



TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

West Bengal LSA

December 2025

Contents

1. Introduction	3
2. Executive Summary (LSA)	3
2.1 Drive test details	3
2.2 Drive test routes	4
2.3 Summary of areas covered	4
2.4 Telecom service providers detected frequency bands	5
2.5 Performance against key QoS parameters	5
3. QoS performance analysis-LSA level.....	6
3.1 Overview.....	7
3.2 Voice performance.....	7
3.3 Data performance.....	10
4. Detailed QoS performance analysis	12
4.1 Overview.....	12
4.2 City	12
4.2.1 Drive test route.....	12
4.2.2 Area Covered	12
4.2.3 Voice performance.....	13
4.2.4 Data performance.....	20
4.3 Hotspots	24
4.3.1 Locations.....	24
4.3.2 Hotspot covered	24
4.3.3 Voice performance.....	24
4.3.4 Data performance (auto-selection mode 5G/4G/3G/2G)	27
4.3.5 Data performance (5G Only & 4G Only Download & Upload Speed)	30
4.4 Walk Test	33
4.4.1 Walk test locations	33
4.4.2 Walk test covered	33
4.4.3 Voice performance.....	33
4.4.4 Data performance.....	37
5. Voice & Data Key findings	39
5.1 Overall Voice.....	39
5.2 Overall Data	39
5.3 Operator wise Key Findings.....	40
6. Annexure	44

6.1 Route wise coverage map	44
6.1.1 City	44
7. Appendix	50
7.1 Appendix-I	50
7.1.1 Drive test setup	50
7.1.2 Drive test Methodology	52
7.2 Appendix-II	54
7.2.1 Network Performance Parameters for Voice calls	54
7.2.2 Network Performance Parameters Data tests	55

1. Introduction

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

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

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

2. Executive Summary (LSA)

2.1 Drive test details

This report covers the findings of the IDT undertaken in West Bengal License Service Area (LSA) during the month of December-2025 under the supervision of TRAI Regional Office (RO) Kolkata. 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 and adjoining areas of Namchi and Gyalshing Districts	City	294.6	02-Dec-2025	05-Dec-2025
2	Namchi	Inter Operator Calling	1 Location	06-Dec-2025	06-Dec-2025
3	Cities and adjoining areas of Namchi and Gyalshing Districts	Hotspot	10 Locations	03-Dec-2025	05-Dec-2025
4	Cities and adjoining areas of Namchi and Gyalshing Districts	Walk Test	2.0	02-Dec-2025	04-Dec-2025

Table-1: Drive test summary.

2.2 Drive test routes

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

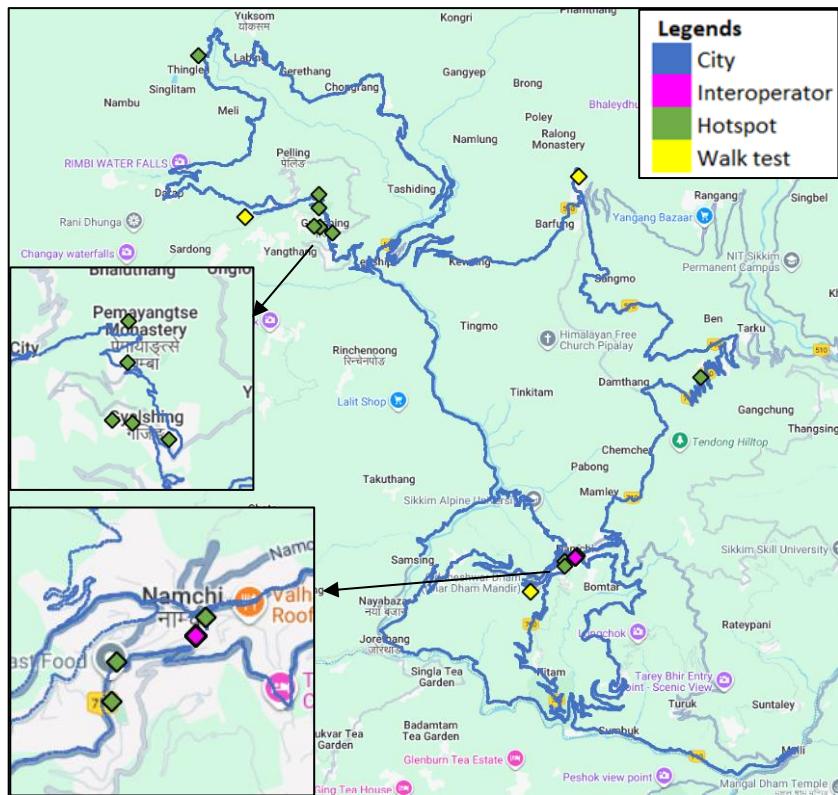


Figure-1: Drive test routes.

2.3 Summary of areas covered

a) City- Melli, Sumbuk, Jorethang, Nayabazar Namchi, Legship, Gyalsing, Darap, Thingle I, Labing, Chongrang, Tashiding, Kewzing, Barfung, Sangmo, Chemchery, Bomtar and Kitam etc.

b) Hotspot

1. D C Office Gyalshing
2. District & Sessions Court Gyalshing
3. District Court Namchi
4. District Hospital Gyalshing
5. District Hospital Namchi
6. Kanchenjunga Falls Thingle I Sikkim
7. Namchi Local Taxi Stand
8. Pemayangtse Monastery Sikkim
9. Temi Tea Garden South Sikkim
10. Zilla Panchayat West Sikkim

c) Walk Test

1. Budha Park Ravangla Sikkim
2. Siddheshwar Dham (Char Dham Mandir) Namchi
3. Skywalk Pelling Sikkim

2.4 Telecom service providers detected frequency bands

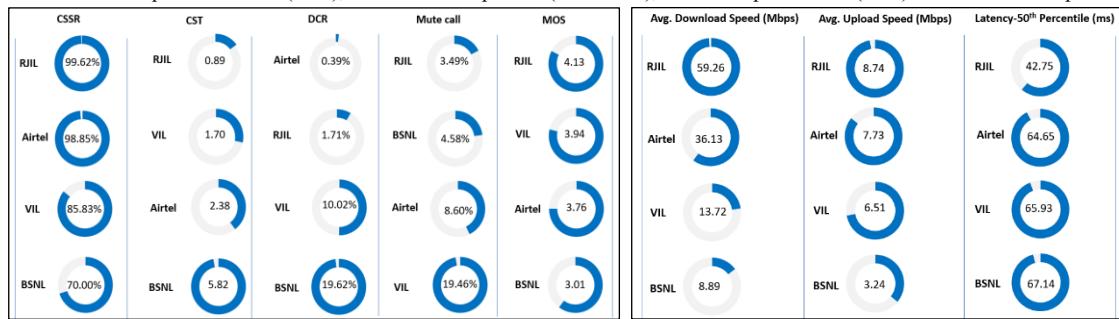
Technologies covered during the IDT and frequency bands in use are summarised in table below:

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
7	Reliance JIO Infocomm Ltd.	4G	850,1800,2300
8	Reliance JIO Infocomm Ltd.	5G	700,3500
9	Vodafone Idea Ltd.	2G	900
10	Vodafone Idea Ltd.	4G	900,1800,2500

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.



Summary-Voice services		Summary-Data services	
Call Setup Success Rate:	Airtel, BSNL, RJIL and VIL have call setup success rate of 98.85%, 70.00%, 99.62% and 85.83% respectively in Auto-selection mode (5G/4G/3G/2G).	Download performance (Overall):	Average download speed of Airtel (5G/4G/2G) is 36.13 Mbps, BSNL (4G/3G/2G) is 8.89 Mbps, RJIL (5G/4G) is 59.26 Mbps and VIL (4G/2G) is 13.72 Mbps.
Call Setup Time:	Airtel, BSNL, RJIL and VIL have call setup time of 2.38, 5.82, 0.89 and 1.70 seconds respectively in Auto-selection mode (5G/4G/3G/2G).	Upload performance (Overall):	Average upload speed of Airtel (5G/4G/2G) is 7.73 Mbps, BSNL (4G/3G/2G) is 3.24 Mbps, RJIL (5G/4G) is 8.74 Mbps and VIL (4G/2G) is 6.51 Mbps.
Drop Call Rate:	Airtel, BSNL, RJIL and VIL have drop call rate of 0.39%, 19.62%, 1.71% and 10.02% respectively in Auto-selection mode (5G/4G/3G/2G).	Latency (Overall):	Airtel, BSNL, RJIL & VIL 50 th percentile latency is 64.65 ms, 67.14 ms, 42.75 ms, 65.93 ms respectively.
Call Silence/Mute Rate:	Airtel, BSNL, RJIL and VIL have silence call rate of 8.60%, 4.58%, 3.49% and 19.46% respectively in packet switched network (5G/4G).	Data performance - Hotspots (in Mbps):	Airtel- 4G D/L: 24.63 4G U/L: 5.78 5G D/L: 20.27 5G U/L: 19.50 BSNL- 4G D/L: 10.43 4G U/L: 7.24 RJIL- 4G D/L: 10.81 4G U/L: 3.51 5G D/L: 123.24 5G U/L: 6.89 VIL- 4G D/L: 6.46 4G U/L: 4.59
Mean Opinion Score (MOS):	Airtel, BSNL, RJIL and VIL have Average MOS of 3.76, 3.01, 4.13 and 3.94 respectively.	Note- "D/L" Download speed, "U/L" Upload speed	

- The poor Signal Strength in auto-selection mode 5G/4G/3G/2G) during **voice** testing has been observed as 17.83%, 47.91%, 8.09% & 27.22% in the **city IDT route** (Namchi and Gyalshing districts of Sikkim state under West Bengal LSA) in case of Airtel, BSNL, RJIL & VIL respectively {refer **figure- 42 to 45** 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 as 40.23%, 52.51%, 40.01% & 46.43% in the **city IDT route** (Namchi and Gyalshing districts of Sikkim state under West Bengal LSA) in case of Airtel, BSNL, RJIL & VIL respectively {refer **figure- 46 to 49** as per the **Section 6.1** under Para-6(Annexure)}.

QoS Performance Analysis- West Bengal LSA

3. QoS performance analysis-LSA level

3.1 Overview

This section provides summary of overall QoS performance of the telecom service provider's network in the LSA by aggregating the results of drive tests conducted in the LSA during the month of December-2025 covering city drive, hotspots and walk test. (Refer Table-1)

3.2 Voice performance

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

Parameters	Service Provider		
	3G/2G network mode only		
	AIRTEL	BSNL	VIL
Call Attempts	368	405	366
Call Setup Success Rate %	99.18	83.46	97.81
Drop Call Rate %	2.19	3.25	0.84
Call Setup Time-Average (Second)	4.86	2.64	5.08
Handover Success Rate %	95.92	97.14	99.10

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

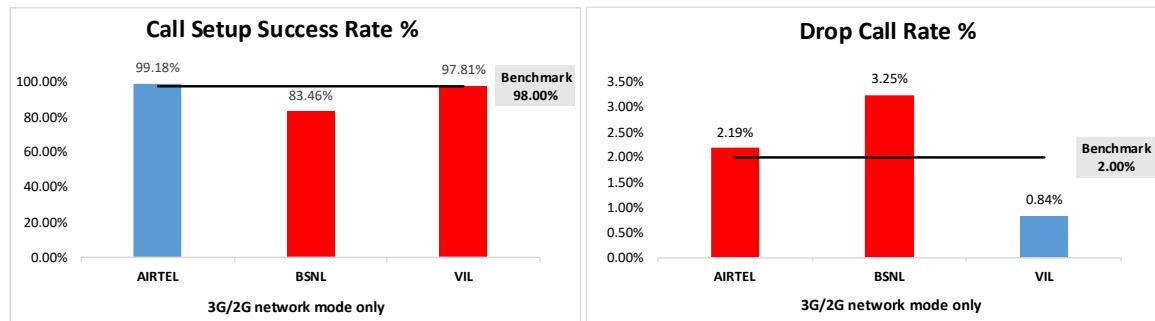


Figure-2: Call setup success rate and drop call rate performance.

Technology	Number of unique cell Id's covered in Voice test- Technology wise		
	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	29	NA
2G	159	68	162

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	523	670	528	593
Call Setup Success Rate %	98.85	70.00	99.62	85.83
Drop Call Rate %	0.39	19.62	1.71	10.02
Call Setup Time-Average (Second)	2.38	5.82	0.89	1.70
Handover Success Rate %	99.93	99.49	99.78	99.79

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

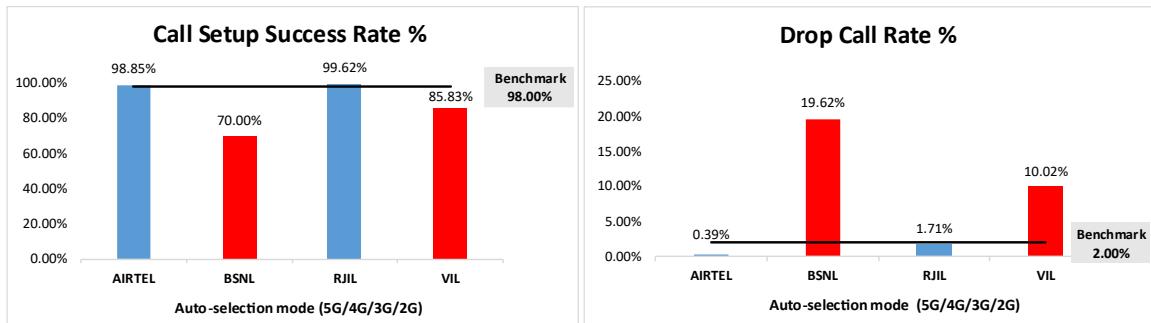


Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	372	284	372	370
Number of silence call for >4 Sec	32	13	13	72
Silence Call Rate %	8.60	4.58	3.49	19.46
Number of silence instances for >4 Sec	48	18	15	112
Number of silence instances for >3 Sec	81	21	32	176
Number of silence instances for >2 sec	167	37	72	385
RTP Jitter (4G & 5G) in ms	7.95	8.67	15.68	11.10
Packet loss Rate Downlink %	3.47	6.13	4.03	8.02
Packet loss Rate Uplink %	2.19	6.89	3.28	4.72

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

Technology	Number of unique cell Id's covered in Voice test- Technology wise			
	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
AIRTEL	BSNL	RJIL	VIL	
5G	0	NA	175	NA
4G	559	100	624	297
3G	NA	21	NA	NA
2G	5	58	NA	76

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	3022	1650	3196	2883
Speech Quality (Average MOS)	3.76	3.01	4.13	3.94
Number of samples with MOS >=4 to <5 (Excellent)	2132	516	2411	2009
Number of samples with MOS >=3 to <4 (Good)	544	249	352	326
Number of samples with MOS >=2 to <3 (Fair)	135	619	124	137
Number of samples with MOS >=1 to <2 (Poor)	211	266	309	411
%age of samples with MOS >=4 to <5 (Excellent)	70.55%	31.27%	75.44%	69.68%
%age of samples with MOS >=3 to <4 (Good)	18.00%	15.09%	11.01%	11.31%
%age of samples with MOS >=2 to <3 (Fair)	4.47%	37.52%	3.88%	4.75%
%age of samples with MOS >=1 to <2 (Poor)	6.98%	16.12%	9.67%	14.26%

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

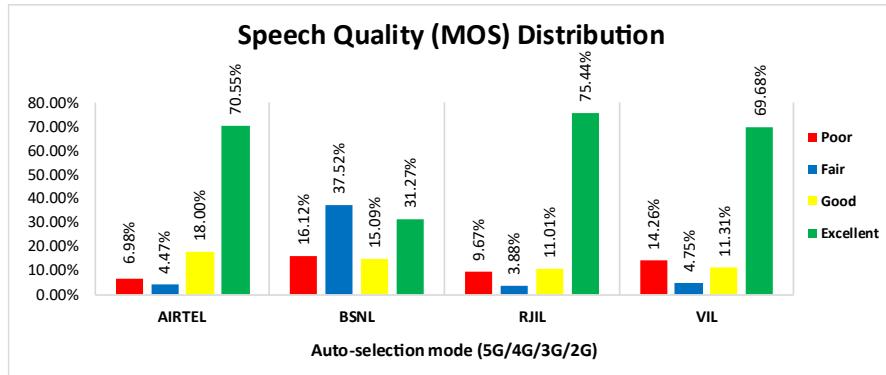


Figure- 4: Distribution of samples in MOS range.

(d) Inter-service provider voice call performance: To check the performance of inter-service provider call setup success rate, total 27 to 32 inter operator calls were attempted at one location which is Hotel Oak, Namchi. The Call setup success rate and call setup time observations are as below.

From Service Provider	Call Setup Success Rate %			
	AIRTEL	BSNL	RJIL	VIL
AIRTEL	NA	100.00	100.00	100.00
BSNL	100.00	NA	100.00	100.00
RJIL	100.00	100.00	NA	100.00
VIL	100.00	89.29	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	3.09	2.32	3.26
BSNL	3.81	NA	7.88	7.92
RJIL	2.26	3.19	NA	2.16
VIL	2.22	2.67	2.06	NA

Table-10: Call setup time across service providers.

