TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Bihar LSA

November 2025

Contents

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 Bihar License Service Area (LSA) during the month of November-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 Hazaribagh District	City	220.9	25-Nov-2025	26-Nov-2025
2	Hazaribagh	Inter Operator Calling	1 Location	28-Nov-2025	28-Nov-2025
3	Cities and adjoining areas of Hazaribagh District and Ranchi to Patna highway (along NH- 20, 19 and 22)	Hotspot	18 Locations	22-Nov-2025	28-Nov-2025
4	Hazaribagh	Walk Test	2.1	26-Nov-2025	27-Nov-2025
5	Ranchi to Patna (along NH- 20, 19 and 22)	Highway	327.5	21-Nov-2025	22-Nov-2025
6	Patna to Ranchi	Railway	376.9	20-Nov-2025	20-Nov-2025

Table-1: Drive test summary

2.2 Drive test routes

The map provides overview of drive test routes indicating city drive, inter-operator call test, hotspots, walk tests, highway and railway as per the legends shown on the map.
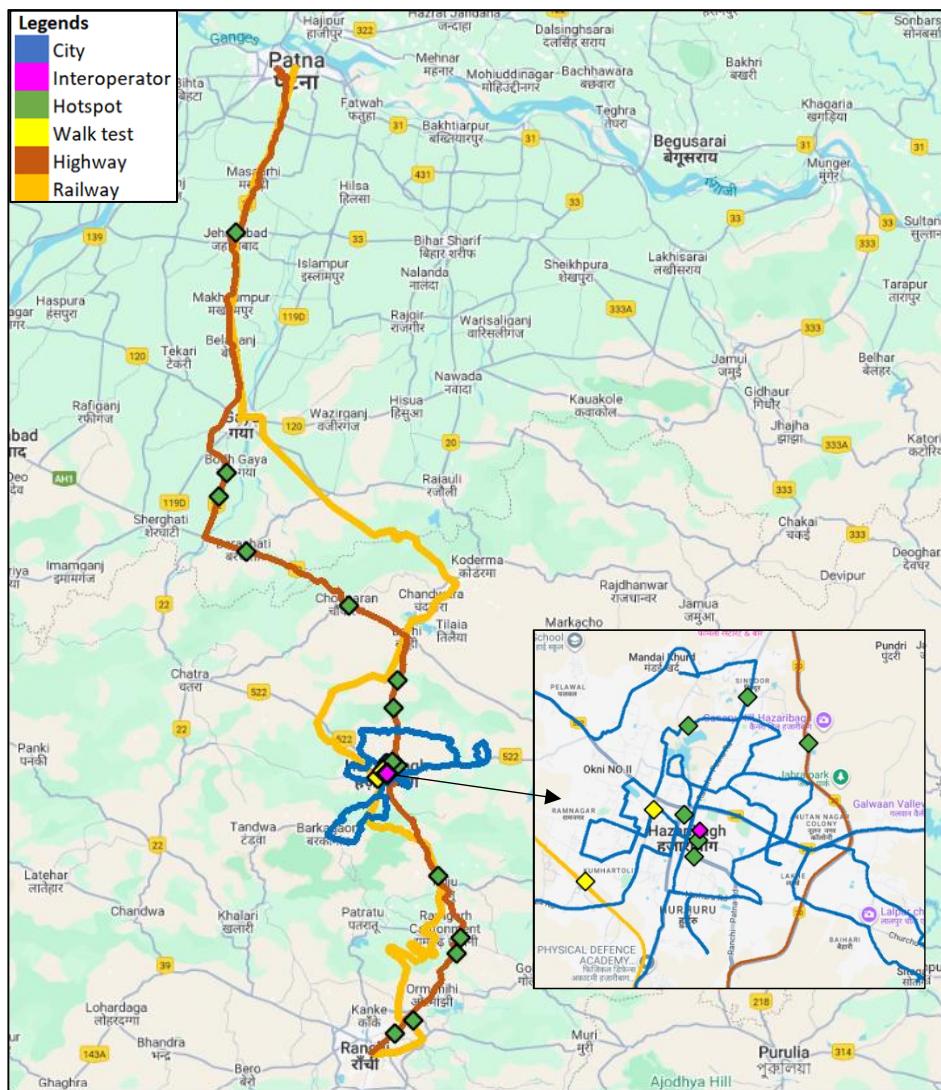
Figure-1: Drive test routes.

2.3 Summary of areas covered

a) **City**- Hadri, Kariyatpur, Harli Peto, Daru, Amnari, Kesura, Sita Garha, Hurhuru, Nawada, Hupad, Haram, Harli, Barkagaon, Pakri Barwadih, Jamuari, Pundri, Sultana, Gadokhar, Lupung, Dumraun, Mandai Khurd, Nawabganj etc.

b) **Hotspot**
1. Barachatti Post Office, Tetariya Khurd, Bihar
2. Birla Institute of Technology, Mesra, Jharkhand
3. Canary Hill Hazaribagh, Jharkhand
4. Civil Court Hazaribagh, Jharkhand
5. Head Post Office, Hazaribagh, Jharkhand
6. Hazaribagh New Bus Stand, Hazaribagh, Jharkhand

7. Hazaribagh Wildlife Sanctuary, Hazaribagh, Jharkhand
8. Hesagarha Panchayat Bhawan, Kasikhap, Jharkhand
9. Kendua More Chauparan Bus Stand, Chouparan, Jharkhand
10. Maa Vindhyavashini College of Education, Karmatanr, Jharkhand
11. Main Gate IIMBG, Gaya, Bihar
12. New Buliding Sheikh Bhikhari Medical College, Hazaribagh, Jharkhand
13. Powergrid Co. of India Ltd. Gaya, Bhanwarbar, Bihar
14. Radha Govind University, Lalki Ghati, Jharkhand
15. Saheed Nirmal Mahto Chowk, Kothar, Jharkhand
16. Shivaji Chowk, Vijaynagar, Ranchi, Jharkhand
17. S.N Sinha College, Jehanabad, Bihar
18. Vinoba Bhave University, Hazaribagh, Jharkhand

c) Walk Test
1. Hazaribagh Town Railway Station, Jharkhand
2. Sadar Hospital Hazaribagh, Jharkhand

d) Highway

Ranchi to Patna (along NH- 20, 19 and 22)

e) Railway

Patna to Ranchi

## 2.4 Telecom service providers detected frequency bands

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

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

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

2.5 Performance against key QoS parameters

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

Summary-Voice services

Call Setup Success Rate: Airtel, BSNL, RJIL and VIL have call setup success rate of 96.63%, 57.80%, 99.21% and 82.99% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Setup Time: Airtel, BSNL, RJIL and VIL have call setup time of 1.74, 3.29, 0.76 and 1.73 seconds respectively in Auto-selection mode (5G/4G/3G/2G).

