor)	2.69%	15.34%	4.76%	5.45%

Table-25: Summary of speech quality (MOS) samples.

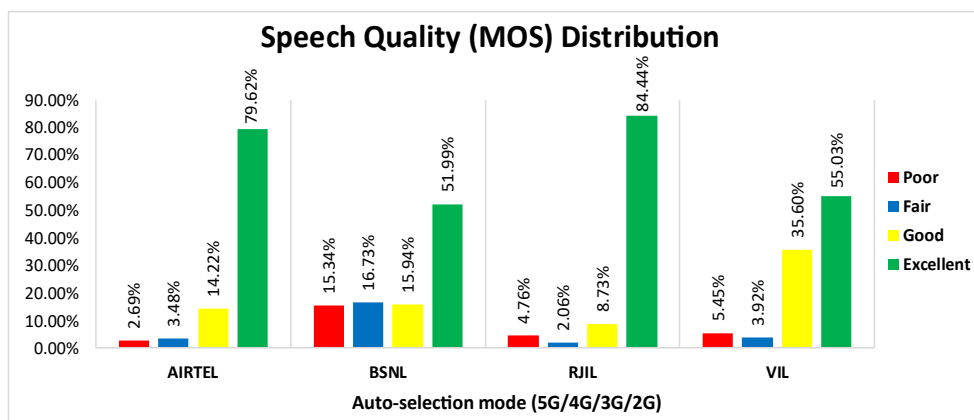


Figure-37: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	0.98%	NA	50.45%	NA
4G	96.60%	91.64%	48.27%	88.23%
3G	NA	0.54%	NA	NA
2G	1.09%	6.90%	NA	10.93%
Limited Service	1.33%	0.92%	1.28%	0.84%

Table-26:Time spent on technology during drive test in auto-selection mode (5G/4G/3G/2G) voice.

Note-

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

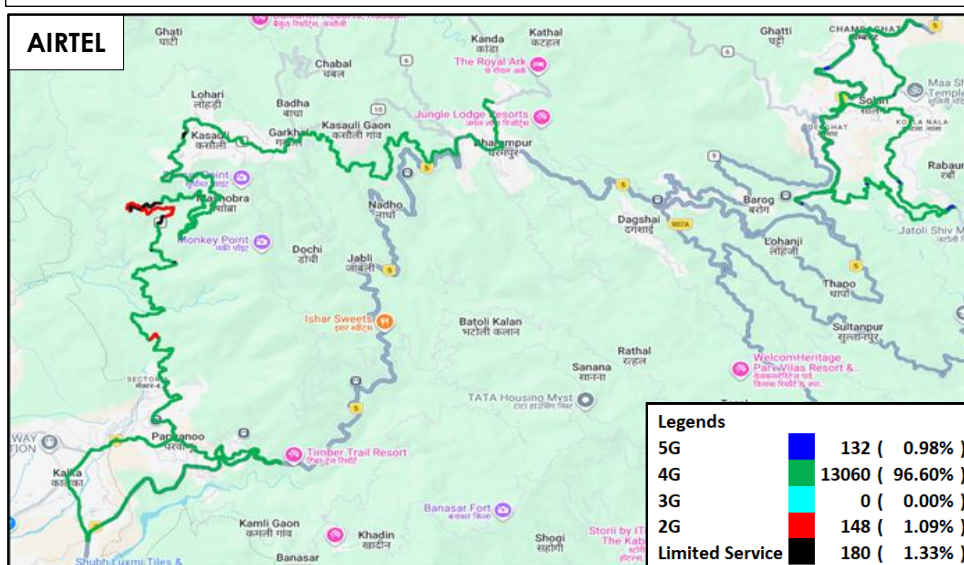


Figure-38: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

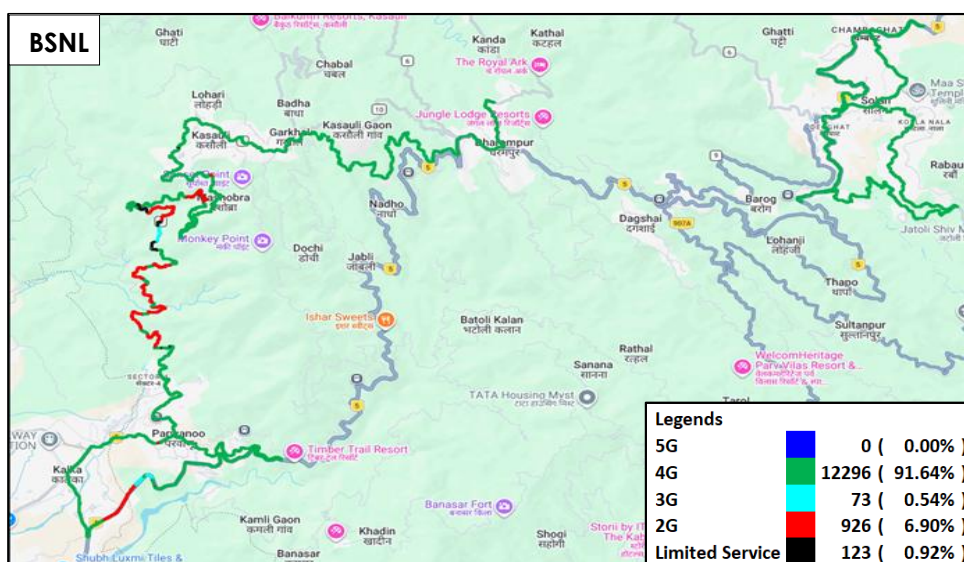


Figure-39: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - BSNL.

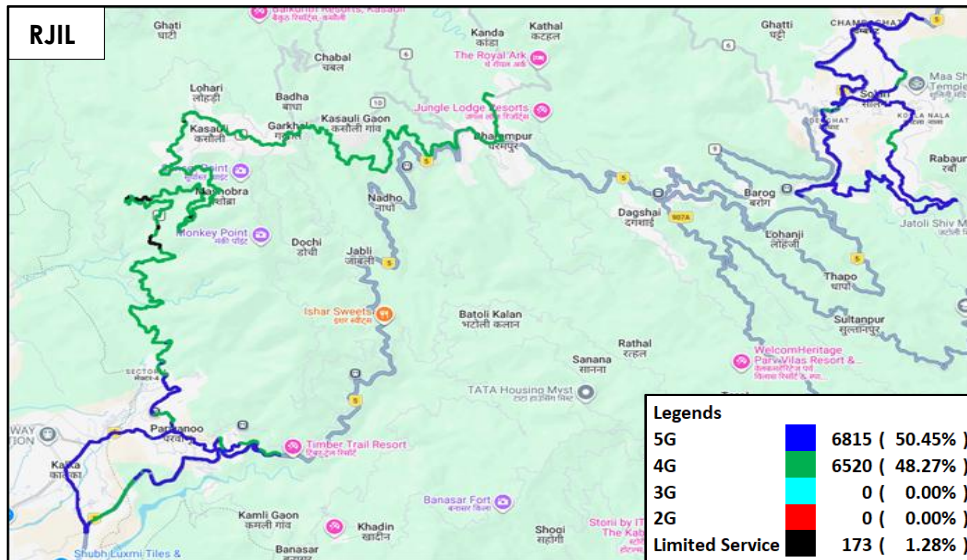


Figure-40: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

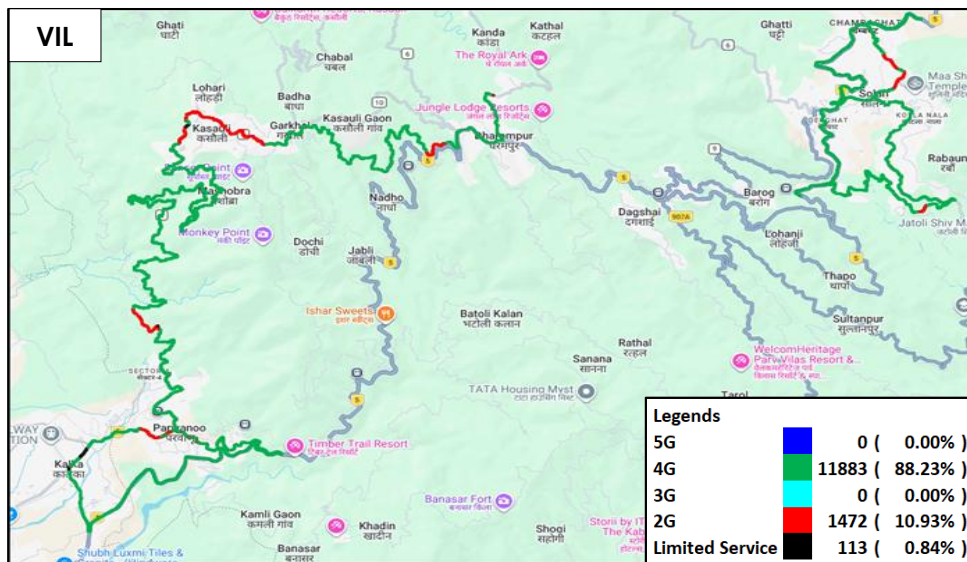


Figure-41: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - VIL.

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) voice. (Refer figure-88, 89, 90 & 91 for map view)

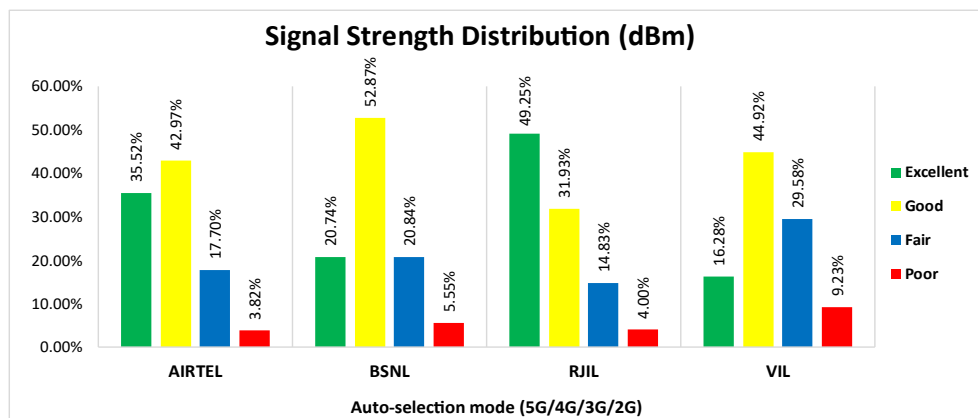


Figure-42: Signal strength distribution auto-selection mode (5G/4G/3G/2G) voice.

Observations:

- Airtel has 36% of samples falling in the excellent signal strength category.
- BSNL has 21% of samples falling in the excellent signal strength category.
- RJIL has 49% of samples falling in the excellent signal strength category.
- VIL has 16% of samples falling in the excellent signal strength category.

4.2.2.4 Data performance

(a) 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	170.17	11.99	208.71	8.77
	80th Percentile	273.01	17.32	338.96	12.58
	20th Percentile	67.17	5.93	81.49	3.17
Upload Throughput (Mbits/s)	Average	26.31	6.35	26.55	6.38
	80th Percentile	46.04	10.33	43.98	8.51
	20th Percentile	7.06	2.22	6.63	3.06
Latency (ms)	50th Percentile	42.78	28.30	22.84	44.10

Table-27: Summary of Data performance in network auto-selection mode.

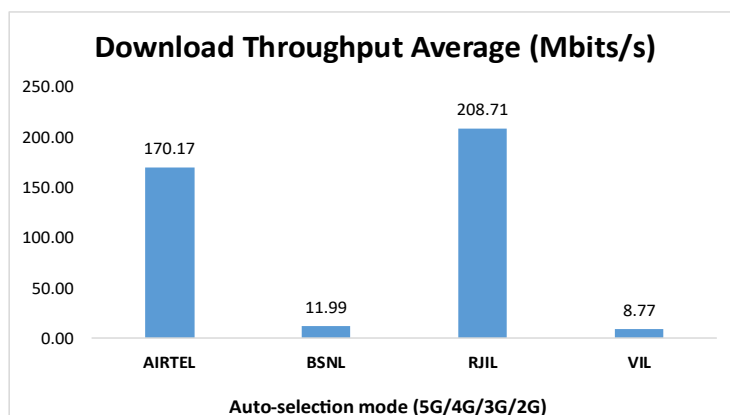


Figure- 43: Download throughput.

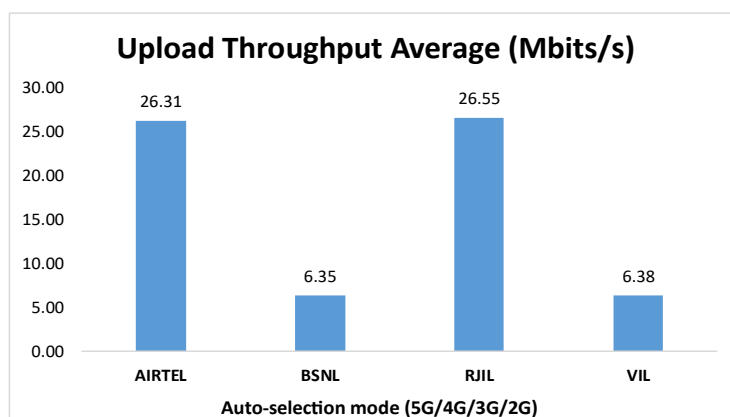


Figure- 44: Upload throughput.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	75.52%	NA	87.68%	NA
4G	20.78%	95.81%	10.78%	97.78%
3G	NA	0.56%	NA	NA
2G	0.11%	1.83%	NA	1.46%
Limited Service	3.59%	1.80%	1.54%	0.76%

Table-28: Time spent on technology during drive test in auto-selection mode (5G/4G/3G/2G) data.

Note-

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

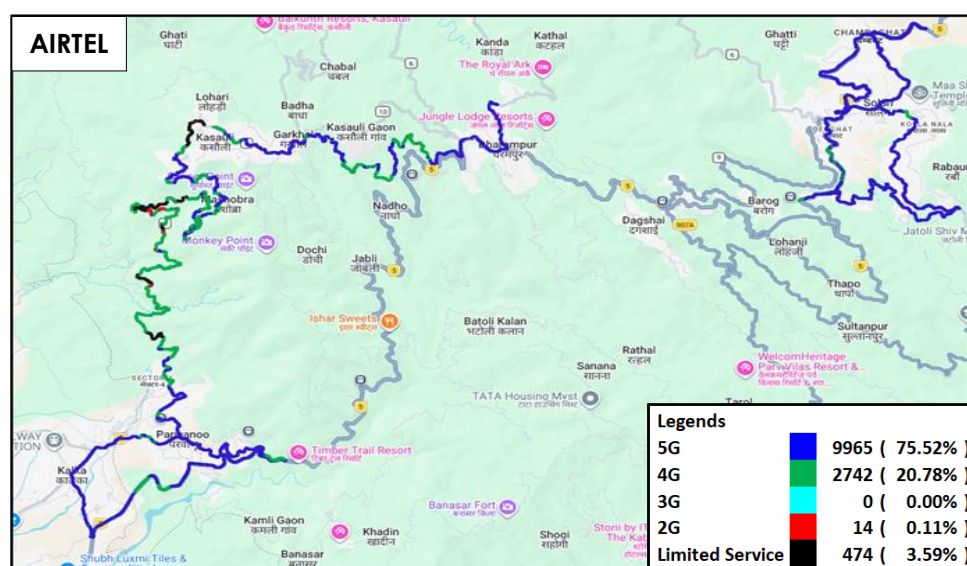


Figure-45: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

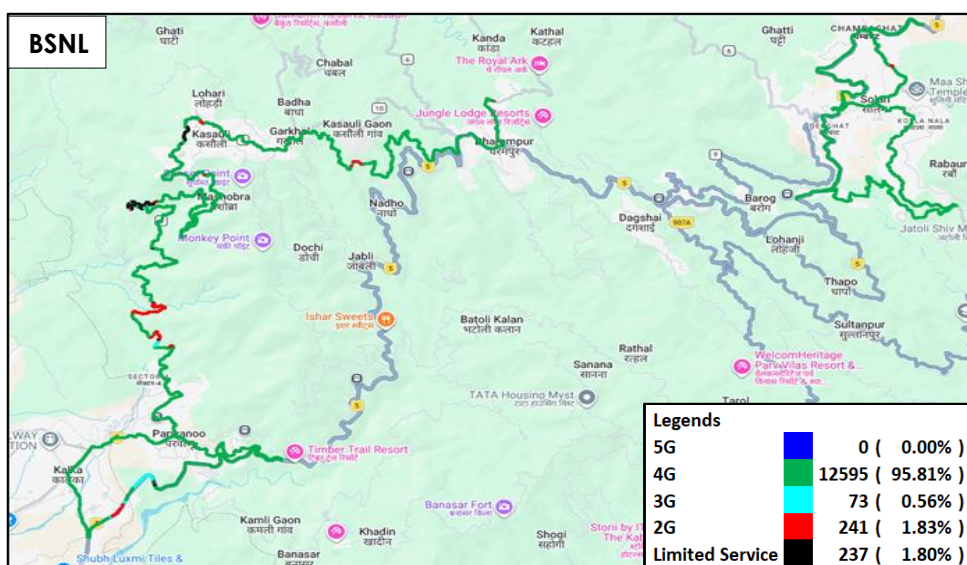


Figure-46: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - BSNL.