Note-

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

3.3 Data performance

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

Parameters	Service Provider				
	Auto-selection mode (5G/4G/3G/2G)				
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput (Mbits/s)	Average	36.13	8.89	59.26	13.72
	80th Percentile	64.14	13.04	91.23	23.45
	20th Percentile	3.14	1.33	3.36	2.70
Upload Throughput (Mbits/s)	Average	7.73	3.24	8.74	6.51
	80th Percentile	7.67	4.74	8.18	8.77
	20th Percentile	1.52	1.12	1.50	1.17
Latency (ms)	50th Percentile	64.65	67.14	42.75	65.93

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

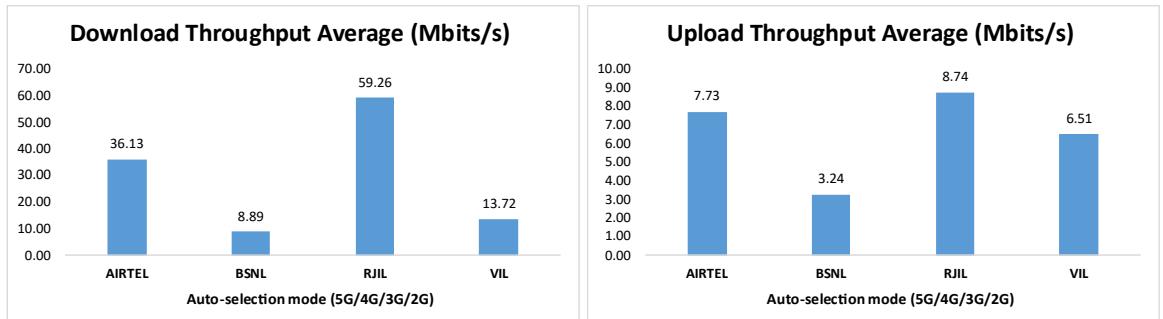


Figure- 5: Download and Upload throughput

Technology	Number of unique cell Id's covered in Data test- Technology wise			
	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	0	NA	225	NA
4G	575	107	481	295
3G	NA	32	NA	NA
2G	47	63	NA	98

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 drive, hotspots and walk test for all telecom service providers, the results of drive tests conducted are shown individually for respective areas/locations.

4.2 City

Drive test has been conducted from 2nd December 2025 to 5th December 2025 in cities and adjoining areas of Namchi and Gyalshing districts. (Refer Table-1)

4.2.1 Drive test route

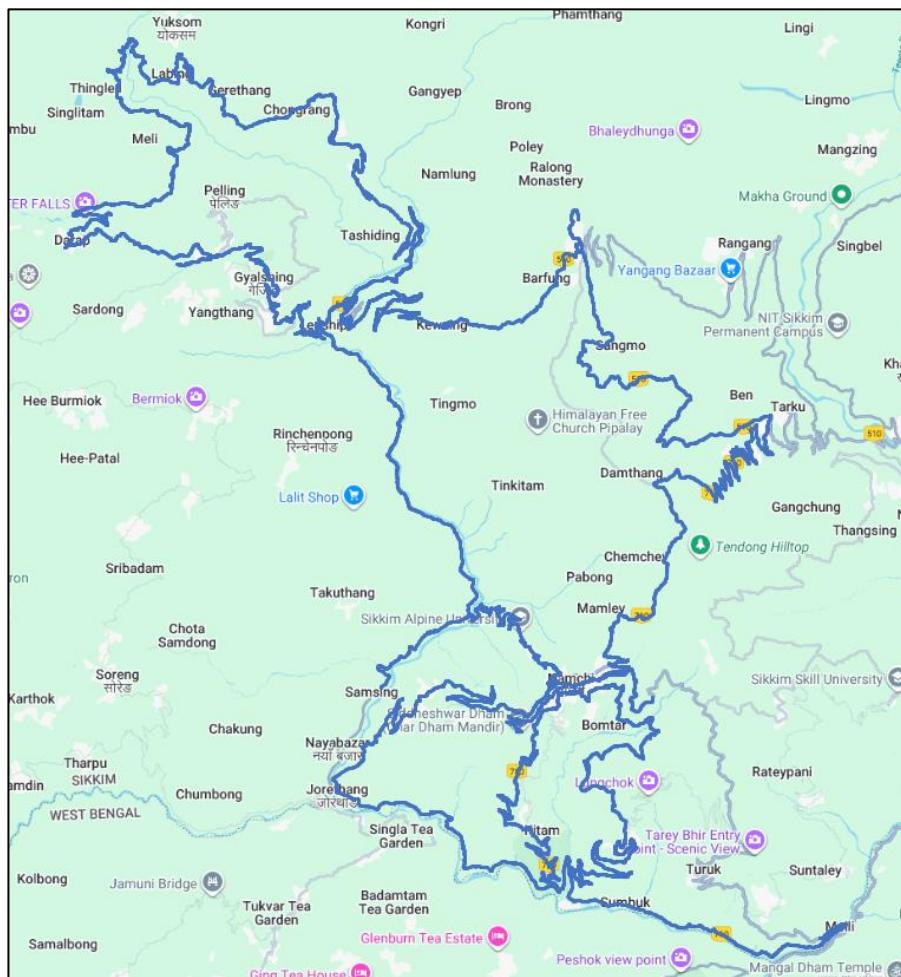


Figure- 6: Drive test routes

4.2.2 Area Covered

Melli, Sumbuk, Jorethang, Nayabazar Namchi, Legship, Gyalsing, Darap, Thingle I, Labing, Chongrang, Tashiding, Kewzing, Barfung, Sangmo, Chemchery, Bomtar and Kitam etc.

4.2.3 Voice performance

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

Parameters	Service Provider		
	3G/2G network mode only		
	AIRTEL	BSNL	VIL
Call Attempts	368	405	366
Call Setup Success Rate %	99.18	83.46	97.81
Drop Call Rate %	2.19	3.25	0.84
Call Setup Time-Average (Second)	4.86	2.64	5.08
Handover Success Rate %	95.92	97.14	99.10

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

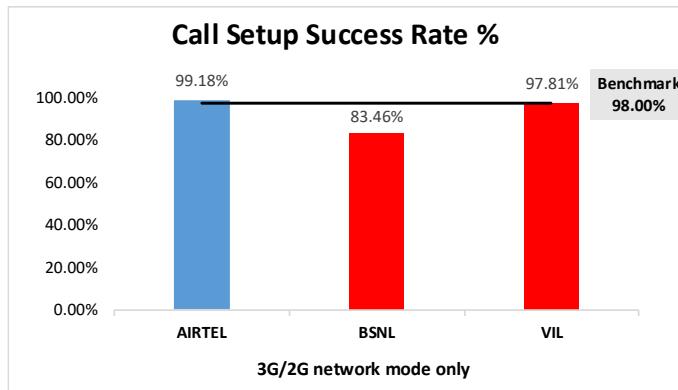


Figure-7: Performance for call setup success rate.

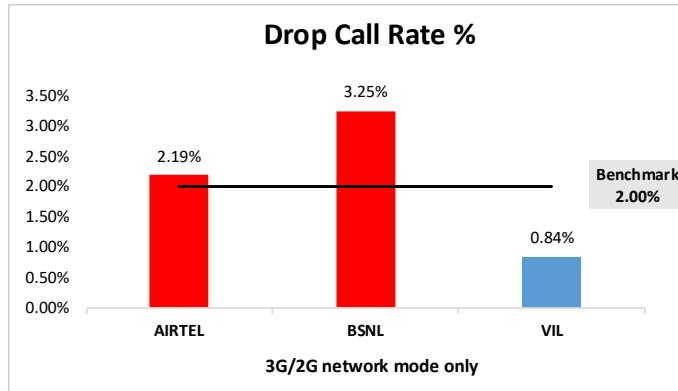


Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	8.47%	NA
2G	99.74%	87.70%	99.74%
Limited Service	0.26%	3.83%	0.26%

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

Note-

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

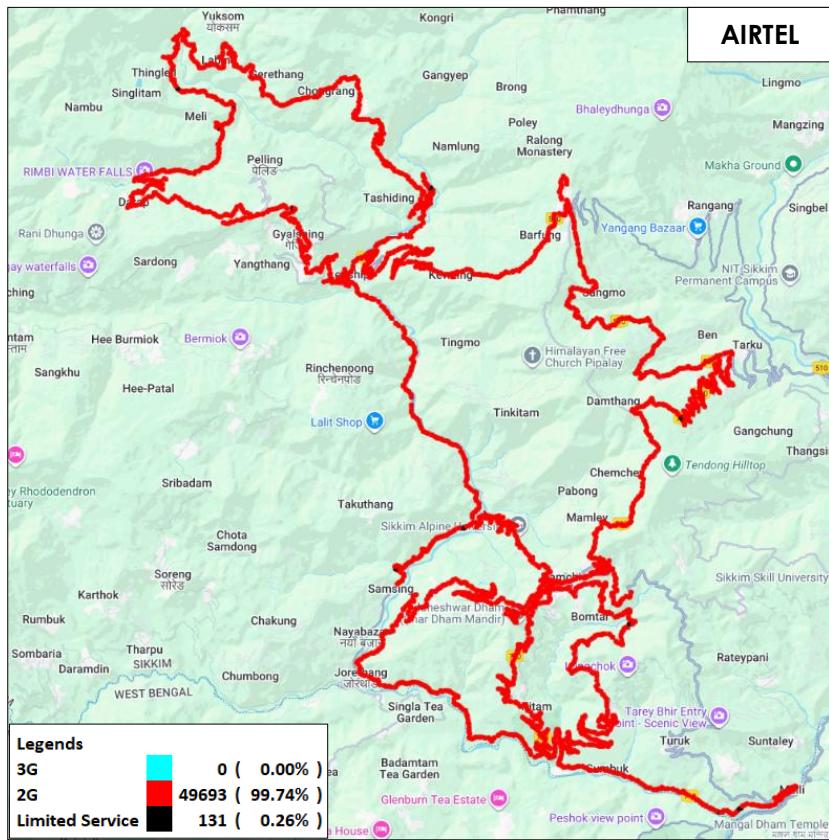


Figure-9: Serving technology plots 3G/2G network mode - AIRTEL.

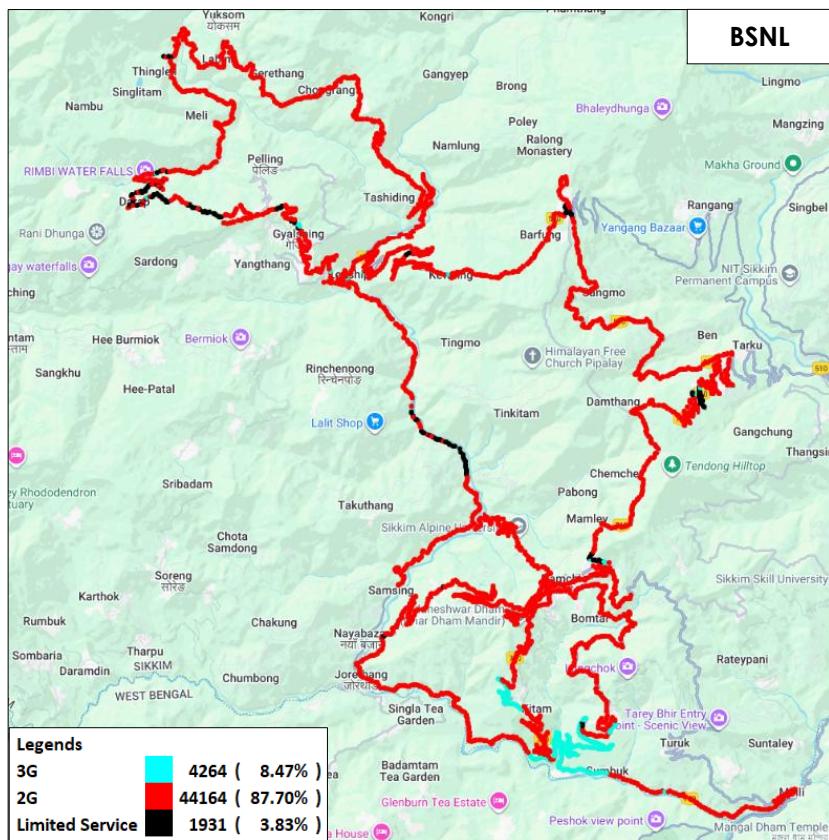


Figure-10: Serving technology plots 3G/2G network mode - BSNL.

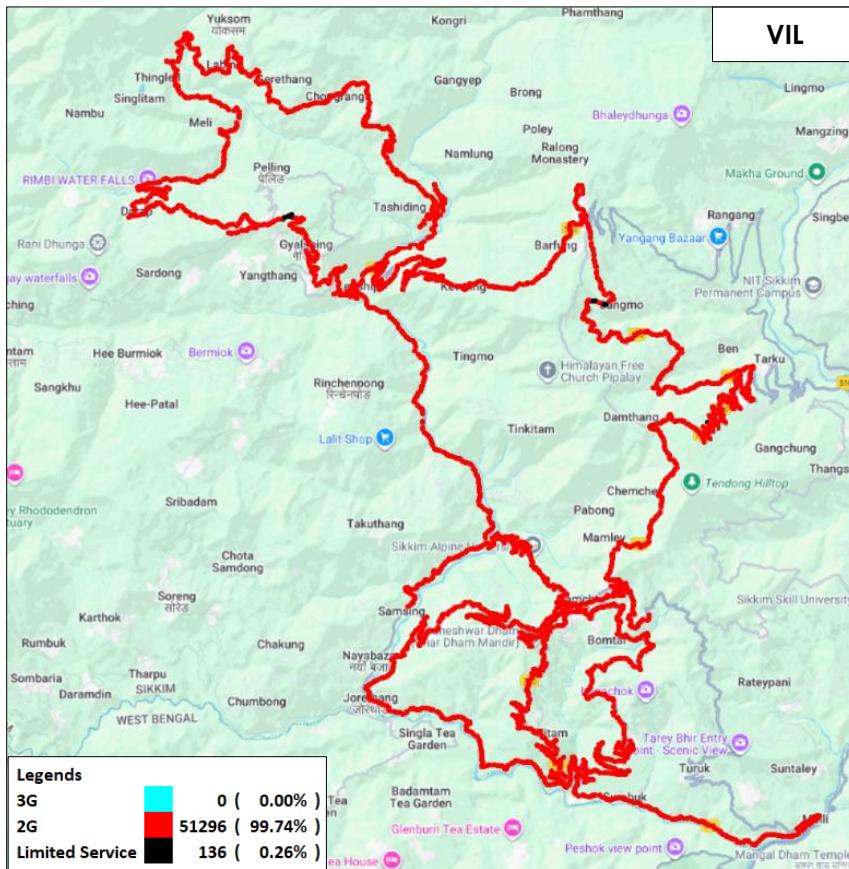


Figure-11: Serving technology plots 3G/2G network mode - VIL.

(c) Network Signal Strength Distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (Refer figure- 39, 40 & 41 for map view)

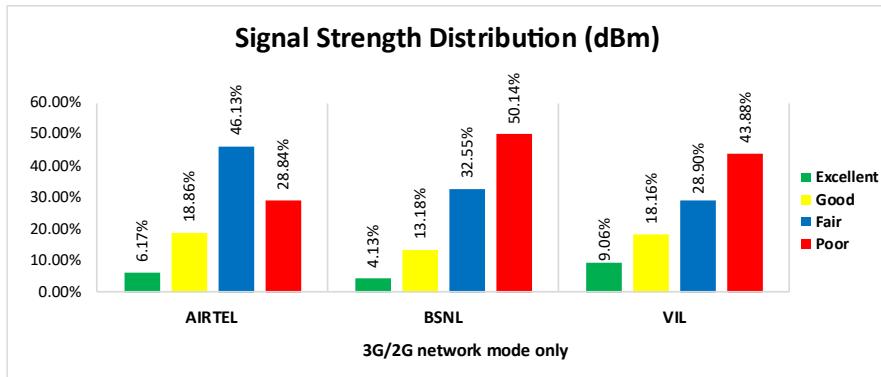


Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 6% of samples falling in the excellent signal strength category.
- BSNL has 4% of samples falling in the excellent signal strength category.
- VIL has 9% 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	383	529	388	451
Call Setup Success Rate %	98.69	65.03	99.48	83.37
Drop Call Rate %	0.53	26.74	2.33	11.17
Call Setup Time Average (Second)	2.40	5.59	0.91	1.69
Handover Success Rate %	99.92	99.48	99.76	99.80

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

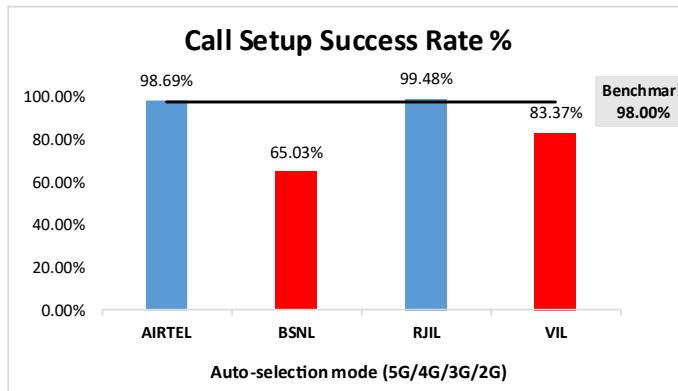


Figure-13: Performance for call setup success rate.