Drop Call Rate: Airtel, BSNL, RJIL and VIL have drop call rate of 0.27%, 6.79%, 0.79% and 8.73% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Silence/Mute Rate: Airtel, RJIL and VIL have silence call rate of 1.98%, 1.44% and 7.89% respectively in packet switched network (5G/4G).

Mean Opinion Score (MOS): Airtel, BSNL, RJIL and VIL have Average MOS of 3.99, 2.64, 4.44 and 4.46 respectively.

Summary-Data services

Data Download performance (Overall): Average download speed of Airtel (5G/4G/2G) is 105.58 Mbps, BSNL (4G/3G/2G) is 4.04 Mbps, RJIL (5G/4G) is 199.26 Mbps and VIL (4G/2G) is 32.09 Mbps.

Data Upload performance (Overall): Average upload speed of Airtel (5G/4G/2G) is 24.47 Mbps, BSNL (4G/3G/2G) is 2.93 Mbps, RJIL (5G/4G) is 23.54 Mbps and VIL (4G/2G) is 12.14 Mbps.

Latency (Overall): Airtel, BSNL, RJIL & VIL 50th percentile latency is 55.95 ms, 64.18 ms, 32.92 ms, 59.27 ms respectively.

Data performance - Hotspots (in Mbps):
Airtel- 4G D/L: 37.25   4G U/L: 9.72
        5G D/L: 132.94   5G U/L: 42.18
BSNL- 4G D/L: 4.49   4G U/L: 6.14
RJIL- 4G D/L: 47.20   4G U/L: 11.97
       5G D/L: 237.78   5G U/L: 29.60
VIL- 4G D/L: 31.09   4G U/L: 12.26

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

- Poor signal strength level has been observed on 5.53%, 46.10%, 4.52% & 23.98% of the route covered during the drive test for Airtel, BSNL, RJIL and VIL correspondingly for city drive.
- Poor signal strength level has been observed on 3.62%, 41.15%, 2.25% & 22.36% of the route covered during the drive test for Airtel, BSNL, RJIL and VIL correspondingly for highway drive.
- Poor signal strength level has been observed on 11.23%, 49.42%, 10.67% & 24.24% of the route covered during the drive test for Airtel, BSNL, RJIL and VIL correspondingly for railway drive.

QoS Performance Analysis-Bihar 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 November 2025 covering city drive, hotspots, walk tests, highway and railway. (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	412	507	640
Call Setup Success Rate %	99.51	74.56	92.66
Drop Call Rate %	0.00	7.14	41.48
Call Setup Time-Average (Second)	5.79	3.02	3.36
Handover Success Rate %	99.52	92.79	97.58

Table-3: Summary of voice call performance in 3G/2G network mode only.
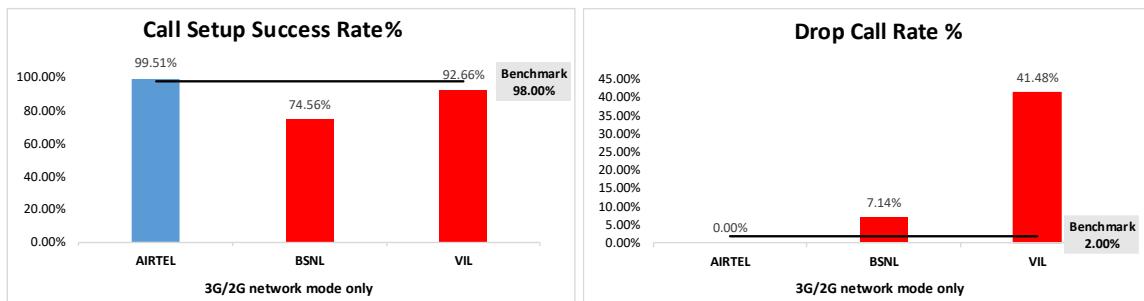
Figure-2: Call setup success rate and drop call rate performance.

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	93	NA
2G	625	235	379

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	771	1071	764	870
Call Setup Success Rate %	96.63	57.80	99.21	82.99
Drop Call Rate %	0.27	6.79	0.79	8.73
Call Setup Time-Average (Second)	1.74	3.29	0.76	1.73
Handover Success Rate %	99.96	85.24	99.87	99.76

Table-5: Summary of voice call performance in network auto-selection mode.
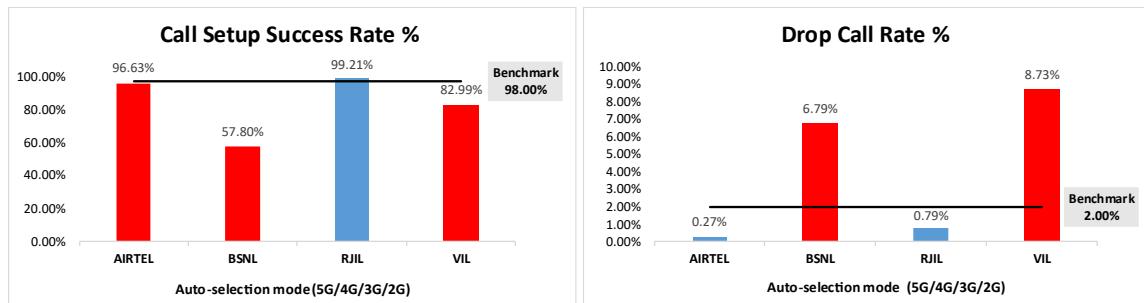
Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	405	366	417	380
Number of silence call for >4 Sec	8	NA	6	30
Silence Call Rate %	1.98	NA	1.44	7.89
Number of silence instances for >4 Sec	8	NA	8	44
Number of silence instances for >3 Sec	17	NA	13	87
Number of silence instances for >2 sec	42	NA	25	217
RTP Jitter (4G & 5G) in ms	5.02	NA	16.24	13.08
Packet loss Rate Downlink %	0.69	NA	1.24	2.86
Packet loss Rate Uplink %	0.66	NA	1.13	3.23

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

Note-
- NA- Due to unavailability of packet switched (VoLTE & VoNR) network in BSNL silence instances are not captured.

