भादूविप्रा
TRAI

TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Andhra Pradesh LSA

April 2026

Contents

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 Andhra Pradesh License Service Area (LSA) during the month of April-2026 under the supervision of TRAI Regional Office (RO) Hyderabad. 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	Hindupur to Hyderabad	Highway	473.7	21-Apr-2026	21-Apr-2026
2	Hyderabad to Hindupur	Railway	515.8	20-Apr-2026	20-Apr-2026

Table-1: Drive test summary.

2.2 Drive test routes

The map provides overview of drive test routes indicating highway drive and railway route as per the legends shown on the map.

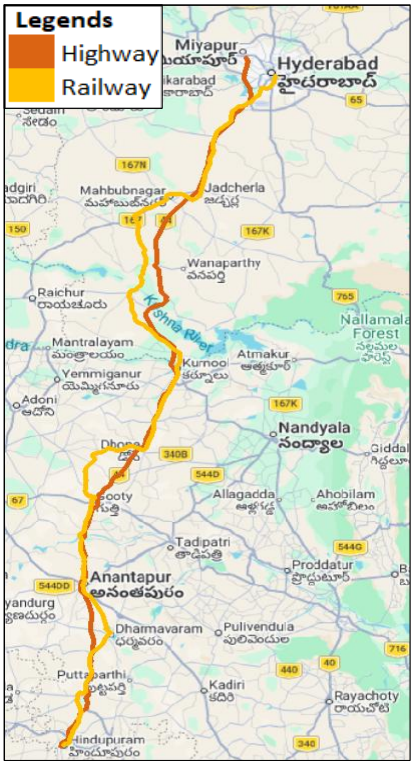


Figure-1: Drive test routes

2.3 Summary of areas covered

a) Highway- Hindupur to Hyderabad passing through Anantapur, Dhone, Kurnool and Jadcherla etc.

b) Railway- Hyderabad to Hindupur passing through Jadcherla, Kurnool Town, Dhone Junction, Gooty Junction, Anantapura and Dharmavaram Junction etc.

2.4 Telecom service providers detected frequency bands

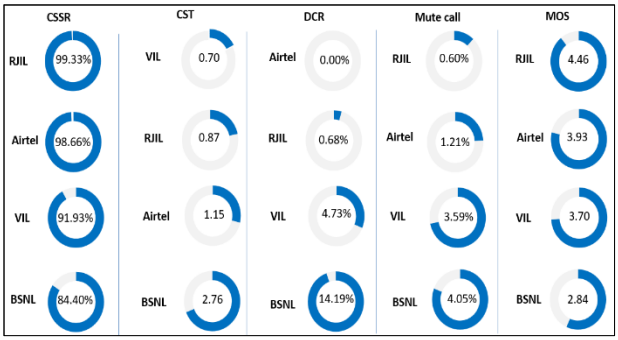
Technologies covered during the IDT and frequency bands in use are summarised in table below:

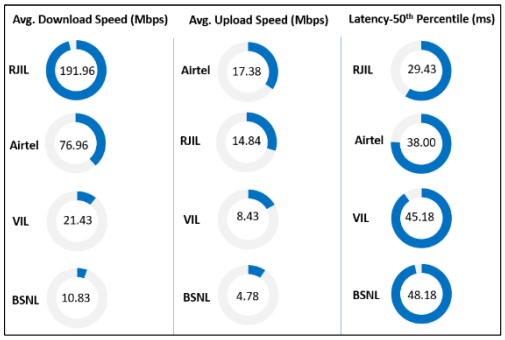
S.no.	Name of TSP	Technology	Frequency Bands (In MHz)
1	Bharti Airtel Ltd.	2G	900,1800
2	Bharti Airtel Ltd.	4G	900,1800,2300
3	Bharti Airtel Ltd.	5G	3500
4	BSNL	2G	900
5	BSNL	3G	2100
6	BSNL	4G	700,2100,2500
7	Reliance JIO Infocomm Ltd.	4G	850,1800,2300
8	Reliance JIO Infocomm Ltd.	5G	700,3500
9	Vodafone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

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

Call Setup Success Rate: Airtel, BSNL, RJIL and VIL have 98.66%, 84.40%, 99.33% and 91.93%, call setup success rate respectively in Auto-selection mode (5G/4G/3G/2G).

Call Setup Time: Airtel, BSNL, RJIL & VIL have call setup time of 1.15, 2.76, 0.87 and 0.70 seconds respectively in Auto-selection mode (5G/4G/3G/2G).

Drop Call Rate: Airtel, BSNL, RJIL and VIL have drop call rate 0.00%, 14.19%, 0.68% and 4.73% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Silence/Mute Rate: Airtel, BSNL, RJIL and VIL have silence call rate 1.21%, 4.05%, 0.60% and 3.59% respectively in packet switched network (4G/5G).

Mean Opinion Score (MOS): Airtel, BSNL, RJIL and VIL have average MOS of 3.93, 2.84, 4.46 and 3.70 respectively.

Summary-Data services

Data Download performance (Overall): Average download speed of Airtel (5G/4G/2G) is 76.96 Mbps, BSNL (4G/3G/2G) is 10.83 Mbps, RJIL (5G/4G) is 191.96 Mbps and VIL (5G/4G/2G) is 21.43 Mbps.

Data Upload performance (Overall): Average upload speed of Airtel (5G/4G/2G) is 17.38 Mbps, BSNL (4G/3G/2G) is 4.78 Mbps, RJIL (5G/4G) is 14.84 Mbps and VIL (5G/4G/2G) is 8.43 Mbps.

Latency (Overall): Airtel, BSNL, RJIL and VIL 50th percentile latency is 38.00 ms, 48.18 ms, 29.43 ms, 45.18 ms respectively.

- The poor Signal Strength in auto-selection mode (5G/4G/3G/2G) during **voice** testing has been observed in 1.27%, 21.80%, 2.26% & 12.11% of the **Highway IDT route** in case of Airtel, BSNL, RJIL & VIL respectively. {refer **figure- 47 to 50** 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 11.62%, 21.68%, 10.87% & 17.56% of the **Highway IDT route** in case of Airtel, BSNL, RJIL & VIL respectively. {refer **figure- 51 to 54** 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 4.78%, 34.90%, 5.26% & 13.37% of the **Railway IDT route** in case of Airtel, BSNL, RJIL & VIL respectively. {refer **figure- 55 to 58** 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 7.99%, 21.08%, 10.88% & 13.08% of the **Railway IDT route** in case of Airtel, BSNL, RJIL & VIL respectively. {refer **figure- 59 to 62** as per the **Section 6.1** under Para-6(Annexure)}

QoS Performance Analysis- Andhra 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 Andhra Pradesh LSA during the month of April-2026 covering highway and railway route. (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	169	178	175
Call Setup Success Rate %	99.41	93.26	97.14
Drop Call Rate %	4.17	6.63	1.76
Call Setup Time-Average (Second)	3.20	3.57	4.27
Handover Success Rate %	94.86	98.60	94.72

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

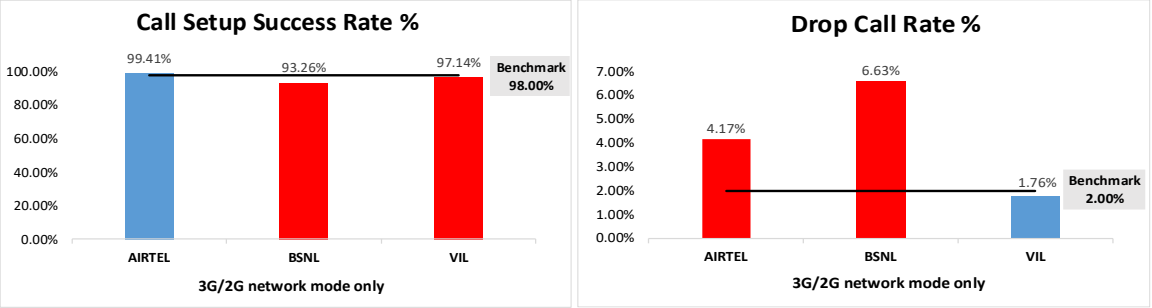


Figure-2: Call setup success rate and drop call rate performance.

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	44	NA
2G	468	202	300

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	299	359	298	322
Call Setup Success Rate %	98.66	84.40	99.33	91.93
Drop Call Rate %	0.00	14.19	0.68	4.73
Call Setup Time-Average (Second)	1.15	2.76	0.87	0.70
Handover Success Rate %	99.90	97.32	99.80	99.93

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

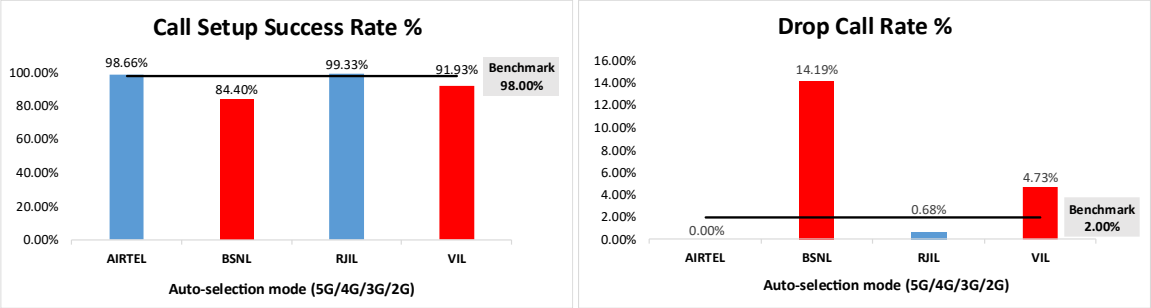


Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	165	148	167	167
Number of silences call for >4 Sec	2	6	1	6
Silence Call Rate %	1.21	4.05	0.60	3.59
Number of silence instances for >4 Sec	2	8	1	7
Number of silence instances for >3 Sec	7	13	4	12
Number of silence instances for >2 sec	25	27	9	29
RTP Jitter (4G & 5G) in ms	4.22	3.73	12.92	14.89
Packet loss Rate Downlink %	0.66	4.75	1.08	1.35
Packet loss Rate Uplink %	0.94	3.12	0.99	1.50

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	785	0
4G	1666	405	1395	989
3G	NA	31	NA	NA
2G	0	275	NA	48

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 mean: 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	2089	1697	2103	2009
Speech Quality (Average MOS)	3.93	2.84	4.46	3.70
Number of samples with MOS >=4 to <5 (Excellent)	1631	329	1824	991
Number of samples with MOS >=3 to <4 (Good)	350	371	175	761
Number of samples with MOS >=2 to <3 (Fair)	55	708	51	151
Number of samples with MOS >=1 to <2 (Poor)	53	289	53	106
%age of samples with MOS >=4 to <5 (Excellent)	78.08%	19.39%	86.73%	49.33%
%age of samples with MOS >=3 to <4 (Good)	16.75%	21.86%	8.32%	37.88%
%age of samples with MOS >=2 to <3 (Fair)	2.63%	41.72%	2.43%	7.52%
%age of samples with MOS >=1 to <2 (Poor)	2.54%	17.03%	2.52%	5.28%

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

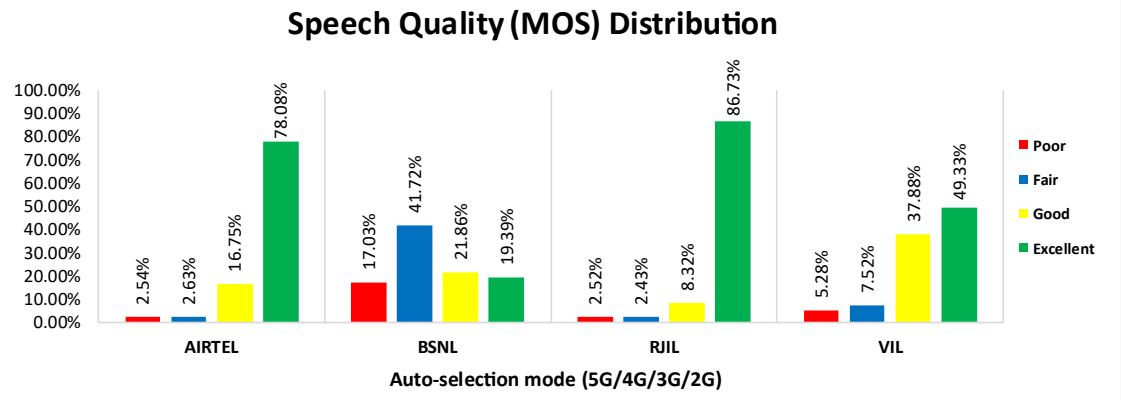


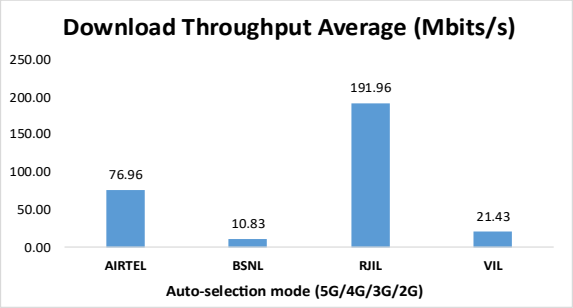
Figure- 4: Distribution of samples in MOS range.