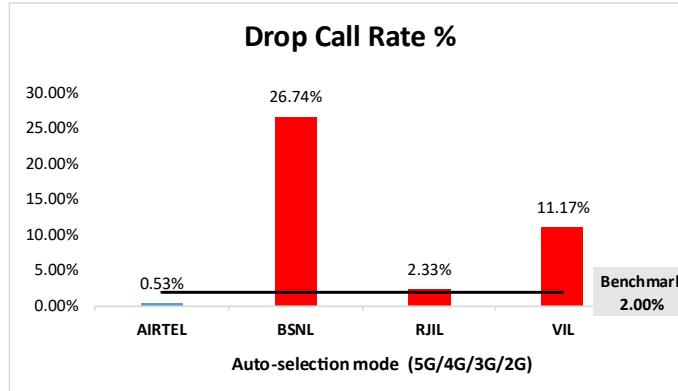


Figure-14: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	372	284	372	370
Number of silence call for >4 Sec	32	13	13	72
Silence Call Rate %	8.60	4.58	3.49	19.46
Number of silence instances for >4 Sec	48	18	15	112
Number of silence instances for >3 Sec	81	21	32	176
Number of silence instances for >2 sec	167	37	72	385
RTP Jitter (4G & 5G) in ms	7.95	8.67	15.68	11.10
Packet loss Rate Downlink %	3.47	6.13	4.03	8.02
Packet loss Rate Uplink %	2.19	6.89	3.28	4.72

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	3022	1650	3196	2883
Speech Quality (Average MOS)	3.76	3.01	4.13	3.94
Number of samples with MOS >=4 to <5 (Excellent)	2132	516	2411	2009
Number of samples with MOS >=3 to <4 (Good)	544	249	352	326
Number of samples with MOS >=2 to <3 (Fair)	135	619	124	137
Number of samples with MOS >=1 to <2 (Poor)	211	266	309	411
%age of samples with MOS >=4 to <5 (Excellent)	70.55%	31.27%	75.44%	69.68%
%age of samples with MOS >=3 to <4 (Good)	18.00%	15.09%	11.01%	11.31%
%age of samples with MOS >=2 to <3 (Fair)	4.47%	37.52%	3.88%	3.88%
%age of samples with MOS >=1 to <2 (Poor)	6.98%	16.12%	9.67%	4.75%

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

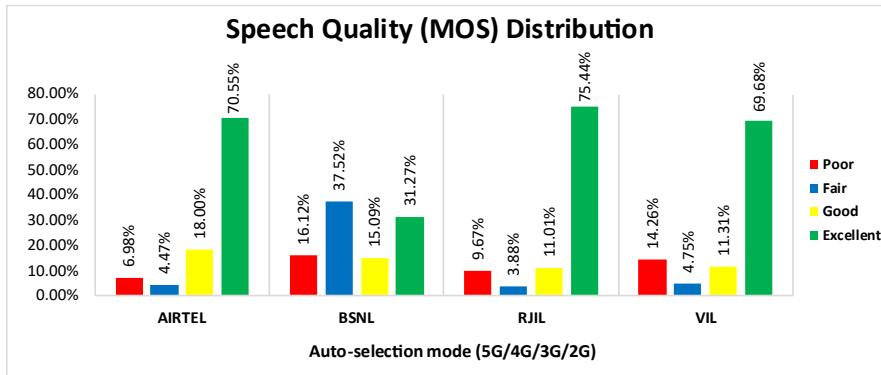


Figure-15: Distribution of samples in MOS range.

(f) Network Technology:

This section represents time spent on various network technologies.

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	5.16%	NA	33.65%	NA
4G	93.85%	43.17%	66.20%	88.35%
3G	NA	13.73%	NA	NA
2G	0.81%	38.17%	NA	9.88%
Limited Service	0.17%	4.93%	0.14%	1.77%

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

Note-

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

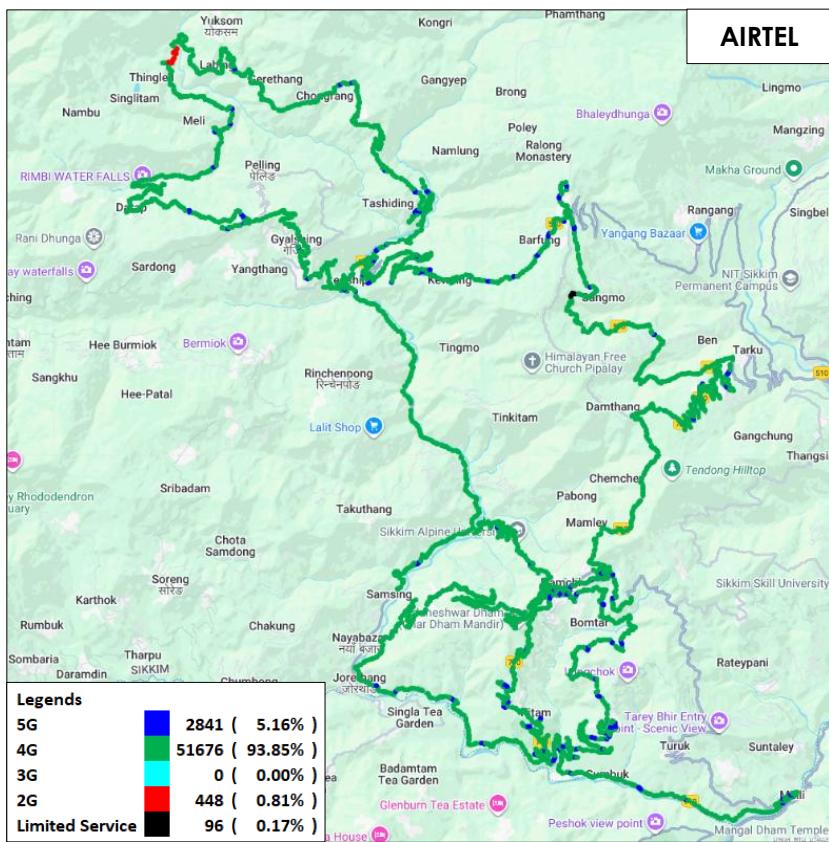


Figure-16: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

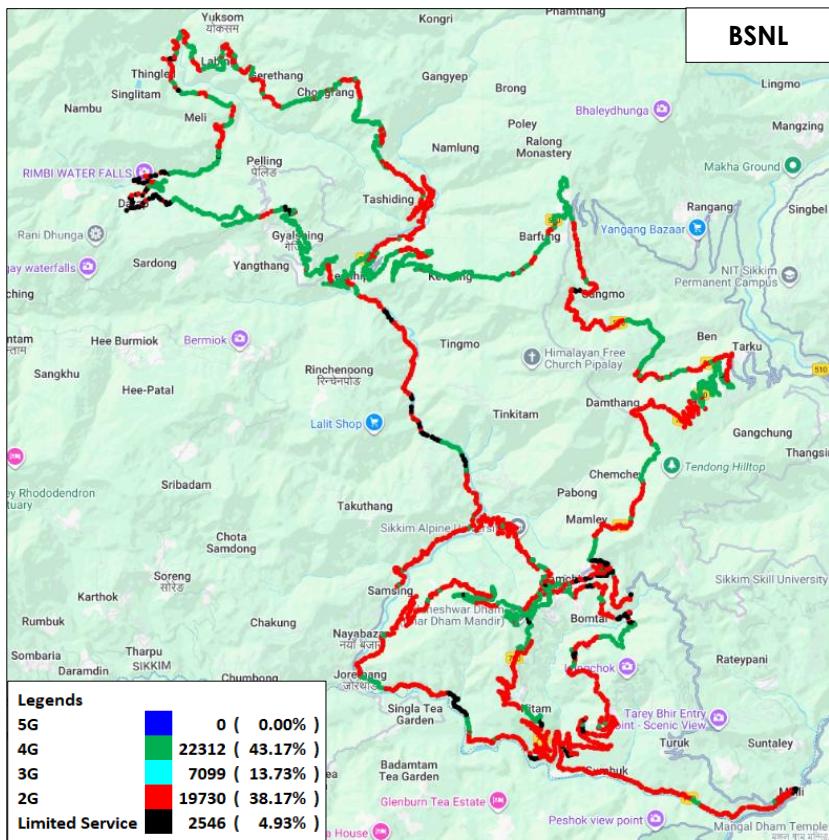


Figure-17: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - BSNL (4G being rolled out).

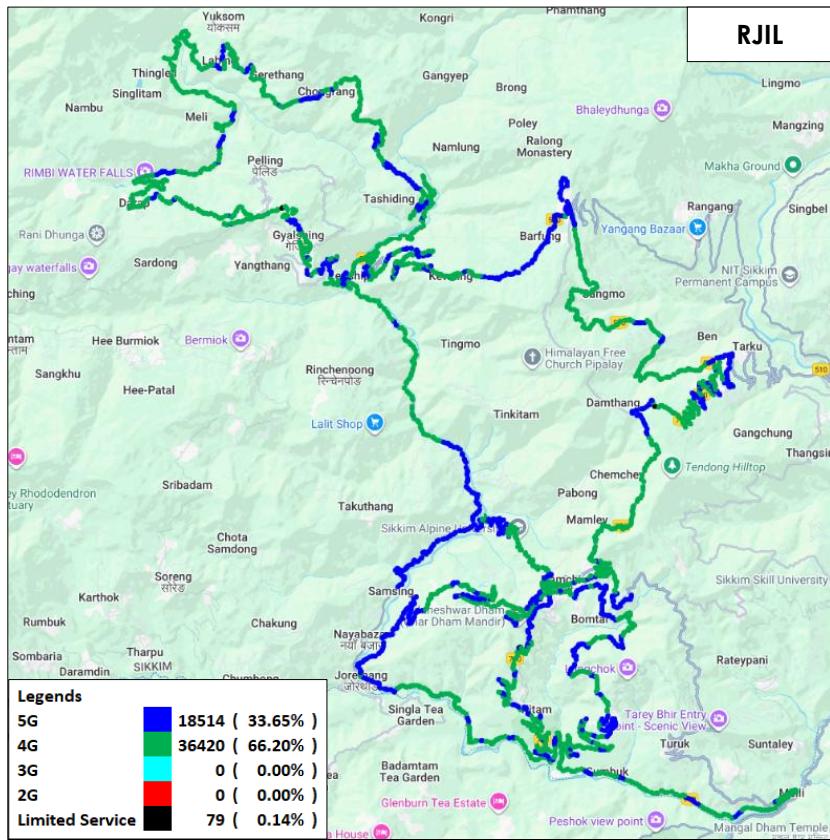


Figure-18: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

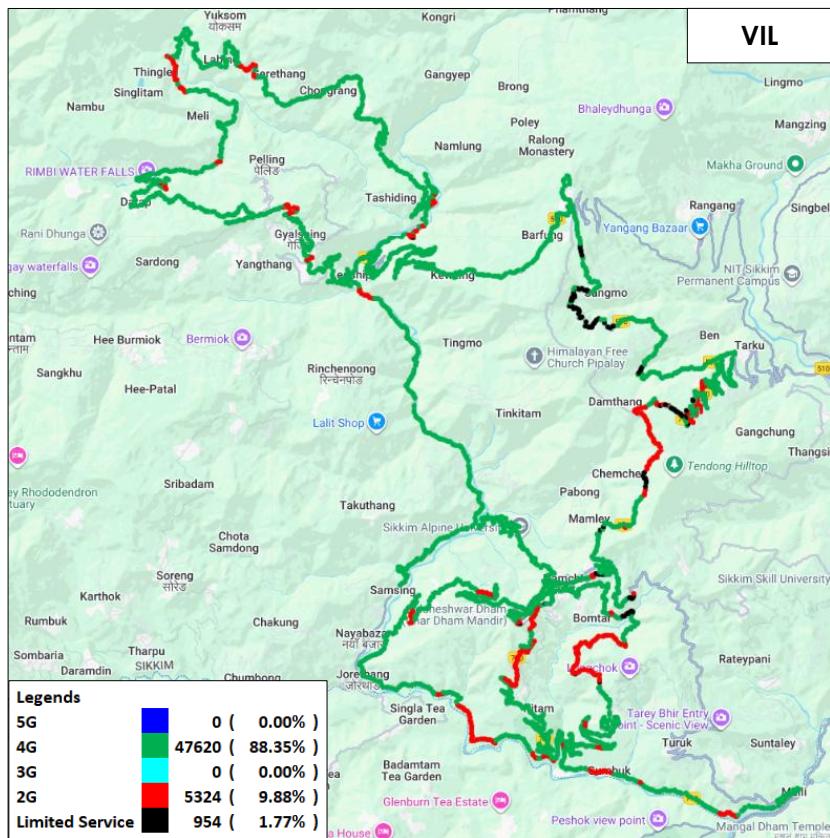


Figure-19: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - VIL.

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) voice. (Refer figure-42, 43, 44 & 45 for map view)

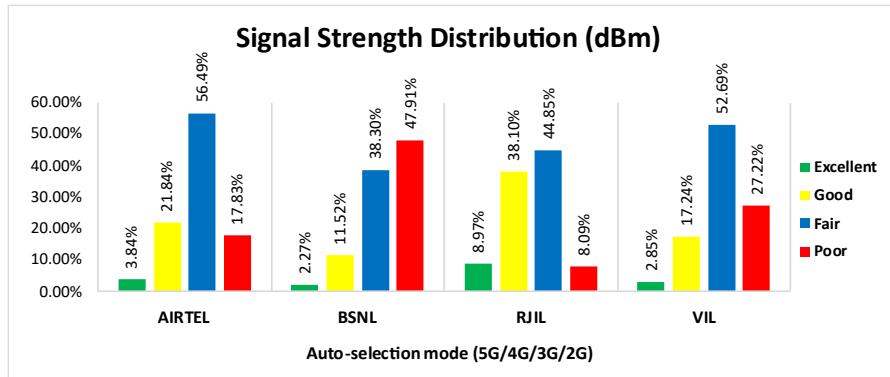


Figure-20: Signal strength distribution auto-selection mode (5G/4G/3G/2G) voice.

Observations:

- Airtel has 4% of samples falling in the excellent signal strength category.
- BSNL has 2% of samples falling in the excellent signal strength category.
- RJIL has 9% of samples falling in the excellent signal strength category.
- VIL has 3% of samples falling in the excellent signal strength category.

4.2.4 Data performance

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

Parameters	Service Provider				
	Auto-selection mode (5G/4G/3G/2G)				
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput (Mbits/s)	Average	33.81	5.48	59.00	13.03
	80th Percentile	56.41	9.45	88.62	22.56
	20th Percentile	2.61	0.50	3.49	2.44
Upload Throughput (Mbits/s)	Average	5.03	2.22	7.90	5.11
	80th Percentile	5.27	2.89	6.14	7.42
	20th Percentile	1.43	0.45	1.31	1.17
Latency (ms)	50th Percentile	63.79	68.88	42.58	62.86

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

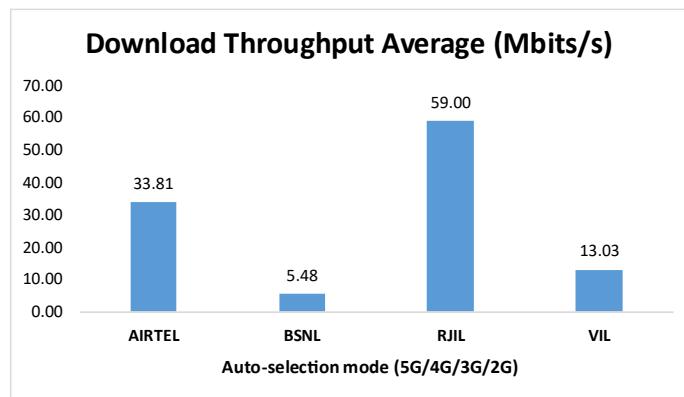


Figure- 21: Download throughput.

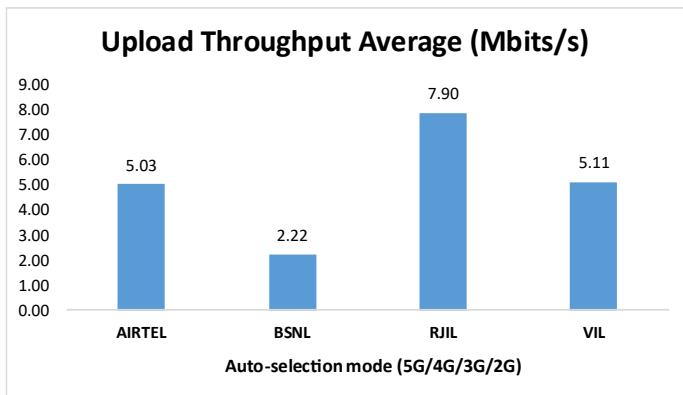


Figure- 22: Upload throughput

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	33.56%	NA	61.44%	NA
4G	60.65%	49.63%	37.91%	83.28%
3G	NA	22.93%	NA	NA
2G	3.10%	14.42%	NA	14.75%
Limited Service	2.69%	13.03%	0.65%	1.97%

Table-20: Time spent on technology during drive test.