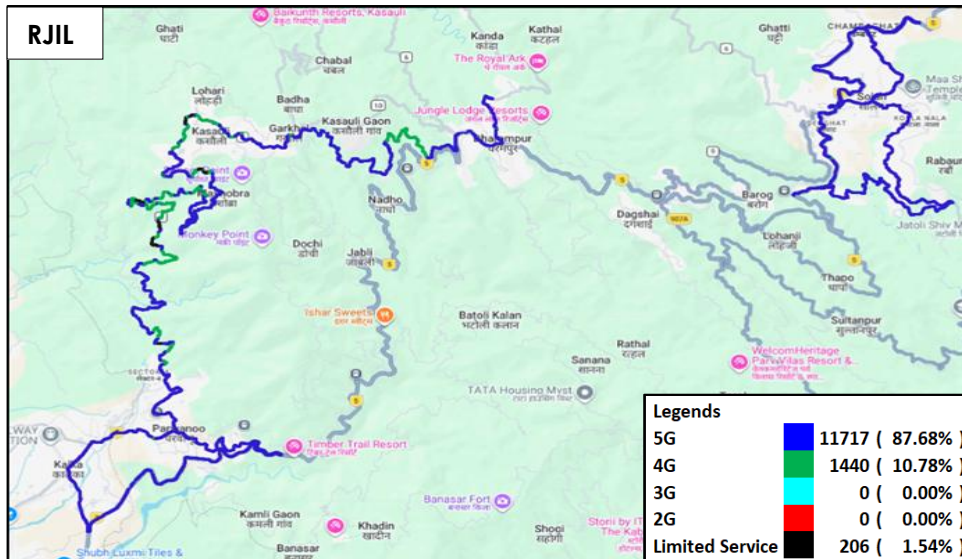


Figure-47: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - RJIL.

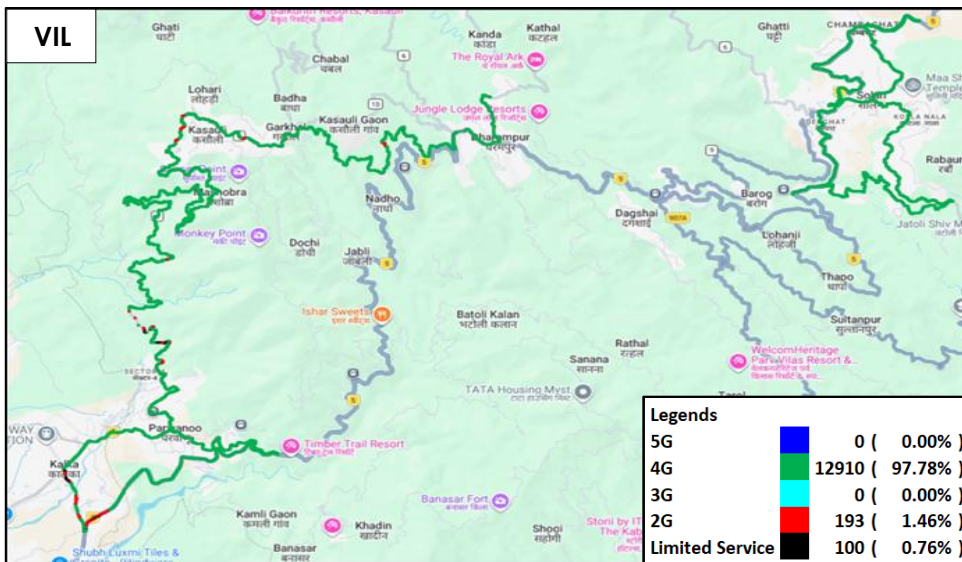


Figure-48: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - VIL.

(c) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) data. (Refer figure-92, 93, 94 & 95 for map view)

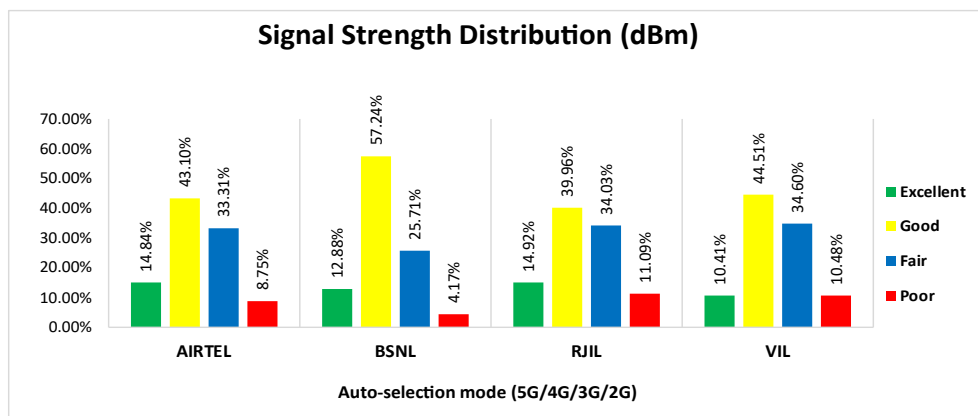


Figure-49: Signal strength distribution auto-selection mode (5G/4G/3G/2G) data.

Observations:

- Airtel has 15% of samples falling in the excellent signal strength category.
- BSNL has 13% of samples falling in the excellent signal strength category.
- RJIL has 15% of samples falling in the excellent signal strength category.
- VIL has 10% of samples falling in the excellent signal strength category.

4.3 Hotspots

Hotspot testing has been conducted from 15th June 2026 to 19th June 2026. Twelve locations have been tested Cities & adjoining area of Shimla and Solan Districts. (Refer Table-1)

4.3.1 Locations

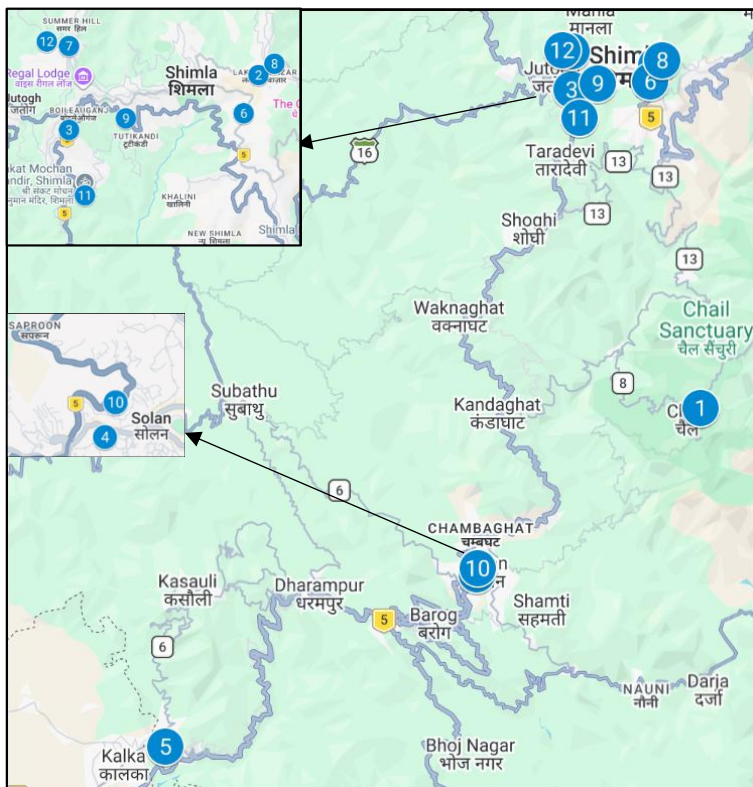


Figure- 50: Hotspot locations.

4.3.2 Hotspot covered

1. Civil Hospital Chail
2. DAV School Shimla
3. District Court Shimla
4. District Court Solan
5. ESI Hospital Parwanoo
6. High Court Shimla
7. HP University Shimla
8. IGMC and Hospital Shimla
9. ISBT Shimla
10. ISBT Solan
11. Shri Sankat Mochan Hanuman Mandir Shimla
12. University Institute of Information Technology Shimla

4.3.3 Voice performance

Overall Voice Performance				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	120	120	120	120
Call Setup Success Rate %	100.00	87.50	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.35	1.41	0.54	1.33

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

Civil Hospital Chail				
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)	1.20	1.24	0.49	3.39

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

DAV School Shimla				
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)	2.31	1.12	0.55	1.59

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

District Court Shimla				
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)	1.35	1.08	0.56	1.16

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

District Court Solan				
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)	1.20	1.03	0.59	1.05

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

ESI Hospital Parwanoo				
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)	1.22	1.10	0.57	1.07

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

High Court Shimla				
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	60.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.20	1.19	0.52	1.10

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

HP University Shimla				
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)	1.30	1.08	0.53	1.21

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

IGMC and Hospital Shimla				
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	70.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.16	2.16	0.54	0.81

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

ISBT Shimla				
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)	1.13	1.27	0.52	1.00

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

ISBT Solan				
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)	1.36	1.09	0.59	1.10

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

Shri Sankat Mochan Hanuman Mandir Shimla				
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)	1.59	1.31	0.54	1.21

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

University Institute of Information Technology Shimla				
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	20.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.18	10.87	0.52	1.24

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

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

Overall Data Performance				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	158.45	15.30	225.72	12.12
Download Throughput 80th Percentile (Mbit/s)	240.63	20.32	320.96	16.68
Download Throughput 20th Percentile (Mbit/s)	79.25	8.47	92.32	5.79
Download Session Setup Success Rate %	100.00	100.00	100.00	91.67
Upload Throughput Average (Mbits/s)	24.43	8.65	21.72	5.15
Upload Throughput 80th Percentile (Mbit/s)	38.66	14.47	32.70	7.90
Upload Throughput 20th Percentile (Mbit/s)	3.08	2.73	5.89	1.92
Upload Session Setup Success Rate %	100.00	100.00	100.00	95.00
Web Browsing Delay (Second)	6.98	2.22	4.88	3.90
Youtube Initial Buffer Delay (Second)	3.03	1.38	1.41	2.21
Latency (ms) - 50th Percentile	43.56	25.29	24.01	48.12
Jitter (ms)	15.91	43.06	11.30	134.19
Packet Loss Rate%	4.54	4.35	2.89	16.39
Packet Loss Rate- 90th percentile	8.08	3.78	1.20	76.90

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

Civil Hospital Chail				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	6.48	17.37	1.22	0.00
Download Session Setup Success Rate %	100.00	100.00	100.00	0.00
Upload Throughput Average (Mbits/s)	1.19	5.88	2.01	0.99
Upload Session Setup Success Rate %	100.00	100.00	100.00	40.00
Web Browsing Delay (Second)	11.51	2.11	12.42	0.00
Youtube Initial Buffer Delay (Second)	6.80	1.00	-	-
Latency (ms) - 50th Percentile	55.00	22.79	37.11	203.19
Jitter (ms)	18.32	17.05	26.96	5792.65
Packet Loss Rate%	29.10	1.80	0.10	97.30

Table-43: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Note- "- "Youtube tests were failed.

DAV School Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	128.97	30.17	101.30	15.72
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	35.85	18.66	7.40	7.49
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	7.22	1.27	2.91	2.87
Youtube Initial Buffer Delay (Second)	1.69	0.85	3.09	2.17
Latency (ms) - 50th Percentile	39.18	25.25	22.75	56.91
Jitter (ms)	7.63	3.71	16.22	5.44
Packet Loss Rate%	0.80	0.40	1.20	0.30

Table-44: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

District Court Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	148.03	13.83	310.57	12.63
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	18.10	7.09	27.86	6.78
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	6.59	2.01	4.22	3.27
Youtube Initial Buffer Delay (Second)	2.35	1.30	0.59	1.85
Latency (ms) – 50 th Percentile	45.08	24.87	22.43	72.82
Jitter (ms)	7.35	2.40	3.74	16.94
Packet Loss Rate%	0.40	0.60	0.00	12.30

Table-45: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

District Court Solan				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	312.32	12.15	178.39	4.79
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	53.33	3.33	18.00	6.28
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	6.70	1.76	3.46	3.12
Youtube Initial Buffer Delay (Second)	1.93	1.57	0.67	1.64
Latency (ms) - 50th Percentile	44.63	27.03	21.84	56.95
Jitter (ms)	8.00	16.05	11.67	5.76
Packet Loss Rate%	0.70	2.60	0.20	0.10

Table-46: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

ESI Hospital Parwanoo				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	151.09	11.34	385.71	12.43
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	34.24	14.90	46.10	12.30
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	7.50	2.11	3.20	4.09
Youtube Initial Buffer Delay (Second)	0.55	1.38	0.72	1.30
Latency (ms)- 50th Percentile	41.17	26.65	22.94	44.08
Jitter (ms)	8.29	3.25	33.05	12.71
Packet Loss Rate%	4.20	1.10	0.10	0.40

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

High Court Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	1.30	6.36	283.49	3.81
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	5.03	3.01	20.18	1.66
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	9.10	1.77	5.74	5.25
Youtube Initial Buffer Delay (Second)	9.39	1.93	0.78	5.07
Latency (ms) - 50th Percentile	49.79	27.60	25.35	44.77
Jitter (ms)	69.79	22.23	3.34	41.68
Packet Loss Rate%	7.20	3.40	0.20	9.60

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

HP University Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	408.91	20.50	238.98	27.35
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	48.16	8.31	31.58	7.62
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	7.02	1.31	4.75	6.08
Youtube Initial Buffer Delay (Second)	3.75	0.97	0.64	0.98
Latency (ms) - 50th Percentile	40.07	26.32	21.37	38.33
Jitter (ms)	3.76	3.38	2.96	3.51
Packet Loss Rate%	0.90	1.90	0.00	0.30

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

IGMC and Hospital Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	163.28	31.63	249.50	12.96
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	27.79	23.71	30.93	3.75
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	5.64	1.18	3.75	2.20
Youtube Initial Buffer Delay (Second)	2.47	0.92	2.24	1.70
Latency (ms) - 50th Percentile	47.75	22.34	500.05	43.23
Jitter (ms)	7.73	2.23	17.59	16.68
Packet Loss Rate%	1.90	0.10	32.60	0.60

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

ISBT Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	179.07	15.05	164.56	9.41
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	19.95	1.92	12.81	3.38
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	7.02	3.08	4.89	2.77
Youtube Initial Buffer Delay (Second)	2.53	2.86	0.63	1.36
Latency (ms) - 50 th Percentile	41.05	26.59	25.57	43.50
Jitter (ms)	5.31	15.83	4.37	20.29
Packet Loss Rate%	2.60	1.40	0.20	3.00

Table-51: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

ISBT Solan				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	150.15	12.65	441.87	11.67
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	35.02	11.22	25.23	5.88
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	4.03	3.05	2.83	4.38
Youtube Initial Buffer Delay (Second)	1.11	1.17	0.56	1.61
Latency (ms) - 50th Percentile	49.93	25.94	25.37	78.24
Jitter (ms)	5.43	3.69	3.17	28.58
Packet Loss Rate%	0.20	0.30	0.00	1.60

Table-52: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Shri Sankat Mochan Hanuman Mandir Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	116.25	3.45	275.91	15.86
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	11.79	2.36	36.78	1.97
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	6.05	6.70	4.41	2.13
Youtube Initial Buffer Delay (Second)	1.64	2.78	0.74	4.66
Latency (ms)- 50th Percentile	46.63	23.46	22.88	43.94
Jitter (ms)	13.82	576.31	3.33	5.27
Packet Loss Rate%	1.40	37.30	0.00	0.10

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

University Institute of Information Technology Shimla				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	135.57	9.08	77.12	6.72
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	2.76	3.46	1.70	1.25
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	6.76	1.55	9.44	8.98
Youtube Initial Buffer Delay (Second)	3.51	1.38	5.67	6.60
Latency (ms) - 50th Percentile	45.48	24.28	23.91	105.60
Jitter (ms)	35.71	6.43	9.17	125.60
Packet Loss Rate%	5.10	1.30	0.10	71.10

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

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

Overall Data Performance					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	177.79	-	220.92	-
	Upload Throughput Average (Mbits/s)	28.72	-	28.50	-
4G	Download Throughput Average (Mbits/s)	26.66	13.62	35.70	10.49
	Upload Throughput Average (Mbits/s)	10.80	11.64	7.58	6.07

Table-55: Overall Summary of 5G only & 4G only data download & upload speed.

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

Civil Hospital Chail					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	-	-	1.12	-
	Upload Throughput Average (Mbits/s)	-	-	1.78	-
4G	Download Throughput Average (Mbits/s)	4.60	15.48	12.74	0.09
	Upload Throughput Average (Mbits/s)	1.34	3.39	0.87	1.54

Table-56: Overall Summary of 5G only & 4G only data download & upload speed.

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

DAV School Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	92.09	-	44.04	-
	Upload Throughput Average (Mbits/s)	31.23	-	2.86	-
4G	Download Throughput Average (Mbits/s)	23.77	31.01	19.56	15.56
	Upload Throughput Average (Mbits/s)	9.31	21.65	6.00	4.30

Table-57: Overall Summary of 5G only & 4G only data download & upload speed.

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

District Court Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	176.03	-	288.78	-
	Upload Throughput Average (Mbits/s)	13.83	-	23.12	-
4G	Download Throughput Average (Mbits/s)	12.04	14.01	85.87	7.91
	Upload Throughput Average (Mbits/s)	6.34	12.42	14.75	4.52

Table-58: Overall Summary of 5G only & 4G only data download & upload speed.

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

District Court Solan					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	377.66	-	234.77	-
	Upload Throughput Average (Mbits/s)	62.01	-	26.36	-
4G	Download Throughput Average (Mbits/s)	89.56	8.19	19.61	5.59
	Upload Throughput Average (Mbits/s)	24.32	8.16	4.88	6.37

Table-59: Overall Summary of 5G only & 4G only data download & upload speed.

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

ESI Hospital Parwanoo					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	190.37	-	457.98	-
	Upload Throughput Average (Mbits/s)	37.94	-	45.51	-
4G	Download Throughput Average (Mbits/s)	14.30	6.67	24.12	9.24
	Upload Throughput Average (Mbits/s)	12.16	23.95	5.79	10.43

Table-60: Overall Summary of 5G only & 4G only data download & upload speed.