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**	76.96	10.83	191.96	21.43
	80th Percentile	149.10	17.83	354.65	35.06
	20th Percentile	5.83	2.07	16.58	7.10
Upload Throughput (Mbits/s)	**Average**	17.38	4.78	14.84	8.43
	80th Percentile	27.82	7.64	25.70	13.62
	20th Percentile	3.00	1.28	2.57	2.77
Latency (ms)	**50th Percentile**	38.00	48.18	29.43	45.18

Table-9: Summary of data performance in network auto-selection mode.



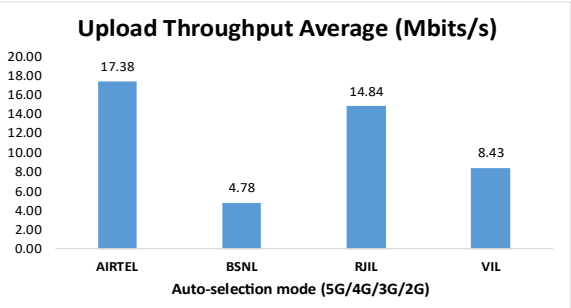


Figure- 5: Download and Upload throughput

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	1130	0
4G	1676	504	530	1035
3G	NA	50	NA	NA
2G	0	153	NA	40

Table-10: 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 highway and railway route for all telecom service providers, the results of drive tests conducted are shown individually for respective areas/locations.

4.2 Highway

Drive test has been conducted on 21st April 2026 covering one Highway route. (Refer table-1)

4.2.1 Drive test route

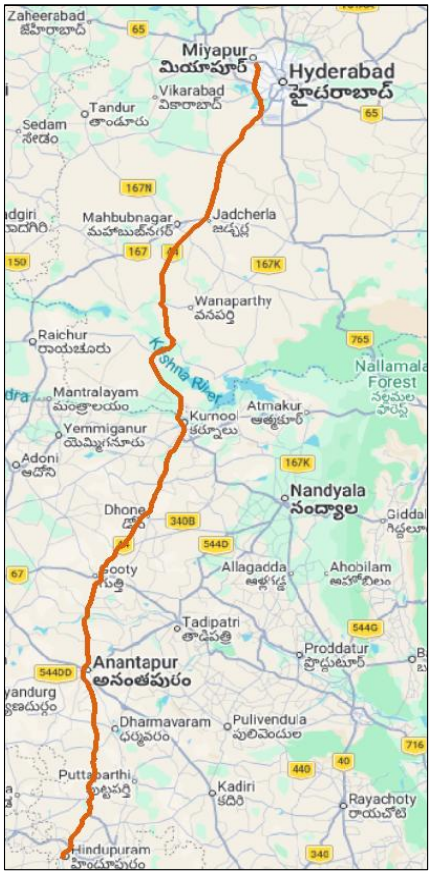


Figure-6: Drive test route Highway.

4.2.2 Routes Covered

Hindupur to Hyderabad passing through Anantapur, Dhone, Kurnool and Jadcherla 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 the 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	169	178	175
Call Setup Success Rate %	99.41	93.26	97.14
Drop Call Rate %	4.17	6.63	1.76
Call Setup Time-Average (Second)	3.20	3.57	4.27
Handover Success Rate %	94.86	98.60	94.72

Table-11: Summary of voice call performance in 3G/2G network mode only.

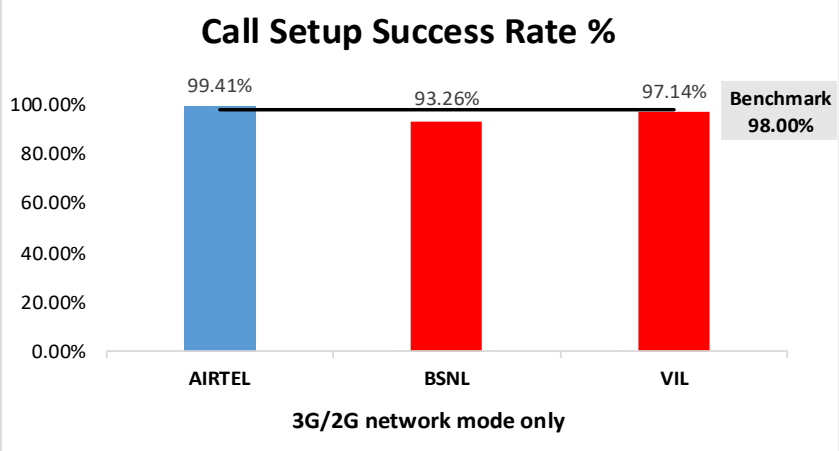


Figure-7: Performance for call setup success rate.

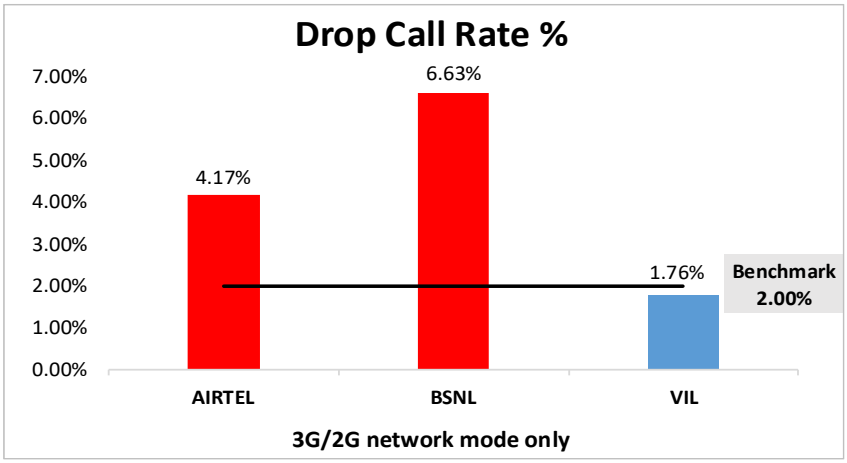


Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	24.00%	NA
2G	100.00%	75.01%	100.00%
Limited Service	0.00%	0.99%	0.00%

Table-12: Time spent on technology during drive test 3G/2G network mode only.

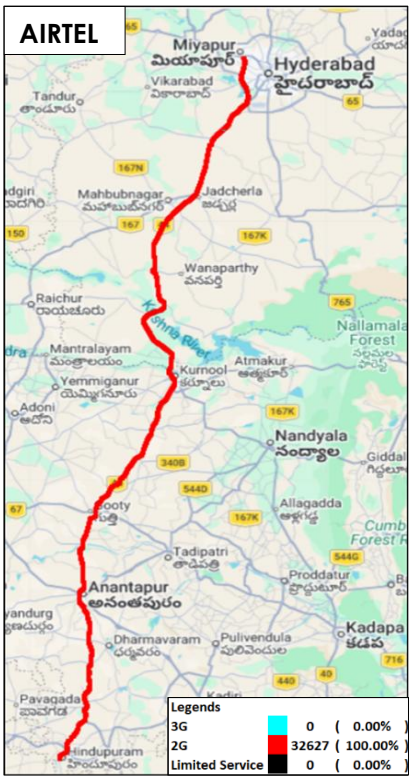


Figure-9: Serving technology plots 3G/2G network mode - AIRTEL.

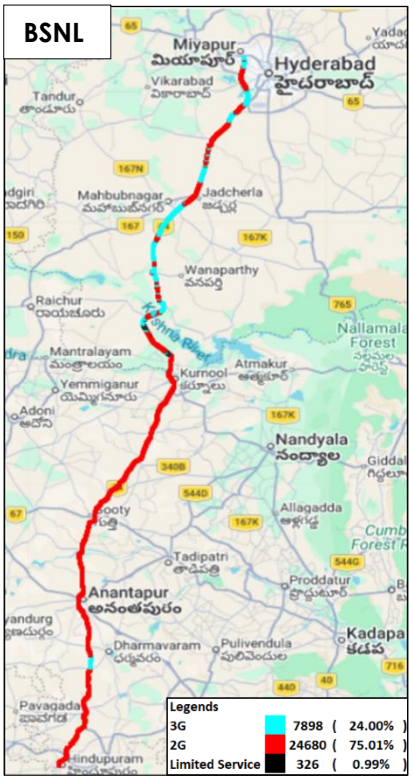


Figure-10: Serving technology plots 3G/2G network mode - BSNL.

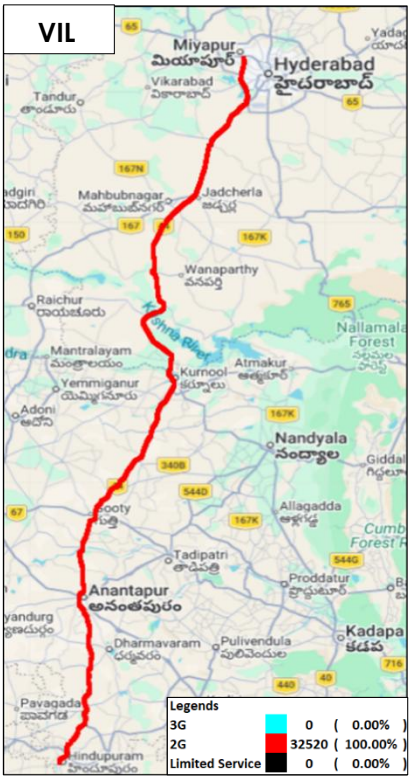


Figure 11: Serving technology plots 3G/2G network mode - VIL.

(c) Network Signal Strength Distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (Refer figure-44, 45 & 46 for map view)

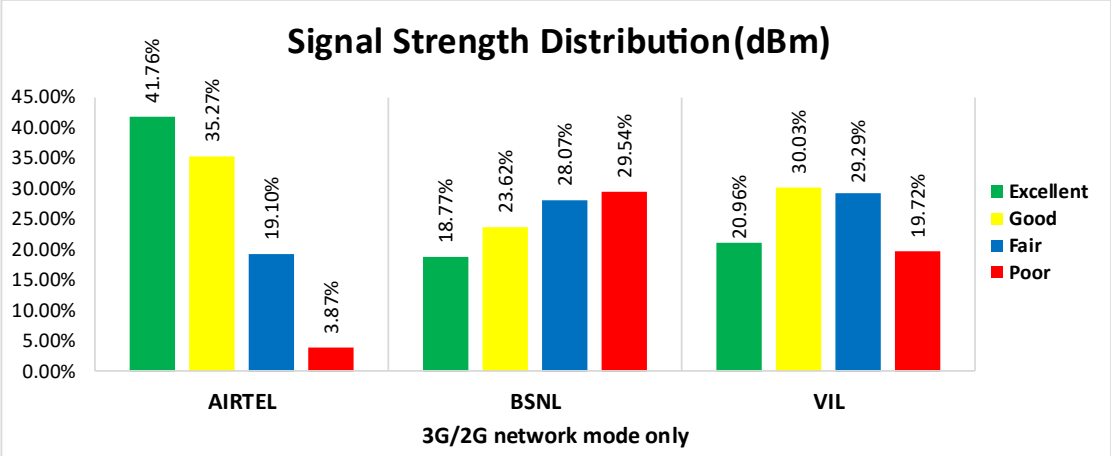


Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 42% of samples falling in the excellent signal strength category.
- BSNL has 19% of samples falling in the excellent signal strength category.
- VIL has 21% 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	171	192	169	180
Call Setup Success Rate %	98.83	88.02	100.00	94.44
Drop Call Rate %	0.00	8.88	0.00	3.53
Call Setup Time Average (Second)	0.94	2.68	0.80	0.68
Handover Success Rate %	99.86	97.52	99.70	100.00

Table-13: Summary of voice call performance in network auto-selection mode.