Number of unique cell Id's covered in Voice test- Technology wise				
Technology	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
5G	0	NA	730	NA
4G	1966	410	1904	672
3G	NA	109	NA	NA
2G	5	378	NA	192

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	4011	2974	4007	3517
Speech Quality (Average MOS)	3.99	2.64	4.44	4.46
Number of samples with MOS >=4 to <5 (Excellent)	3318	0	3487	3107
Number of samples with MOS >=3 to <4 (Good)	558	1209	293	221
Number of samples with MOS >=2 to <3 (Fair)	67	1155	96	63
Number of samples with MOS >=1 to <2 (Poor)	68	610	131	126
%age of samples with MOS >=4 to <5 (Excellent)	82.72%	0.00%	87.02%	88.34%
%age of samples with MOS >=3 to <4 (Good)	13.91%	40.65%	7.31%	6.28%
%age of samples with MOS >=2 to <3 (Fair)	1.67%	38.84%	2.40%	1.79%
%age of samples with MOS >=1 to <2 (Poor)	1.70%	20.51%	3.27%	3.58%

Table-8: Summary of speech quality (MOS) samples.
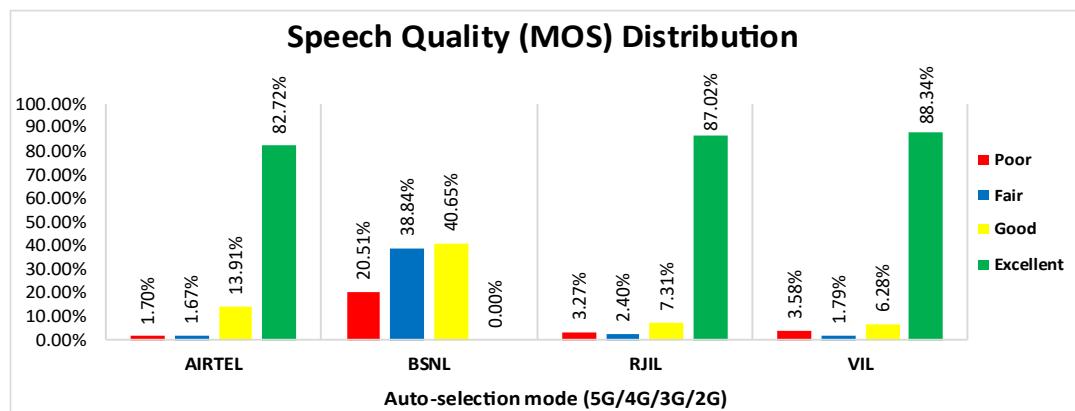
Figure- 4: Distribution of samples in MOS range.

(d) Inter-service provider voice call performance:
To check the performance of inter-service provider call setup success rate, total 32 to 39 inter operator calls were attempted at one location which is Head Post Office, Hazaribagh, Jharkhand. The Call setup success rate and call setup time observations are as below.

Call Setup Success Rate %				
From Service Provider	**To Service Provider**			
	AIRTEL	BSNL	RJIL	VIL
AIRTEL	NA	100.00	100.00	100.00
BSNL	100.00	NA	100.00	100.00
RJIL	100.00	100.00	NA	100.00
VIL	100.00	100.00	97.44	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	7.54	0.99	1.62
BSNL	4.64	NA	4.79	4.11
RJIL	1.92	6.84	NA	1.95
VIL	1.46	6.91	1.65	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**	105.58	4.04	199.26	32.09
	80th Percentile	186.21	5.83	363.63	51.50
	20th Percentile	23.52	0.48	25.74	11.35
Upload Throughput (Mbits/s)	**Average**	24.47	2.93	23.54	12.14
	80th Percentile	42.10	3.95	41.57	21.51
	20th Percentile	4.86	1.22	2.60	2.80
Latency (ms)	**50th Percentile**	55.95	64.18	32.92	59.27

Table-11: Summary of data performance in network auto-selection mode.
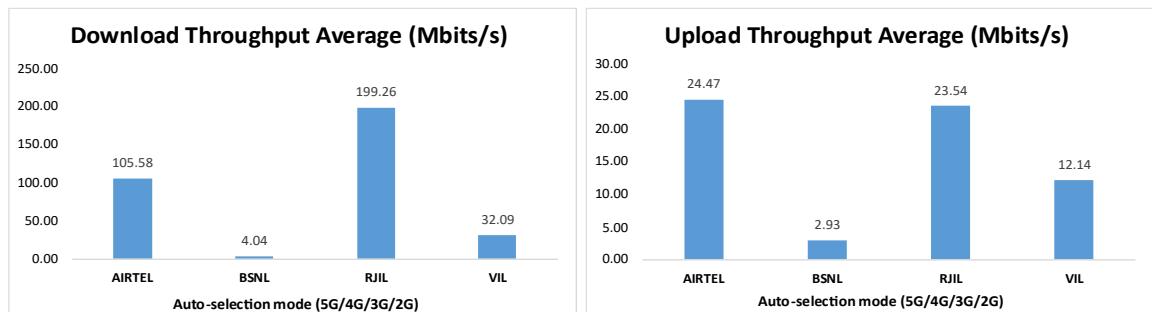
Figure- 5: Download and Upload throughput.