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

High Court Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	-	-	323.75	-
	Upload Throughput Average (Mbits/s)	-	-	87.16	-
4G	Download Throughput Average (Mbits/s)	1.31	6.97	78.96	3.75
	Upload Throughput Average (Mbits/s)	5.74	5.57	21.30	4.48

Table-61: Overall Summary of 5G only & 4G only data download & upload speed.

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

HP University Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	356.06	-	211.09	-
	Upload Throughput Average (Mbits/s)	42.13	-	12.71	-
4G	Download Throughput Average (Mbits/s)	71.17	20.42	52.49	21.12
	Upload Throughput Average (Mbits/s)	18.93	12.08	5.92	7.68

Table-62: Overall Summary of 5G only & 4G only data download & upload speed.

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

IGMC and Hospital Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	129.36	-	226.27	-
	Upload Throughput Average (Mbits/s)	25.61	-	10.44	-
4G	Download Throughput Average (Mbits/s)	24.81	15.26	21.40	8.50
	Upload Throughput Average (Mbits/s)	6.69	10.44	5.58	8.92

Table-63: Overall Summary of 5G only & 4G only data download & upload speed.

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

ISBT Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	162.69	-	194.61	-
	Upload Throughput Average (Mbits/s)	14.76	-	14.54	-
4G	Download Throughput Average (Mbits/s)	34.29	21.27	39.90	21.55
	Upload Throughput Average (Mbits/s)	12.49	10.83	4.77	13.08

Table-64: Overall Summary of 5G only & 4G only data download & upload speed.

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

ISBT Solan					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	139.53	-	369.57	-
	Upload Throughput Average (Mbits/s)	40.37	-	98.58	-
4G	Download Throughput Average (Mbits/s)	23.92	13.87	39.19	9.65
	Upload Throughput Average (Mbits/s)	19.87	15.93	8.40	5.11

Table-65: Overall Summary of 5G only & 4G only data download & upload speed.

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

Shri Sankat Mochan Hanuman Mandir Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	139.26	-	248.21	-
	Upload Throughput Average (Mbits/s)	17.55	-	15.78	-
4G	Download Throughput Average (Mbits/s)	9.28	4.56	23.48	12.98
	Upload Throughput Average (Mbits/s)	9.48	14.52	11.81	1.87

Table-66: Overall Summary of 5G only & 4G only data download & upload speed.

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

University Institute of Information Technology Shimla					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	14.87	-	50.89	-
	Upload Throughput Average (Mbits/s)	1.76	-	3.12	-
4G	Download Throughput Average (Mbits/s)	10.89	6.07	7.79	2.69
	Upload Throughput Average (Mbits/s)	2.94	1.27	0.89	1.79

Table-67: Overall 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 18th June 2026 and 19th June 2026. Two locations have been tested in Shimla city. (Refer Table-1)

4.4.1 Walk test locations



Figure-51: Walk Test locations.

4.4.2 Walk Test Covered

1. Mall Road Shimla
2. Shimla Railway Station

4.4.3 Voice Performance

Mall Road Shimla				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	29	31	29	29
Call Setup Success Rate %	100.00	90.32	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.20	1.70	0.60	1.18

Table-68: Summary of voice call performance in network auto-selection mode (5G/4G/3G/2G).

Shimla Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	15	16	15	16
Call Setup Success Rate %	100.00	87.50	100.00	87.50
Drop Call Rate %	0.00	21.43	0.00	7.14
Call Setup Time-Average (Second)	1.28	5.14	1.09	4.66

Table-69: 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)

Mall Road Shimla				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	59.11	12.81	173.34	8.72
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	19.36	5.57	22.87	4.74
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Latency (ms) - 50th Percentile	52.35	105.97	23.84	55.15

Table-70: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

Shimla Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	47.33	12.10	70.58	1.65
Download Session Setup Success Rate %	91.67	100.00	100.00	66.67
Upload Throughput Average (Mbits/s)	18.98	8.20	8.60	1.55
Upload Session Setup Success Rate %	100.00	100.00	100.00	81.82
Latency (ms) - 50th Percentile	61.12	25.18	23.44	80.27

Table-71: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

4.5 Highway

Drive test has been conducted on 15th June 2026 covering one highway route Solan to Shimla. (Refer Table-1)

4.5.1 Drive test route



Figure-52: Drive test routes.

4.5.2 Routes covered

Chamabghat, Salogra, Kandaghat, Majhol, Kashmari, Tara Devi and Boileauganj etc.

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	22	24	22
Call Setup Success Rate %	95.45	95.83	95.45
Drop Call Rate %	0.00	21.74	9.52
Call Setup Time-Average (Second)	3.40	4.74	5.52
Handover Success Rate %	96.40	98.92	94.38

Table-72: Summary of voice call performance in 3G/2G network mode only.

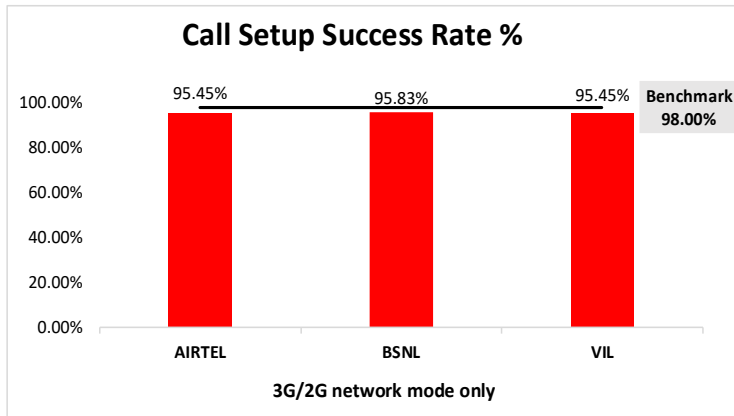


Figure-53: Performance for call setup success rate.

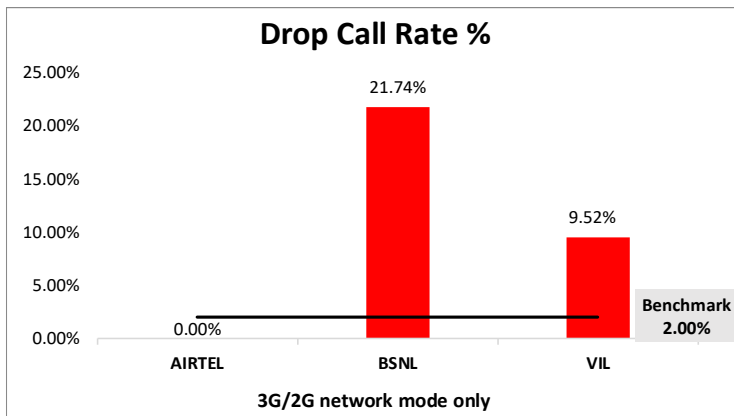


Figure-54: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	0.22%	NA
2G	100.00%	99.65%	100.00%
Limited Service	0.00%	0.12%	0.00%

Table-73: Time spent on technology during drive test 3G/2G network mode.



Figure-55: Serving technology plots 3G/2G network mode - AIRTEL.



Figure-56: Serving technology plots 3G/2G network mode - BSNL.



Figure-57: 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- 96, 97 & 98 for map view)

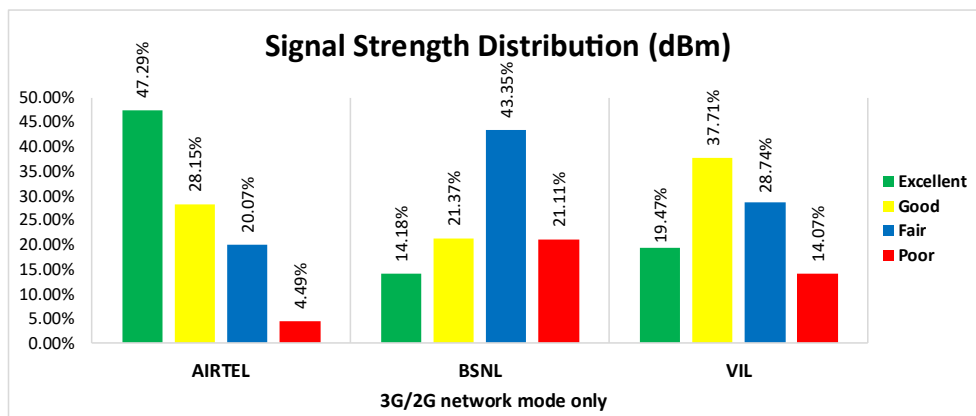


Figure-58: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 47% of samples falling in the excellent signal strength category.
- BSNL has 14% of samples falling in the excellent signal strength category.
- VIL has 19% 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	22	31	22	21
Call Setup Success Rate %	100.00	70.97	100.00	100.00
Drop Call Rate %	4.55	36.36	0.00	0.00
Call Setup Time Average (Second)	1.25	2.64	0.63	2.41
Handover Success Rate %	100.00	99.19	100.00	100.00

Table-74: Summary of voice call performance in network auto-selection mode.

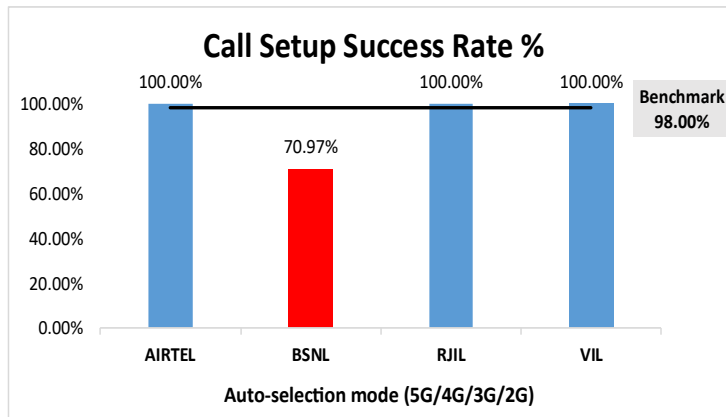


Figure-59: Performance for call setup success rate.

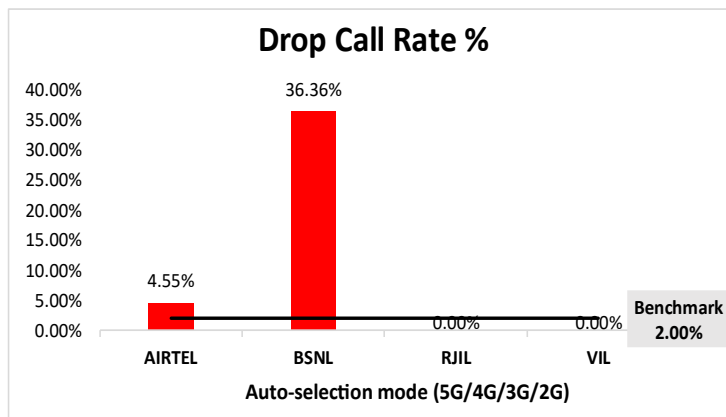


Figure-60: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	21	25	21	23
Number of silences call for >4 Sec	2	2	0	1
Silence Call Rate %	9.52	8	0	4.35
Number of silence instances for >4 Sec	2	3	0	1
Number of silence instances for >3 Sec	3	7	0	1
Number of silence instances for >2 sec	9	12	1	8
RTP Jitter (4G & 5G) in ms	3.77	6.98	17.12	17.35
Packet loss Rate Downlink %	2.05	8.42	1.04	3.78
Packet loss Rate Uplink %	2.26	5.73	1.21	5.01

Table-75: Summary of silence instances & packet loss rate for mobile to mobile call.

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

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

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls in table-75	272	153	271	256
Speech Quality (Average MOS)	3.86	3.60	4.40	2.98
Number of samples with MOS >=4 to <5 (Excellent)	207	100	226	88
Number of samples with MOS >=3 to <4 (Good)	45	16	28	42
Number of samples with MOS >=2 to <3 (Fair)	5	13	7	64
Number of samples with MOS >=1 to <2 (Poor)	15	24	10	62
%age of samples with MOS >=4 to <5 (Excellent)	76.10%	65.36%	83.39%	34.38%
%age of samples with MOS >=3 to <4 (Good)	16.54%	10.46%	10.33%	16.41%
%age of samples with MOS >=2 to <3 (Fair)	1.84%	8.50%	2.58%	25.00%
%age of samples with MOS >=1 to <2 (Poor)	5.51%	15.69%	3.69%	24.22%

Table-76: Summary of speech quality (MOS) samples.

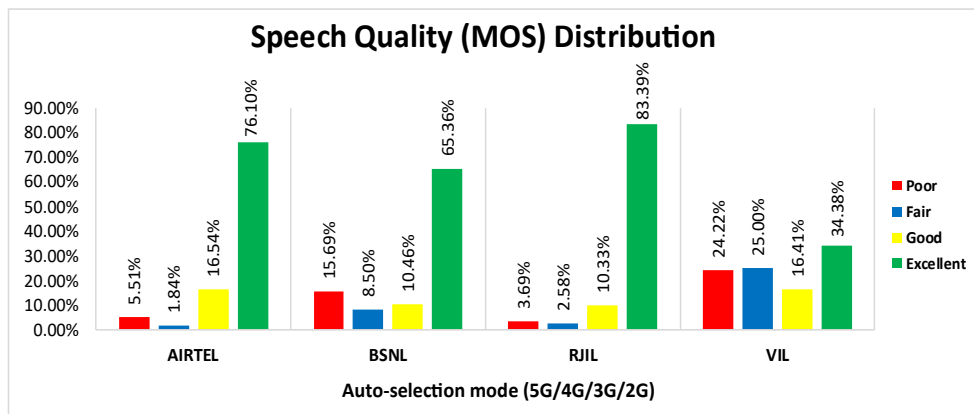


Figure-61: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	0.72%	NA	82.95%	NA
4G	99.28%	77.72%	17.05%	84.32%
3G	NA	0.00%	NA	NA
2G	0.00%	21.99%	NA	15.68%
Limited Service	0.00%	0.29%	0.00%	0.00%

Table-77:Time spent on technology during drive test in auto-selection mode (5G/4G/3G/2G) voice.

Note-

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

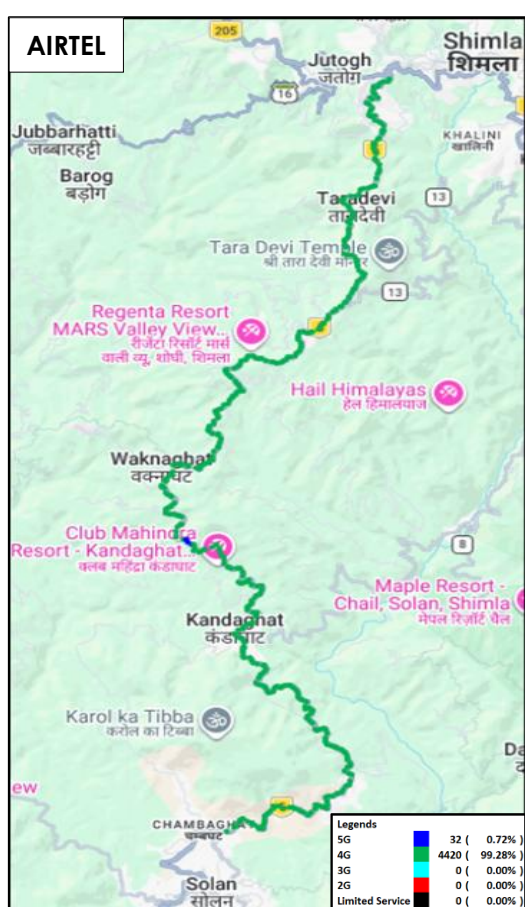


Figure-62: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

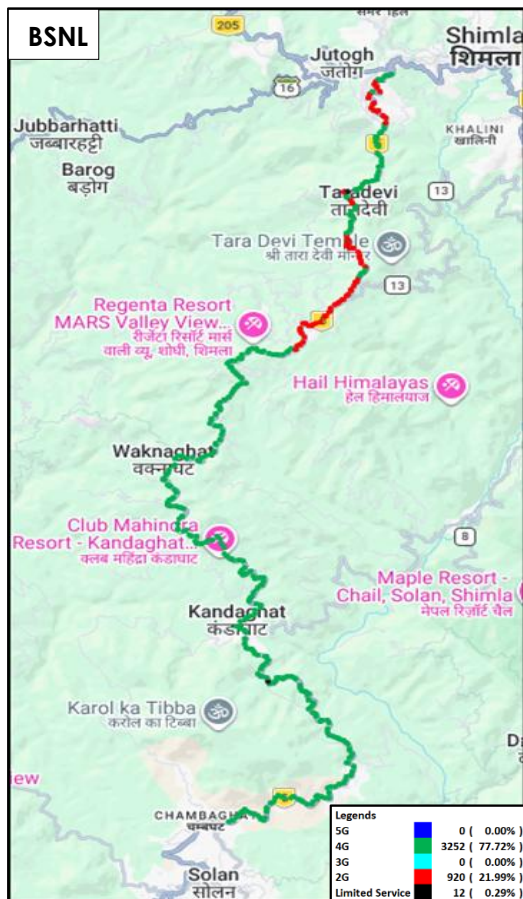


Figure-63: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - BSNL.