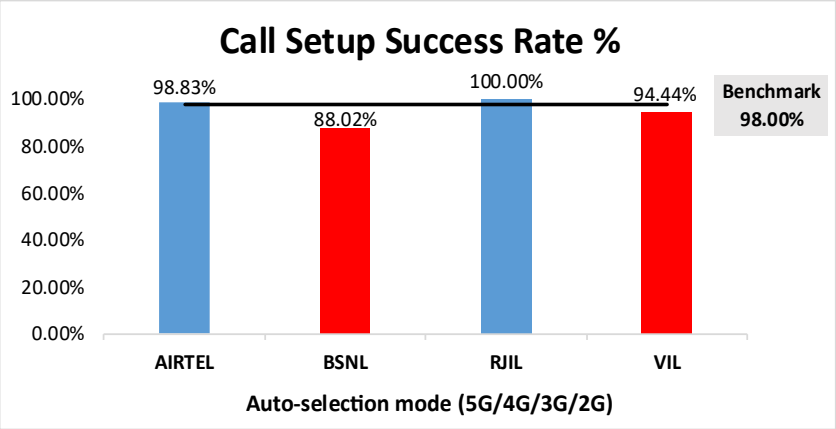


Figure-13: Performance for call setup success rate.

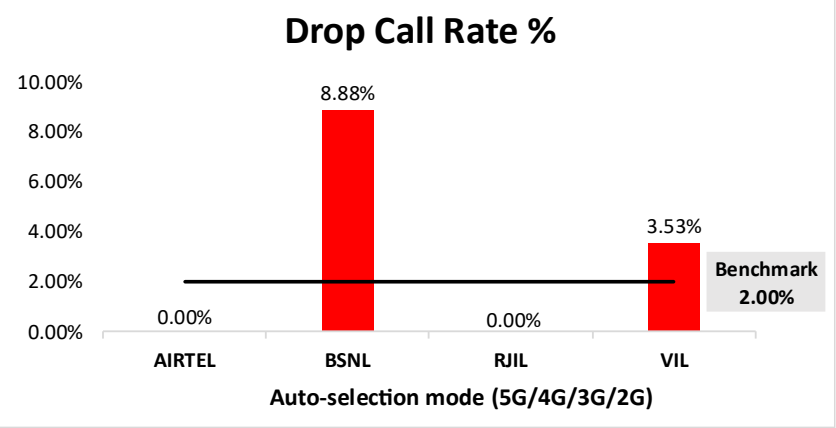


Figure-14: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	165	148	167	167
Number of silence call for >4 Sec	2	6	1	6
Silence Call Rate %	1.21	4.05	0.60	3.59
Number of silence instances for >4 Sec	2	8	1	7
Number of silence instances for >3 Sec	7	13	4	12
Number of silence instances for >2 sec	25	27	9	29
RTP Jitter (4G & 5G) in ms	4.22	3.73	12.92	14.89
Packet loss Rate Downlink %	0.66	4.75	1.08	1.35
Packet loss Rate Uplink %	0.94	3.12	0.99	1.50

Table-14: Summary of silence instances & packet loss rate for mobile to mobile call.

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

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

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls in table-14	2089	1697	2103	2009
Speech Quality (Average MOS)	3.93	2.84	4.46	3.70
Number of samples with MOS >=4 to <5 (Excellent)	1631	329	1824	991
Number of samples with MOS >=3 to <4 (Good)	350	371	175	761
Number of samples with MOS >=2 to <3 (Fair)	55	708	51	151
Number of samples with MOS >=1 to <2 (Poor)	53	289	53	106
%age of samples with MOS >=4 to <5 (Excellent)	78.08%	19.39%	86.73%	49.33%
%age of samples with MOS >=3 to <4 (Good)	16.75%	21.86%	8.32%	37.88%
%age of samples with MOS >=2 to <3 (Fair)	2.63%	41.72%	2.43%	7.52%
%age of samples with MOS >=1 to <2 (Poor)	2.54%	17.03%	2.52%	5.28%

Table-15: Summary of speech quality (MOS) samples.

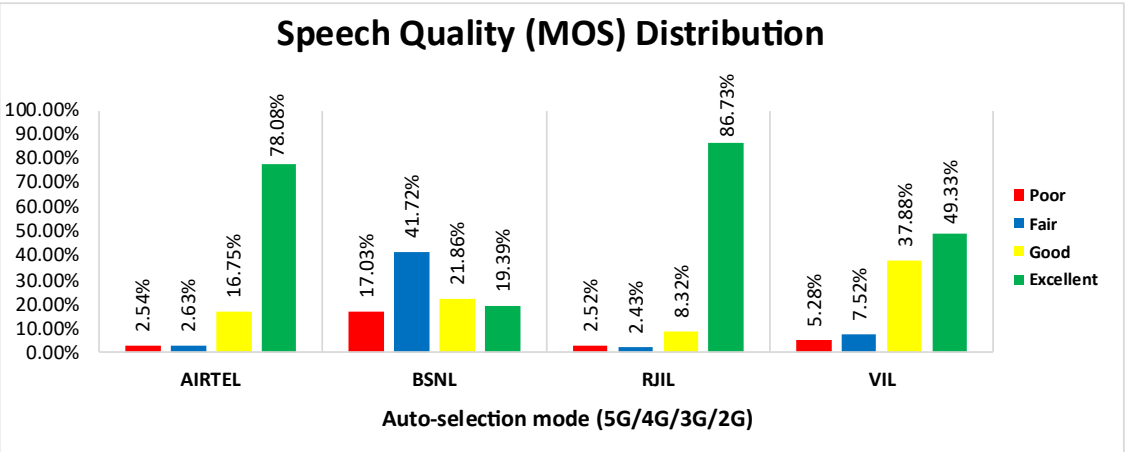


Figure-15: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	0.77%	NA	74.34%	0.01%
4G	99.23%	53.04%	25.66%	94.22%
3G	NA	5.16%	NA	NA
2G	0.00%	41.52%	NA	5.67%
Limited Service	0.00%	0.29%	0.00%	0.10%

Table-16: 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.

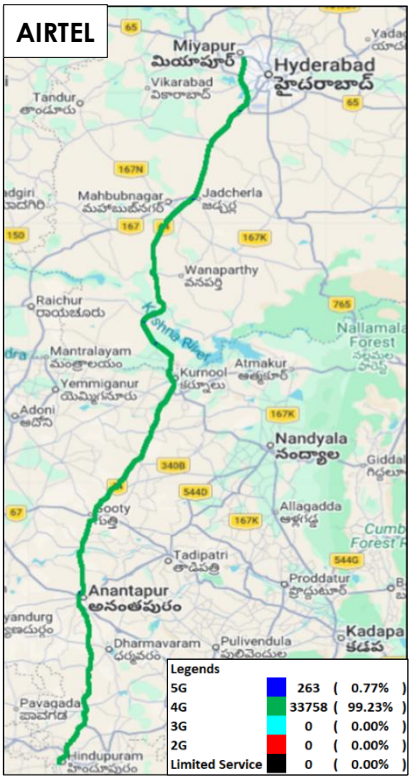


Figure-16: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

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

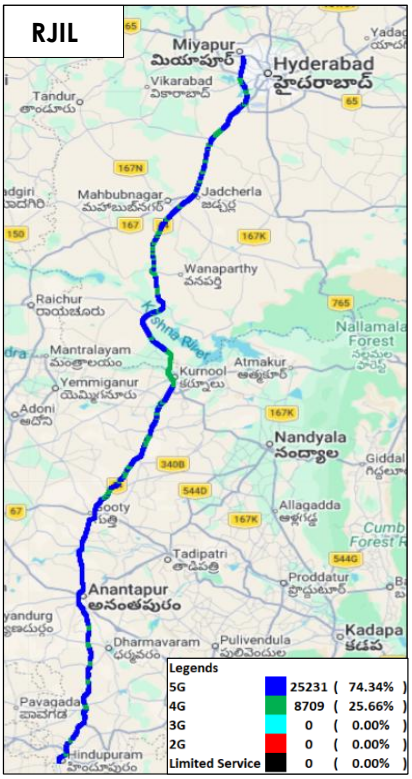


Figure-18: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

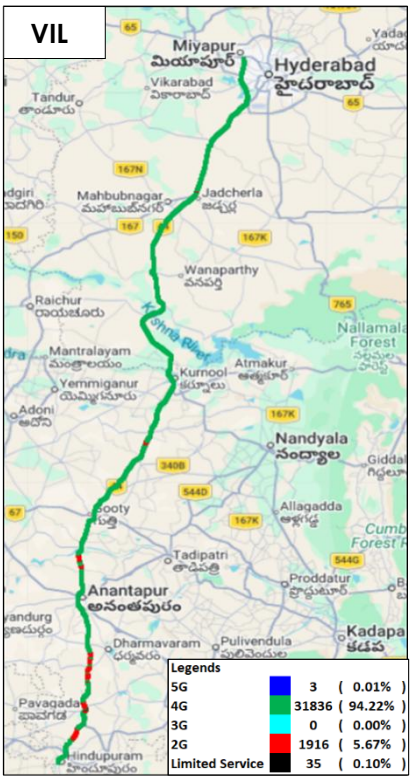


Figure-19: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - VIL.

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) voice. (Refer figure-47, 48, 49 & 50 for map view)

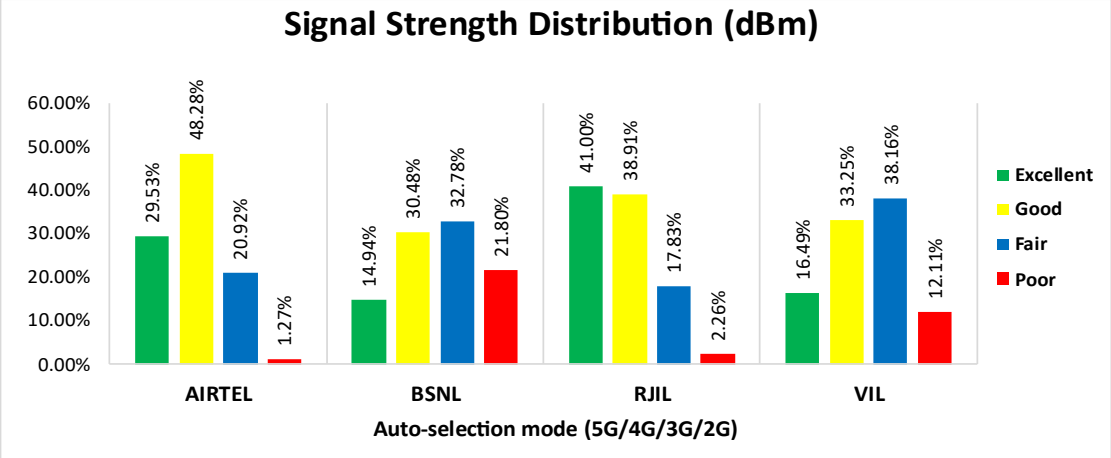


Figure-20: Signal strength distribution auto-selection mode 5G/4G/3G/2G voice.

Observations:

- Airtel has 30% of samples falling in the excellent signal strength category.
- BSNL has 15% of samples falling in the excellent signal strength category.
- RJIL has 41% of samples falling in the excellent signal strength category.
- VIL has 16% 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	109.79	10.96	244.03	22.62
	80th Percentile	184.75	18.54	440.87	35.96
	20th Percentile	28.46	0.64	55.87	7.49
Upload Throughput (Mbits/s)	Average	22.50	4.00	18.02	7.49
	80th Percentile	35.31	6.18	31.18	11.50
	20th Percentile	5.82	1.20	2.76	2.45
Latency (ms)	50th Percentile	34.13	47.93	23.03	44.73

Table-17: Summary of Data performance in network auto-selection mode.

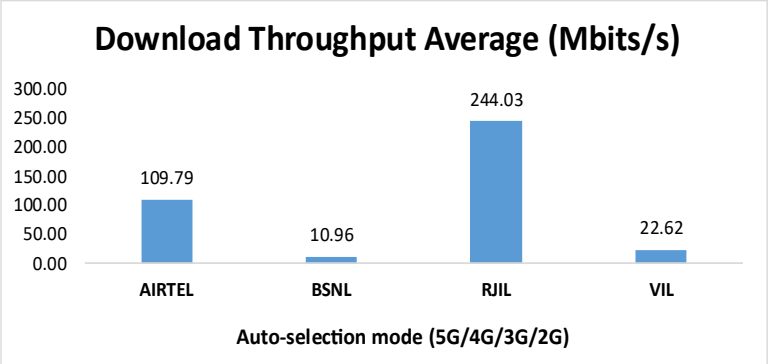


Figure 22: Download throughput.