Note-

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

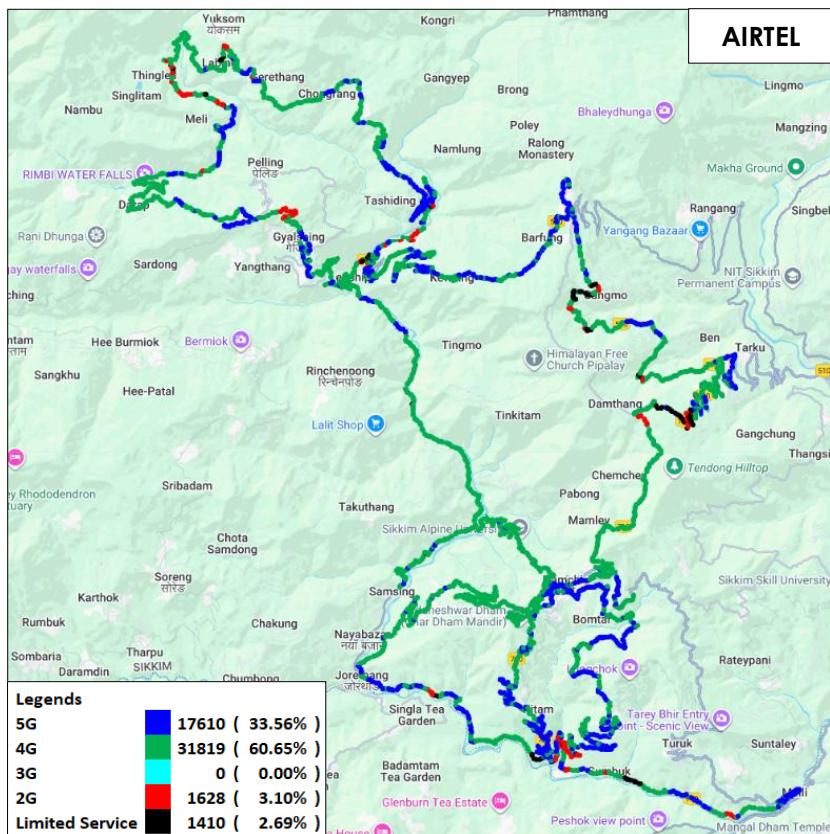


Figure-23: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

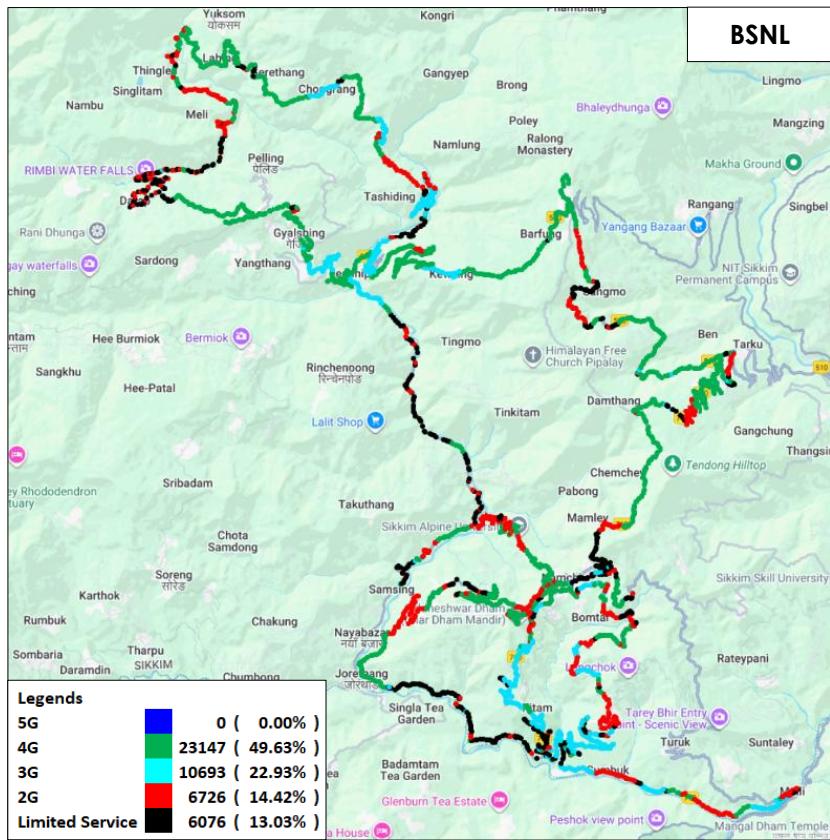


Figure-24: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - BSNL (4G being rolled out).

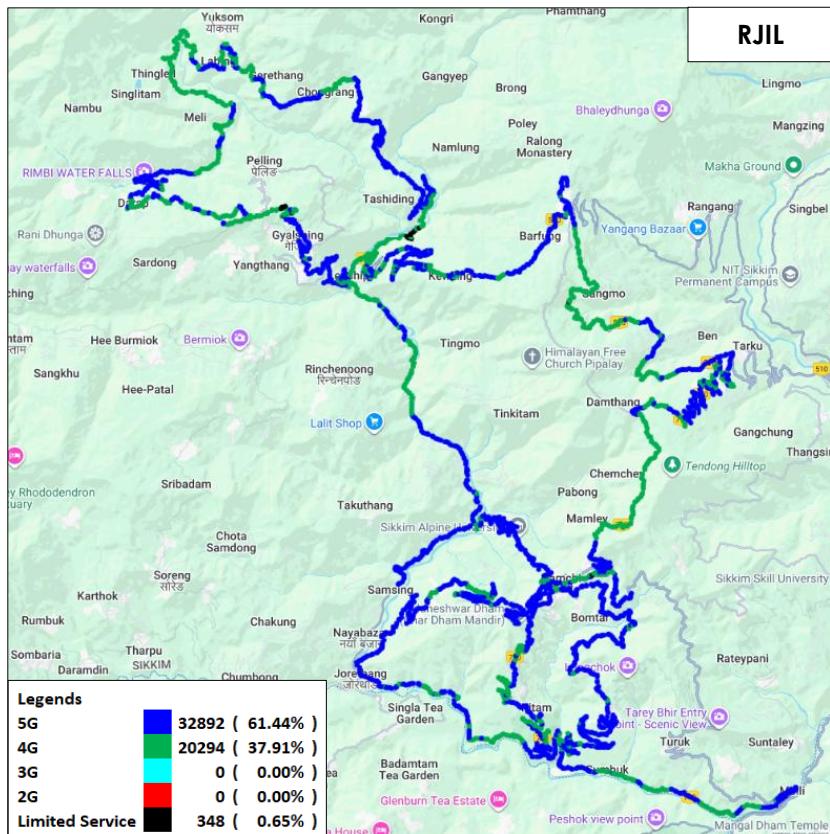


Figure-25: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - RJIL.

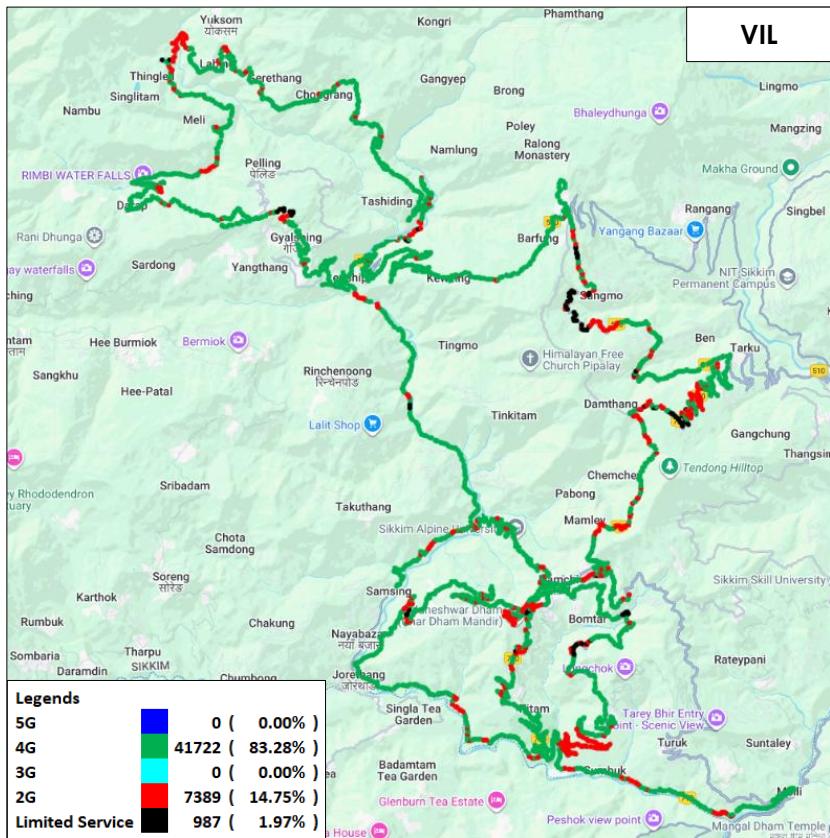


Figure-26: Serving technology plots in auto-selection mode (5G/4G/3G/2G) data - VIL.

(c) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) data. (Refer figure-46, 47, 48 & 49 for map view)

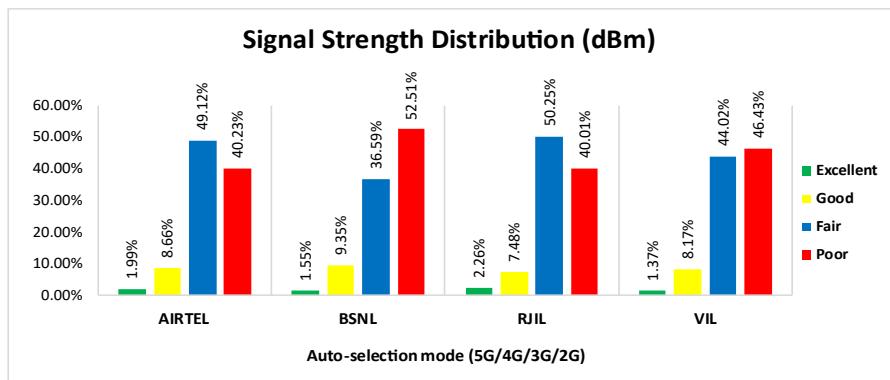


Figure-27: Signal strength distribution auto-selection mode (5G/4G/3G/2G) data.

Observations:

- Airtel has 2% of samples falling in the excellent signal strength category.
- BSNL has 2% of samples falling in the excellent signal strength category.
- RJIL has 2% of samples falling in the excellent signal strength category.
- VIL has 1% of samples falling in the excellent signal strength category.

4.3 Hotspots

Hotspot testing has been done from 3rd December 2025 to 5th December 2025. Ten locations have been tested in cities and adjoining areas of Namchi and Gyalshing districts. (refer table-1)

4.3.1 Locations

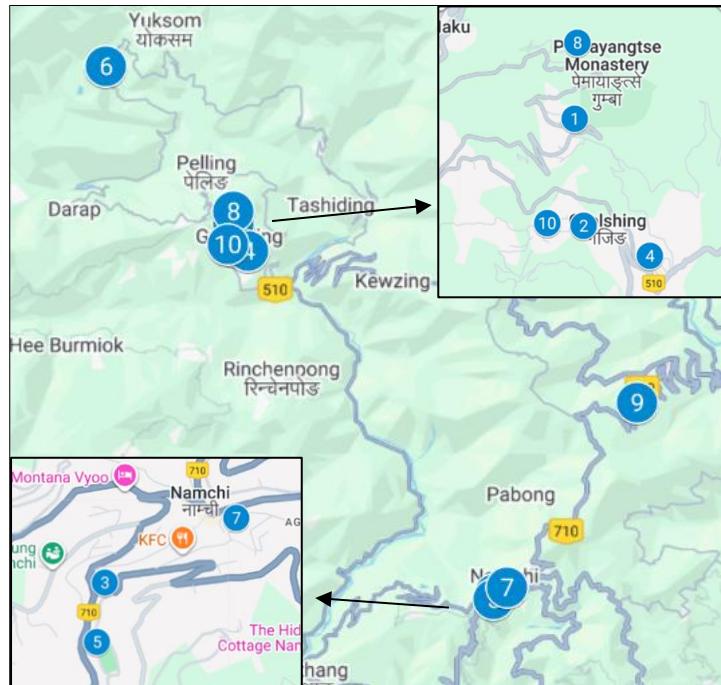


Figure- 28: Hotspot locations

4.3.2 Hotspot covered

1. D C Office Gyalshing
2. District & Sessions Court Gyalshing
3. District Court Namchi
4. District Hospital Gyalshing
5. District Hospital Namchi
6. Kanchenjunga Falls Thingle I Sikkim
7. Namchi Local Taxi Stand
8. Pemayangtse Monastery Sikkim
9. Temi Tea Garden South Sikkim
10. Zilla Panchayat West Sikkim

4.3.3 Voice performance

Overall Voice Performance				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	100	100	100	100
Call Setup Success Rate %	99.00	86.00	100.00	97.00
Drop Call Rate %	0.00	0.00	0.00	5.15
Call Setup Time-Average (Second)	2.36	6.89	0.74	1.21

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

D C Office Gyalshing				
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	80.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.94	7.24	0.51	1.12

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

District & Sessions Court Gyalshing				
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)	1.88	7.29	0.50	0.99

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

District Court Namchi				
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)	1.76	7.15	0.55	0.86

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

District Hospital Gyalshing				
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)	1.84	7.19	0.58	1.11

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

District Hospital Namchi				
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)	1.84	7.38	0.53	0.98

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

Kanchenjunga Falls Thingle I Sikkim				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	90.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	4.51	3.84	0.54	1.42

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

Namchi Local Taxi Stand				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	0.00	100.00	100.00
Drop Call Rate %	0.00	-	0.00	0.00
Call Setup Time-Average (Second)	1.85	-	0.54	0.99

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

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

Pemayangtse Monastery Sikkim				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	10	10	10	10
Call Setup Success Rate %	90.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	4.24	7.21	1.74	1.19

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

Temi Tea Garden South Sikkim				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	90.00	100.00	70.00
Drop Call Rate %	0.00	0.00	0.00	71.43
Call Setup Time-Average (Second)	2.09	7.23	0.57	3.07

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

Zilla Panchayat West Sikkim				
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)	1.85	7.25	1.34	0.98

Table-31: 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)	25.46	10.19	81.36	13.35
Download Throughput 80th Percentile (Mbit/s)	26.27	20.23	151.33	22.23
Download Throughput 20th Percentile (Mbit/s)	5.40	3.79	3.43	5.06
Download Session Setup Success Rate %	82.00	78.00	100.00	74.00
Upload Throughput Average (Mbits/s)	7.23	2.23	3.39	5.56
Upload Throughput 80th Percentile (Mbit/s)	11.89	3.56	6.30	14.30
Upload Throughput 20th Percentile (Mbit/s)	2.10	1.20	1.60	1.17
Upload Session Setup Success Rate %	88.00	76.47	100.00	74.00
Web Browsing Delay (Second)	4.81	5.13	6.84	8.77
Youtube Initial Buffer Delay (Second)	1.54	3.43	2.28	2.41
Latency (ms) - 50th Percentile	69.28	68.00	44.56	70.67
Jitter (ms)	61.51	36.08	34.10	52.54
Packet Loss Rate%	35.35	30.60	18.46	46.53
Packet Loss Rate- 90th percentile	100.00	100.00	57.28	100.00

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

D C Office Gyalshing				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	8.14	6.18	399.32	21.20
Download Session Setup Success Rate %	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	2.41	1.11	6.20	2.33
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	3.70	3.11	5.18	5.71
Youtube Initial Buffer Delay (Second)	2.60	-	0.61	1.05
Latency (ms) - 50th Percentile	69.66	71.61	32.84	67.19
Jitter (ms)	40.86	4.73	4.09	6.86
Packet Loss Rate%	28.60	10.60	0.40	1.00

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

Note--- Youtube tests were failed.

District & Sessions Court Gyalshing				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	16.43	8.60	69.69	21.28
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	2.49	1.46	4.94	1.40
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	4.74	4.37	4.27	11.42
Youtube Initial Buffer Delay (Second)	1.26	3.22	2.73	4.79
Latency (ms) - 50th Percentile	78.79	71.60	36.01	68.74
Jitter (ms)	15.12	4.06	44.72	31.52
Packet Loss Rate%	7.70	10.90	20.50	37.30

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

District Court Namchi				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	5.82	22.63	114.35	16.23
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	13.85	4.20	2.16	15.44
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	3.44	5.89	7.81	7.96
Youtube Initial Buffer Delay (Second)	1.66	3.10	4.15	0.88
Latency (ms) - 50th Percentile	87.89	61.67	40.55	69.91
Jitter (ms)	55.42	12.74	4.00	4.75
Packet Loss Rate%	32.50	0.70	0.10	0.60

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

District Hospital Gyalshing				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	86.68	4.98	19.56	4.81
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	8.63	2.01	1.86	1.03
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	4.88	2.33	3.94	8.56
Youtube Initial Buffer Delay (Second)	0.79	4.27	6.59	5.66
Latency (ms) - 50th Percentile	58.59	64.51	80.60	70.69
Jitter (ms)	6.18	4.70	30.45	113.02
Packet Loss Rate%	0.60	0.40	53.20	14.90

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

District Hospital Namchi				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	14.41	23.51	37.59	22.71
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	12.49	4.74	2.88	18.01
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.54	6.39	14.11	6.99
Youtube Initial Buffer Delay (Second)	1.08	2.24	-	0.84
Latency (ms) - 50th Percentile	78.49	59.53	40.04	47.70
Jitter (ms)	67.36	224.04	8.49	3.77
Packet Loss Rate%	35.70	12.40	9.00	8.50

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

Note--" Youtube tests were failed.

Kanchenjunga Falls Thingle I Sikkim				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	0.50	-	7.43	-
Download Session Setup Success Rate %	20.00	0.00	100.00	0.00
Upload Throughput Average (Mbits/s)	1.22	-	1.02	-
Upload Session Setup Success Rate %	40.00	0.00	100.00	0.00
Web Browsing Delay (Second)	0.00	-	10.32	-
Youtube Initial Buffer Delay (Second)	-	-	-	-
Latency (ms) - 50th Percentile	-	-	91.65	-
Jitter (ms)	-	-	48.78	-
Packet Loss Rate%	100.00	100.00	26.80	100.00

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

Note--- Respective data tests were failed.

Namchi Local Taxi Stand				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	53.30	-	5.06	7.38
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	14.61	-	2.13	1.32
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	5.39	-	4.09	13.47
Youtube Initial Buffer Delay (Second)	1.09	-	2.20	-
Latency (ms) - 50th Percentile	50.49	-	48.96	88.09
Jitter (ms)	10.69	-	94.82	31.94
Packet Loss Rate%	41.40	100.00	33.20	72.40

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

Note--- Respective data tests were failed.

Pemayangtse Monastery Sikkim				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	5.72	8.92	3.07	1.37
Download Session Setup Success Rate %	80.00	100.00	100.00	60.00
Upload Throughput Average (Mbits/s)	1.62	1.53	1.41	1.21
Upload Session Setup Success Rate %	100.00	100.00	100.00	40.00
Web Browsing Delay (Second)	9.03	2.55	7.93	10.50
Youtube Initial Buffer Delay (Second)	4.50	3.37	-	-
Latency (ms) - 50th Percentile	61.59	67.87	55.96	150.45
Jitter (ms)	145.29	6.16	69.10	105.66
Packet Loss Rate%	22.90	15.70	38.10	89.80

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

Note--- Youtube tests were failed.