Figure-64: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

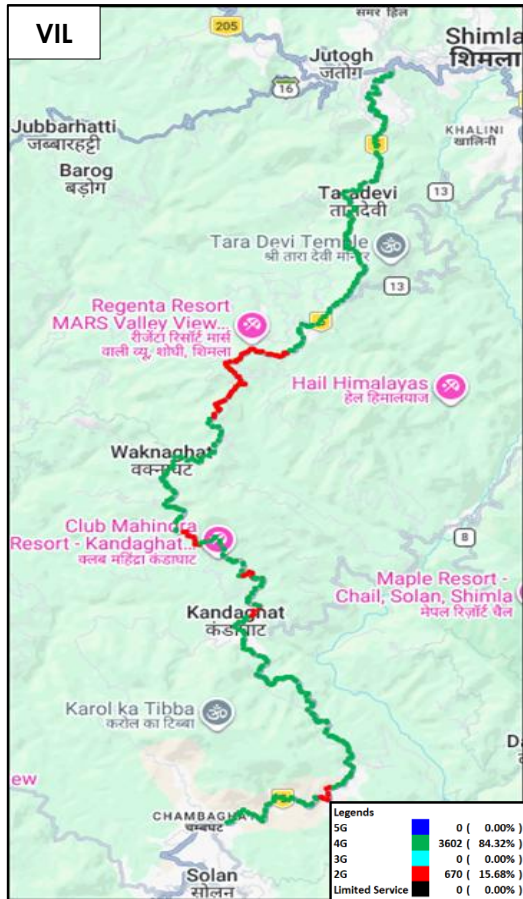


Figure-65: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - VIL.

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) voice. (Refer figure-99, 100, 101 & 102 for map view)

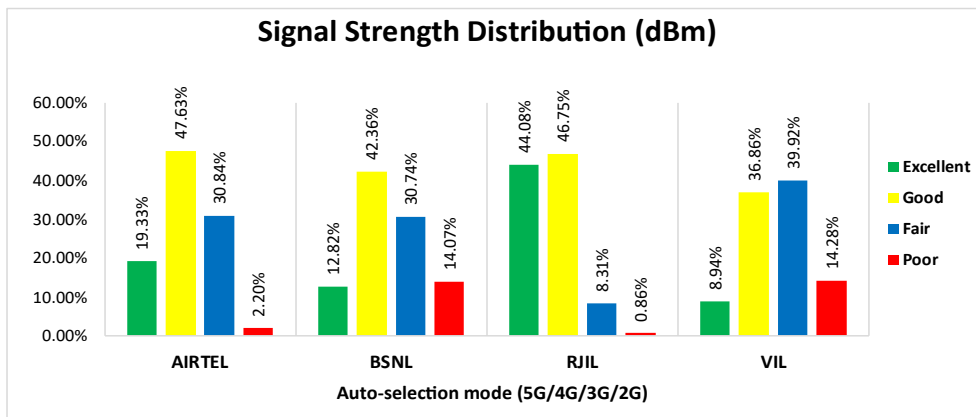


Figure-66: Signal strength distribution auto-selection mode (5G/4G/3G/2G) voice.

Observations:

- Airtel has 19% of samples falling in the excellent signal strength category.
- BSNL has 13% of samples falling in the excellent signal strength category.
- RJIL has 44% of samples falling in the excellent signal strength category.
- VIL has 9% 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 (Mbits/s)	Average	81.98	11.20	126.64	9.13
	80th Percentile	108.16	13.65	217.90	14.04
	20th Percentile	20.97	7.58	33.87	2.62
Upload Throughput (Mbits/s)	Average	13.73	4.31	14.87	4.88
	80th Percentile	23.53	5.34	28.56	7.51
	20th Percentile	2.09	1.33	3.11	1.77
Latency (ms)	50th Percentile	46.40	28.88	25.31	69.13

Table-78: Summary of Data performance in network auto-selection mode.

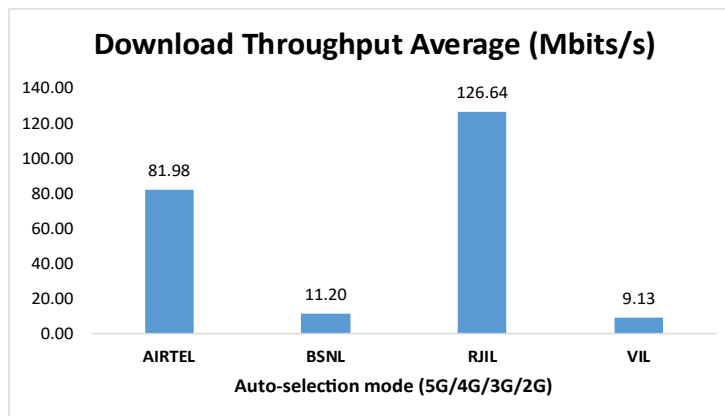


Figure-67: Download throughput.

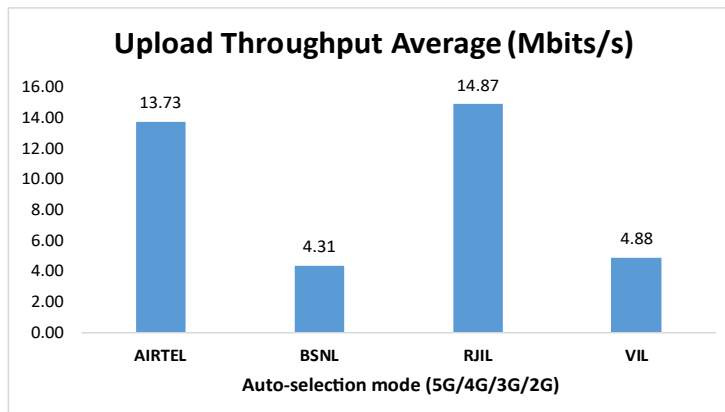


Figure- 68: Upload throughput.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	62.01%	NA	94.44%	NA
4G	37.71%	92.81%	5.56%	96.70%
3G	NA	0.05%	NA	NA
2G	0.28%	1.89%	NA	3.30%
Limited Service	0.00%	5.25%	0.00%	0.00%

Table-79: Time spent on technology during drive test in auto-selection mode (5G/4G/3G/2G) data.

Note-

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

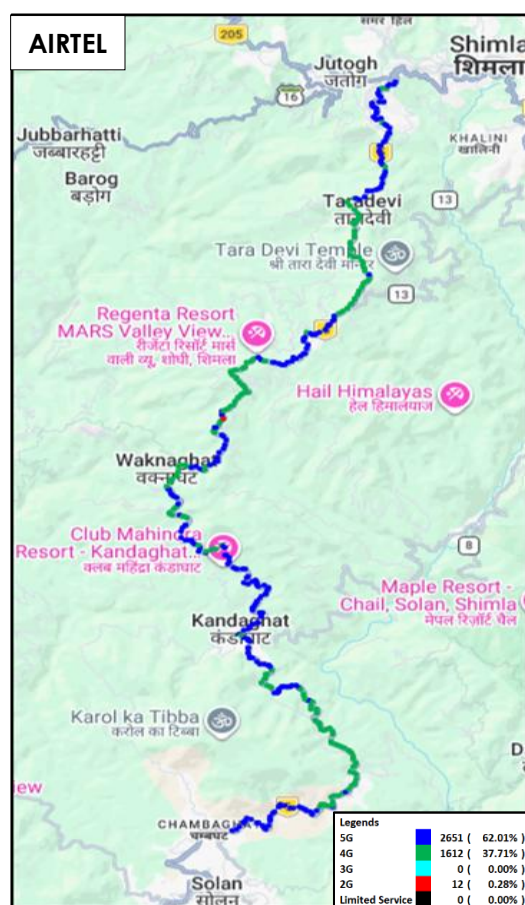


Figure-69: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

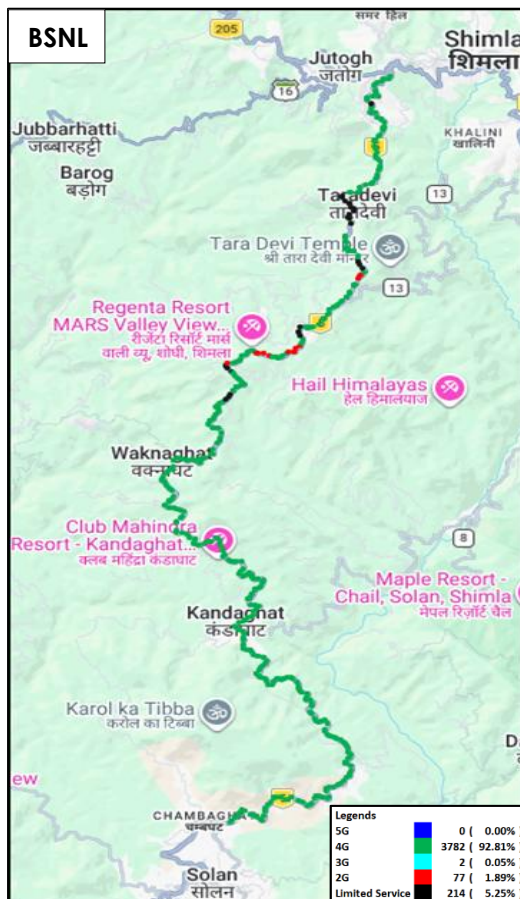


Figure-70: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - BSNL.



Figure-71: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - RJIL.

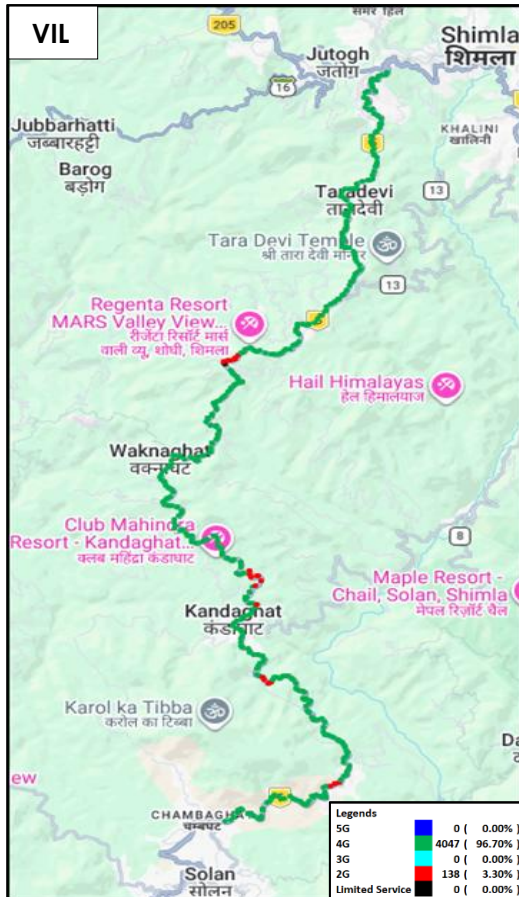


Figure-72: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - VIL.

(c) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) data. (Refer figure-103, 104, 105 & 106 for map view)

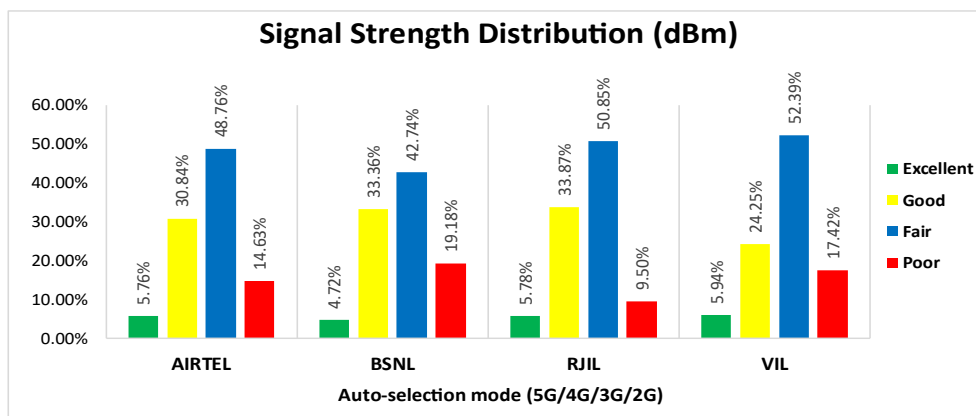


Figure-73: Signal strength distribution auto-selection mode (5G/4G/3G/2G) data.

Observations:

- Airtel has 6% of samples falling in the excellent signal strength category.
- BSNL has 5% of samples falling in the excellent signal strength category.
- RJIL has 6% of samples falling in the excellent signal strength category.
- VIL has 6% of samples falling in the excellent signal strength category.

5. Voice & Data Key findings

5.1 Overall Voice

1. Call Setup Success Rate:

- a) Airtel, BSNL and VIL have 97.62%, 94.68% and 94.02% call setup success rate respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL and VIL have 98.48%, 81.47%, 98.50% and 92.48% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)
- c) Airtel, BSNL and VIL have 100.00% call setup success rate while calling on peer service provider's network for inter-operator calls. (refer table-9)
- d) RJIL had a 100.00% call setup success when calling Airtel and VIL whereas call blocking was observed when calling BSNL. (refer table-9)

2. Call Setup Time:

- a) Airtel, BSNL and VIL call setup time is 3.37, 4.37 and 4.54 seconds respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL & VIL call setup time is 1.46, 2.25, 0.76 & 2.10 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, VIL, Airtel and RJIL have 6.44%, 4.70%, 4.18% and 2.26% silence call rate respectively. Further BSNL has higher RTP packet loss rate in downlink (6.92%) compared to VIL (3.85%), RJIL (2.30%) & Airtel (1.91%). In uplink the RTP packet loss rate is higher for BSNL (6.22%) compared to VIL (3.41%), RJIL (2.36%) & Airtel (1.84%). (refer table-6)

4. Drop Call Rate:

- a) Airtel, BSNL and VIL drop call rate is 2.06%, 5.06% and 3.28% respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL and VIL drop call rate is 0.70%, 10.19%, 0.97% and 3.77% respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

5.2 Overall Data

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

- a) Airtel, BSNL, RJIL and VIL average download speeds are 104.90 Mbps, 11.82 Mbps, 173.58 Mbps and 9.88 Mbps respectively. (refer table-11)
- b) Airtel, BSNL, RJIL and VIL average upload speeds are 17.61 Mbps, 5.63 Mbps, 18.20 Mbps and 4.27 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 158.45 Mbps, 15.30 Mbps, 225.72 Mbps and 12.12 Mbps respectively. (refer table-42)
- b) Airtel, BSNL, RJIL and VIL average upload speeds are 24.43 Mbps, 8.65 Mbps, 21.72 Mbps and 5.15 Mbps respectively. (refer table-42)

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

- a) Airtel, BSNL, RJIL and VIL have 100.00%, 100.00%, 100.00% and 91.67% download session setup success rate respectively. (refer table-42)
- b) Airtel, BSNL, RJIL and VIL have 100.00%, 100.00%, 100.00% and 95.00% upload session setup success rate respectively. (refer table-42)

5.3 Operator wise Key Findings

1.Airtel:

Voice

- 97.62% call setup success rate and 2.06% 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)
- 98.48% call setup success rate and 0.70% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 98.77% call setup success rate and 2.00% drop call rate have been observed in 3G/2G network mode for Shimla district drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 99.28% call setup success rate and 0.24% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Shimla district drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-15)
- 94.12% call setup success rate and 2.68% drop call rate have been observed in 3G/2G network mode for Solan district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-21)
- 93.65% call setup success rate and 2.54% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-23)
- 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-29)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-68 & 69)
- 95.45% call setup success rate and 0.00% drop call rate have been observed in 3G/2G network mode for Solan to Shimla highway route. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-72)
- 100.00% call setup success rate and 4.55% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan to Shimla highway route. Performance is not meeting the benchmark of 2.00% for drop call rate. (refer table-74)

Data

- Airtel has 104.90 Mbps average download speed & 17.61 Mbps average upload speed for LSA. (refer table-11)
- Airtel has 83.09 Mbps average download speed & 13.90 Mbps average upload speed across measured routes for Shimla district drive. (refer table-19)
- Airtel has 170.17 Mbps average download speed & 26.31 Mbps average upload speed across measured routes for Solan district drive. (refer table-27)
- Civil Hospital Chail and High Court Shimla have less download speed (less than 100 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-43 & 48)

- Civil Hospital Chail, District Court Shimla, High Court Shimla, ISBT Shimla, Shri Sankat Mochan Hanuman Mandir Shimla and University Institute of Information Technology Shimla have less upload speed (less than 20 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-43, 45, 48, 51, 53 & 54)
- Both Walk test locations have less download speed (less than 100 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-70 & 71)
- Both Walk test locations have less upload speed (less than 20 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-70 & 71)
- Airtel has 81.98 Mbps average download speed & 13.73 Mbps average upload speed across measured routes for Solan to Shimla highway route. (refer table-78)

2. BSNL:

Voice

- 94.68% call setup success rate and 5.06% 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)
- 81.47% call setup success rate and 10.19% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 94.76% call setup success rate and 4.27% drop call rate have been observed in 3G/2G network mode for Shimla district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 77.96% call setup success rate and 12.08% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Shimla district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-15)
- 94.17% call setup success rate and 4.42% drop call rate have been observed in 3G/2G network mode for Solan district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-21)
- 88.81% call setup success rate and 9.24% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-23)
- 87.50% 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-29)
- 90.32% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Mall Road Shimla walk test location. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-68)
- 87.50% call setup success rate and 21.43% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Shimla Railway Station walk test location. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-69)

- 95.83% call setup success rate and 21.74% drop call rate have been observed in 3G/2G network mode for Solan to Shimla highway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-72)
- 70.97% call setup success rate and 36.36% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan to Shimla highway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-74)

Data

- BSNL has 11.82 Mbps average download speed & 5.63 Mbps average upload speed for LSA. (refer table-11)
- BSNL has 10.99 Mbps average download speed & 4.81 Mbps average upload speed across measured routes for Shimla district drive. (refer table-19)
- BSNL has 11.99 Mbps average download speed & 6.35 Mbps average upload speed across measured routes for Solan district drive. (refer table-27)
- High Court Shimla, Shri Sankat Mochan Hanuman Mandir Shimla and University Institute of Information Technology Shimla have less download speed (less than 10 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-48, 53 & 54)
- ISBT Shimla has less upload speed (less than 2 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-51)
- BSNL has 11.20 Mbps average download speed & 4.31 Mbps average upload speed across measured routes for Solan to Shimla highway route. (refer table-78)