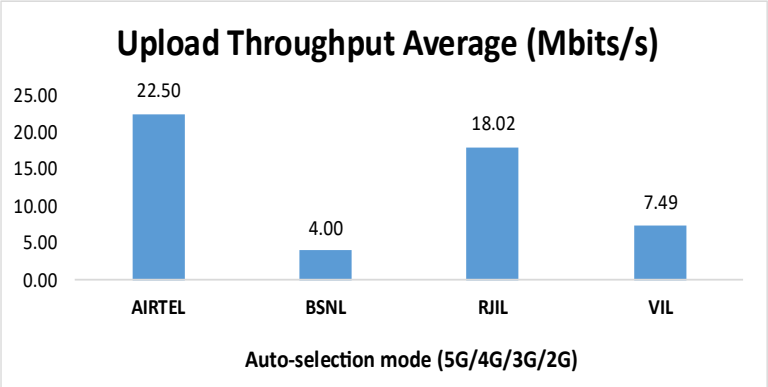


Figure-23: Upload throughput.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	59.70%	NA	90.96%	0.81%
4G	40.00%	76.80%	9.04%	95.58%
3G	NA	6.76%	NA	NA
2G	0.01%	15.75%	NA	3.06%
Limited Service	0.29%	0.69%	0.00%	0.55%

Table-18: 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.

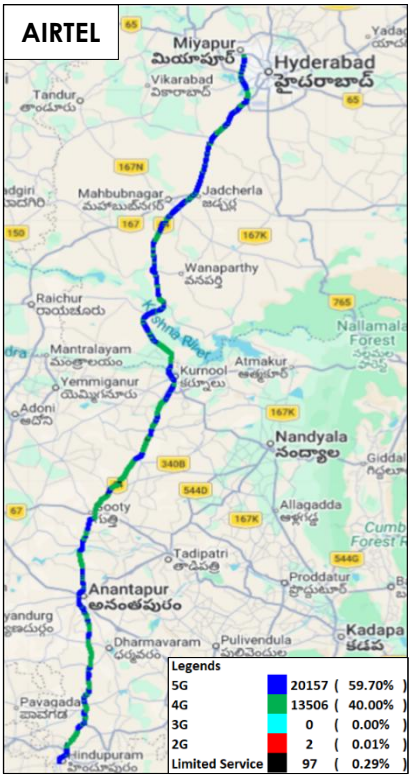


Figure-24: Serving technology plot in auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

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

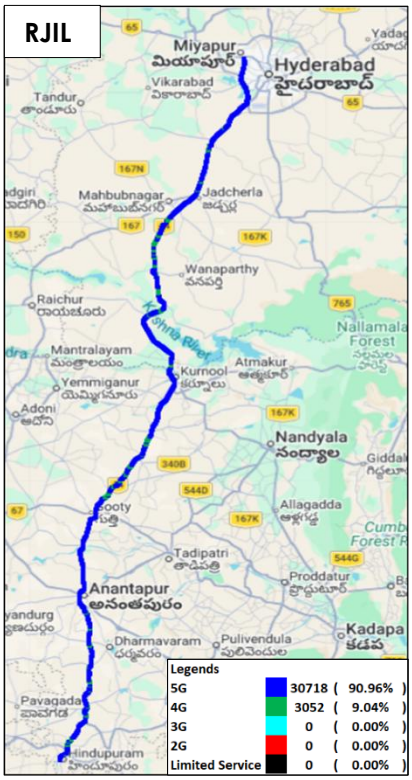


Figure-26: Serving technology plot in auto-selection mode (5G/4G/3G/2G) data - RJIL.

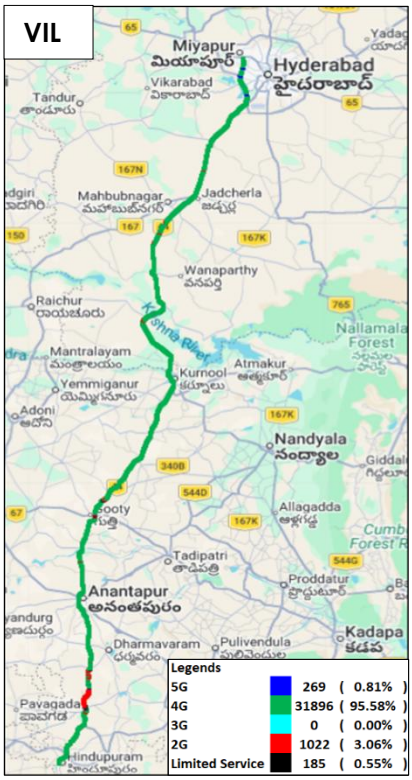


Figure-27: Serving technology plot in auto-selection mode (5G/4G/3G/2G) data - VIL.

(c) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) data. (Refer figure-51, 52, 53 & 54 for map view)

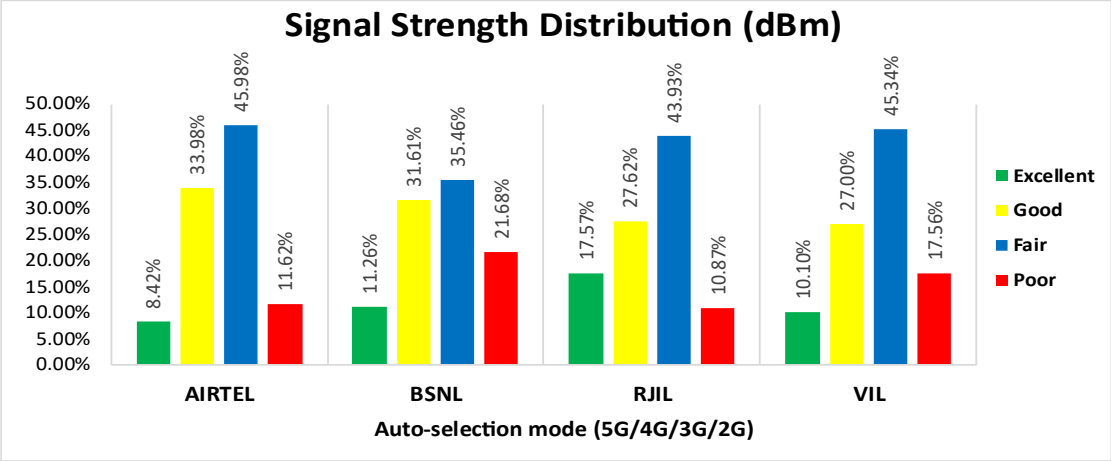


Figure-28: Signal strength distribution auto-selection mode (5G/4G/3G/2G) data.

Observations:

- Airtel has 8% of samples falling in the excellent signal strength category.
- BSNL has 11% of samples falling in the excellent signal strength category.
- RJIL has 18% of samples falling in the excellent signal strength category.
- VIL has 10% of samples falling in the excellent signal strength category.

4.3 Railway

Drive test has been conducted on 20th April 2026 covering one Railway route. (Refer rable-1)

4.3.1 Drive test route

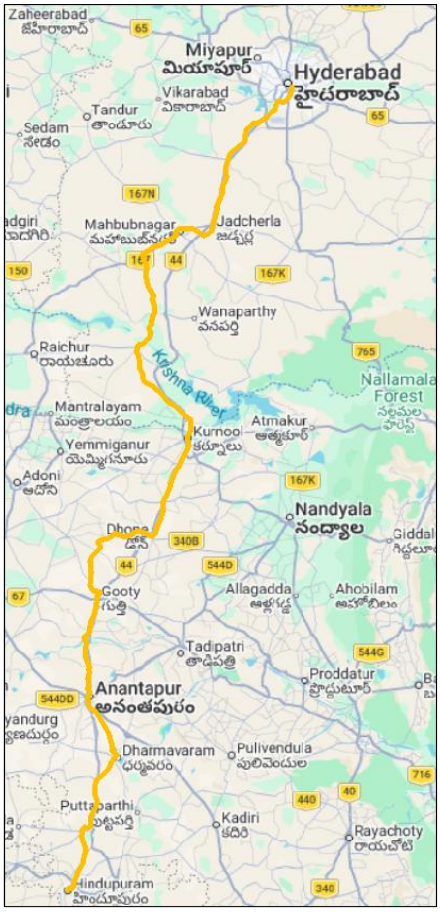


Figure-29: Drive test route Railway.

4.3.2 Routes Covered

Hyderabad to Hindupur passing through Jadcherla, Kurnool Town, Dhone Junction, Gooty Junction, Anantapura and Dharmavaram Junction etc.

4.3.3 Voice Performance

(a) 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	128	167	129	142
Call Setup Success Rate %	98.44	80.24	98.45	88.73
Drop Call Rate %	0.00	20.90	1.57	6.35
Call Setup Time Average (Second)	1.43	2.86	0.97	0.74
Handover Success Rate %	99.93	97.09	99.88	99.87

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

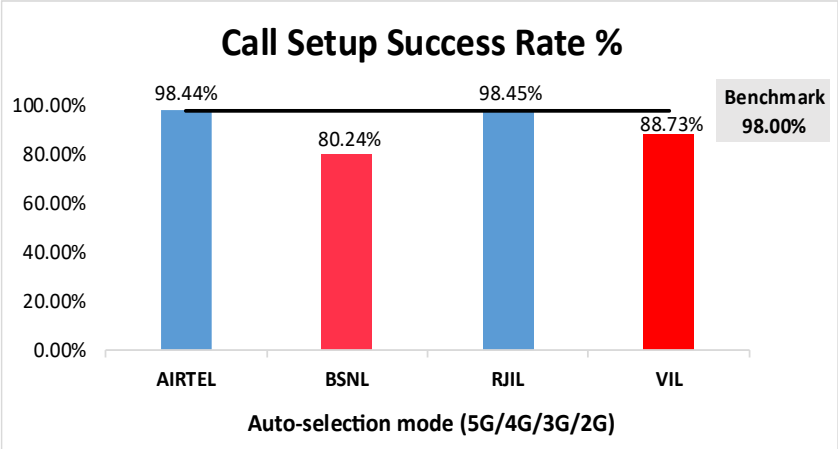


Figure-30: Performance for call setup success rate.

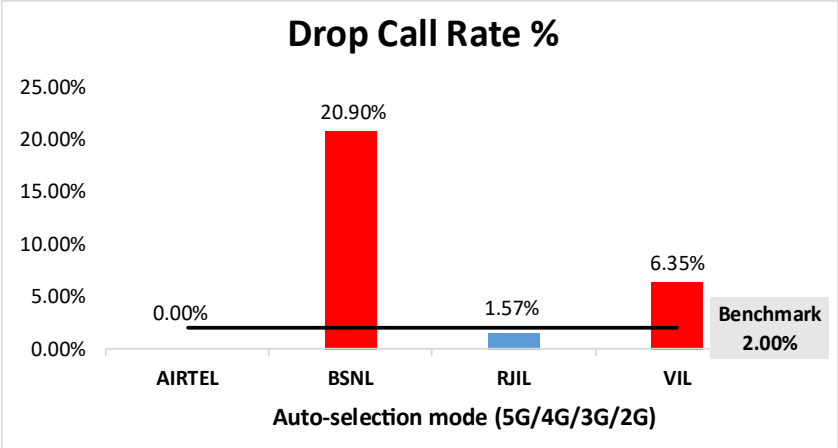


Figure-31: Performance for drop call rate.

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

Technology	Service Provider			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	0.69%	NA	9.16%	0.00%
4G	99.29%	36.77%	90.52%	91.73%
3G	NA	9.43%	NA	NA
2G	0.00%	51.92%	NA	7.52%
Limited Service	0.02%	1.88%	0.33%	0.75%

Table-20: 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.

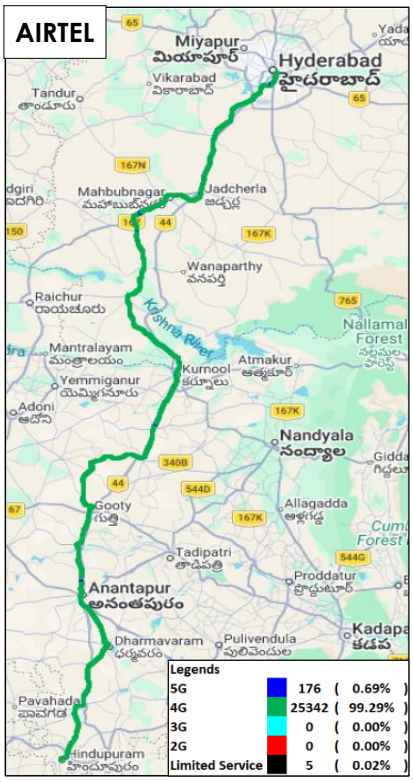


Figure-32: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

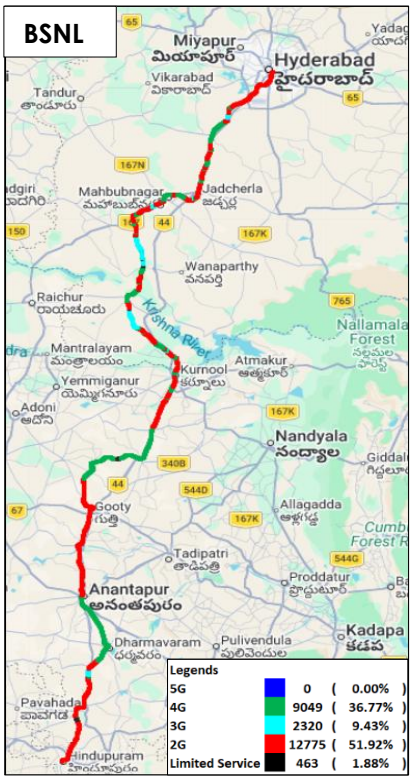


Figure-33: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - BSNL.