Number of unique cell Id's covered in Data test- Technology wise				
Technology	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	0	NA	1165	NA
4G	2071	598	961	719
3G	NA	88	NA	NA
2G	23	122	NA	203

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, walk tests, highway and railway 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 on 25th November 2025 and 26th November 2025 in Cities and adjoining areas of Hazaribagh District. (Refer Table-1)

4.2.1 Drive test route
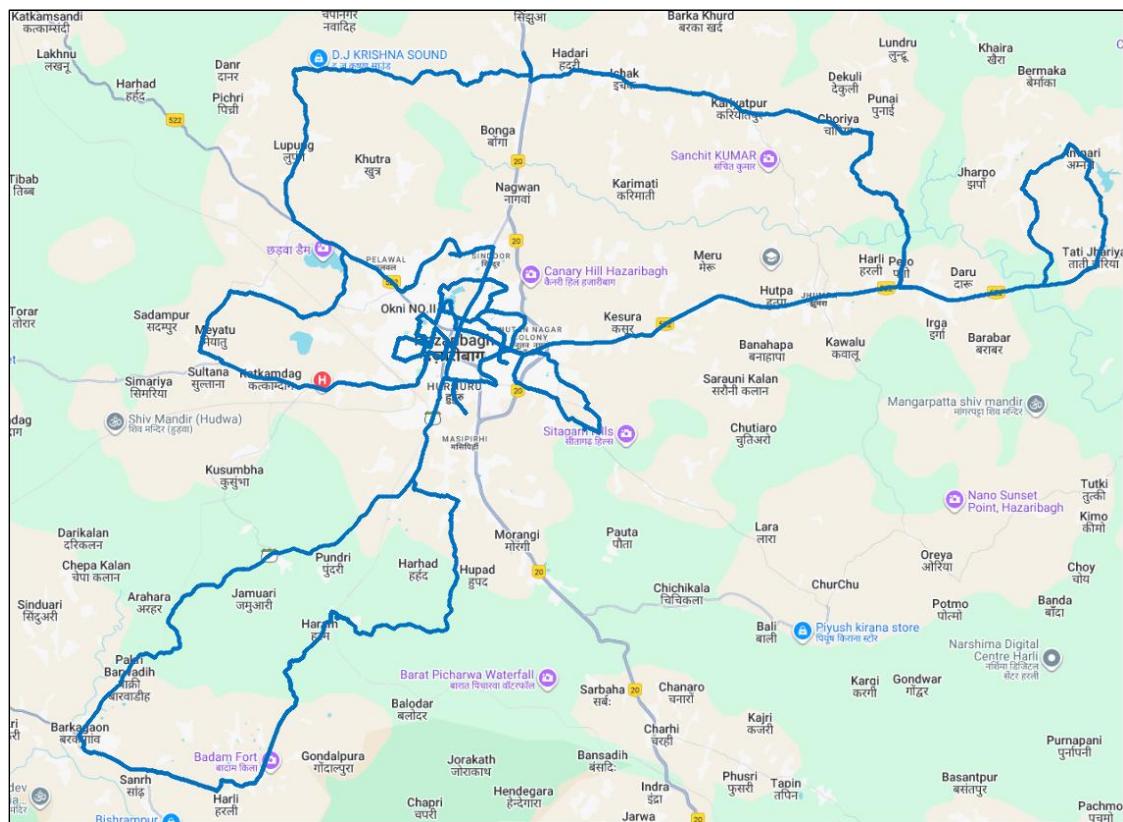
Figure- 6: Drive test routes.

4.2.2 Area Covered

Hadri, Kariyatpur, Harli Peto, Daru, Amnari, Kesura, Sita Garha, Hurhuru, Nawada, Hupad, Haram, Harli, Barkagaon, Pakri Barwadih, Jamuari, Pundri, Sultana, Gadokhar, Lupung, Dumraun, Mandai Khurd, Nawabganj 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	275	328	446
Call Setup Success Rate %	99.64	76.22	92.60
Drop Call Rate %	0.00	5.60	45.52
Call Setup Time-Average (Second)	5.78	3.09	3.29
Handover Success Rate %	99.32	95.15	98.65

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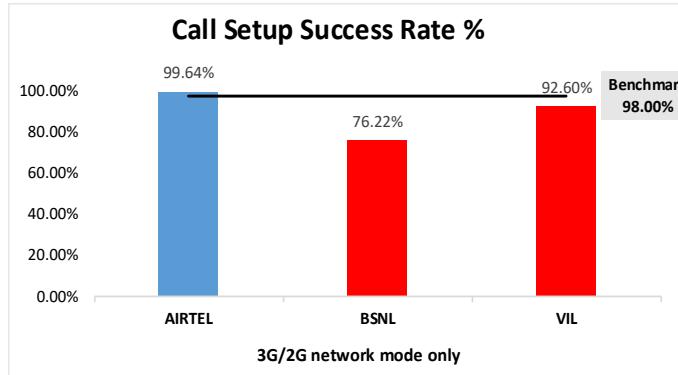

**Figure-7:** Performance for call setup success rate.
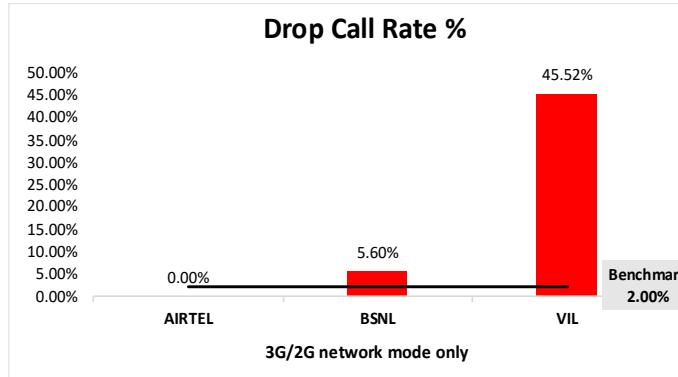
Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	BSNL	VIL
3G	NA	12.88%	NA
2G	99.96%	80.82%	97.36%
Limited Service	0.04%	6.31%	2.64%