Temi Tea Garden South Sikkim				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	0.93	3.78	0.99	-
Download Session Setup Success Rate %	20.00	100.00	100.00	0.00
Upload Throughput Average (Mbits/s)	1.72	1.39	2.01	-
Upload Session Setup Success Rate %	40.00	100.00	100.00	0.00
Web Browsing Delay (Second)	0.00	9.03	7.98	-
Youtube Initial Buffer Delay (Second)	-	8.49	-	-
Latency (ms) - 50th Percentile	100.52	82.00	50.12	-
Jitter (ms)	211.41	18.82	18.89	-
Packet Loss Rate%	81.10	44.20	3.10	100.00

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

Note -- Respective data tests were failed.

Zilla Panchayat West Sikkim				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	19.13	2.13	156.57	5.47
Download Session Setup Success Rate %	100.00	100.00	100.00	80.00
Upload Throughput Average (Mbits/s)	6.32	1.21	9.32	1.12
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	5.71	19.53	5.70	11.51
Youtube Initial Buffer Delay (Second)	1.71	-	0.71	10.63
Latency (ms) - 50th Percentile	60.35	75.89	36.69	67.38
Jitter (ms)	10.23	9.80	22.70	123.88
Packet Loss Rate%	3.00	11.10	0.20	40.80

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

Note -- Youtube tests were failed.

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

Overall Data Performance					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	20.27	-	123.24	-
	Upload Throughput Average (Mbits/s)	19.50	-	6.89	-
4G	Download Throughput Average (Mbits/s)	24.63	10.43	10.81	6.46
	Upload Throughput Average (Mbits/s)	5.78	7.24	3.51	4.59

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

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

D C Office Gyalshing					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbits/s)	8.66	-	430.38	-
	Upload Throughput Average (Mbits/s)	4.61	-	14.86	-
4G	Download Throughput Average (Mbits/s)	49.64	9.55	20.73	14.08
	Upload Throughput Average (Mbits/s)	3.58	6.15	2.8	5.89

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

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

District & Sessions Court Gyalshing						
Parameters		Service Provider				
		AIRTEL	BSNL	RJIL	VIL	
5G	Download Throughput Average (Mbits/s)	-	-	65.74	-	
	Upload Throughput Average (Mbits/s)	-	-	15.74	-	
4G	Download Throughput Average (Mbits/s)	25.63	11.64	16.84	9.73	
	Upload Throughput Average (Mbits/s)	2.40	5.75	3.01	1.37	

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

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

District Court Namchi						
Parameters		Service Provider				
		AIRTEL	BSNL	RJIL	VIL	
5G	Download Throughput Average (Mbits/s)	4.06	-	99.77	-	
	Upload Throughput Average (Mbits/s)	18.13	-	2.49	-	
4G	Download Throughput Average (Mbits/s)	9.52	15.94	4.14	6.00	
	Upload Throughput Average (Mbits/s)	7.17	14.28	3.24	1.73	

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

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

District Hospital Gyalshing						
Parameters		Service Provider				
		AIRTEL	BSNL	RJIL	VIL	
5G	Download Throughput Average (Mbits/s)	-	-	90.00	-	
	Upload Throughput Average (Mbits/s)	-	-	3.06	-	
4G	Download Throughput Average (Mbits/s)	55.56	5.08	1.19	3.59	
	Upload Throughput Average (Mbits/s)	8.91	6.85	0.93	2.12	

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

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

District Hospital Namchi						
Parameters		Service Provider				
		AIRTEL	BSNL	RJIL	VIL	
5G	Download Throughput Average (Mbits/s)	10.45	-	85.26	-	
	Upload Throughput Average (Mbits/s)	14.31	-	1.70	-	
4G	Download Throughput Average (Mbits/s)	14.84	22.41	5.76	9.59	
	Upload Throughput Average (Mbits/s)	4.98	15.35	5.13	15.85	

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

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

Kanchenjunga Falls Thingle I Sikkim					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbps)	-	-	-	-
	Upload Throughput Average (Mbps)	-	-	-	-
4G	Download Throughput Average (Mbps)	-	-	9.12	0.51
	Upload Throughput Average (Mbps)	-	-	1.48	0.81

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

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

Namchi Local Taxi Stand					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbps)	51.30	-	5.90	-
	Upload Throughput Average (Mbps)	32.61	-	1.93	-
4G	Download Throughput Average (Mbps)	17.09	-	4.19	4.02
	Upload Throughput Average (Mbps)	14.72	-	10.31	6.66

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

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

Pemayangtse Monastery Sikkim					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbps)	-	-	0.42	-
	Upload Throughput Average (Mbps)	-	-	2.12	-
4G	Download Throughput Average (Mbps)	9.60	9.90	0.81	1.81
	Upload Throughput Average (Mbps)	2.35	4.89	1.38	1.06

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

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

Temi Tea Garden South Sikkim					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbps)	19.38	-	102.02	-
	Upload Throughput Average (Mbps)	1.62	-	4.06	-
4G	Download Throughput Average (Mbps)	2.74	3.05	32.31	-
	Upload Throughput Average (Mbps)	0.98	1.46	3.02	1.27

Table-52: Overall Summary of 5G only & 4G only data download & upload speed.

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

Zilla Panchayat West Sikkim					
Parameters		Service Provider			
		AIRTEL	BSNL	RJIL	VIL
5G	Download Throughput Average (Mbps)	-	-	157.11	-
	Upload Throughput Average (Mbps)	-	-	16.06	-
4G	Download Throughput Average (Mbps)	19.55	5.85	12.99	4.08
	Upload Throughput Average (Mbps)	5.03	3.22	3.79	3.49

Table-53: 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 from 2nd December 2025 to 4th December 2025. Three locations have been tested in cities and adjoining areas of Namchi and Gyalshing districts. (refer table-1)

4.4.1 Walk test locations



Figure-29: Walk test locations.

4.4.2 Walk test covered

1. Budha Park Ravangla Sikkim
2. Siddheshwar Dham (Char Dham Mandir) Namchi
3. Skywalk Pelling Sikkim

4.4.3 Voice performance

i) Budha Park Ravangla Sikkim

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

Parameters	Budha Park Ravangla Sikkim			
	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	12	12	12	12
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	1.95	7.38	0.93	0.94
Handover Success Rate %	-	-	100.00	100.00

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

Note- “-”Handover did not attempt.

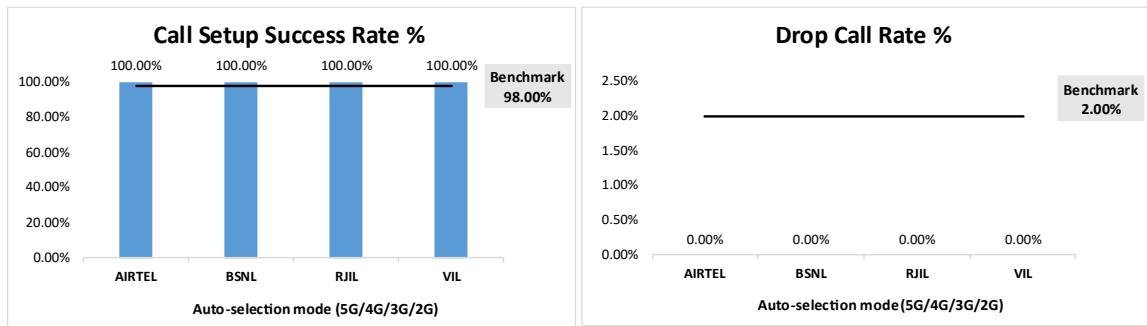


Figure- 30: Performance for call setup success rate and drop call rate.

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

Budha Park Ravangla Sikkim				
Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	14.23%	NA	100.00%	NA
4G	85.77%	100.00%	0.00%	100.00%
3G	NA	0.00%	NA	NA
2G	0.00%	0.00%	NA	0.00%
Limited service	0.00%	0.00%	0.00%	0.00%

Table-55: Time spent on technology during walk test.

(c) Network Signal Strength distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G).

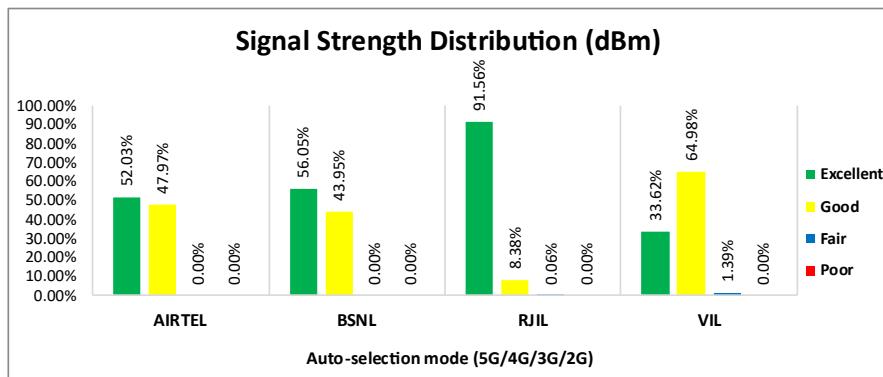


Figure-31: Signal strength distribution auto-selection mode (5G/4G/3G/2G).

ii) Siddheshwar Dham (Char Dham Mandir) Namchi

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

Parameters	Siddheshwar Dham (Char Dham Mandir) Namchi			
	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	16	16	16	14
Call Setup Success Rate %	100.00	100.00	100.00	85.71
Drop Call Rate %	0.00	0.00	0.00	16.67
Call Setup Time-Average (Sec)	2.57	2.43	0.58	3.13
Handover Success Rate %	100.00	100.00	100.00	92.86

Table-56: Summary of Voice performance in network auto-selection mode (5G/4G/3G/2G).

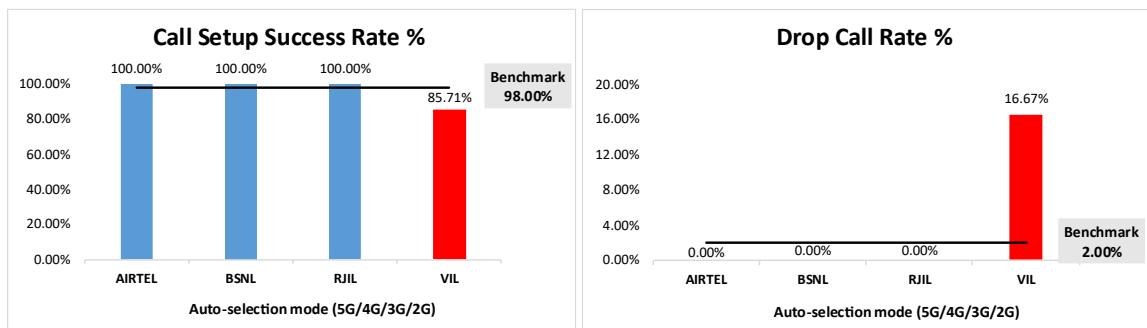


Figure- 32: Performance for call setup success rate and drop call rate.

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

Siddheshwar Dham (Char Dham Mandir) Namchi				
Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	1.94%	NA	39.32%	NA
4G	98.06%	100.00%	60.68%	26.27%
3G	NA	0.00%	NA	NA
2G	0.00%	0.00%	NA	72.00%
Limited service	0.00%	0.00%	0.00%	1.73%

Table-57: Time spent on technology during walk test.

(c) Network Signal Strength distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G).

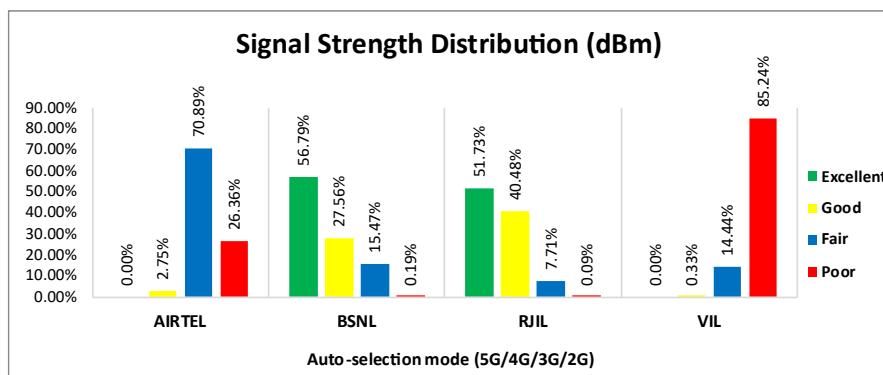


Figure-33: Signal strength distribution auto-selection mode (5G/4G/3G/2G).

iii) Skywalk Pelling Sikkim

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

Parameters	Skywalk Pelling Sikkim			
	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
Call Attempt	AIRTEL	BSNL	RJIL	VIL
Call Setup Success Rate %	100.00	84.62	100.00	75.00
Drop Call Rate %	0.00	0.00	0.00	16.67
Call Setup Time-Average (Sec)	2.00	7.48	1.55	5.40
Handover Success Rate %	100.00	-	100.00	100.00

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

Note- --"Handover did not attempt.

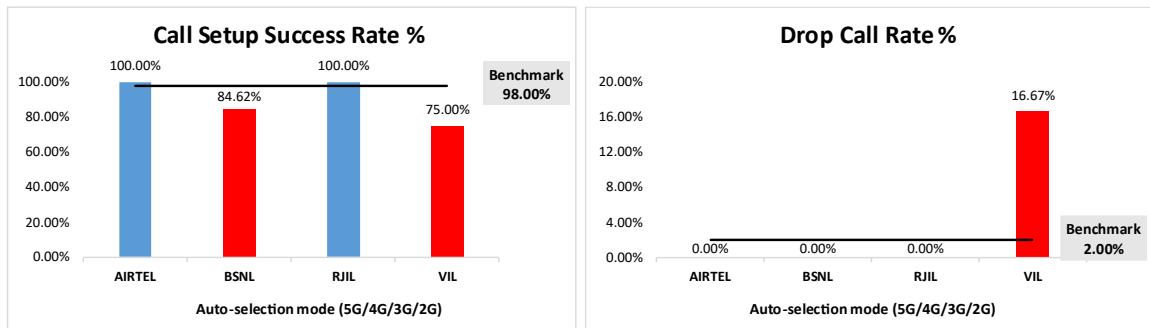


Figure- 34: Performance for call setup success rate and drop call rate.

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

Skywalk Pelling Sikkim				
Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	5.93%	NA	14.77%	NA
4G	94.07%	99.49%	85.23%	68.93%
3G	NA	0.00%	NA	NA
2G	0.00%	0.00%	NA	28.17%
Limited service	0.00%	0.51%	0.00%	2.89%

Table-59: Time spent on technology during walk test.

(c) Network Signal Strength distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G).

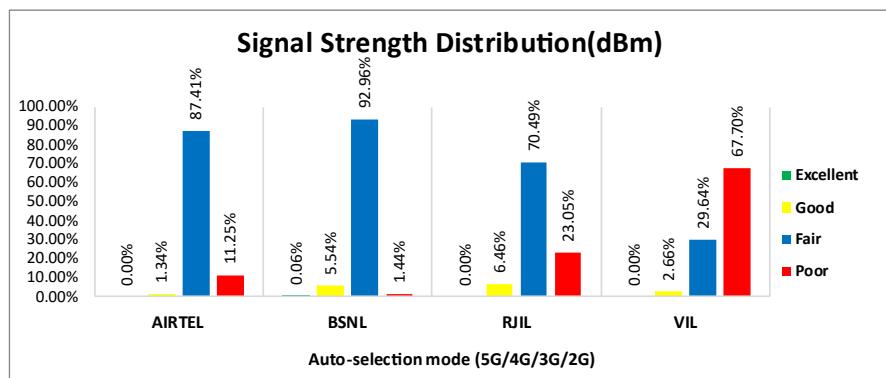


Figure-35: Signal strength distribution auto-selection mode (5G/4G/3G/2G).