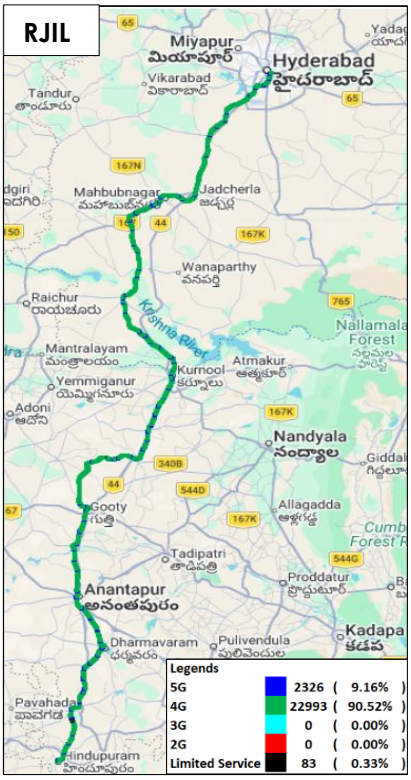


Figure-34: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - RJIL.

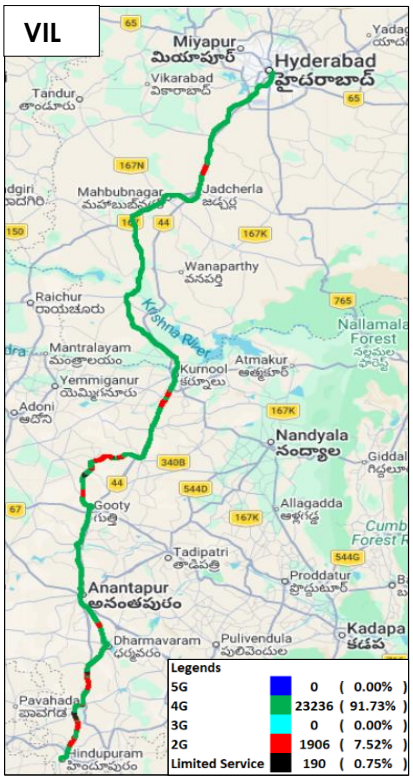


Figure-35: Serving technology plots in auto-selection mode (5G/4G/3G/2G) voice - VIL.

(c) Network Signal Strength Distribution: The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G) voice. (Refer figure-55, 56, 57 & 58 for map view)

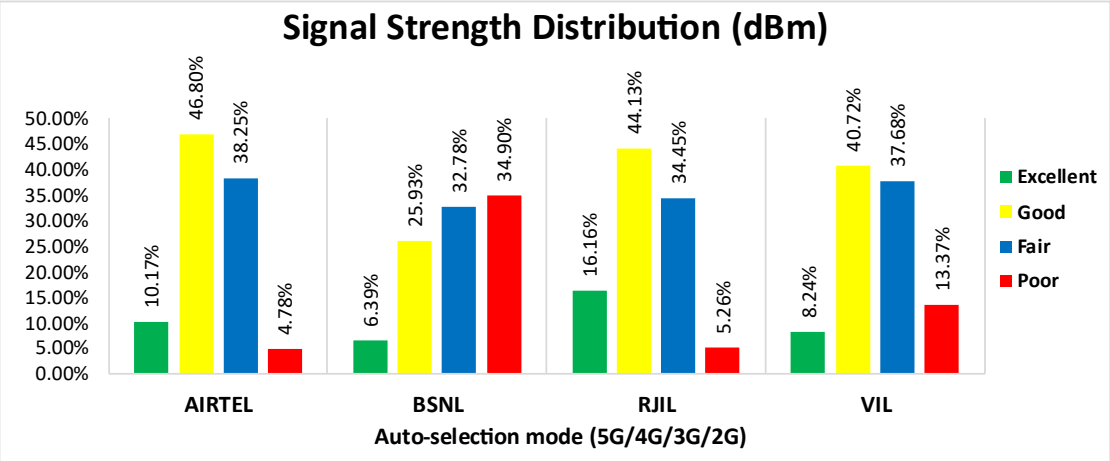


Figure-36: Signal strength distribution auto-selection mode 5G/4G/3G/2G voice.

Observations:

- Airtel has 10% of samples falling in the excellent signal strength category.
- BSNL has 6% of samples falling in the excellent signal strength category.
- RJIL has 16% of samples falling in the excellent signal strength category.
- VIL has 8% of samples falling in the excellent signal strength category.

4.3.4 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	25.60	10.61	119.61	19.87
	80th Percentile	40.99	15.94	230.43	30.65
	20th Percentile	1.09	3.74	5.16	6.70
Upload Throughput (Mbits/s)	Average	9.38	6.02	10.41	9.69
	80th Percentile	13.39	9.54	15.81	16.23
	20th Percentile	1.94	1.69	2.33	3.24
Latency (ms)	50th Percentile	44.91	48.54	36.78	45.73

Table-21: Summary of Data performance in network auto-selection mode

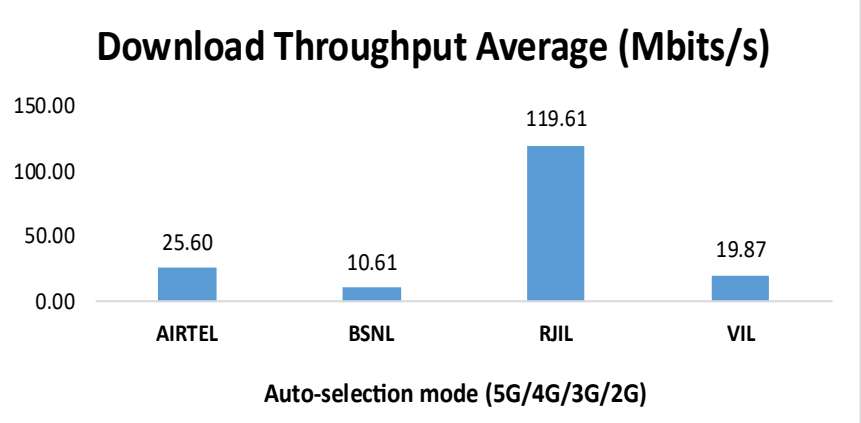


Figure-37: Download throughput

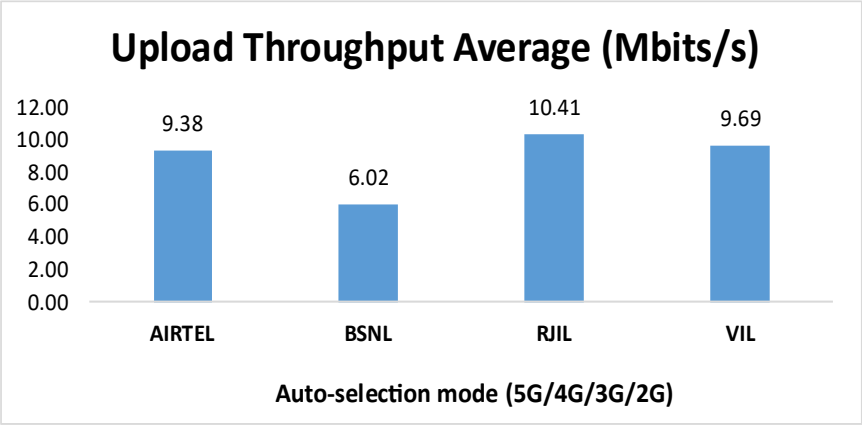


Figure-38: Upload throughput

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

Technology	Service Provider			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	26.01%	NA	84.44%	0.07%
4G	73.99%	64.70%	15.54%	97.56%
3G	NA	19.29%	NA	NA
2G	0.00%	14.91%	NA	1.46%
Limited Service	0.00%	1.10%	0.02%	0.91%

Table-22: 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.

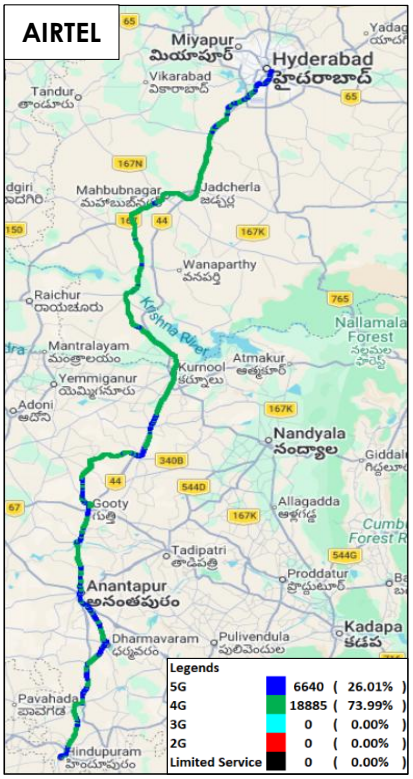


Figure-39: Serving technology plot in auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

Figure-40: Serving technology plot in auto-selection mode (5G/4G/3G/2G) data - BSNL.

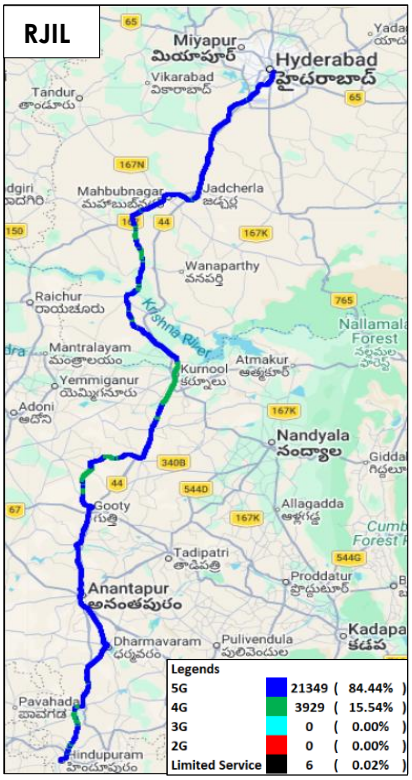


Figure-41: Serving technology plot in auto-selection mode (5G/4G/3G/2G) data - RJIL.

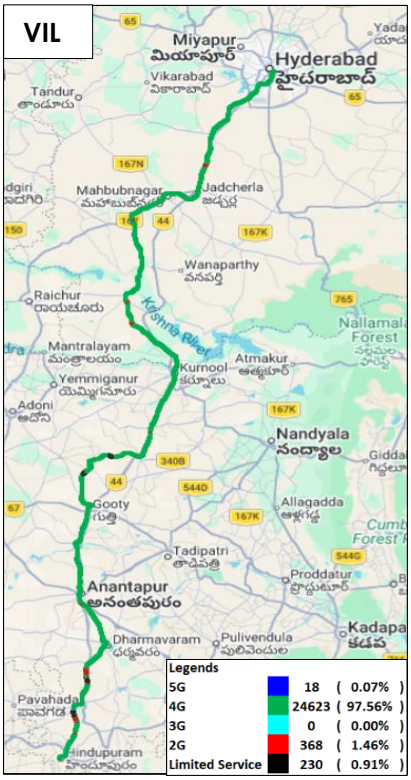


Figure-42: Serving technology plot in auto-selection mode (5G/4G/3G/2G) data - VIL.