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

Note-
- NA- Service provider doesn't provide services in respective technology.
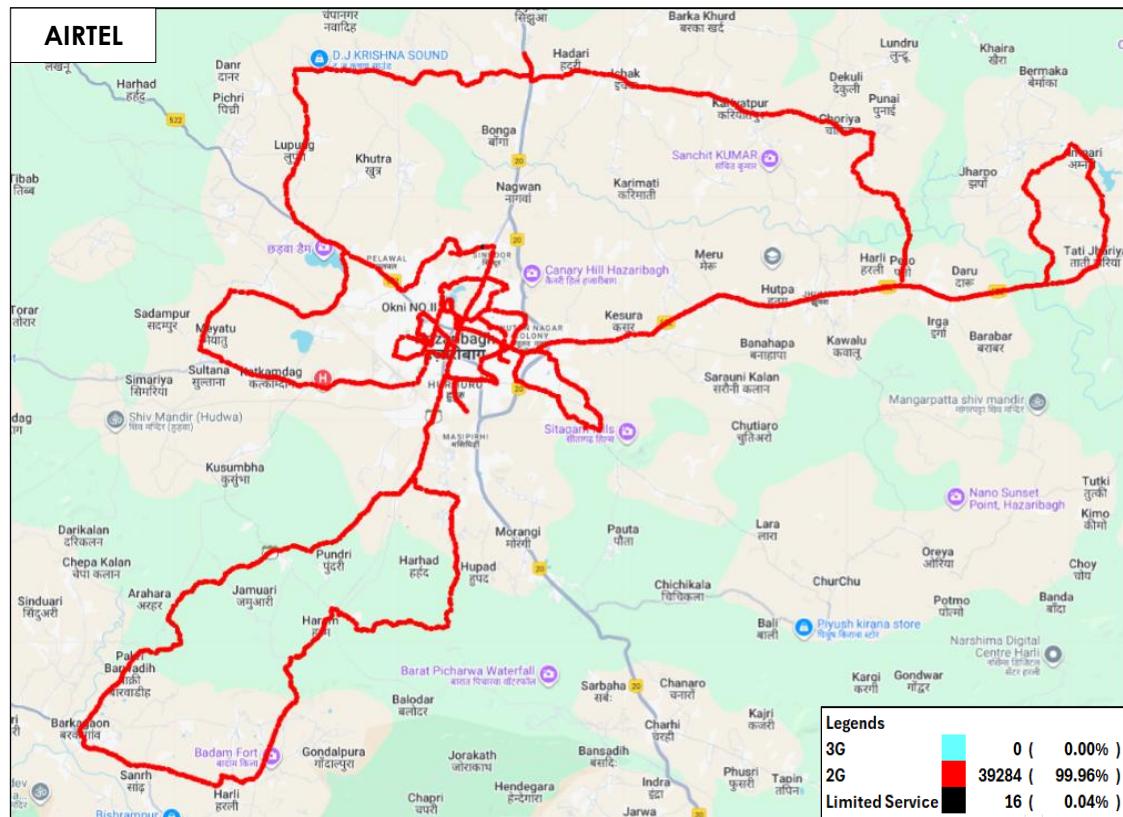
**Figure-9:** Serving technology plots 3G/2G network mode – AIRTEL
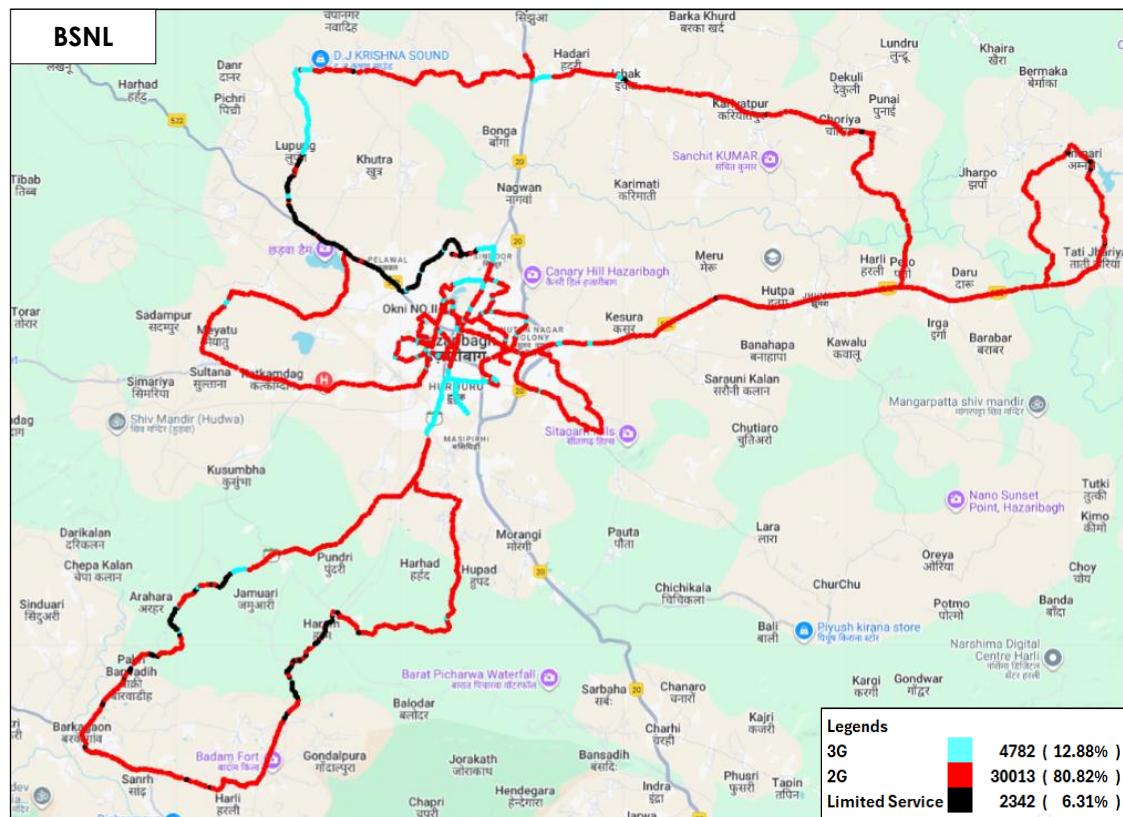
**Figure-10:** Serving technology plots 3G/2G network mode –BSNL