3. RJIL:

Voice

- 98.50% call setup success rate and 0.97% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 100.00% call setup success rate and 0.24% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Shimla district drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-15)
- 91.41% call setup success rate and 5.13% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-23)
- 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-29)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-68 & 69)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan to Shimla highway route. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-74)

Data

- RJIL has 173.58 Mbps average download speed & 18.20 Mbps average upload speed for LSA. (refer table-11)
- RJIL has 163.01 Mbps average download speed & 15.43 Mbps average upload speed across measured routes for Shimla district drive. (refer table-19)
- RJIL has 208.71 Mbps average download speed & 26.55 Mbps average upload speed across measured routes for Solan district drive. (refer table-27)
- Civil Hospital Chail and University Institute of Information Technology Shimla have less download speed (less than 100 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-43 & 54)
- Civil Hospital Chail, DAV School Shimla, District Court Solan, ISBT Shimla and University Institute of Information Technology Shimla have less upload speed (less than 20 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-43, 44, 46, 51 & 54)
- Shimla Railway Station has less download speed (less than 100 Mbps) out of total 2 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-71)
- Shimla Railway Station has less upload speed (less than 20 Mbps) out of total 2 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-71)
- RJIL has 126.64 Mbps average download speed & 14.87 Mbps average upload speed across measured routes for Solan to Shimla highway route. (refer table-78)

**4. VIL:
Voice**

- 94.02% call setup success rate and 3.28% 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)
- 92.48% call setup success rate and 3.77% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 94.65% call setup success rate and 3.34% drop call rate have been observed in 3G/2G network mode for Shimla district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 88.56% call setup success rate and 5.17% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Shimla district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-15)
- 91.60% call setup success rate and 1.83% drop call rate have been observed in 3G/2G network mode for Solan district drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-21)
- 96.72% call setup success rate and 4.24% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan district drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-23)
- 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-29)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Mall Road Shimla walk test location. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-68)
- 87.50% call setup success rate and 7.14% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Shimla Railway Station walk test location. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-69)
- 95.45% call setup success rate and 9.52% drop call rate have been observed in 3G/2G network mode for Solan to Shimla highway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-72)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Solan to Shimla highway route. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-74)

Data

- VIL has 9.88 Mbps average download speed & 4.27 Mbps average upload speed for LSA. (refer table-11)
- VIL has 10.30 Mbps average download speed & 3.32 Mbps average upload speed across measured routes for Shimla district drive. (refer table-19)
- VIL has 8.77 Mbps average download speed & 6.38 Mbps average upload speed across measured routes for Solan district drive. (refer table-27)
- Civil Hospital Chail, District Court Solan, High Court Shimla, ISBT Shimla and University Institute of Information Technology Shimla have less download speed (less than 10 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-43, 46, 48, 51 & 54)
- Civil Hospital Chail, High Court Shimla, Shri Sankat Mochan Hanuman Mandir Shimla and University Institute of Information Technology Shimla have less upload speed (less than 2 Mbps) out of total 12 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-43, 48, 53 & 54)
- Both walk test locations have less download speed (less than 10 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-70 & 71)
- Shimla Railway Station has less upload speed (less than 2 Mbps) out of total 2 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-71)
- VIL has 9.13 Mbps average download speed & 4.88 Mbps average upload speed across measured routes for Solan to Shimla highway route. (refer table-78)

6. Annexure

6.1 Route wise coverage map

6.1.1 City

i) Shimla District

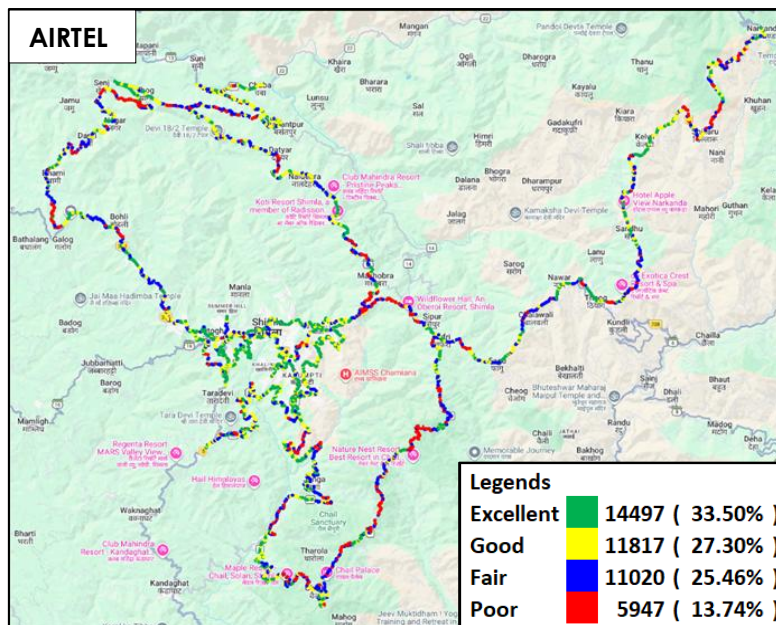


Figure-74: Signal strength 3G/2G network mode voice - AIRTEL.

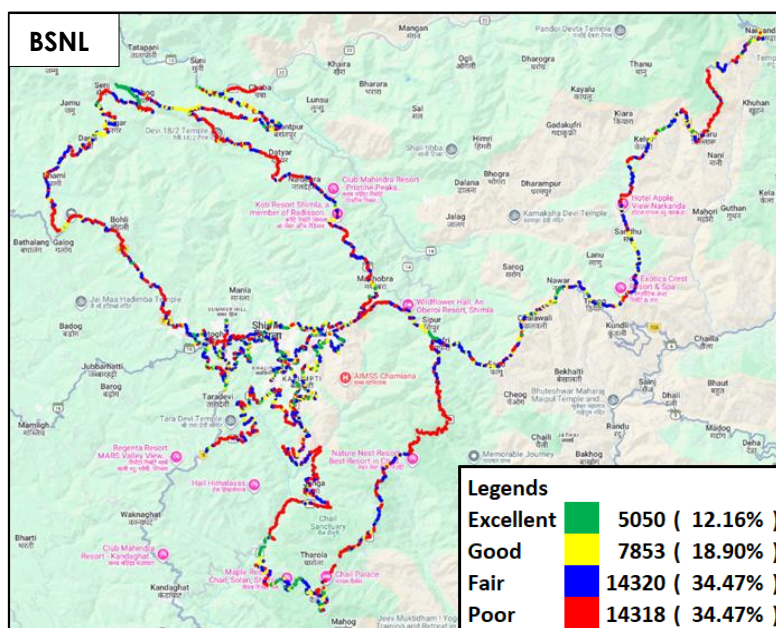


Figure-75: Signal strength 3G/2G network mode voice - BSNL.

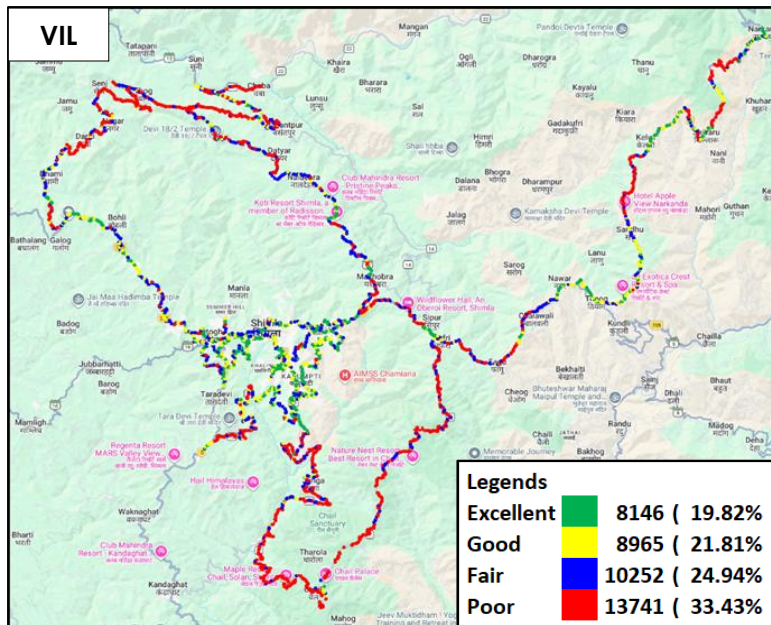


Figure-76: Signal strength 3G/2G network mode voice - VIL.

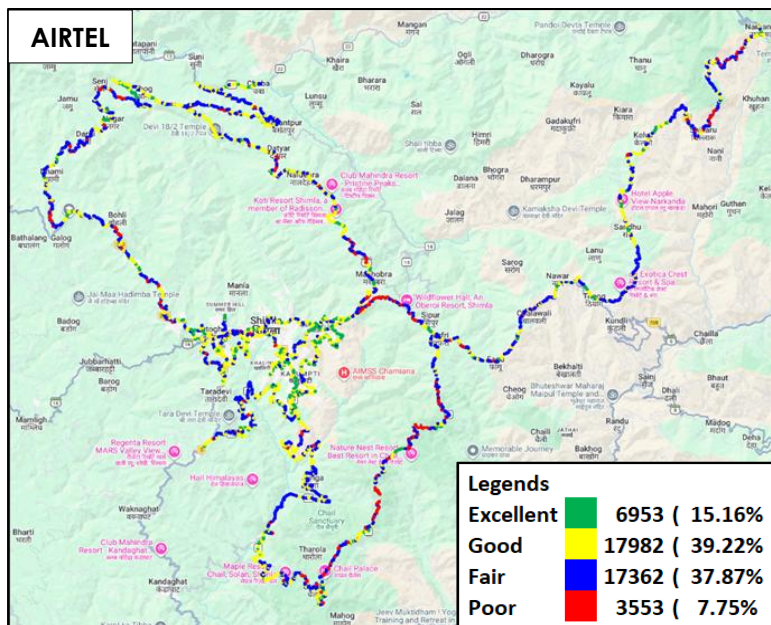


Figure-77: Signal strength auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

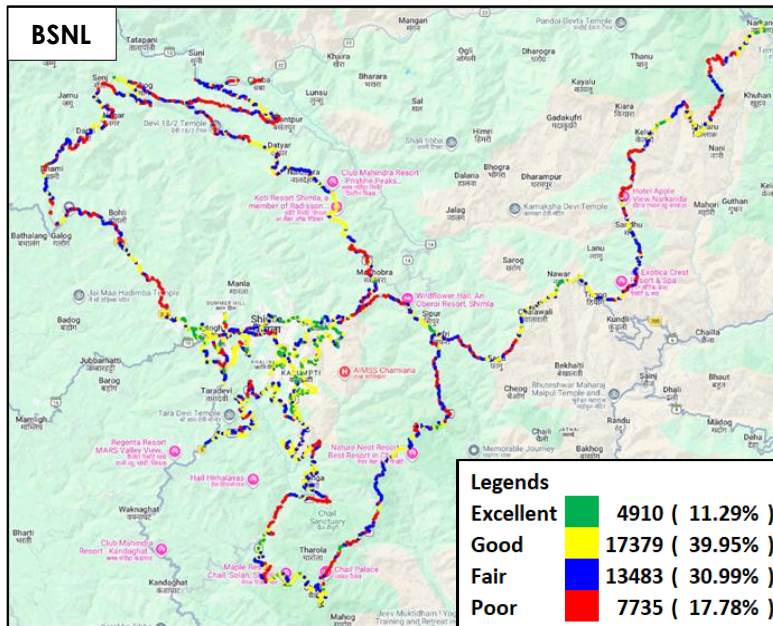


Figure-78: Signal strength auto-selection mode (5G/4G/3G/2G) voice - BSNL.

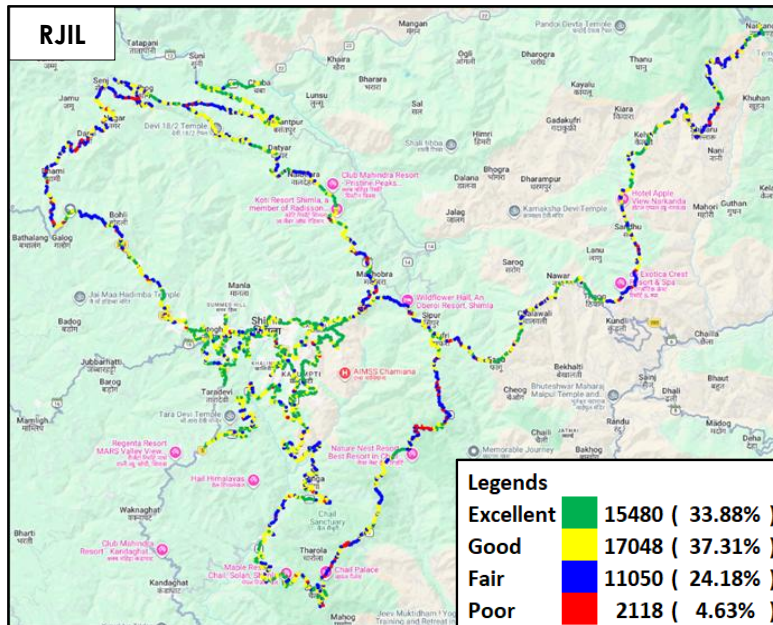


Figure-79: Signal strength auto-selection mode (5G/4G/3G/2G) voice - RJIL.

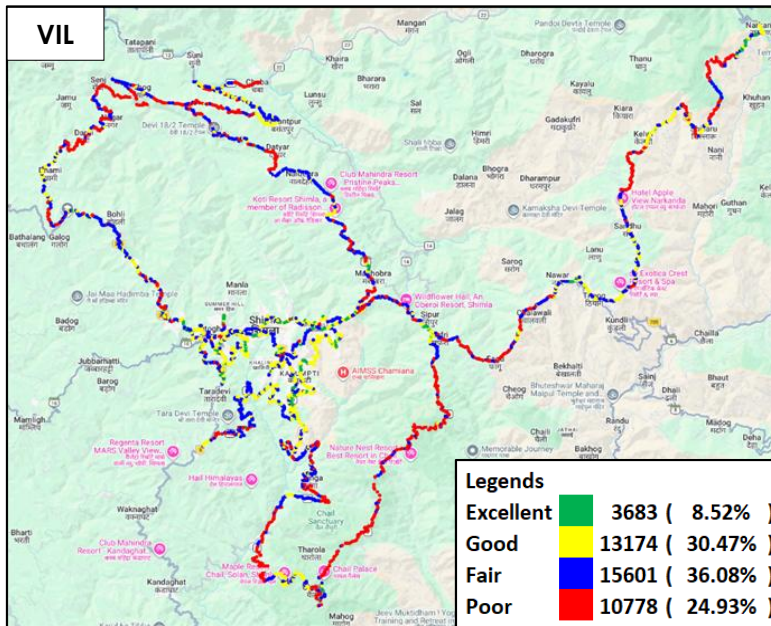


Figure-80: Signal strength auto-selection mode (5G/4G/3G/2G) voice - VIL.

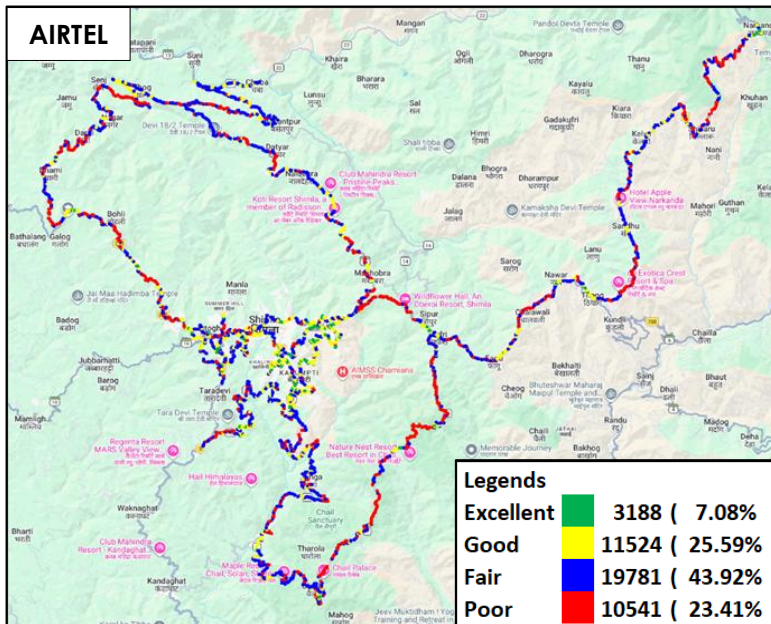


Figure-81: Signal strength auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

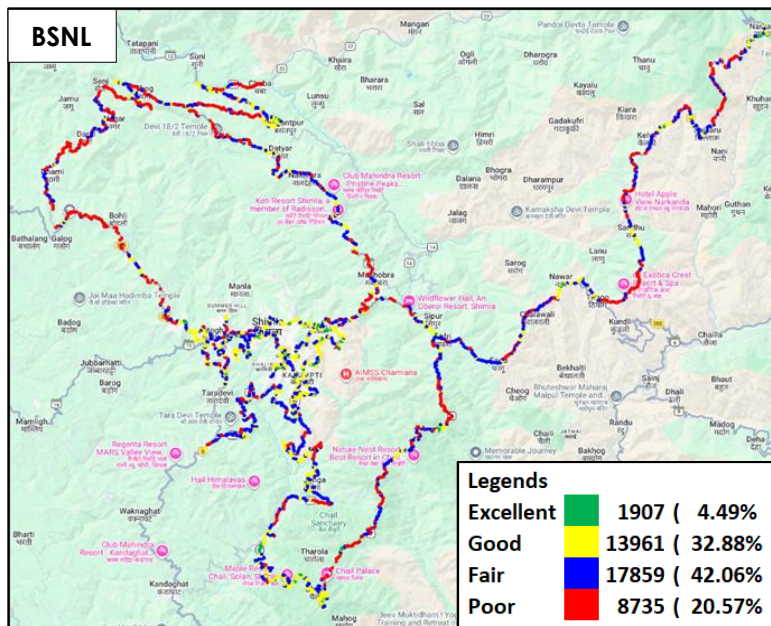


Figure-82: Signal strength auto-selection mode (5G/4G/3G/2G) data - BSNL.