(c) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G) data. (Refer figure-59, 60, 61 & 62 for map view)

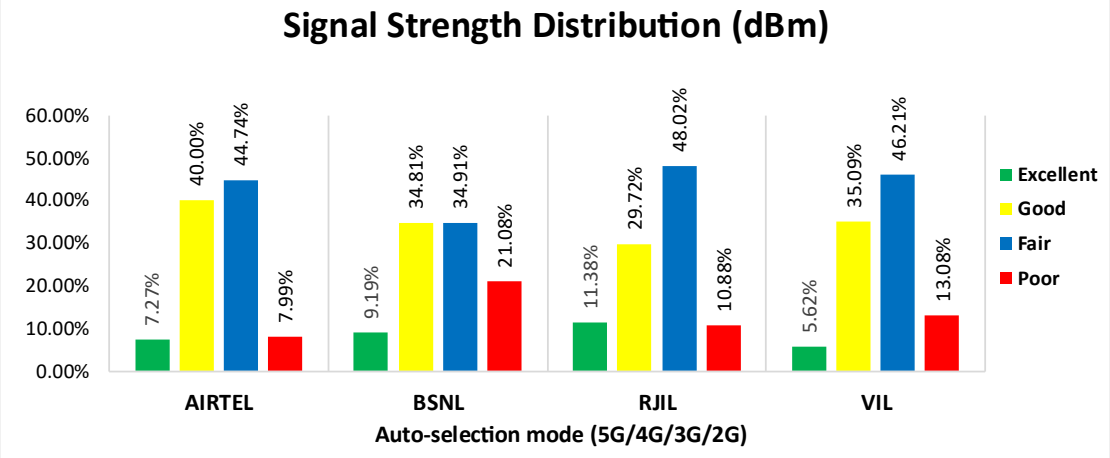


Figure-43: Signal strength distribution auto-selection mode (5G/4G/3G/2G) data.

Observations:

- Airtel has 7% of samples falling in the excellent signal strength category.
- BSNL has 9% of samples falling in the excellent signal strength category.
- RJIL has 11% 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 99.41%, 93.26% and 97.14% call setup success rate respectively in 3G/2G network mode. (refer table-3)

b) Airtel, BSNL, RJIL and VIL have 98.66%, 84.40%, 99.33% and 91.93% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

2. Call Setup Time:

a) Airtel, BSNL and VIL call setup time is 3.20, 3.57 & 4.27 seconds respectively in 3G/2G network mode. (refer table-3)

b) Airtel, BSNL, RJIL & VIL call setup time is 1.15, 2.76, 0.87 & 0.70 seconds respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

3. Call Silence/Mute Rate: In packet switched network (4G/5G) BSNL, VIL, Airtel & RJIL have 4.05%, 3.59% 1.21% & 0.60% silence call rate respectively. Further BSNL has higher RTP packet loss rate in downlink (4.75%) compared to VIL (1.35%), RJIL (1.08%) & Airtel (0.66%). In uplink the RTP packet loss rate is higher for BSNL (3.12%) compared to VIL (1.50%), RJIL (0.99%) & Airtel (0.94%). (refer table-6)

4. Drop Call Rate:

a) Airtel, BSNL and VIL drop call rate is 4.17%, 6.63% and 1.76% respectively in 3G/2G network mode. (refer table-3)

b) Airtel, BSNL, RJIL and VIL drop call rate is 0.00%, 14.19%, 0.68% and 4.73% 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 76.96 Mbps, 10.83 Mbps, 191.96 Mbps and 21.43 Mbps respectively. (refer table-9)

b) Airtel, BSNL, RJIL and VIL average upload speeds are 17.38 Mbps, 4.78 Mbps, 14.84 Mbps and 8.43 Mbps respectively. (refer table-9)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 99.41% call setup success rate and 4.17% drop call rate have been observed in 3G/2G network mode for LSA/highway route. Performance is not meeting the benchmark of 2.00% for drop call rate. (refer table-3 & 11)
- 98.66% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 98.83% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the highway route. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-13)

- 98.44% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the railway route. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-19)

Data

- Airtel has 76.96 Mbps average download speed & 17.38 Mbps average upload speed for LSA. (refer table-9)
- Airtel has 109.79 Mbps average download speed & 22.50 Mbps average upload speed across the measured routes for highway drive. (refer table-17)
- Airtel has 25.60 Mbps average download speed & 9.38 Mbps average upload speed across measured routes for railway drive. (refer table-21)

2. BSNL:

Voice

- 93.26% call setup success rate and 6.63% drop call rate have been observed in 3G/2G network mode for LSA/highway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3 & 11)
- 84.40% call setup success rate and 14.19% 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)
- 88.02% call setup success rate and 8.88% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the highway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 80.24% call setup success rate and 20.90% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the railway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-19)

Data

- BSNL has 10.83 Mbps average download speed & 4.78 Mbps average upload speed for LSA. (refer table-9)
- BSNL has 10.96 Mbps average download speed & 4.00 Mbps average upload speed across the measured routes for highway drive. (refer table-17)
- BSNL has 10.61 Mbps average download speed & 6.02 Mbps average upload speed across measured routes for railway drive. (refer table-21)

3. RJIL:

Voice

- 99.33% call setup success rate and 0.68% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the highway route. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 98.45% call setup success rate and 1.57% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the railway route. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-19)

Data

- RJIL has 191.96 Mbps average download speed & 14.84 Mbps average upload speed for LSA. (refer table-9)
- RJIL has 244.03 Mbps average download speed & 18.02 Mbps average upload speed across the measured routes for highway drive. (refer table-17)
- RJIL has 119.61 Mbps average download speed & 10.41 Mbps average upload speed across measured routes for railway drive. (refer table-21)

4. VIL:

Voice

- 97.14% call setup success rate and 1.76% drop call rate have been observed in 3G/2G network mode for LSA/highway route. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-3 & 11)
- 91.93% call setup success rate and 4.73% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for LSA. Performance is not meeting benchmark of 98.00% & 2.00% respectively. (refer table-5)
- 94.44% call setup success rate and 3.53% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the highway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)
- 88.73% call setup success rate and 6.35% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) across the railway route. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-19)

Data

- VIL has 21.43 Mbps average download speed & 8.43 Mbps average upload speed for LSA. (refer table-9)
- VIL has 22.62 Mbps average download speed & 7.49 Mbps average upload speed across the measured routes for highway drive. (refer table-17)
- VIL has 19.87 Mbps average download speed & 9.69 Mbps average upload speed across measured routes for railway drive. (refer table-21)

6. Annexure

6.1 Route wise coverage map

6.1.1 Highway

i) Hindupur to Hyderabad

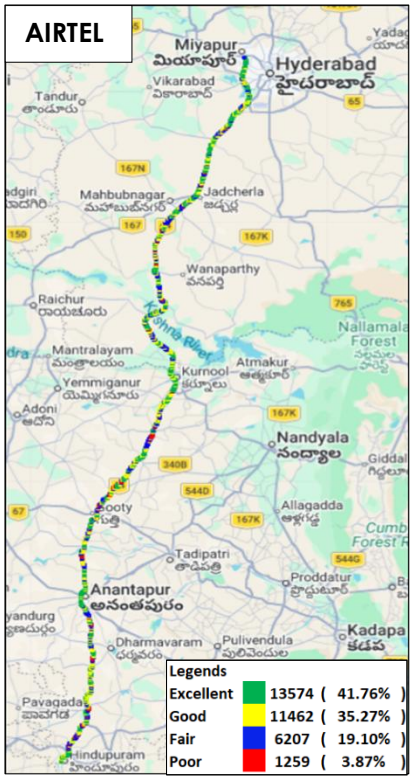


Figure-44: Signal strength 3G/2G network mode - AIRTEL.

Figure-45: Signal strength 3G/2G network mode - BSNL.

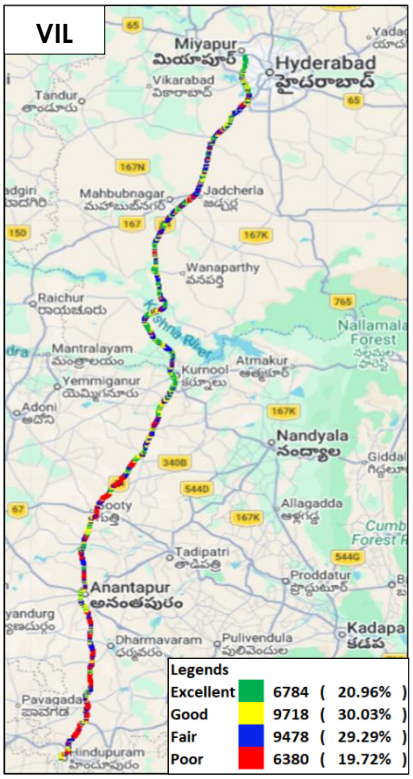


Figure-46: Signal strength 3G/2G network mode - VIL.

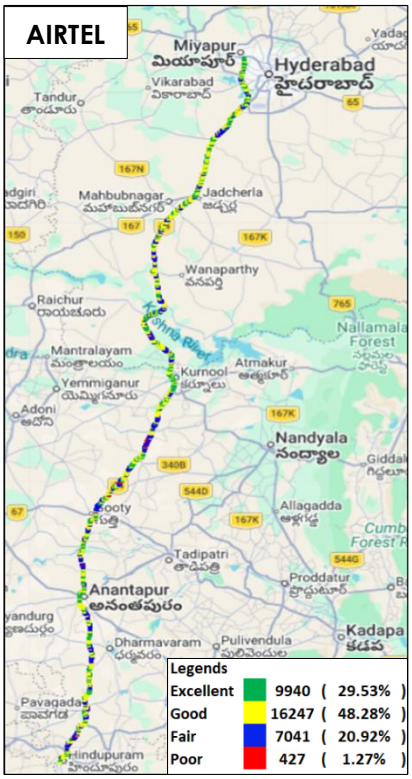


Figure-47: Signal strength auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

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

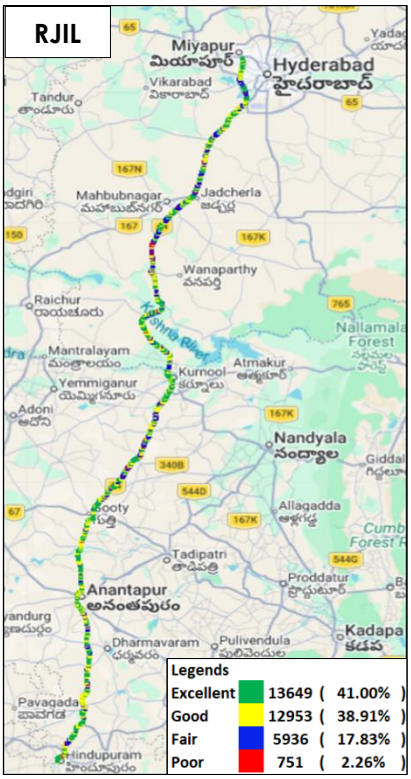


Figure-49: Signal strength auto-selection mode (5G/4G/3G/2G) voice - RJIL.

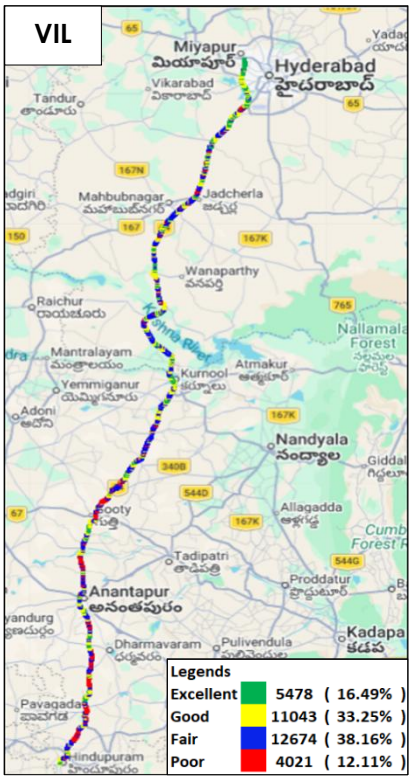


Figure-50: Signal strength auto-selection mode (5G/4G/3G/2G) voice - VIL.