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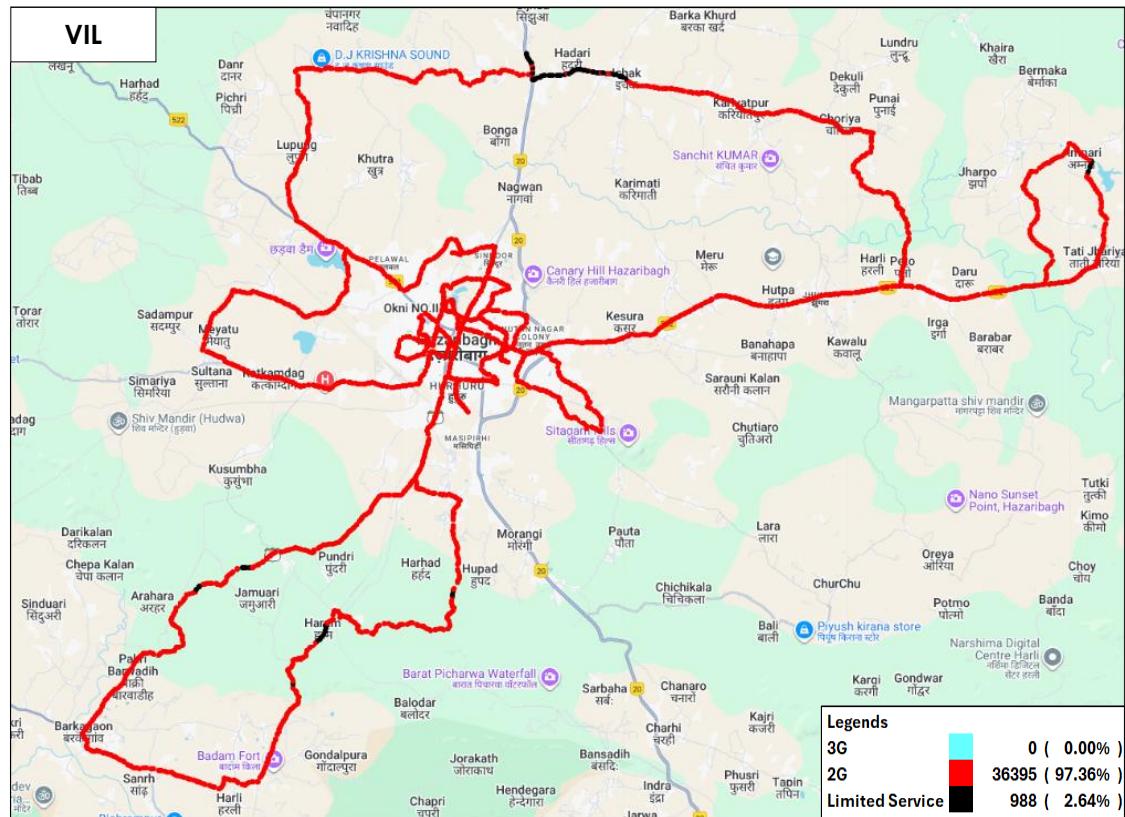
Figure-11: Serving technology plots 3G/2G network mode –VIL

(c) Network Signal Strength Distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (Refer figure- 58, 59 & 60 for map view)
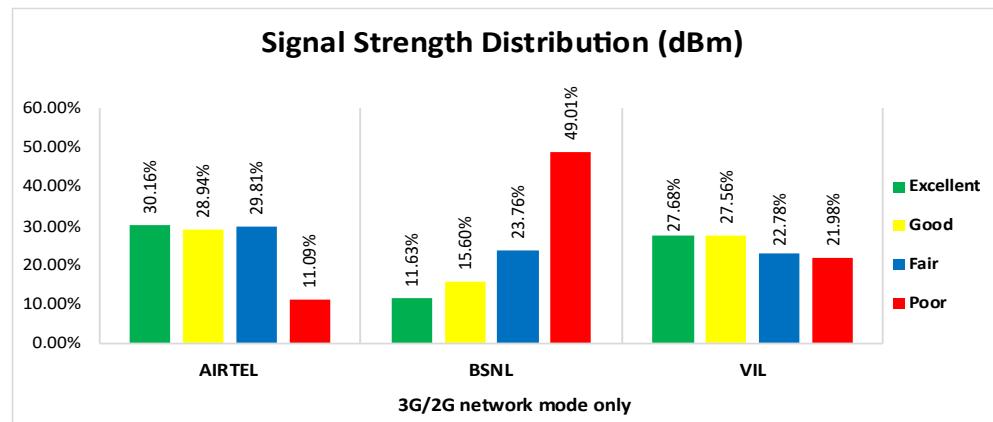

Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 30% of samples falling in the excellent signal strength category.
- BSNL has 12% of samples falling in the excellent signal strength category.
- VIL has 28% of samples falling in the excellent signal strength category.

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(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	289	341	294	318
Call Setup Success Rate %	99.65	72.14	99.66	89.31
Drop Call Rate %	0.00	8.54	0.34	7.75
Call Setup Time Average (Second)	1.70	3.31	0.79	1.96
Handover Success Rate %	100.00	96.03	99.88	99.71

**Table-15:** Summary of voice call performance in network auto-selection mode.
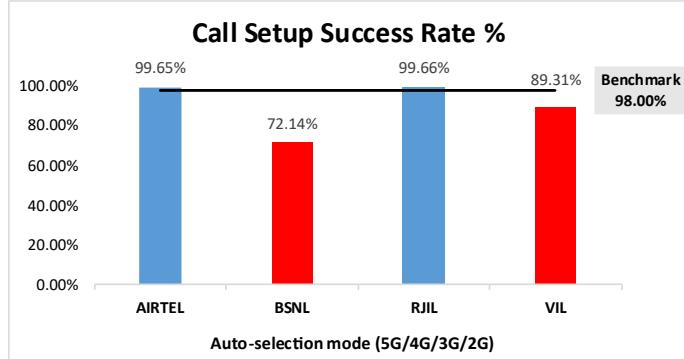
**Figure-13:** Performance for call setup success rate.
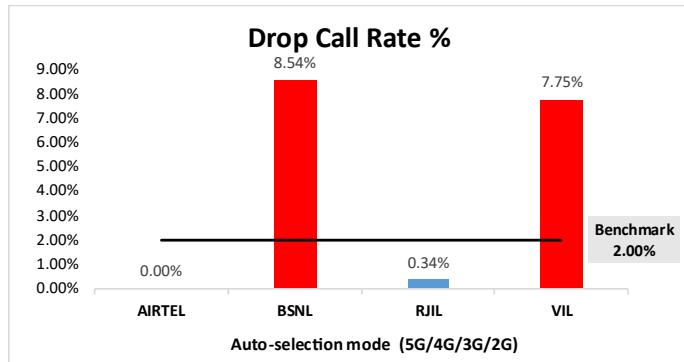
Figure-14: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	280	220	287	262
Number of silence call for >4 Sec	4	NA	4	22
Silence Call Rate %	1.43	NA	1.39	8.40
Number of silence instances for >4 Sec	4	NA	5	34
Number of silence instances for >3 Sec	7	NA	6	55
Number of silence instances for >2 sec	21	NA	11	131
RTP Jitter (4G & 5G) in ms	4.36	NA	16.18	12.84
Packet loss Rate Downlink %	0.54	NA	0.88	3.14
Packet loss Rate Uplink %	0.48	NA	0.77	3.68

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

Note-
- NA- Due to unavailability of packet switched (VoLTE & VoNR) network in BSNL silence instances are not captured.