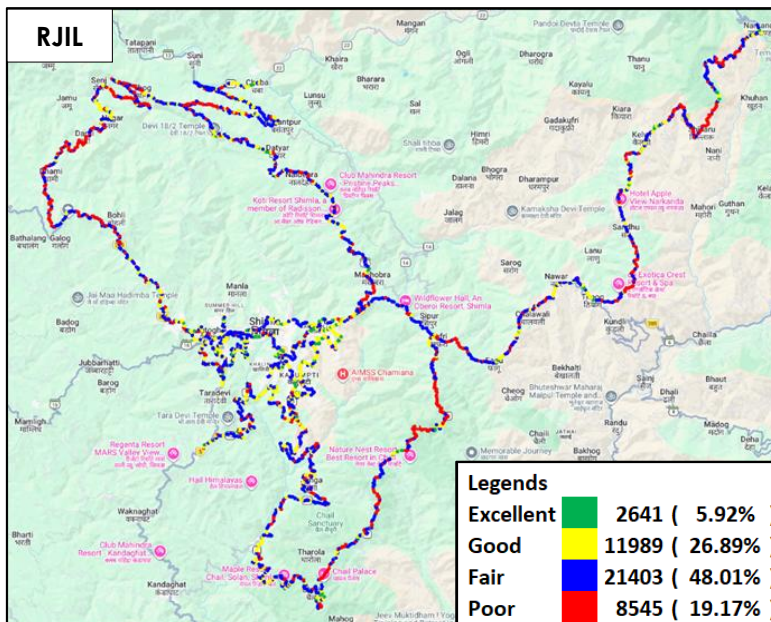


Figure-83: Signal strength auto-selection mode (5G/4G/3G/2G) data - RJIL.

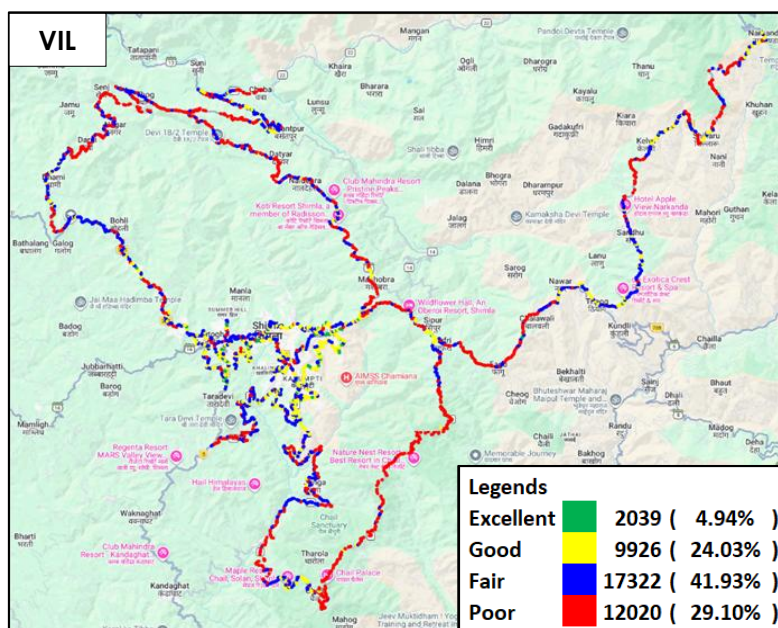


Figure-84: Signal strength auto-selection mode (5G/4G/3G/2G) data - VIL.

ii) Solan District

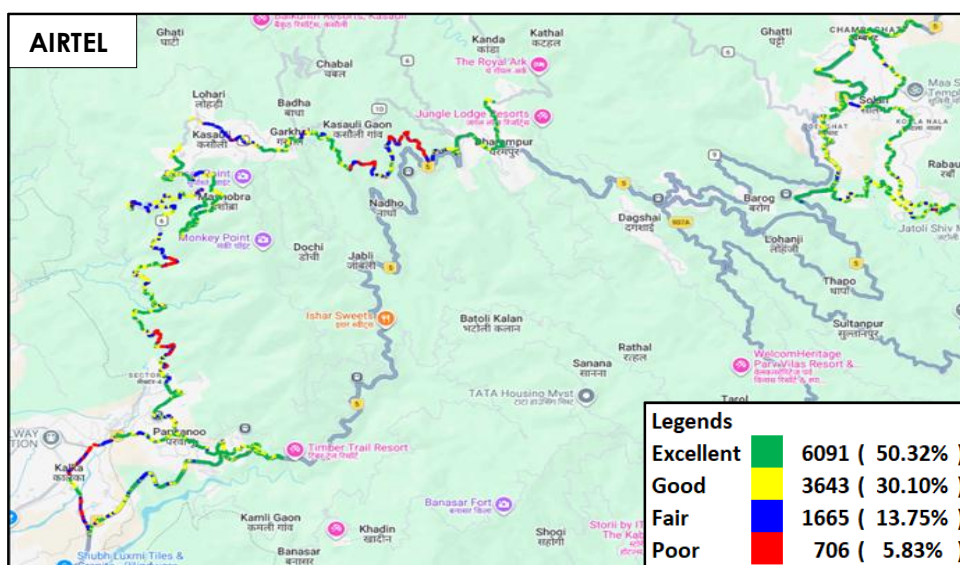


Figure-85: Signal strength 3G/2G network mode voice - AIRTEL.

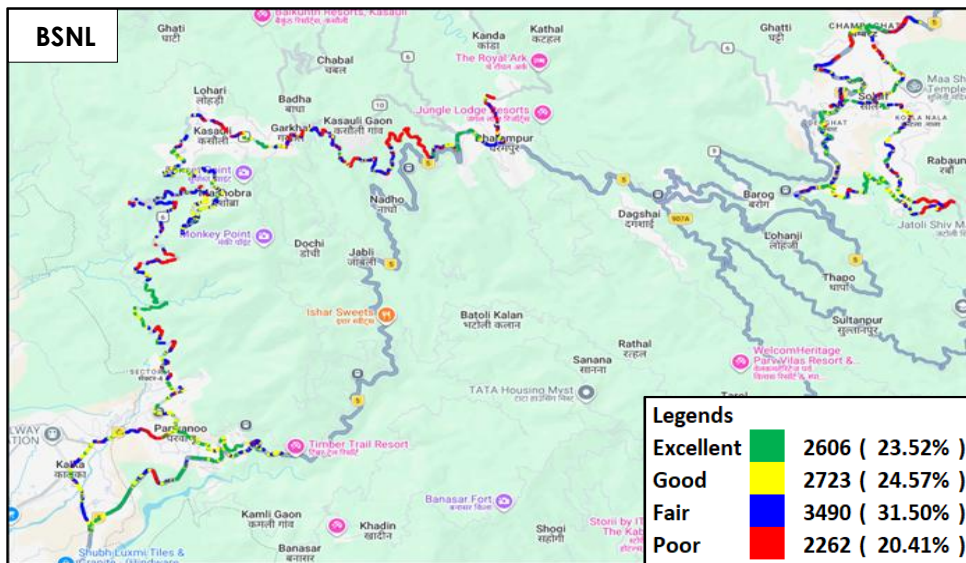


Figure-86: Signal strength 3G/2G network mode voice - BSNL.

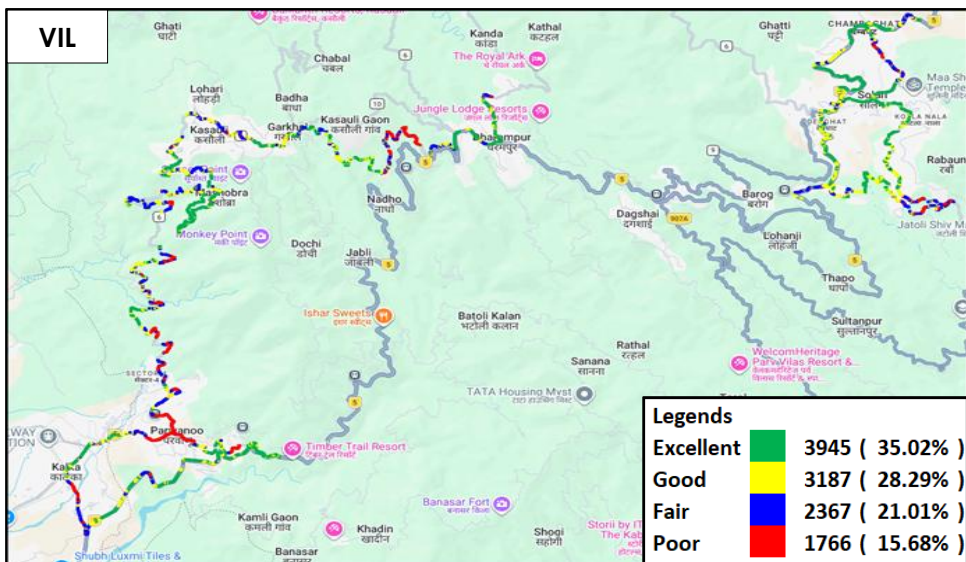


Figure-87: Signal strength 3G/2G network mode voice - VIL.

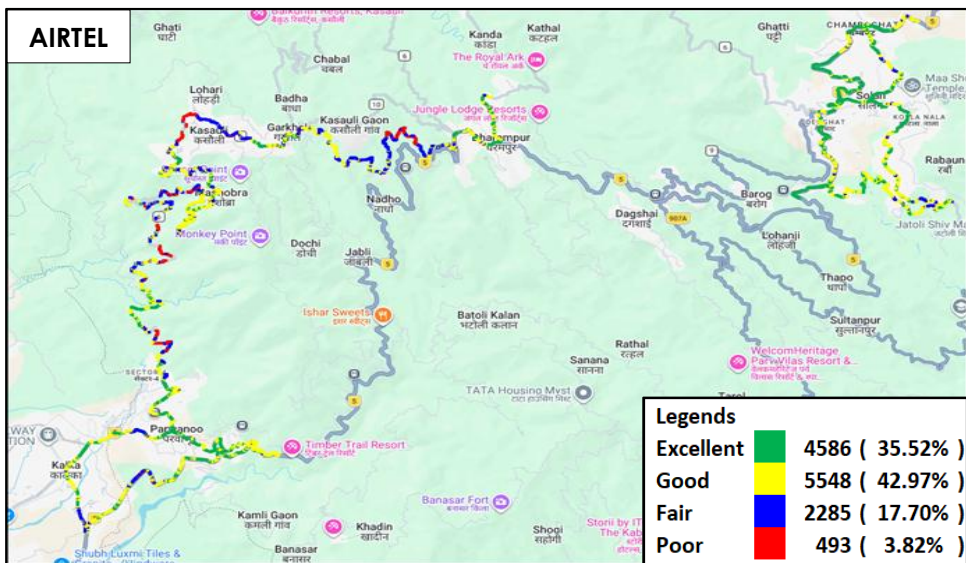


Figure-88: Signal strength auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

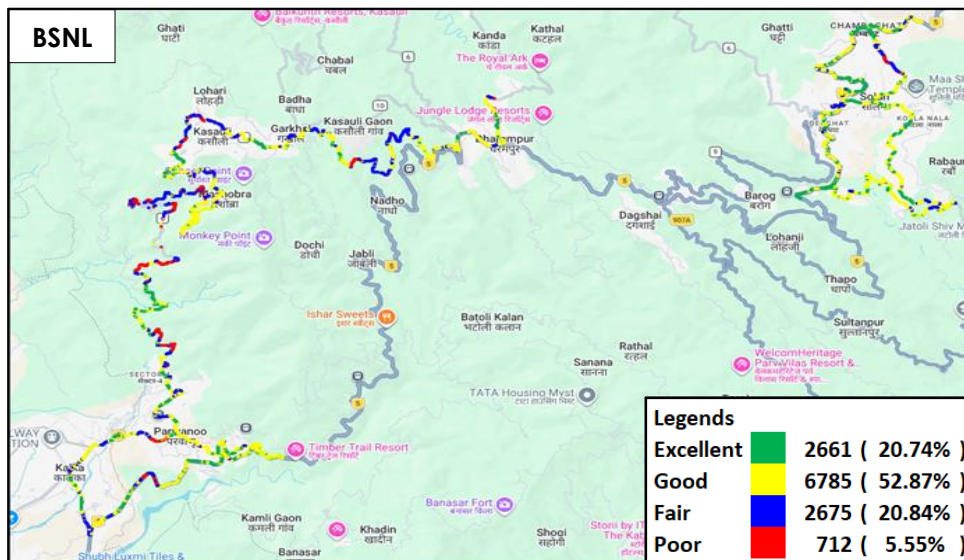


Figure-89: Signal strength auto-selection mode (5G/4G/3G/2G) voice - BSNL.

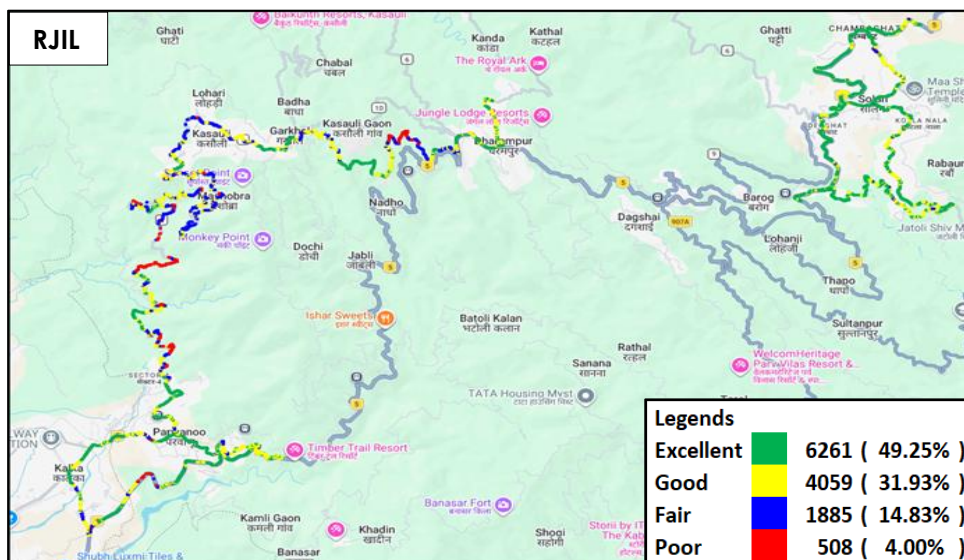


Figure-90: Signal strength auto-selection mode (5G/4G/3G/2G) voice - RJIL.

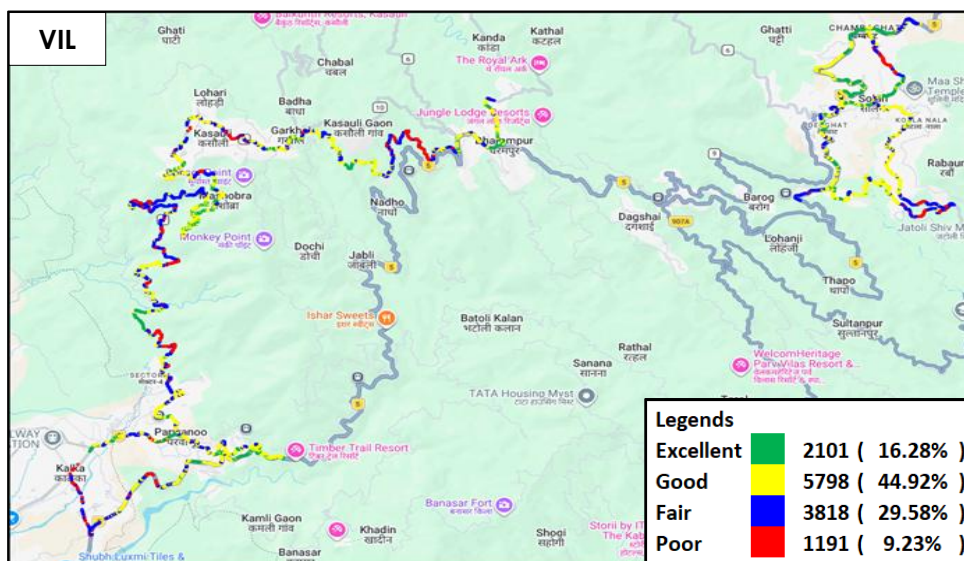


Figure-91: Signal strength auto-selection mode (5G/4G/3G/2G) voice - VIL.