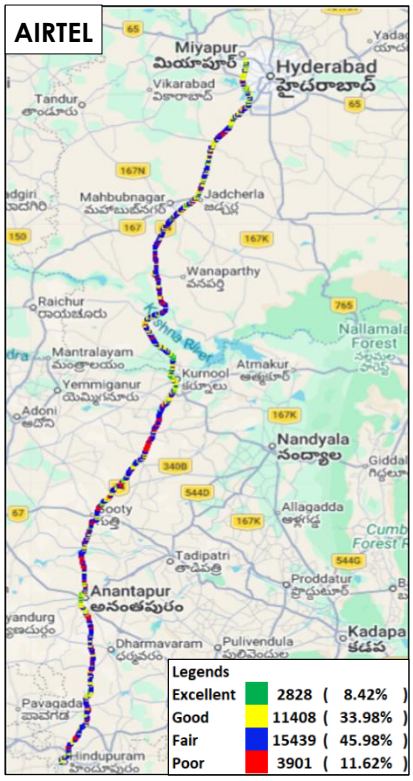


Figure-51: Signal strength auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

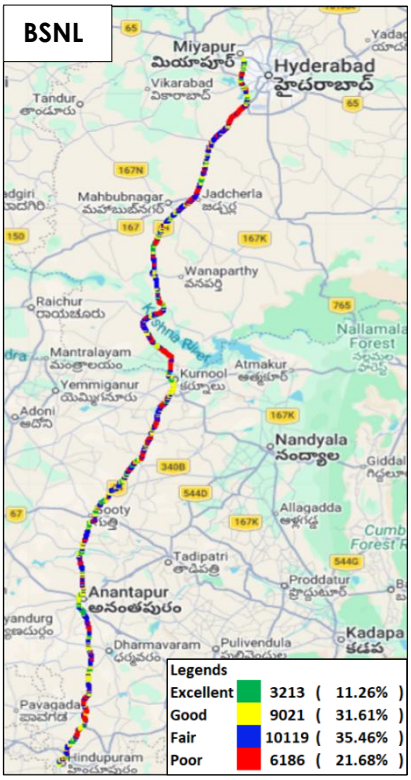


Figure-52: Signal strength auto-selection mode (5G/4G/3G/2G) data - BSNL.

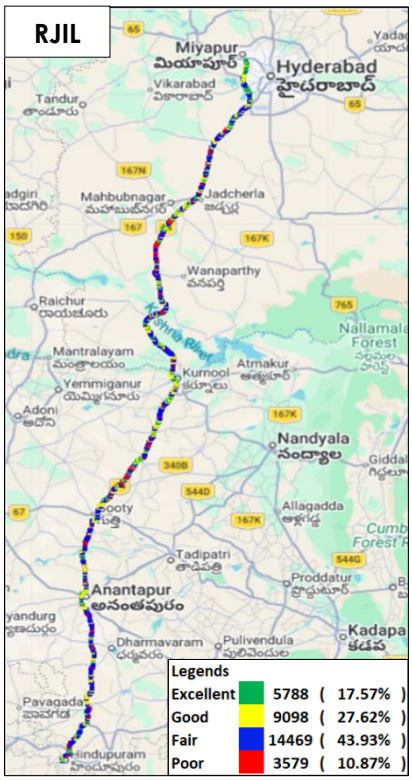


Figure-53: Signal strength auto-selection mode (5G/4G/3G/2G) data - RJIL.

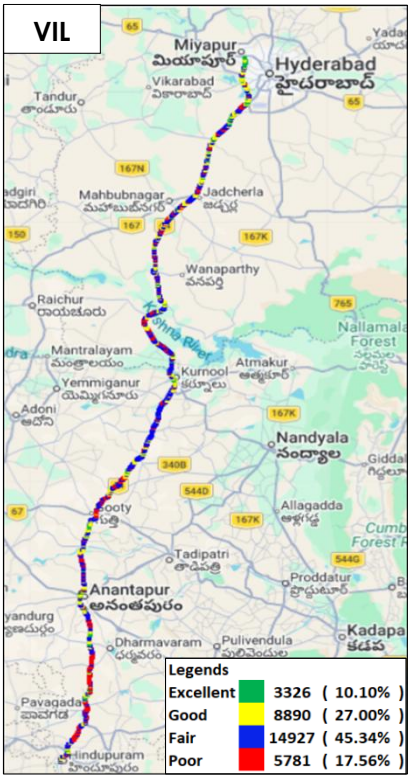


Figure-54: Signal strength auto-selection mode (5G/4G/3G/2G) data - VIL.

6.1.2 Railway

i) Hyderabad to Hindupur

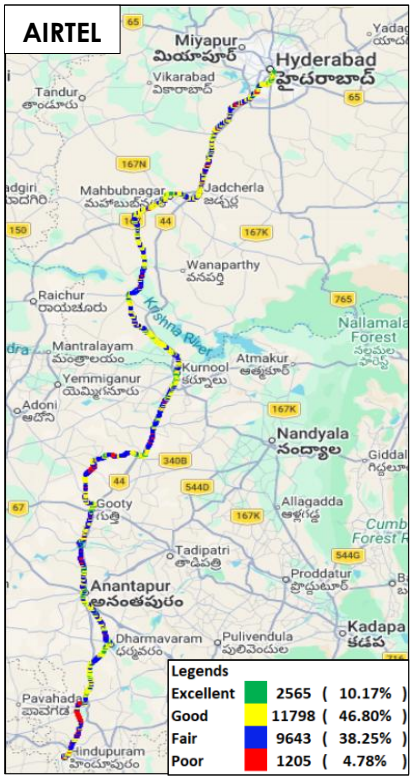


Figure-55: Signal strength auto-selection mode (5G/4G/3G/2G) voice - AIRTEL.

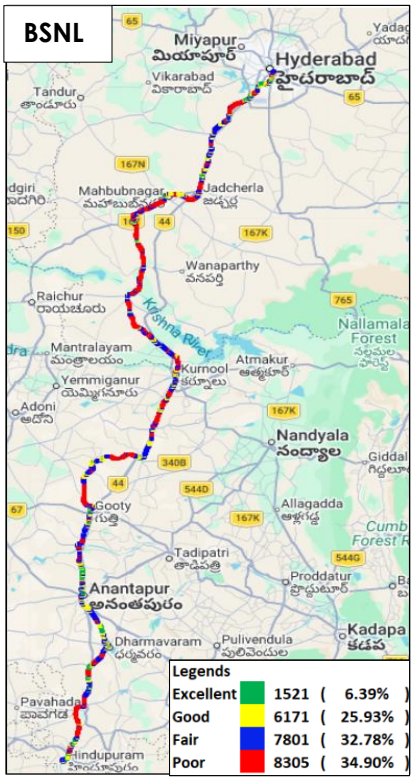


Figure-56: Signal strength auto-selection mode (5G/4G/3G/2G) voice - BSNL.

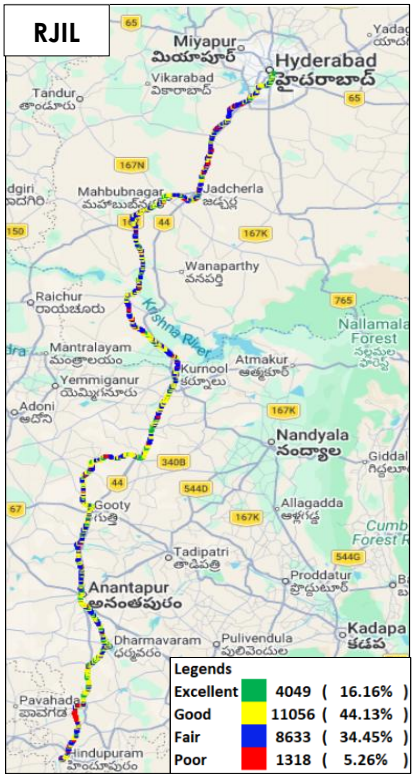


Figure-57: Signal strength auto-selection mode (5G/4G/3G/2G) voice - RJIL.

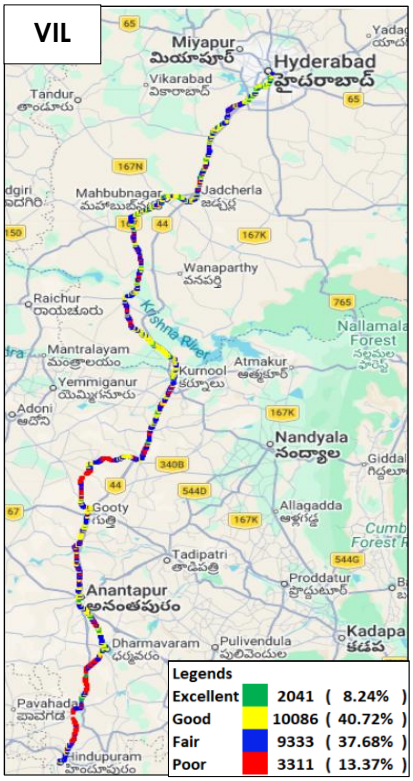


Figure-58: Signal strength auto-selection mode (5G/4G/3G/2G) voice - VIL.

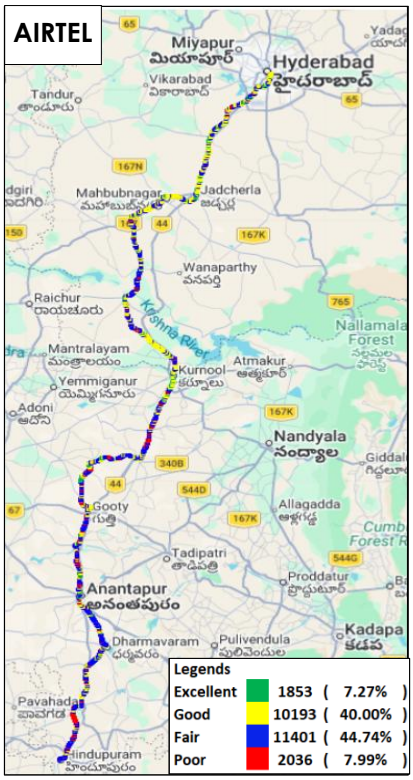


Figure-59: Signal strength auto-selection mode (5G/4G/3G/2G) data - AIRTEL.

Figure-60: Signal strength auto-selection mode (5G/4G/3G/2G) data - BSNL.

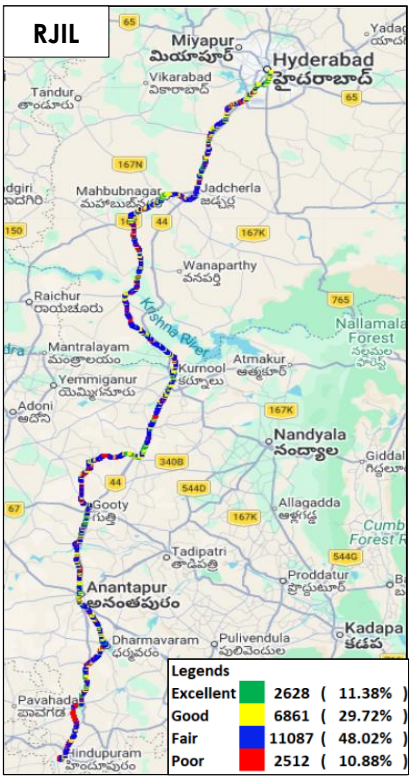


Figure-61: Signal strength auto-selection mode (5G/4G/3G/2G) data - RJIL.

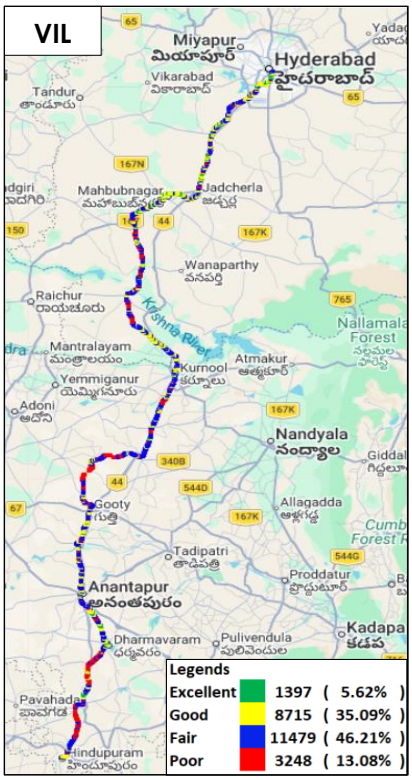


Figure-62: Signal strength auto-selection mode (5G/4G/3G/2G) data - VIL.

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		180 Sec
Wait/ Guard Time		15 Sec

Table-23: 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**
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, 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-24: 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.