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

Mean opinion score indicate quality of speech observed during the drive test across different technologies. This parameter has been calculated for mobile to mobile calls made within same operator network in auto mode (5G/4G/3G/2G). As per ITU-T Recommendation P.863.1, MOS 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	2458	1500	2492	2150
Speech Quality (Average MOS)	4.00	2.52	4.47	4.47
Number of samples with MOS >=4 to <5 (Excellent)	2071	0	2182	1908
Number of samples with MOS >=3 to <4 (Good)	320	471	187	140
Number of samples with MOS >=2 to <3 (Fair)	35	702	64	33
Number of samples with MOS >=1 to <2 (Poor)	32	327	59	69
%age of samples with MOS >=4 to <5 (Excellent)	84.26%	0.00%	87.56%	88.74%
%age of samples with MOS >=3 to <4 (Good)	13.02%	31.40%	7.50%	6.51%
%age of samples with MOS >=2 to <3 (Fair)	1.42%	46.80%	2.57%	1.53%
%age of samples with MOS >=1 to <2 (Poor)	1.30%	21.80%	2.37%	3.21%

Table-17: Summary of speech quality (MOS) samples.
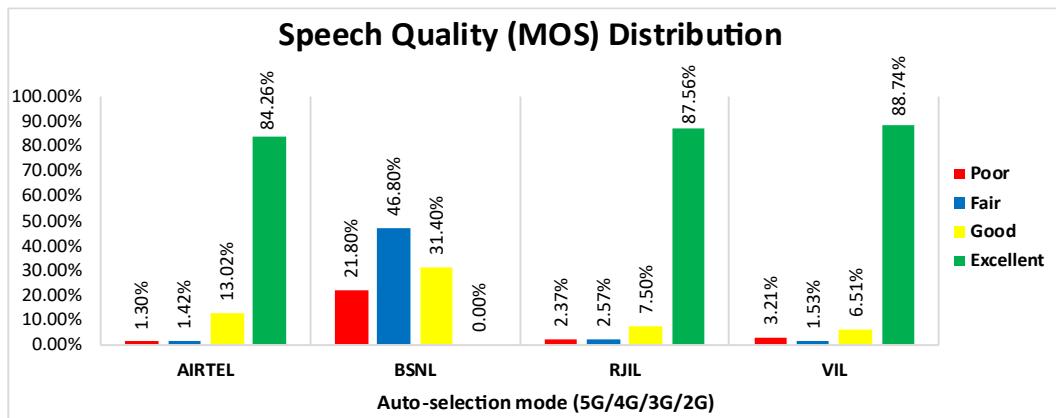
Figure-15: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	5.32%	NA	57.50%	NA
4G	94.49%	7.64%	42.48%	80.05%
3G	NA	7.91%	NA	NA
2G	0.01%	78.21%	NA	18.28%
Limited Service	0.18%	6.24%	0.01%	1.67%