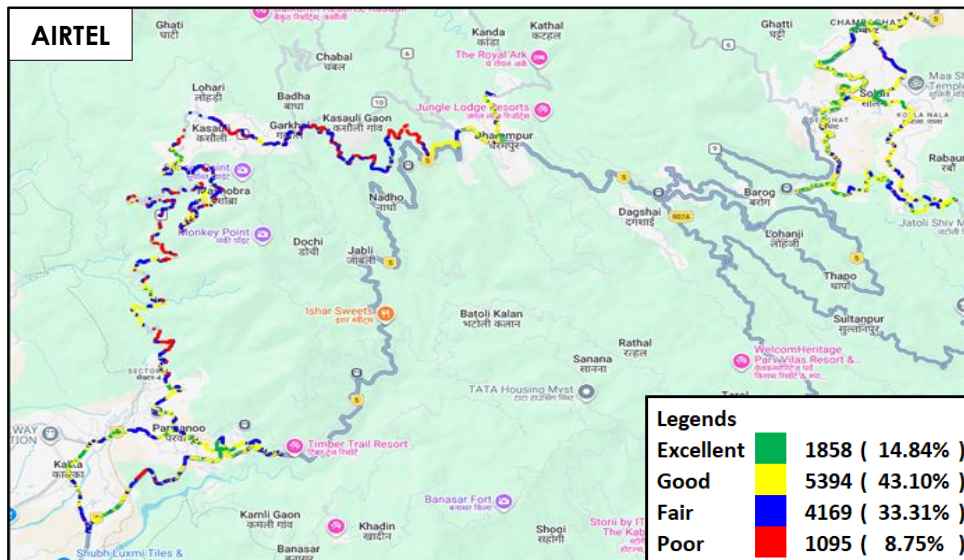


Figure-92: Signal strength auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

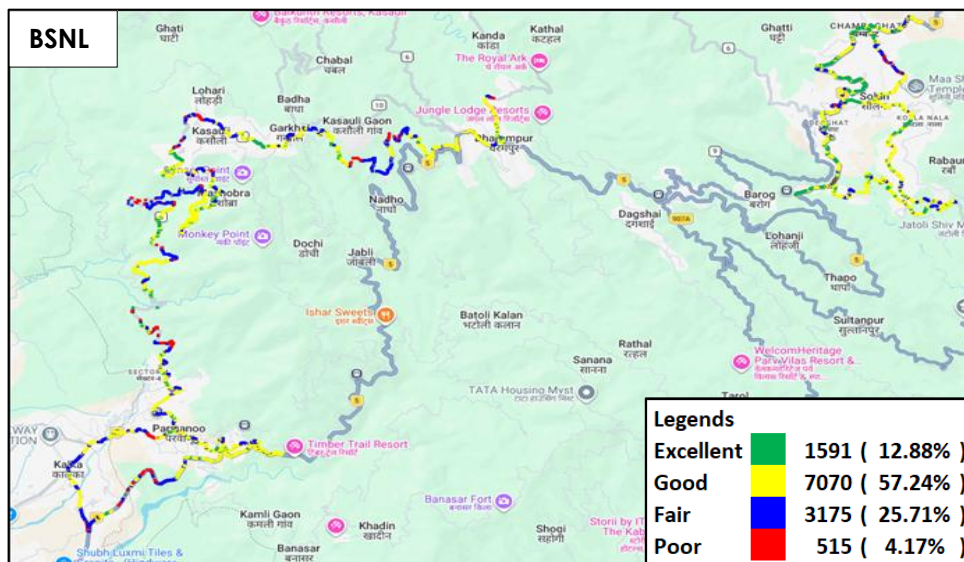


Figure-93: Signal strength auto-selection mode (5G/4G/3G/2G) data - BSNL.

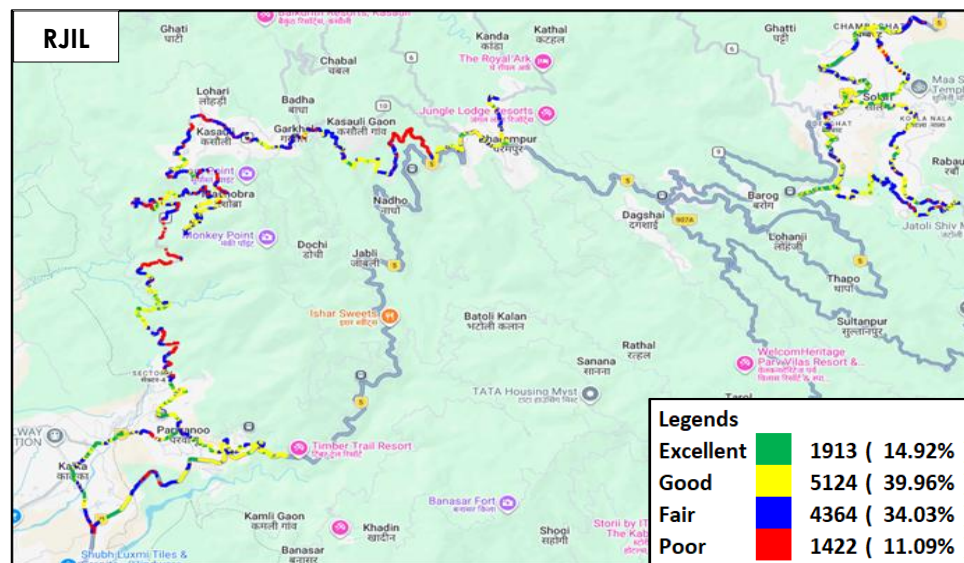


Figure-94: Signal strength auto-selection mode (5G/4G/3G/2G) data - RJIL.

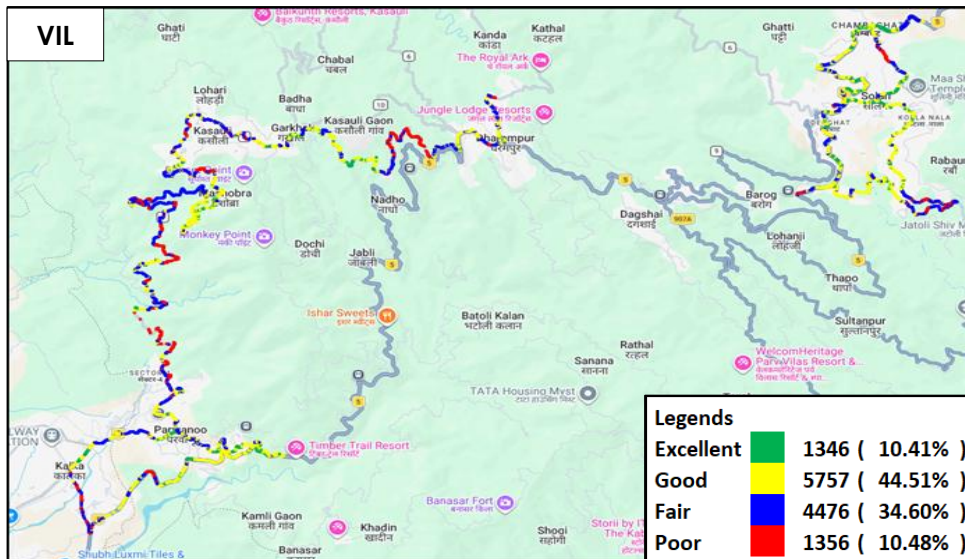


Figure-95: Signal strength auto-selection mode (5G/4G/3G/2G) data - VIL.

6.2.1 Highway

i) Solan to Shimla

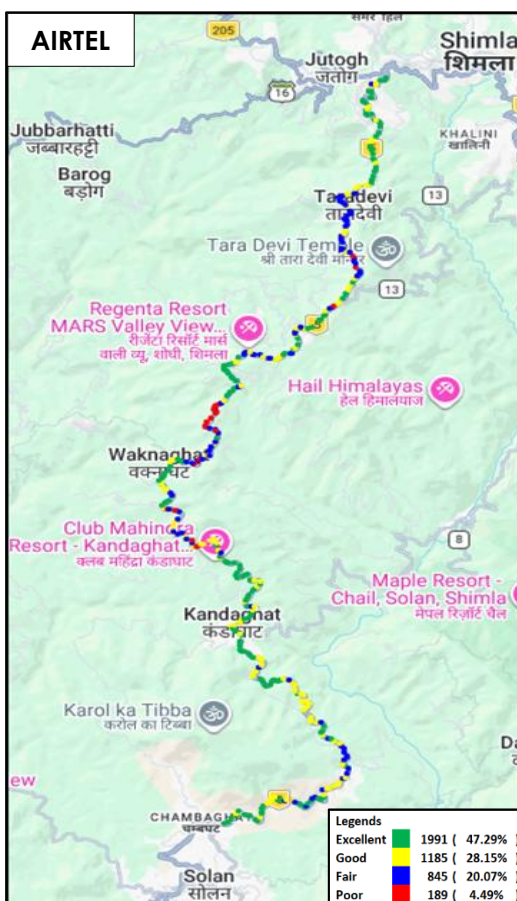


Figure-96: Signal strength 3G/2G network mode voice - AIRTEL.

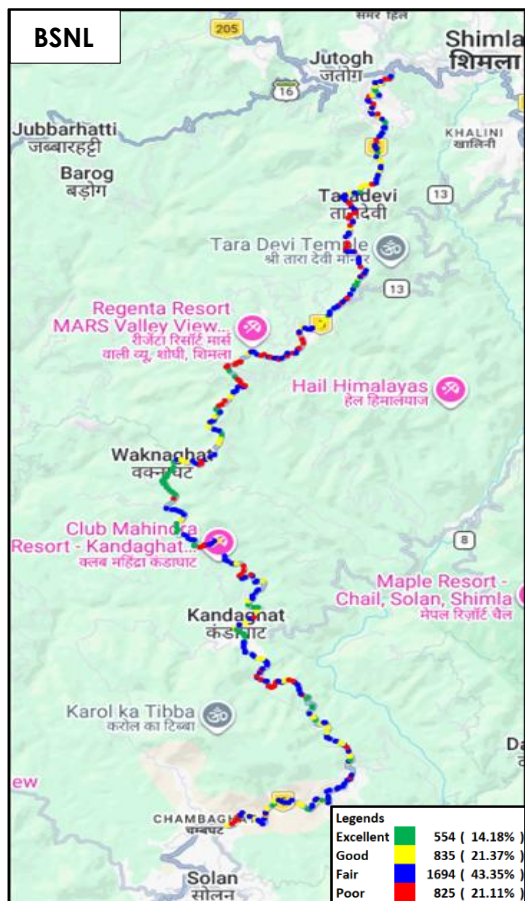


Figure-97: Signal strength 3G/2G network mode voice - BSNL.

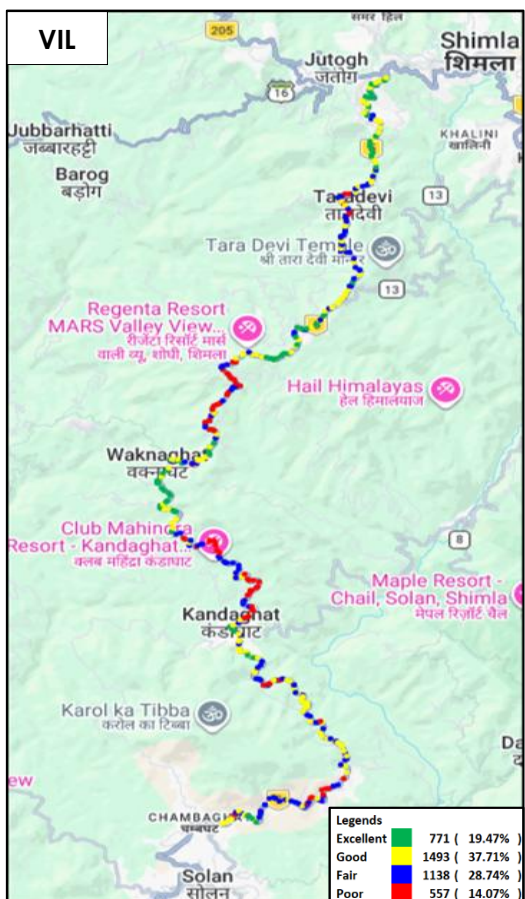


Figure-98: Signal strength 3G/2G network mode voice - VIL.

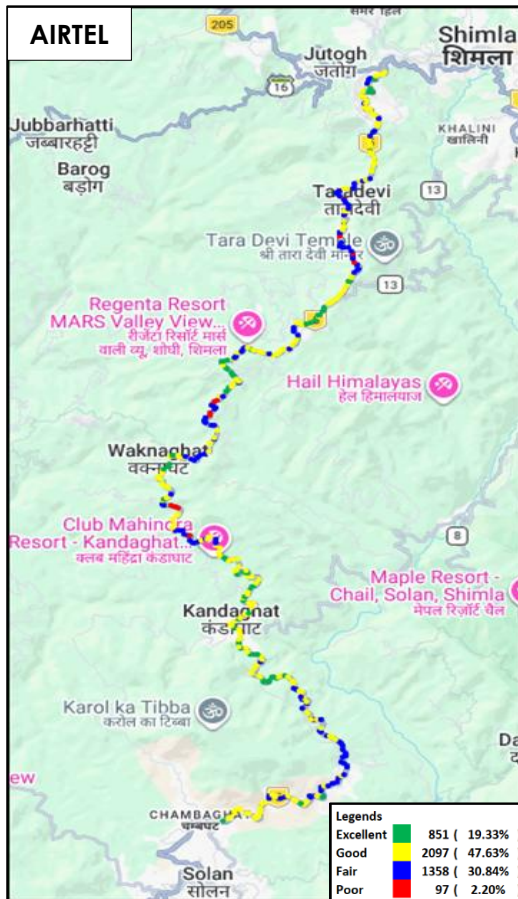


Figure-99: Signal strength auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

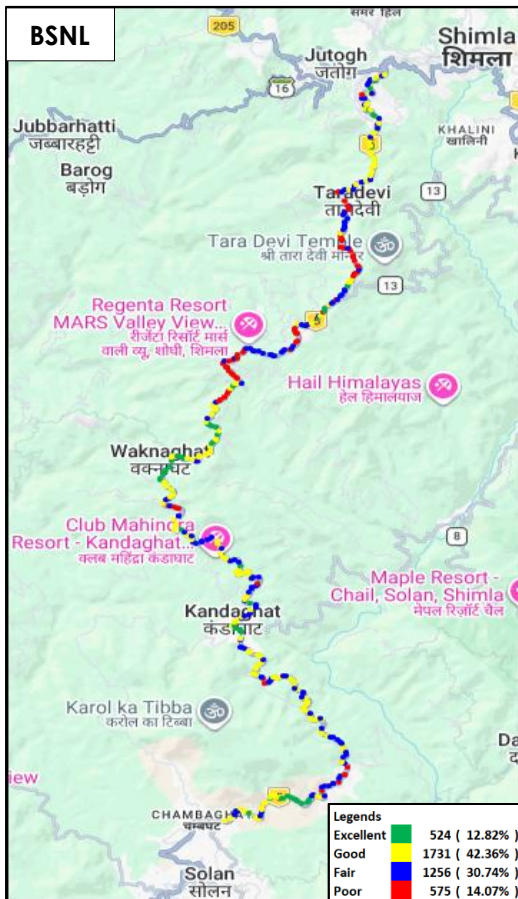


Figure-100: Signal strength auto-selection mode (5G/4G/3G/2G) voice - BSNL.

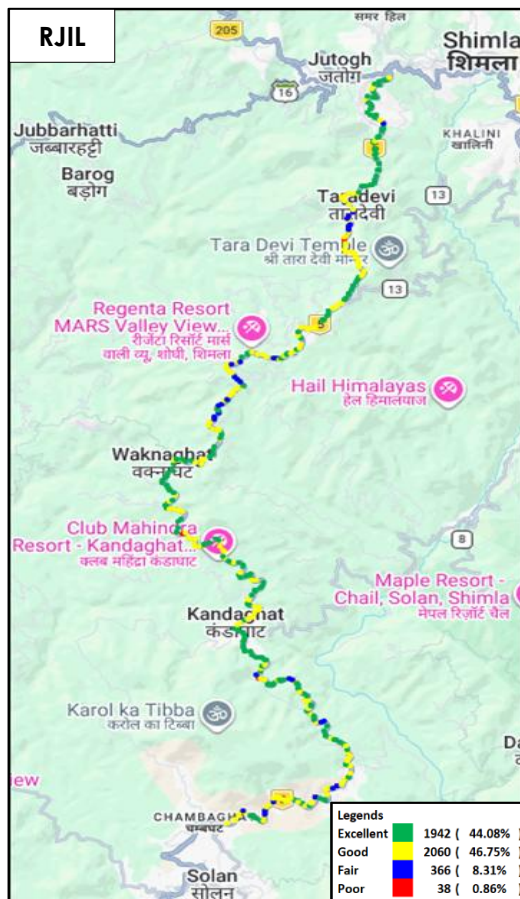


Figure-101: Signal strength auto-selection mode (5G/4G/3G/2G) voice - RJIL.

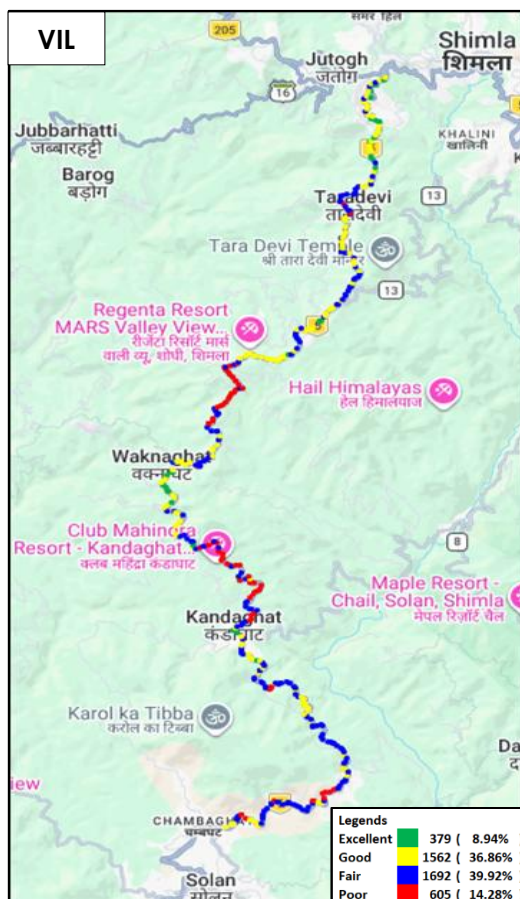


Figure-102: Signal strength auto-selection mode (5G/4G/3G/2G) voice - VIL.