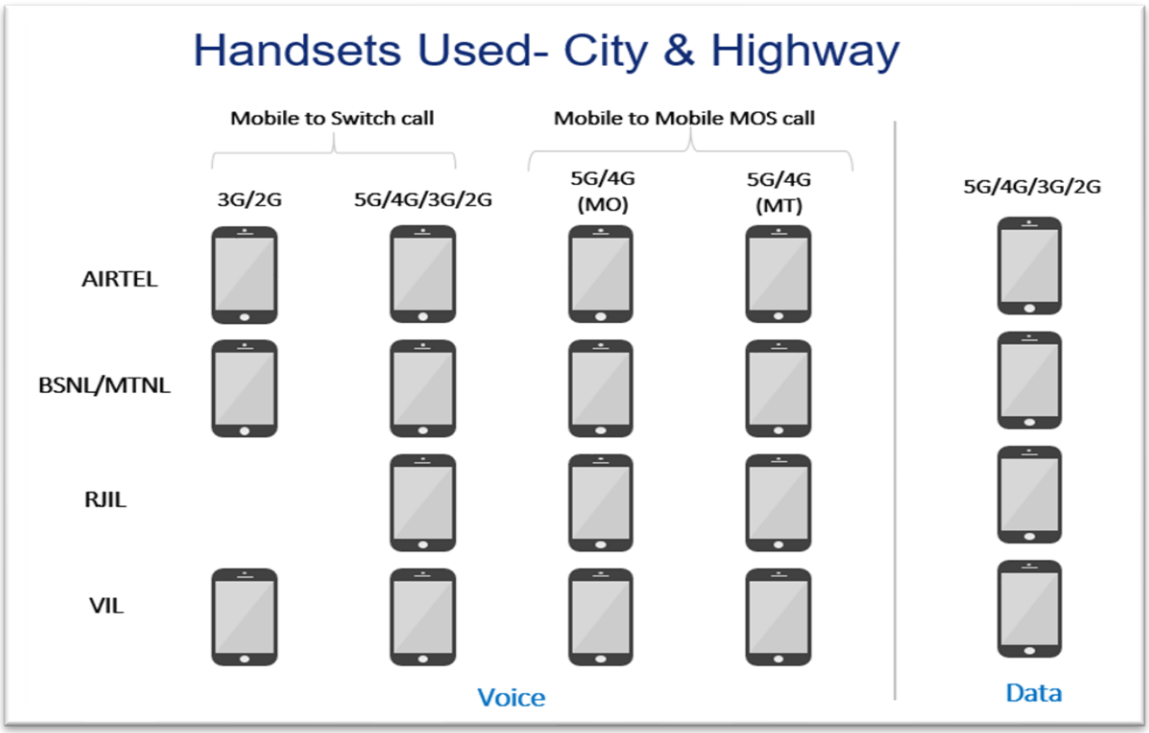


Figure-63: Number of handsets used in city & highway drive

MO: Mobile originating

MT: Mobile terminating

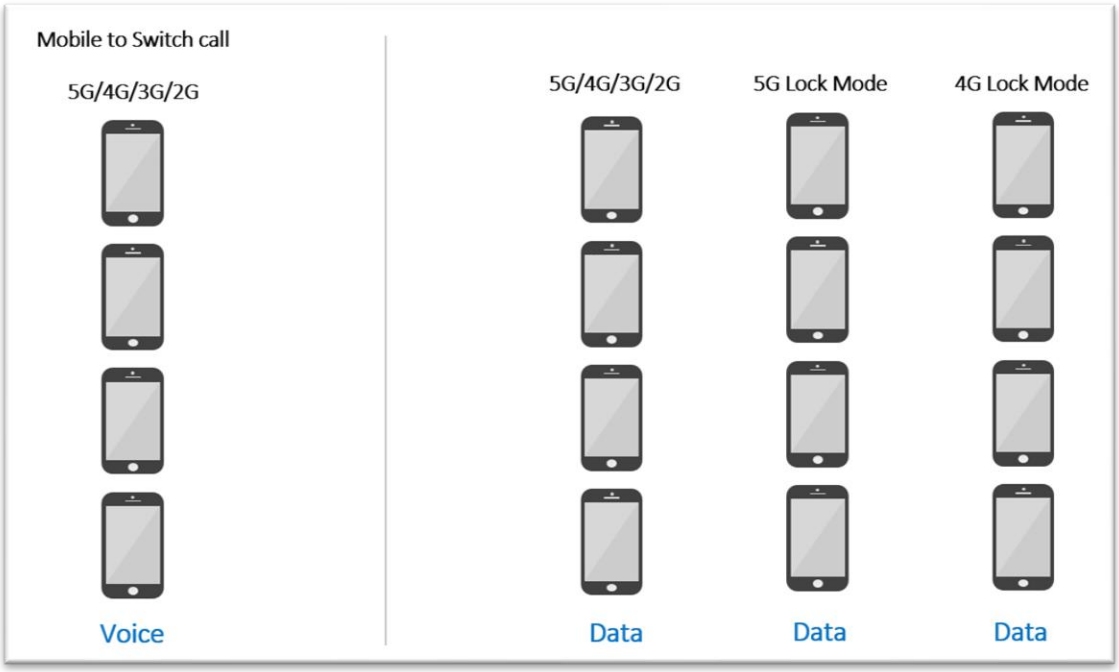


Figure-64: Number of handsets used in railway/metro/walktest/hotspot/ coastal area

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)

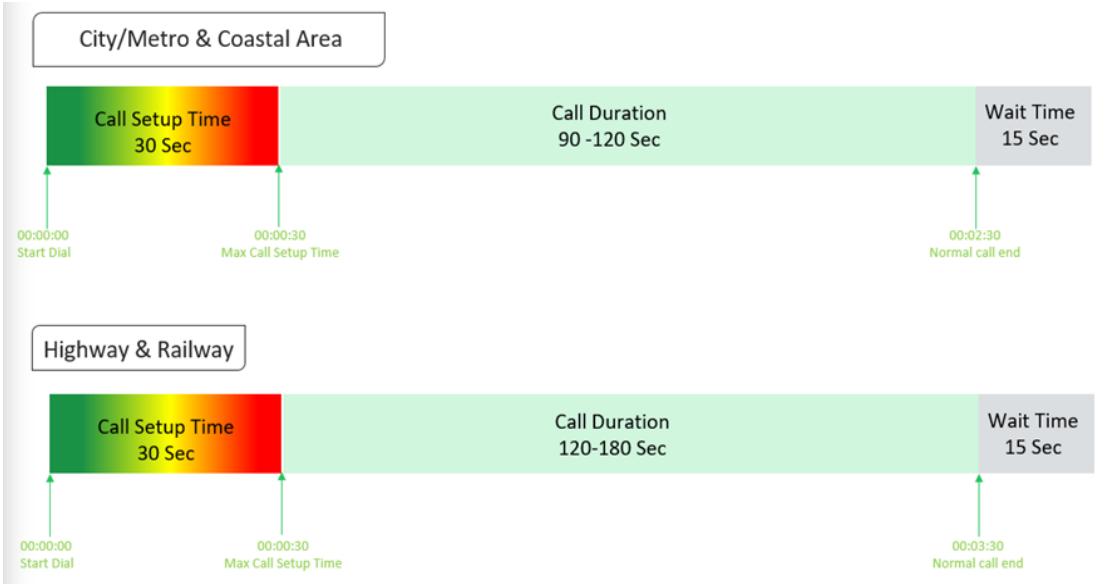


Figure-65: Voice test script for city/railway/metro/highway & coastal area

- 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-66: 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

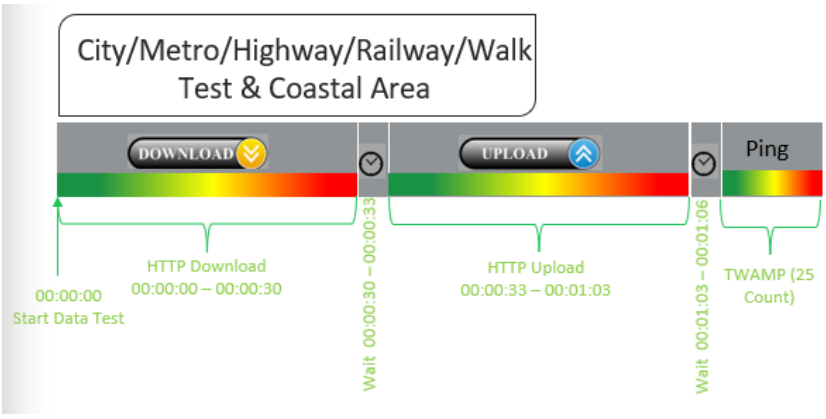


Figure-67: Data test script used in city/metro/railway/highway/walk test & coastal area

(d) Static Data(internet) testing

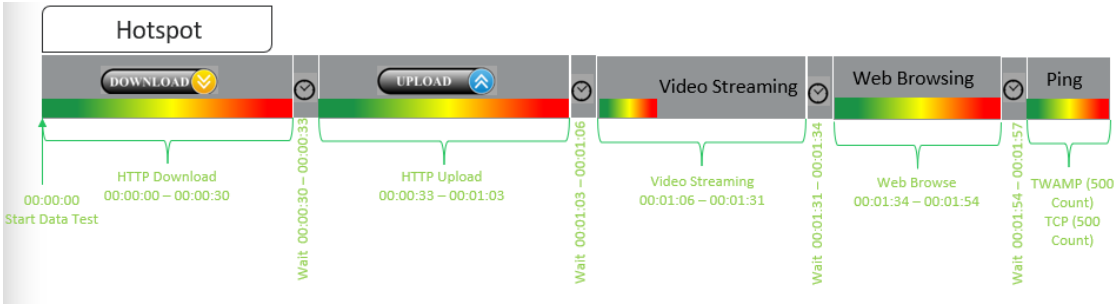


Figure-68: Data test script used at hotspot

- 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 $\geq$ 4 and < 5 Good : MOS $\geq$ 3 and < 4 Fair : MOS $\geq$ 2 and < 3 Poor : MOS $\geq$ 1 and < 2
Handover Success Rate	Handover Success Rate = Count of successful handovers (All Technology Handover combined) / Total count of Handover Attempt (All Technology Handover combined) *100 Handover type which are considered- 2G Inter & Intra cell, 3G Soft & IRAT, 4G Inter & Intra frequency & SRVCC, 5G Inter & Intra frequency & 5G to 4G handovers.
Silence Call	A call which has ≥ 4 sec continuous RTP gap is considered as a Silence Call. Silence call rate = (count of silence call / Total calls established) *100 If a call observes multiple silence count >=4 sec in a particular established call it has been taken as one silent event.

<table>
<tr><td>Jitter</td><td>The inter arrival jitter is the difference in the relative transit time for two packets. The relative transit time is the difference between a packet's Real-time Transport Protocol (RTP) timestamp and the receiver's clock at the time of arrival, measured in the same units. If Si is the RTP timestamp from packet i, and Ri is the time of arrival in RTP timestamps units for packet i, then for two packets i and j the inter-arrival jitter D can be expressed as:
D(i,j) = (Rj - Ri) - (Sj - Si)

The interarrival jitter is calculated continuously as each data packet i is received from source SSRC_n, using this difference D for that packet and the previous packet i-1 in order of arrival (not necessarily in sequence), according to the formula
J(i) = J(i-1) + (|D(i-1,i)| - J(i-1))/16 or 8</td></tr>
<tr><td>Downlink Packet Drop Rate</td><td>Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call originating handset.
This KPI is calculated from MOS call for packet call only (VoNR/VoLTE)</td></tr>
<tr><td>Uplink Packet Drop Rate</td><td>Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call terminating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE).</td></tr>
<tr><td>Signal Strength</td><td>Signal strength is the signal power level received by the wireless user.

<table>
<tr><td rowspan="2">Parameter Name</td><td rowspan="2">Technology</td><td colspan="4">Signal Strength (dBm)</td></tr>
<tr><td>Excellent</td><td>Good</td><td>Fair</td><td>Poor</td></tr>
<tr><td>Rx Level</td><td>GSM</td><td>0 to ≥ -65</td><td><-65 to ≥ -75</td><td><-75 to ≥-85</td><td><-85 to min</td></tr>
<tr><td>RSCP</td><td>WCDMA</td><td>0 to ≥ -70</td><td><-70 to ≥ -80</td><td><-80 to ≥ -90</td><td><-90 to min</td></tr>
<tr><td>RSRP</td><td>LTE</td><td>0 to ≥ -80</td><td><-80 to ≥ -95</td><td><-95 to ≥-110</td><td><-110 to min</td></tr>
<tr><td>SS_RSRP</td><td>NR</td><td>0 to ≥ -80</td><td><-80 to ≥ -95</td><td><-95 to ≥-110</td><td><-110 to min</td></tr>
</table>
</td></tr>
</table>

Table-25: 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-26: Network performance parameter and definition Data

Disclaimer: The observations presented above and, in the reports, represent the performance of the service providers on the area/route under test on the day/time of conducting the drive test and no inference whatsoever may be drawn regarding the quality of the telecom service by the service providers in the whole city/state/licensed service area.

Hardik Rajeshbhai Patel

Digitally signed by Hardik Rajeshbhai Patel
Date: 2026.05.06 18:44:41 +05'30'