4.4.4 Data performance

i) Budha Park Ravangla Sikkim

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

Budha Park Ravangla Sikkim				
Parameters	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	144.90	14.19	42.79	32.46
Download Throughput 80th Percentile	173.78	14.66	109.83	36.27
Download Throughput 20th Percentile	129.66	12.94	0.20	30.04
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	82.03	13.45	53.28	40.11
Upload Throughput 80th Percentile	90.95	16.28	76.71	50.57
Upload Throughput 20th Percentile	71.29	9.74	36.36	25.80
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Latency (ms)-50th Percentile	41.70	56.63	39.78	51.18

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

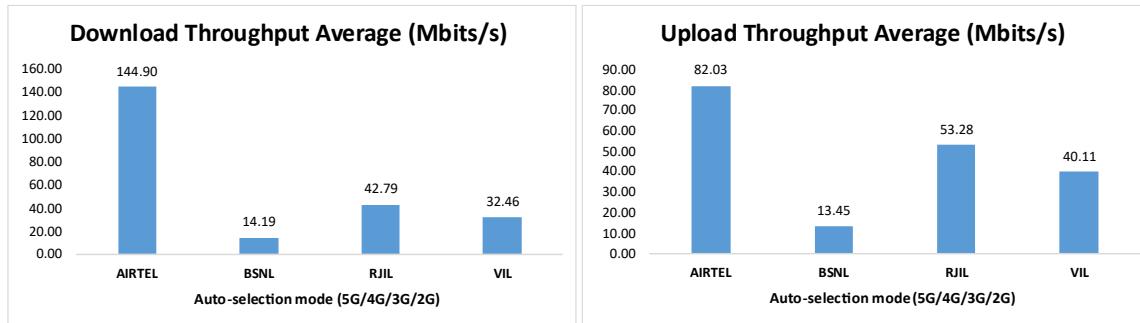


Figure- 36: Download and Upload throughput.

ii) Siddheshwar Dham (Char Dham Mandir) Namchi

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

Siddheshwar Dham (Char Dham Mandir) Namchi				
Parameters	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	2.39	33.21	49.55	1.70
Download Throughput 80th Percentile	3.70	39.32	56.68	2.26
Download Throughput 20th Percentile	1.15	28.52	31.80	1.15
Download Session Setup Success Rate %	100.00	100.00	100.00	10.53
Upload Throughput Average (Mbits/s)	2.35	9.22	15.65	1.16
Upload Throughput 80th Percentile	3.06	12.18	20.84	1.16
Upload Throughput 20th Percentile	1.62	5.12	4.88	1.16
Upload Session Setup Success Rate %	100.00	100.00	100.00	5.56
Latency (ms)-50th Percentile	119.65	62.49	31.94	96.14

Table-61: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

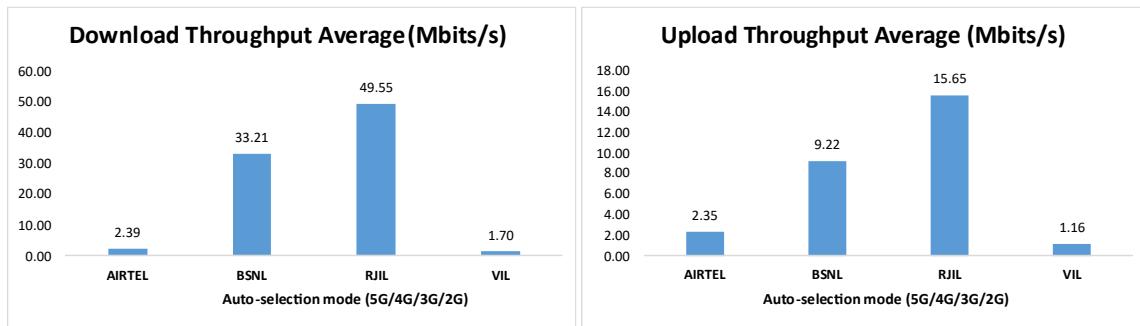


Figure- 37: Download and Upload throughput.

iii) Skywalk Pelling Sikkim

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

Skywalk Pelling Sikkim				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	35.30	7.53	8.19	10.91
Download Throughput 80th Percentile	59.68	8.81	15.35	14.94
Download Throughput 20th Percentile	11.23	6.31	2.71	4.25
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	3.35	2.80	4.26	3.46
Upload Throughput 80th Percentile	4.55	3.16	6.48	3.28
Upload Throughput 20th Percentile	1.92	1.57	1.35	1.59
Upload Session Setup Success Rate %	100.00	100.00	100.00	91.67
Latency (ms)-50th Percentile	60.05	101.27	42.14	64.81

Table-62: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

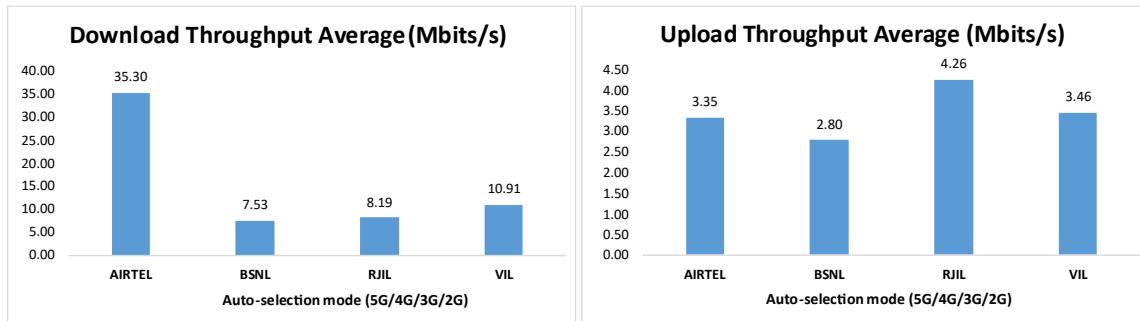


Figure- 38: Download and Upload throughput.

5. Voice & Data Key findings

5.1 Overall Voice

1. Call Setup Success Rate:

- a) Airtel, BSNL and VIL have 99.18%, 83.46% and 97.81% call setup success rate respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL and VIL have 98.85%, 70.00%, 99.62% and 85.83% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)
- c) Airtel, BSNL and RJIL have 100.00% call setup success rate while calling on peer service provider's network for inter-operator calls. (refer table-9)
- d) VIL had a 100.00% call setup success when calling Airtel and RJIL whereas call blocking was observed when calling BSNL. (refer table-9)

2. Call Setup Time:

- a) Airtel, BSNL and VIL call setup time is 4.86, 2.64 and 5.08 seconds respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL & VIL call setup time is 2.38, 5.82, 0.89 & 1.70 seconds respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

3. Call Silence/Mute Rate:

In packet switched network (4G/5G) Airtel, BSNL, RJIL and VIL have 8.60%, 4.58%, 3.49% and 19.46% silence call rate respectively. Further Airtel, BSNL, RJIL & VIL downlink RTP packet loss is 3.47%, 6.13%, 4.03% and 8.02% respectively. In uplink Airtel, BSNL, RJIL & VIL RTP packet loss is 2.19%, 6.89%, 3.28% & 4.72% respectively. (refer table-6)

4. Drop Call Rate:

- a) Airtel, BSNL and VIL drop call rate is 2.19%, 3.25% and 0.84% respectively in 3G/2G network mode. (refer table-3)
- b) Airtel, BSNL, RJIL and VIL drop call rate is 0.39%, 19.62%, 1.71% and 10.02% 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 36.13 Mbps, 8.89 Mbps, 59.26 Mbps and 13.72 Mbps respectively. (refer table-11)
- b) Airtel, BSNL, RJIL and VIL average upload speeds are 7.73 Mbps, 43.24 Mbps, 8.74 Mbps and 6.51 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 25.46 Mbps, 10.19 Mbps, 81.36 Mbps and 13.35 Mbps respectively. (refer table-32)
- b) Airtel, BSNL, RJIL and VIL average upload speeds are 7.23 Mbps, 2.23 Mbps, 3.39 Mbps and 5.56 Mbps respectively. (refer table-32)

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

- a) Airtel, BSNL, RJIL and VIL have 82.00%, 78.00%, 100.00% & 74.00% download session setup success rate respectively. (refer table-32)
- b) Airtel, BSNL, RJIL and VIL have 88.00%, 76.47%, 100.00% & 74.00% upload session setup success rate respectively. (refer table-32)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 99.18% call setup success rate and 2.19% drop call rate have been observed in 3G/2G network mode for LSA/city drive. Performance is not meeting the benchmark of 2.00% for drop call rate. (refer table-3 & 13)
- 98.85% call setup success rate and 0.39% 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)
- 98.69% call setup success rate and 0.53% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-15)
- 99.00% 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-21)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at all walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 54, 56 & 58)

Data

- Airtel has 36.13 Mbps average download speed & 7.73 Mbps average upload speed for LSA. (refer table-11)
- Airtel has 33.81 Mbps average download speed & 5.03 average upload speed across the measured routes for city drive. (refer table-19)
- All hotspot locations have less download speed (less than 100 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-33 to 42)
- All hotspot locations have less upload speed (less than 20 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-33 to 42)
- Siddheshwar Dham (Char Dham Mandir) Namchi and Skywalk Pelling Sikkim have less download speed (less than 100 Mbps) out of total 3 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-61 & 62).
- Siddheshwar Dham (Char Dham Mandir) Namchi and Skywalk Pelling Sikkim have less upload speed (less than 20 Mbps) out of total 3 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-61 & 62).

2. BSNL:

Voice

- 83.46% call setup success rate and 3.25% drop call rate have been observed in 3G/2G network mode for LSA/city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3 & 13)
- 70.00% call setup success rate and 19.62% 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)
- 65.03% call setup success rate and 26.74% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-15)

- 86.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-21)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Budha Park Ravangla Sikkim and Siddheshwar Dham (Char Dham Mandir) Namchi walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 54 & 56)
- 84.62% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Skywalk Pelling Sikkim walk test location. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table- 58)

Data

- BSNL has 8.89 Mbps average download speed & 3.24 Mbps average upload speed for LSA. (refer table-11)
- BSNL has 5.48 Mbps average download speed & 2.22 Mbps average upload speed across the measured routes for city drive. (refer table-19)
- All hotspot locations have less download speed (less than 10 Mbps) except District Court Namchi and District Hospital Namchi in auto-selection mode (5G/4G/3G/2G). (refer table-33, 34, 36, 38, 39, 40, 41 & 42)
- All hotspot locations have less upload speed (less than 2 Mbps) except District Court Namchi, District Hospital Gyalshing and District Hospital Namchi in auto-selection mode (5G/4G/3G/2G). (refer table-33, 34, 38, 39, 40, 41 & 42)
- Skywalk Pelling Sikkim has less download speed (less than 10 Mbps) out of total 3 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-62).

3. RJIL:

Voice

- 99.62% call setup success rate and 1.71% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 99.48% call setup success rate and 2.33% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is not meeting the benchmark of 2.00% for drop call rate. (refer table-15)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-21)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at all walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 54, 56 & 58)

Data

- RJIL has 59.26 Mbps average download speed & 8.74 Mbps average upload speed for LSA. (refer table-11)
- RJIL has 59.00 Mbps average download speed & 7.90 Mbps average upload speed across the measured routes for city drive. (refer table-19)

- District & Sessions Court Gyalshing, District Hospital Gyalshing, District Hospital Namchi, Kanchenjunga Falls Thingle I Sikkim, Namchi Local Taxi Stand, Pemayangtse Monastery Sikkim and Temi Tea Garden South Sikkim have less download speed (less than 100 Mbps) out of total 10 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-34, 36, 37, 38, 39, 40, & 41)
- All hotspot locations have less upload speed (less than 20 Mbps) in auto-selection mode (5G/4G/3G/2G). (refer table-33 to 42)
- All walk test locations have less download speed (less than 100 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table-60, 61 & 62).
- Siddheshwar Dham (Char Dham Mandir) Namchi and Skywalk Pelling Sikkim have less upload speed (less than 20 Mbps) out of total 3 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-61 & 62).

4. VIL:

Voice

- 97.81% call setup success rate and 0.84% drop call rate have been observed in 3G/2G network mode for LSA/city drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-3 & 13)
- 85.83% call setup success rate and 10.02% 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)
- 83.37% call setup success rate and 11.17% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-15)
- 97.00% call setup success rate and 5.15% 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% & 2.00% respectively. (refer table-21)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 53, 55 & 57)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Budha Park Ravangla Sikkim walk test location. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table- 54)
- 85.71% call setup success rate and 16.67% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Siddheshwar Dham (Char Dham Mandir) Namchi walk test location. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table- 56)
- 75.00% call setup success rate and 16.67% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Skywalk Pelling Sikkim walk test location. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table- 58)

Data

- VIL has 13.72 Mbps average download speed & 6.51 Mbps average upload speed for LSA. (refer table-11)

- VIL has 13.03 Mbps average download speed & 5.11 Mbps average upload speed across the measured routes for city drive. (refer table-19)
- District Hospital Gyalshing, Kanchenjunga Falls Thingle I Sikkim, Namchi Local Taxi Stand, Pemayangtse Monastery Sikkim, Temi Tea Garden South Sikkim and Zilla Panchayat West Sikkim have less download speed (less than 10 Mbps) out of total 10 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-36, 38, 39, 40, 41 & 42)
- District & Sessions Court Gyalshing, District Hospital Gyalshing, Kanchenjunga Falls Thingle I Sikkim, Namchi Local Taxi Stand, Pemayangtse Monastery Sikkim, Temi Tea Garden South Sikkim and Zilla Panchayat West Sikkim have less upload speed (less than 2 Mbps) out of total 10 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-34, 36, 38, 39, 40, 41 & 42)
- Siddheshwar Dham (Char Dham Mandir) Namchi has less download speed (less than 10 Mbps) out of total 3 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-61).
- Siddheshwar Dham (Char Dham Mandir) Namchi has less upload speed (less than 2 Mbps) out of total 3 walk test locations for auto-selection mode (5G/4G/3G/2G). (refer table-61).

6. Annexure

6.1 Route wise coverage map

6.1.1 City

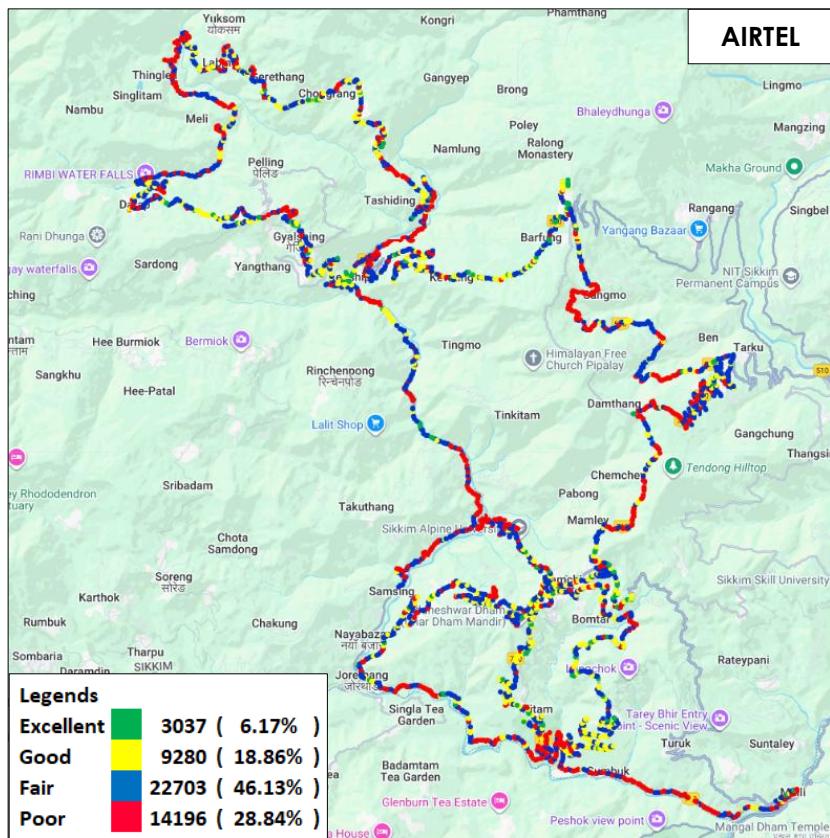


Figure-39: Signal strength 3G/2G network mode voice - AIRTEL.

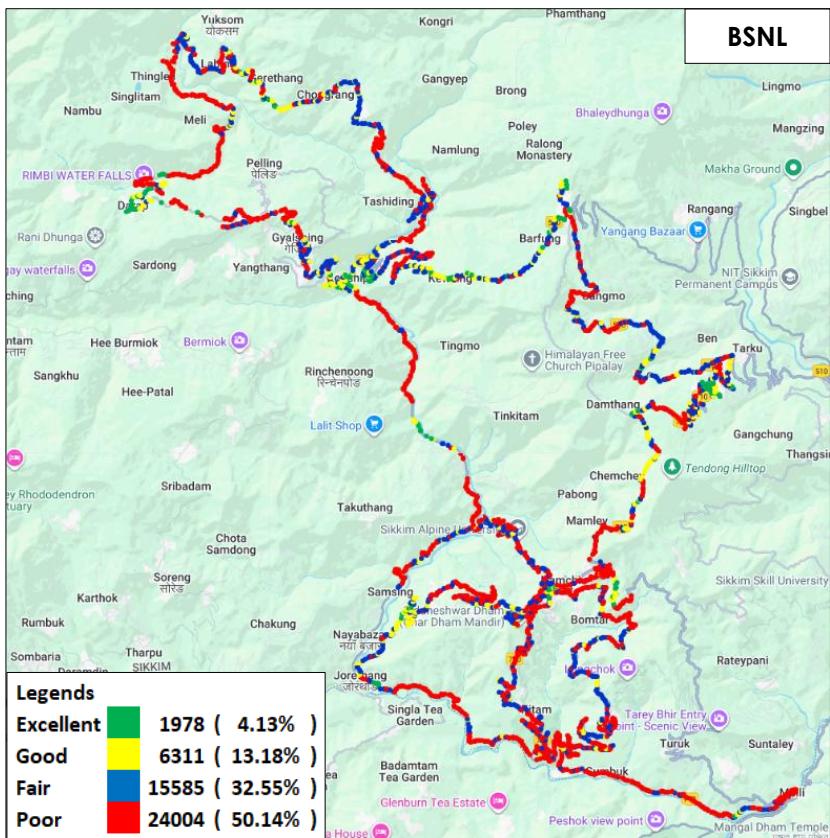


Figure-40: Signal strength 3G/2G network mode voice - BSNL.