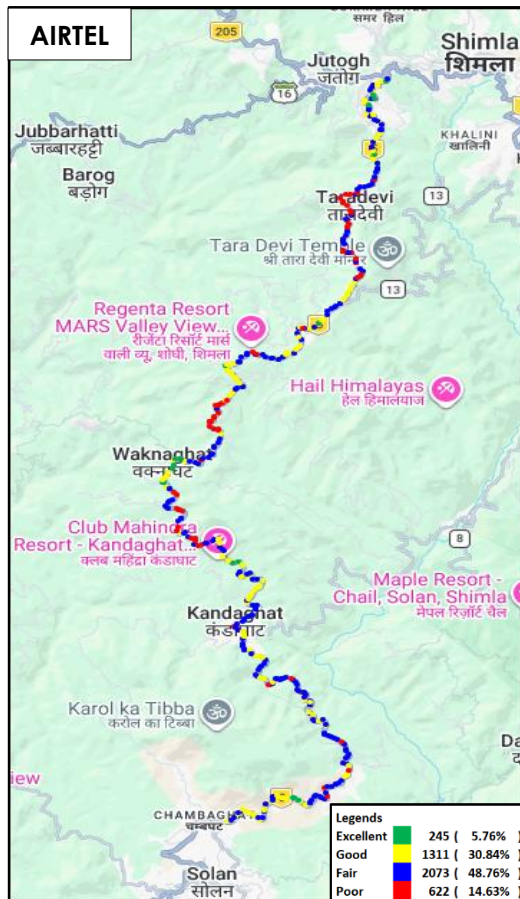


Figure-103: Signal strength auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

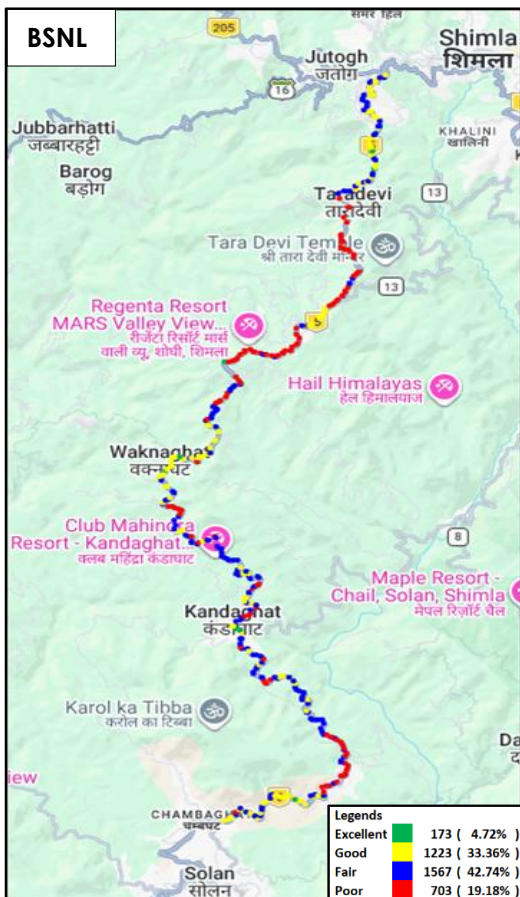


Figure-104: Signal strength auto-selection mode (5G/4G/3G/2G) data - BSNL.

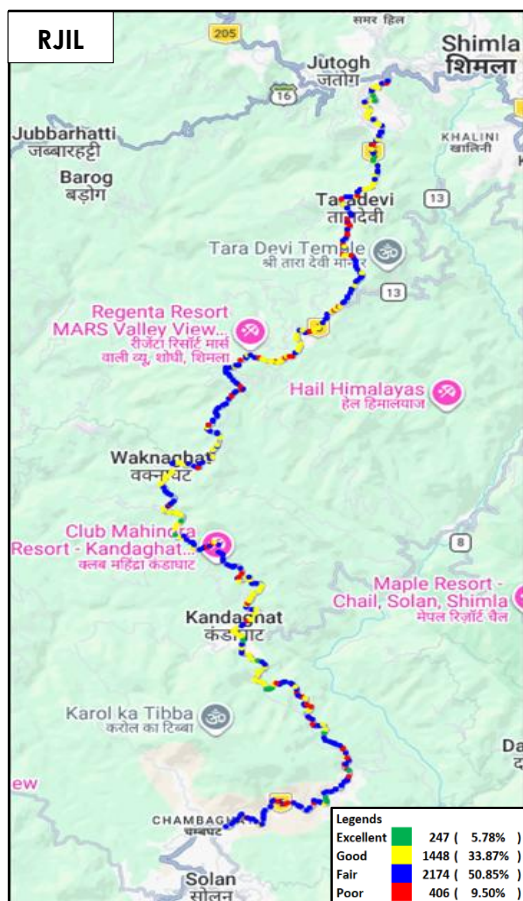


Figure-105: Signal strength auto-selection mode (5G/4G/3G/2G) data - RJIL.

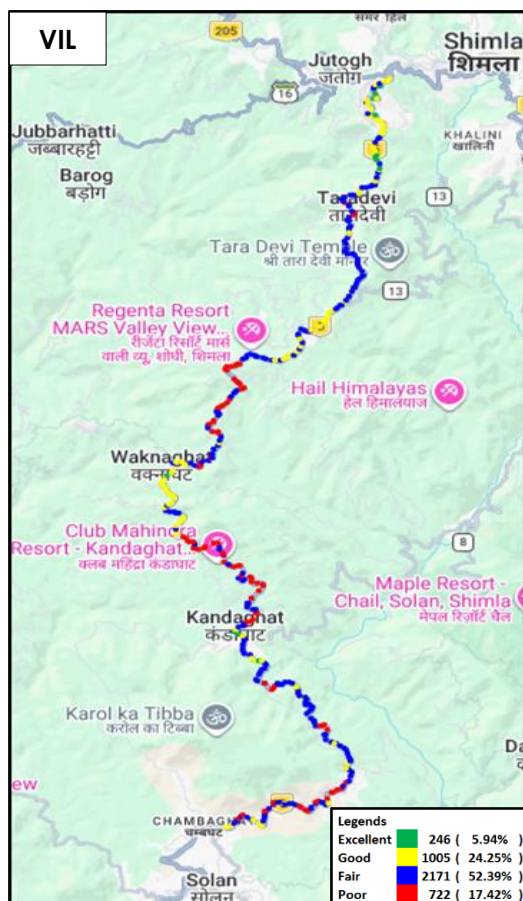


Figure-106: Signal strength auto-selection mode (5G/4G/3G/2G) data - VIL.

7. Appendix

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

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

7.1 Appendix-I

7.1.1 Drive test setup

Voice Call		
Call details	Technology	Detail
Call Setup Timeout	• 3G/2G auto mode- switch Call • 5G/4G/3G/2G auto mode- switch Call • 5G/4G MOS Call	30 Sec
Call Duration		90/180 seconds
Wait/ Guard Time		15 Sec

Table-80: Voice test detail

Note-

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

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

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

Table-81: Data test detail

Note-

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

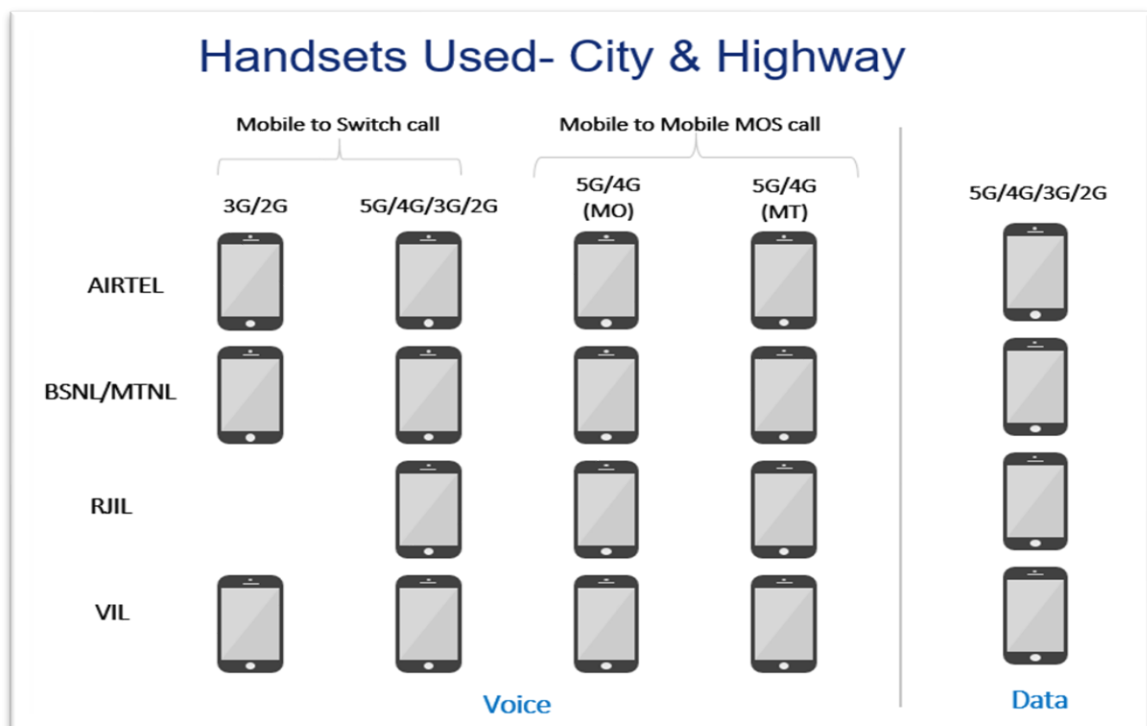


Figure-107: Number of handsets used in city & highway drive

MO: Mobile originating

MT: Mobile terminating

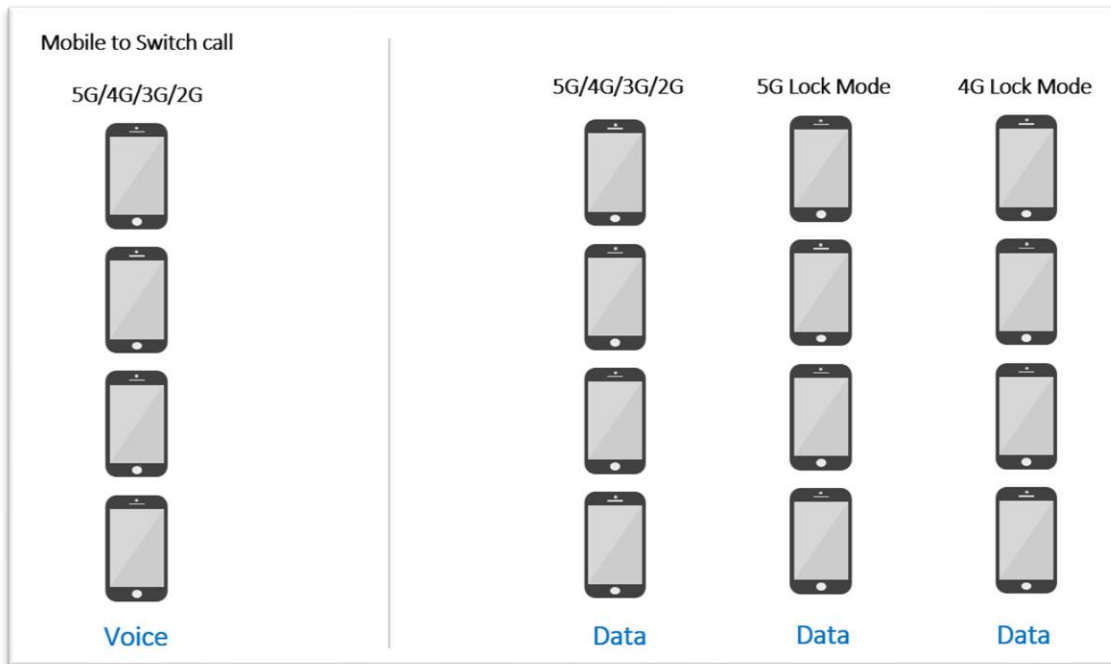


Figure-108: Number of handsets used in railway/metro/walktest/hotspot/coastal area.

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)

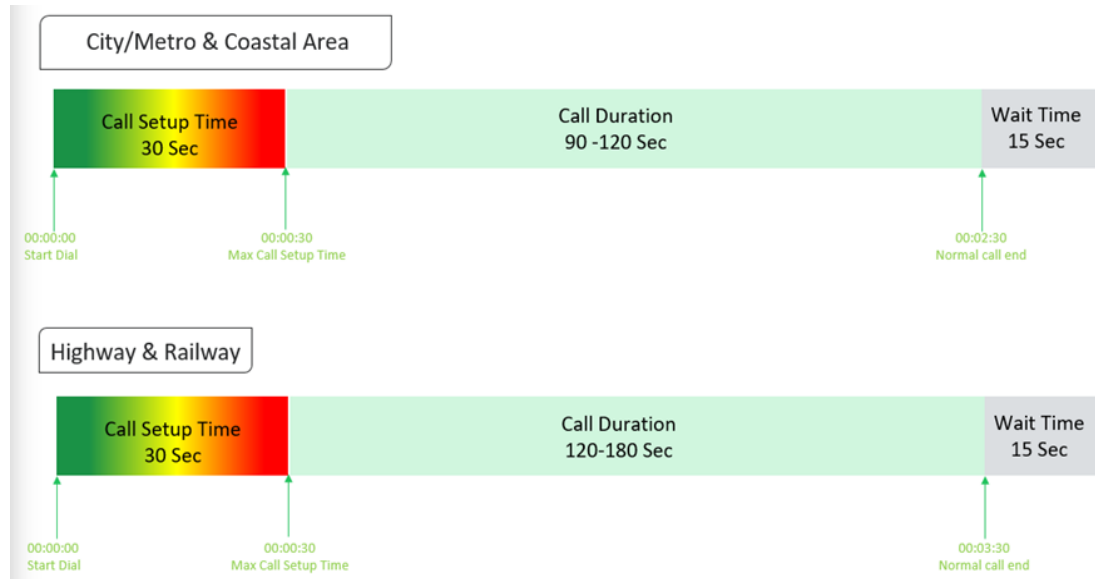


Figure-109: Voice test script for city/railway/metro/highway & coastal area

- 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-110: 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

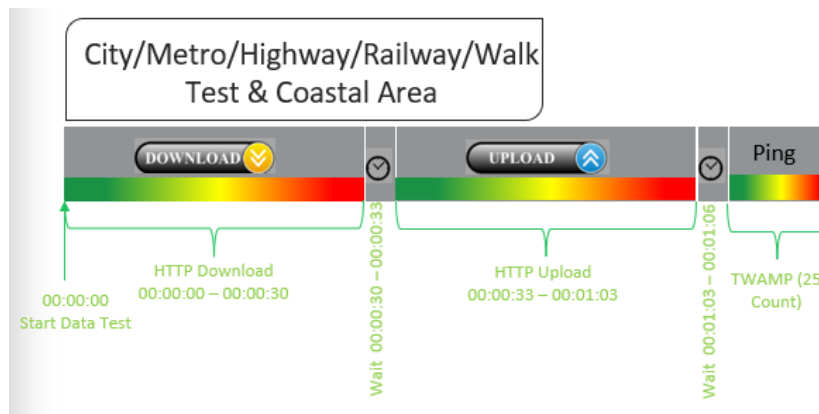


Figure-111: Data test script used in city/metro/railway/highway/walk test & coastal area

(d) Static Data(internet) testing

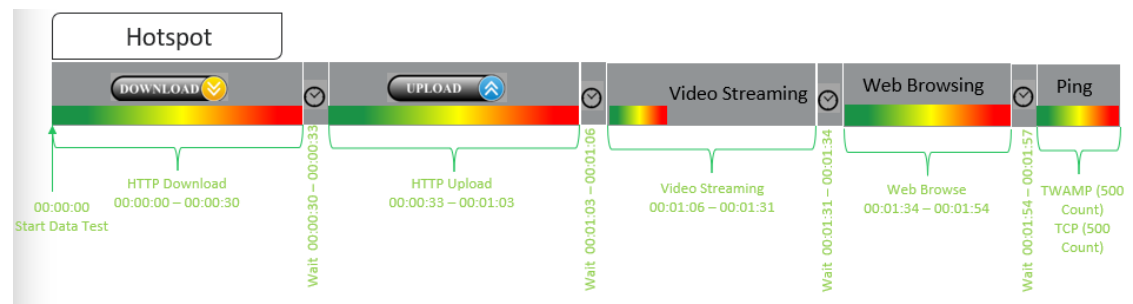


Figure-112: Data test script used at hotspot

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

7.2 Appendix-II

7.2.1 Network Performance Parameters for Voice calls

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

Jitter	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: $D(i,j) = (R_j - R_i) - (S_j - S_i)$ The interarrival jitter is calculated continuously as each data packet i is received from source $SSRC_n$, using this difference D for that packet and the previous packet $i-1$ in order of arrival (not necessarily in sequence), according to the formula $J(i) = J(i-1) + (D(i-1,i) - J(i-1))/16$ or 8																																		
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	Signal strength is the signal power level received by the wireless user. <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
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SS_RSRP	NR	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min																														

Table-82: Network performance parameter and definition voice

7.2.2 Network Performance Parameters Data tests

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

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

Table-83: 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.