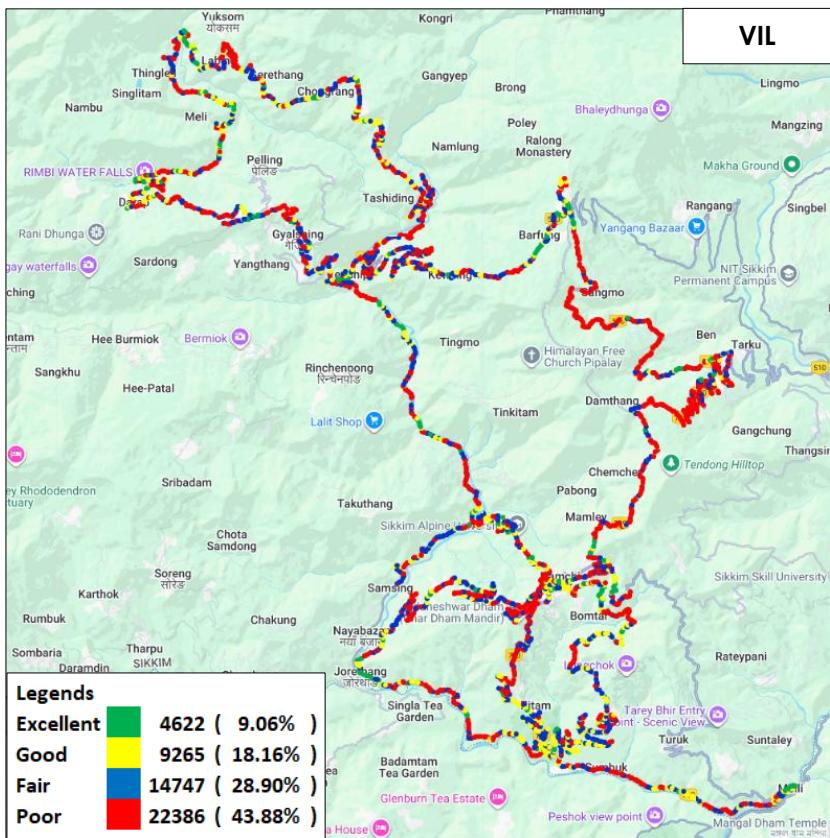


Figure-41: Signal strength 3G/2G network mode voice - VIL.

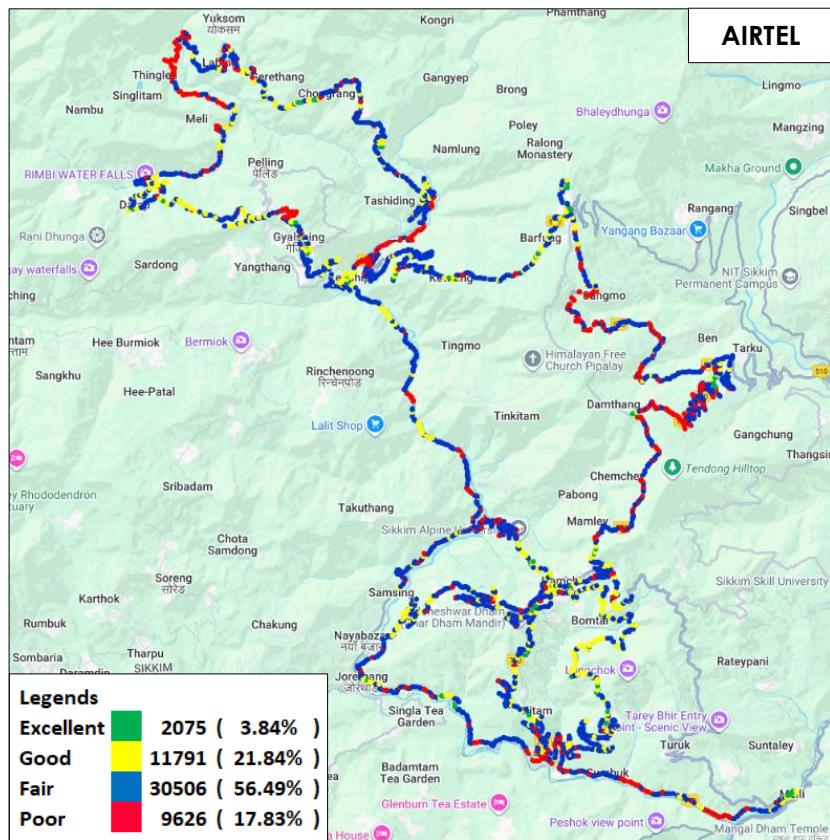


Figure-42: Signal strength auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

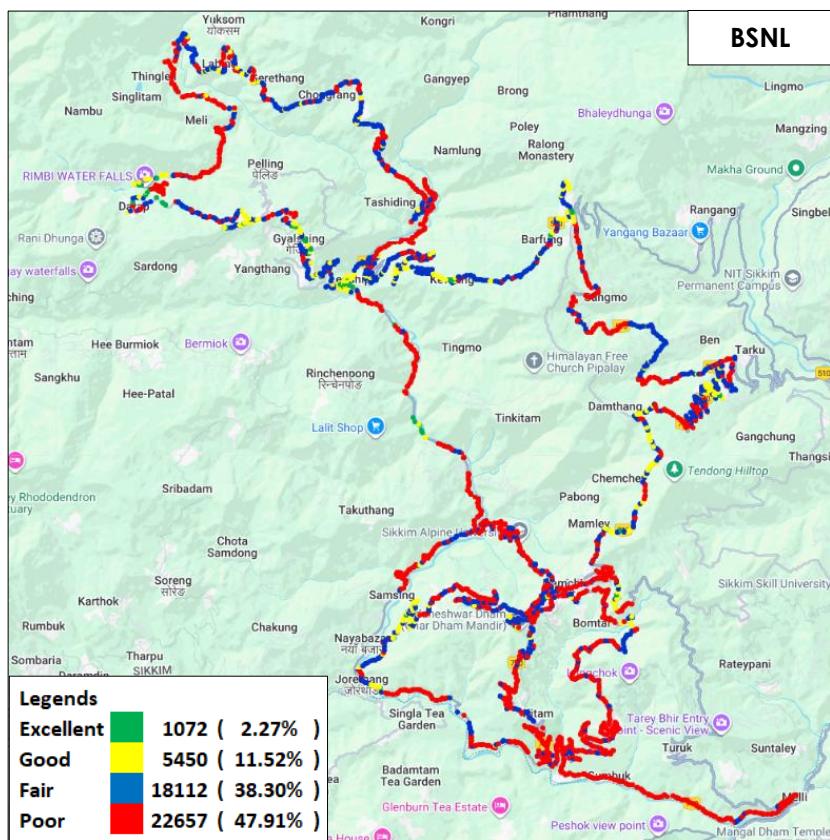


Figure-43: Signal strength auto-selection mode (5G/4G/3G/2G) voice - BSNL (4G being rolled out).

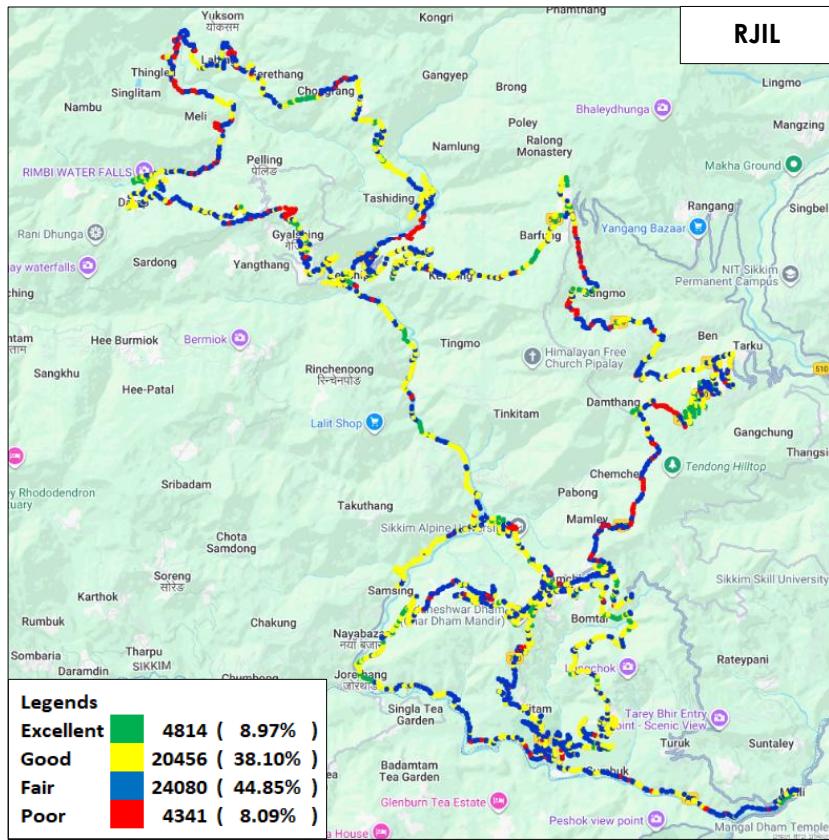


Figure-44: Signal strength auto-selection mode (5G/4G/3G/2G) voice - RJIL.

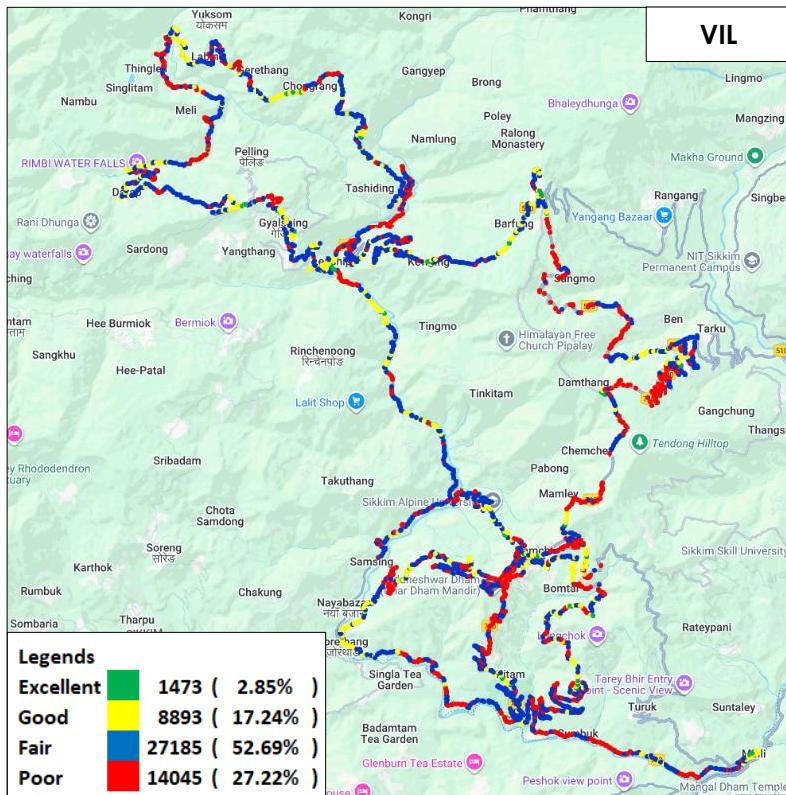


Figure-45: Signal strength auto-selection mode (5G/4G/3G/2G) voice - VIL.

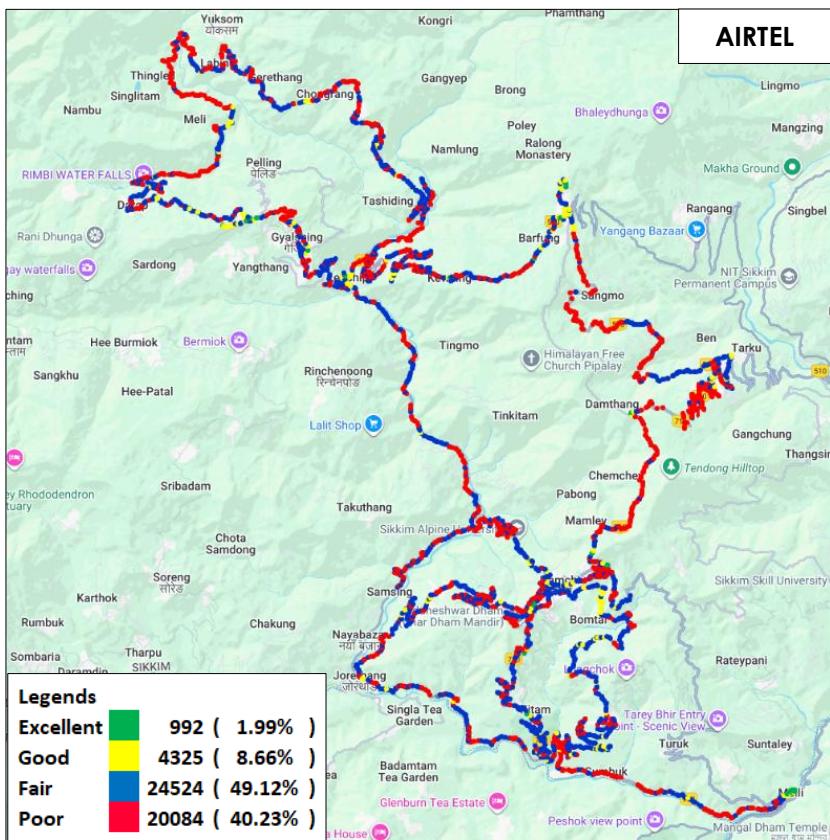


Figure-46: Signal strength auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

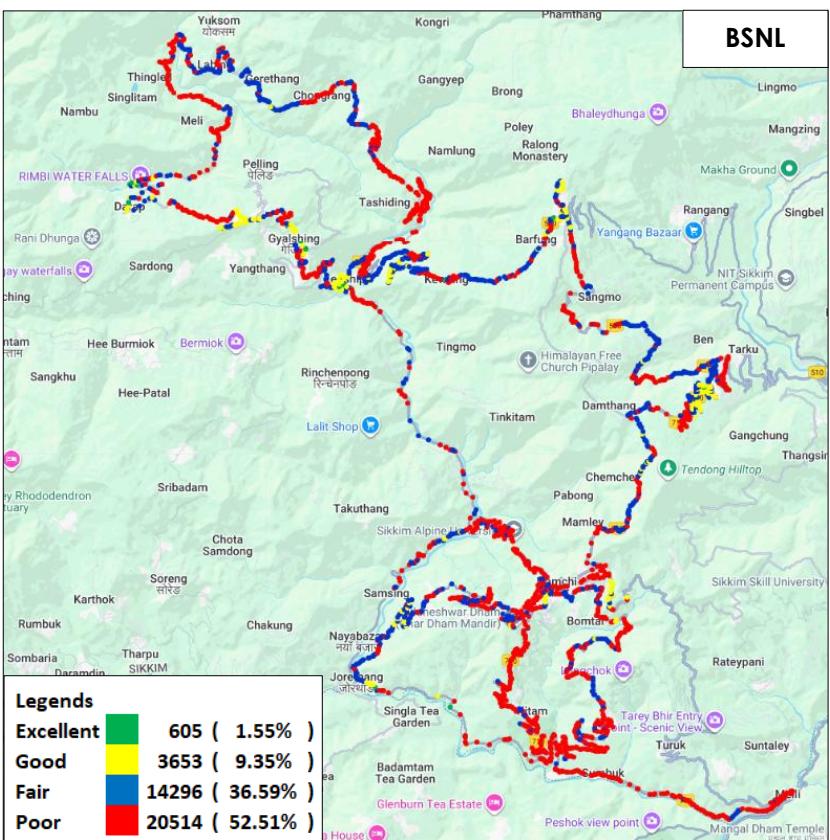


Figure-47: Signal strength auto-selection mode (5G/4G/3G/2G) data - BSNL (4G being rolled out).

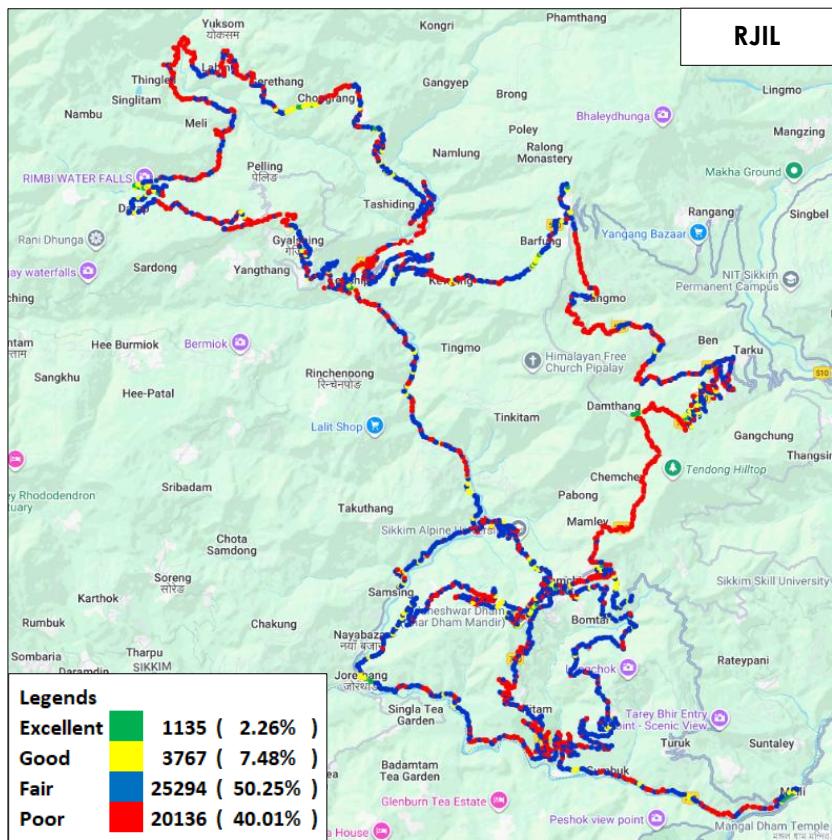


Figure-48: Signal strength auto-selection mode (5G/4G/3G/2G) data - RJIL.

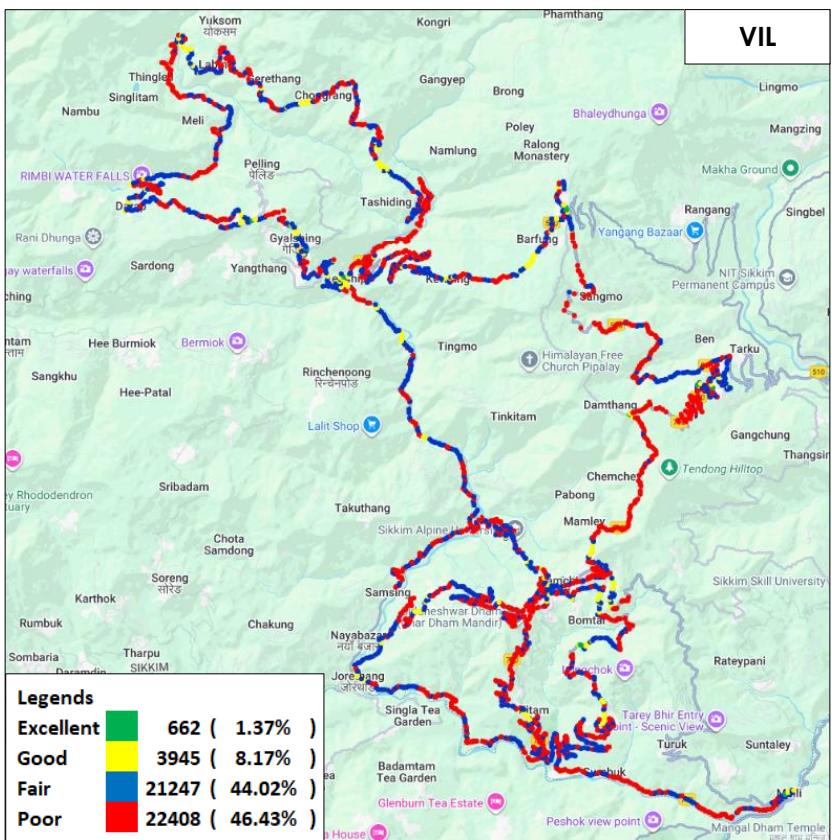


Figure-49: Signal strength auto-selection mode (5G/4G/3G/2G) data - VIL.

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	30 Sec
Call Duration	• 5G/4G/3G/2G auto mode- switch Call	120 Sec
Wait/ Guard Time	• 5G/4G MOS Call	15 Sec

Table-63: Voice test detail

Note-

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

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

Latency & Jitter (TWAMP-UDP)		25 count- Dynamic 500 count- Hotspot Payload- 512 bytes in all drive
Packet Loss Rate (TWAMP-UDP & TCP)		500 counts (TWAMP-UDP) 500 counts (TCP) at each hotspot Payload- 512 bytes in all drive

Table-64: 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.
- Delhi-based TRAI server was used for HTTP Download, Upload, TCP and TWAMP testing for Airtel, BSNL and RJIL.
- VIL server was used for HTTP Download and HTTP Upload, the Delhi-based TRAI server was used for TCP and TWAMP testing for VIL.

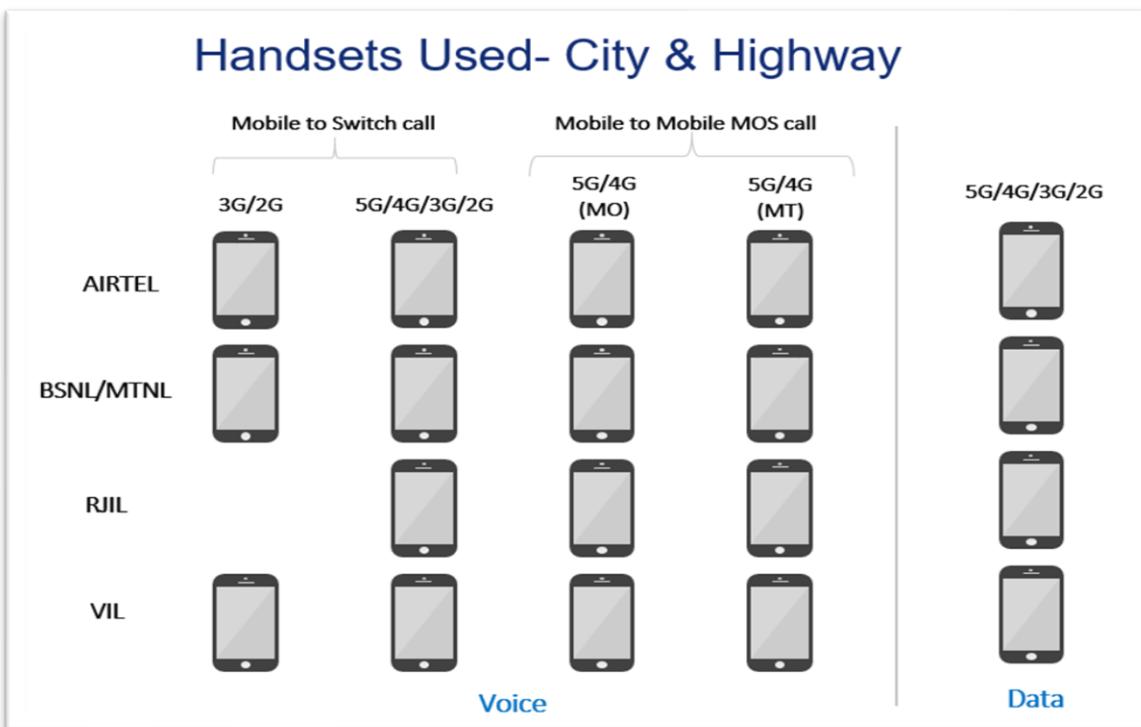


Figure-50: Number of handsets used in city & highway drive

MO: Mobile originating

MT: Mobile terminating

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

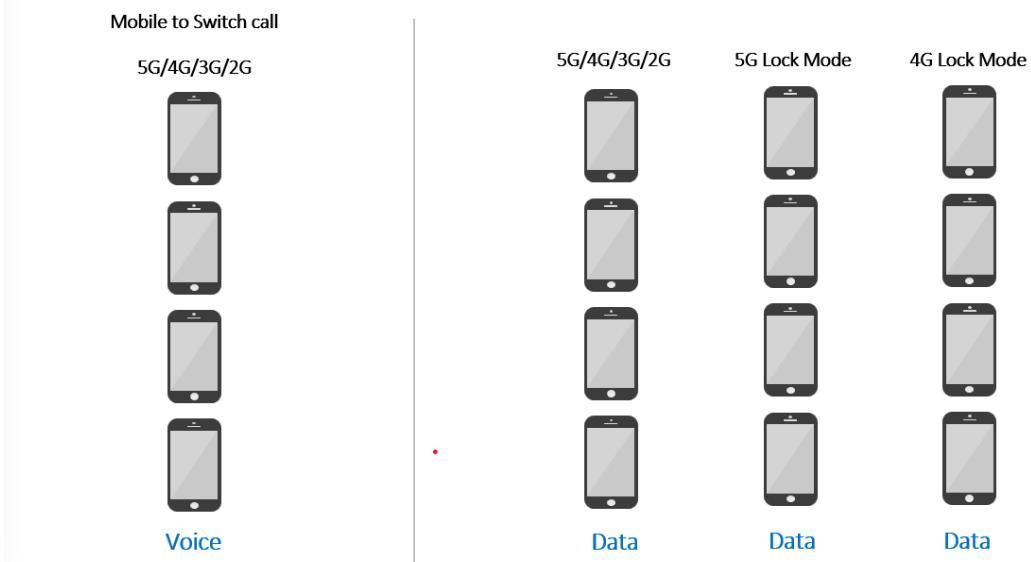


Figure-51: Number of handsets used in railway/metro/walktest/hotspot & coastal area

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)

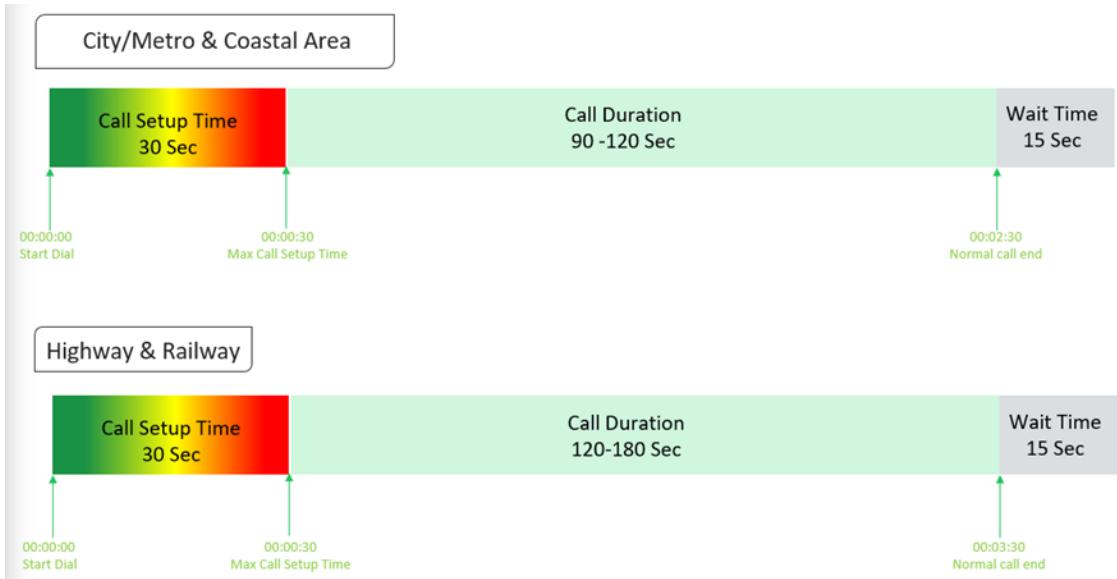


Figure-52: Voice test script for city/railway/metro/highway & coastal area

- 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-53: 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

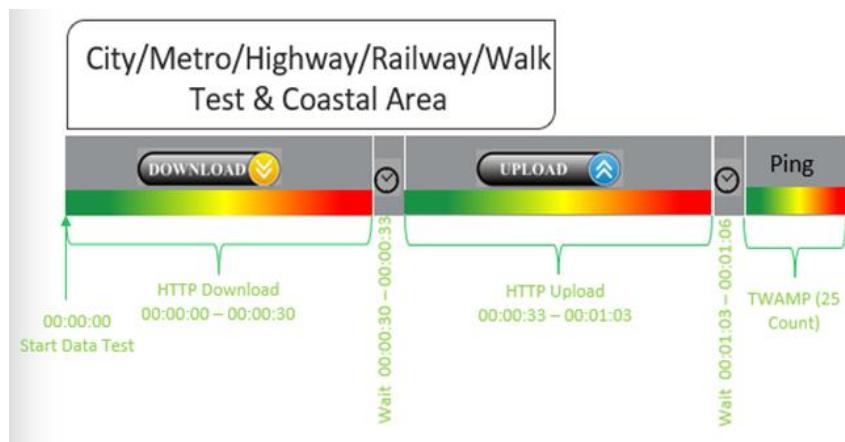


Figure-54: Data test script used in city/metro/railway/highway/walk test & coastal area

(d) Static Data(internet) testing

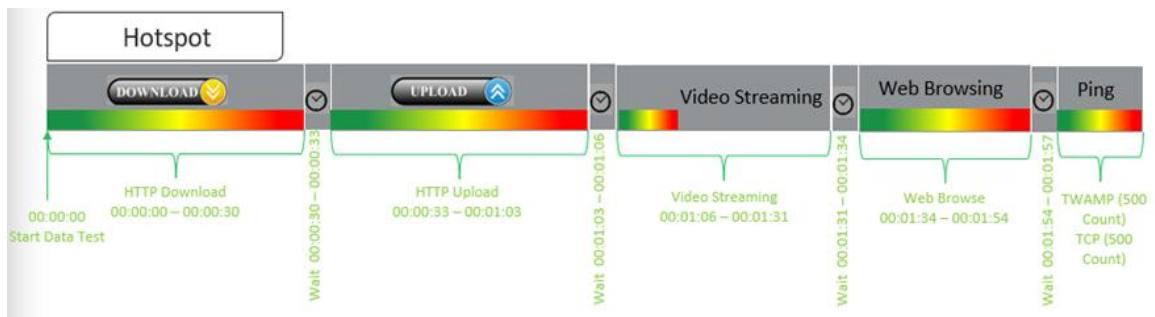


Figure-55: Data test script used at hotspot

- 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	<p>(i) Call Setup Success Rate is defined as the ratio of Established Calls to Call Attempts. 'Established Calls' mean the following events have happened in call setup:</p> <ul style="list-style-type: none"> (a) Call attempt is made (b) The signaling channel is allocated (c) The call is routed to the outwards path of the terminating network (d) An alert signal is received by caller in the form of ring back tone, busy tone, or an announcement. <p>$\text{CSSR} = (\text{Total Call Established} / \text{Total Call Attempt}) * 100$</p> <p>As per QoS Regulation 2024 benchmark value is $\geq 98\%$</p>
Drop Call Rate	<p>Drop call represents the service provider network's ability to maintain a call once it has been successfully established. This parameter shall include both incoming calls and outgoing calls which, once they have been established and have an assigned traffic channel/ bearer, are dropped, or interrupted before their normal completion by the user, the cause of the early termination being within the service provider's network</p> <p>$\text{Drop Call Rate} = (\text{Total Drop Call} / \text{Total Call Established}) * 100$</p> <p>As per QoS Regulation 2024 benchmark value is $\leq 2\%$</p>
Call Setup Time	<p>Time taken from call initiate to call alerting/ringing.</p> <p>$\text{Call Setup Time} = \text{T2} - \text{T1}$</p> <p>T2- Ringing (VoLTE/VoNR) & Alerting (for WCDMA & GSM), T1- Invite (VoLTE/VoNR) & CM Service Request (for WCDMA & GSM)</p>
Voice Quality (MOS)	<p>Voice quality in mobile networks is measured with algorithms based on ITU-T P.863 (POLQA). The grading for Voice quality has been given as:</p> <p>Excellent: $\text{MOS} \geq 4$ and < 5 Good : $\text{MOS} \geq 3$ and < 4 Fair : $\text{MOS} \geq 2$ and < 3 Poor : $\text{MOS} \geq 1$ and < 2</p>
Handover Success Rate	<p>Handover Success Rate = Count of successful handovers (All Technology Handover combined) / Total count of Handover Attempt (All Technology Handover combined) *100</p> <p>Handover type which are considered- 2G Inter & Intra cell, 3G Soft & IRAT, 4G Inter & Intra frequency & SRVCC, 5G Inter & Intra frequency & 5G to 4G handovers.</p>
Silence Call	<p>A call which has ≥ 4 sec continuous RTP gap is considered as a Silence Call.</p> <p>$\text{Silence call rate} = (\text{count of silence call} / \text{Total calls established}) * 100$</p> <p>If a call observes multiple silence count ≥ 4 sec in a particular established call it has been taken as one silent event.</p>

Jitter	<p>The inter arrival jitter is the difference in the relative transit time for two packets. The relative transit time is the difference between a packet's Real-time Transport Protocol (RTP) timestamp and the receiver's clock at the time of arrival, measured in the same units. If S_i is the RTP timestamp from packet i, and R_i is the time of arrival in RTP timestamps units for packet i, then for two packets i and j the inter-arrival jitter D can be expressed as:</p> $D(i,j) = (R_j - R_i) - (S_j - S_i)$ <p>The interarrival jitter is calculated continuously as each data packet i is received from source $SSRC_n$, using this difference D for that packet and the previous packet $i-1$ in order of arrival (not necessarily in sequence), according to the formula</p> $J(i) = J(i-1) + (D(i-1,i) - J(i-1))/16 \text{ or } 8$																																		
Downlink Packet Drop Rate	<p>Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call originating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE)</p>																																		
Uplink Packet Drop Rate	<p>Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call terminating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE).</p>																																		
Signal Strength	<p>Signal strength is the signal power level received by the wireless user.</p> <table border="1"> <thead> <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> </thead> <tbody> <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> </tbody> </table>	Parameter Name	Technology	Signal Strength (dBm)				Excellent	Good	Fair	Poor	Rx Level	GSM	0 to ≥ -65	<-65 to ≥ -75	<-75 to ≥ -85	<-85 to min	RSCP	WCDMA	0 to ≥ -70	<-70 to ≥ -80	<-80 to ≥ -90	<-90 to min	RSRP	LTE	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min	SS_RSRP	NR	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min
Parameter Name	Technology			Signal Strength (dBm)																															
		Excellent	Good	Fair	Poor																														
Rx Level	GSM	0 to ≥ -65	<-65 to ≥ -75	<-75 to ≥ -85	<-85 to min																														
RSCP	WCDMA	0 to ≥ -70	<-70 to ≥ -80	<-80 to ≥ -90	<-90 to min																														
RSRP	LTE	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min																														
SS_RSRP	NR	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min																														

Table-65: Network performance parameter and definition voice

7.2.2 Network Performance Parameters Data tests

Parameter Name	Definition
Download Speed (Mbps)	<p>The download speed is defined as the data transmission rate that is achieved for downloading a test file from a test server to a test device.</p> <p>Download Speed = Total bytes transferred during download / Total time for transfer</p> <ul style="list-style-type: none"> 80th percentile (upper range) & 20th percentile (lower range) value has been calculated for download throughput in dynamic drive and Hotspot combine data
Upload Speed (Mbps)	<p>The upload speed is the data transmission rate that is achieved for uploading a test file from a test device to a test server.</p> <p>Upload Speed = Total bytes transferred during upload / Total time for transfer.</p> <ul style="list-style-type: none"> 80th percentile (upper range) & 20th percentile (lower range) value has been calculated for upload throughput in dynamic drive and Hotspot combine data.
Download Session Setup Success Rate	<p>(total download session established (successfully connected to server)/ total download session attempt) *100. This KPI has been calculated for Hotspot only.</p>

Upload Session Setup Success Rate	(total upload session established (successfully connected to server)/ total upload session attempt)*100. This KPI need to report for Hotspot only.
Web Page Download Time	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 $\text{IPDV}(i) = D(i) - D(i-1)$ 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 ping) >90 ms considered as packet loss and included in packet loss rate. * Packet loss rate is calculated based on ICMP * 90th percentile for Packet loss rate has been reported in overall Hotspot performance summary.

Table-66: 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.