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

Note-
- NA- Service provider doesn't provide services in respective technology.
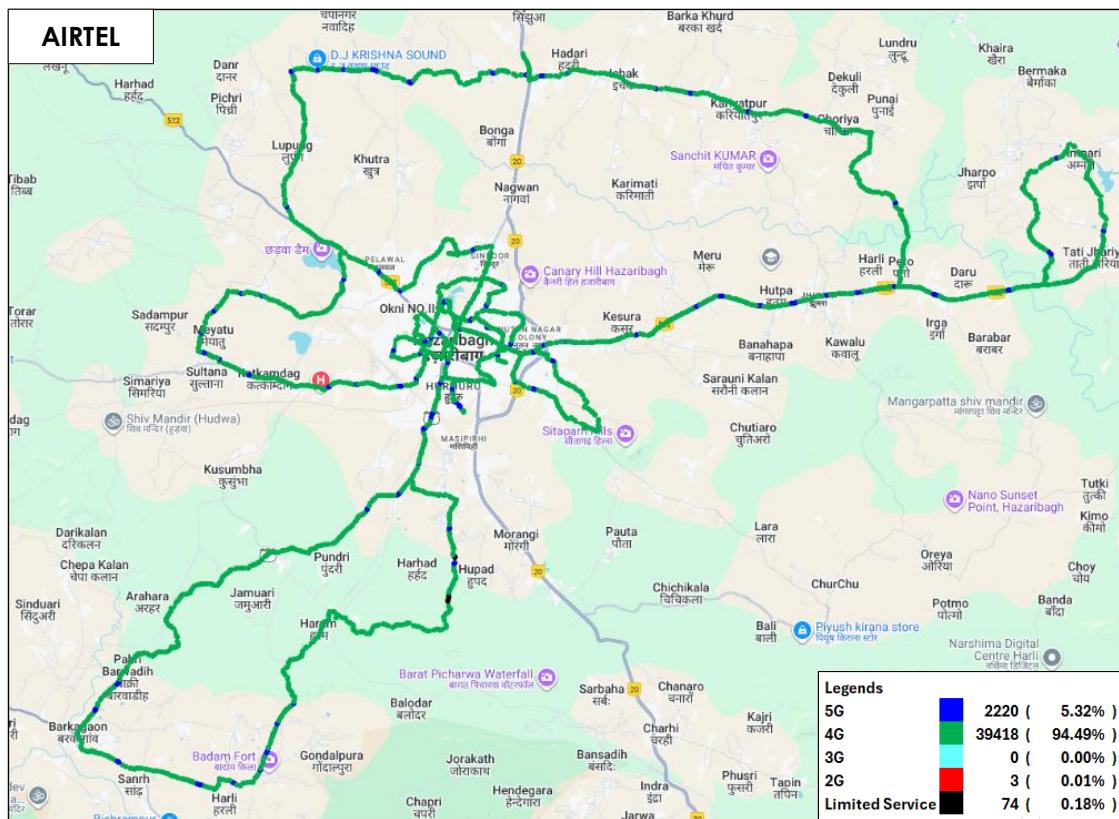
Figure-16: Serving technology plots in auto-selection mode (5G/4G/3G/2G) -AIRTEL
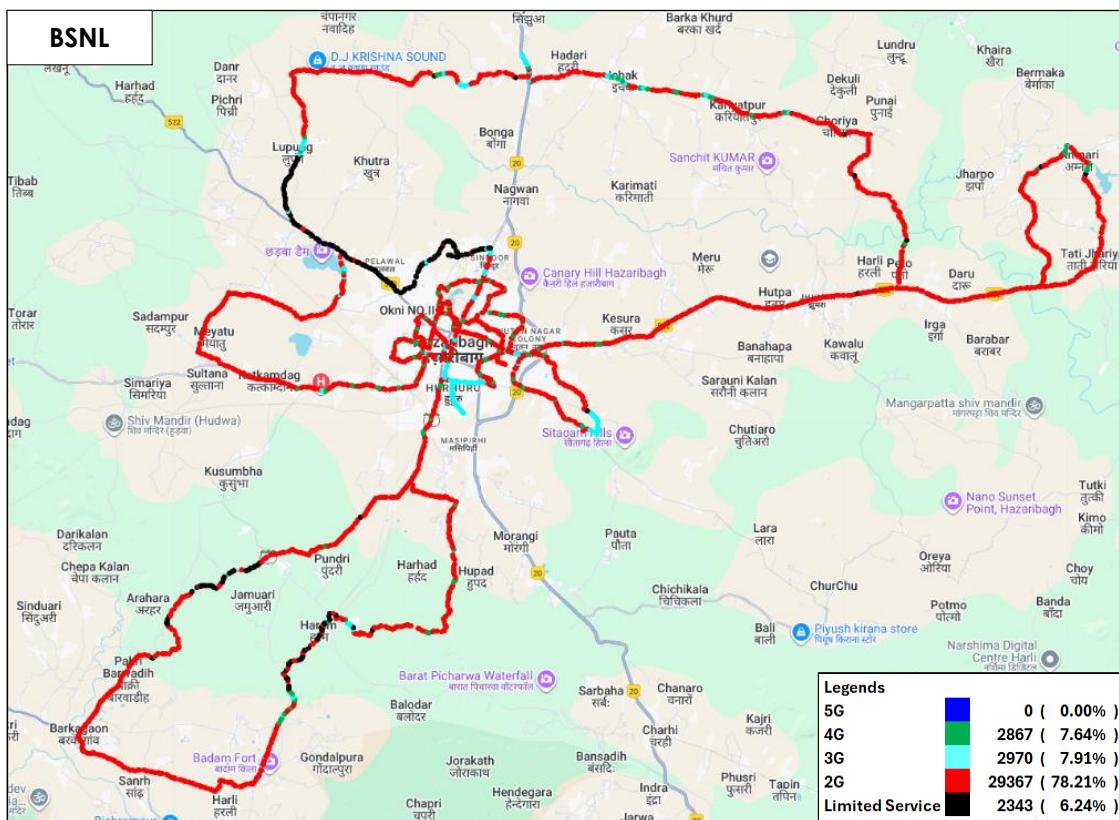
Figure-17: Serving technology plots in auto-selection mode (5G/4G/3G/2G) - BSNL (4G being rolled out)
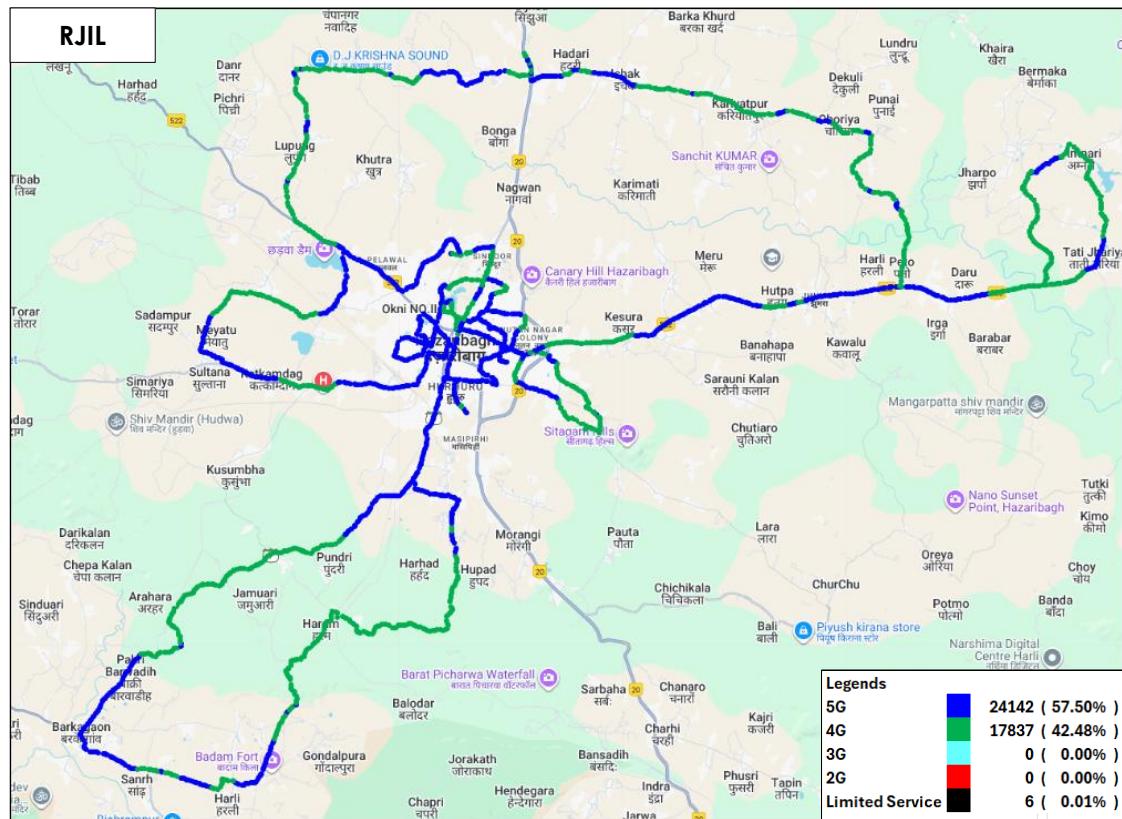
**Figure-18:** Serving technology plots in auto-selection mode (5G/4G/3G/2G)- RJIL
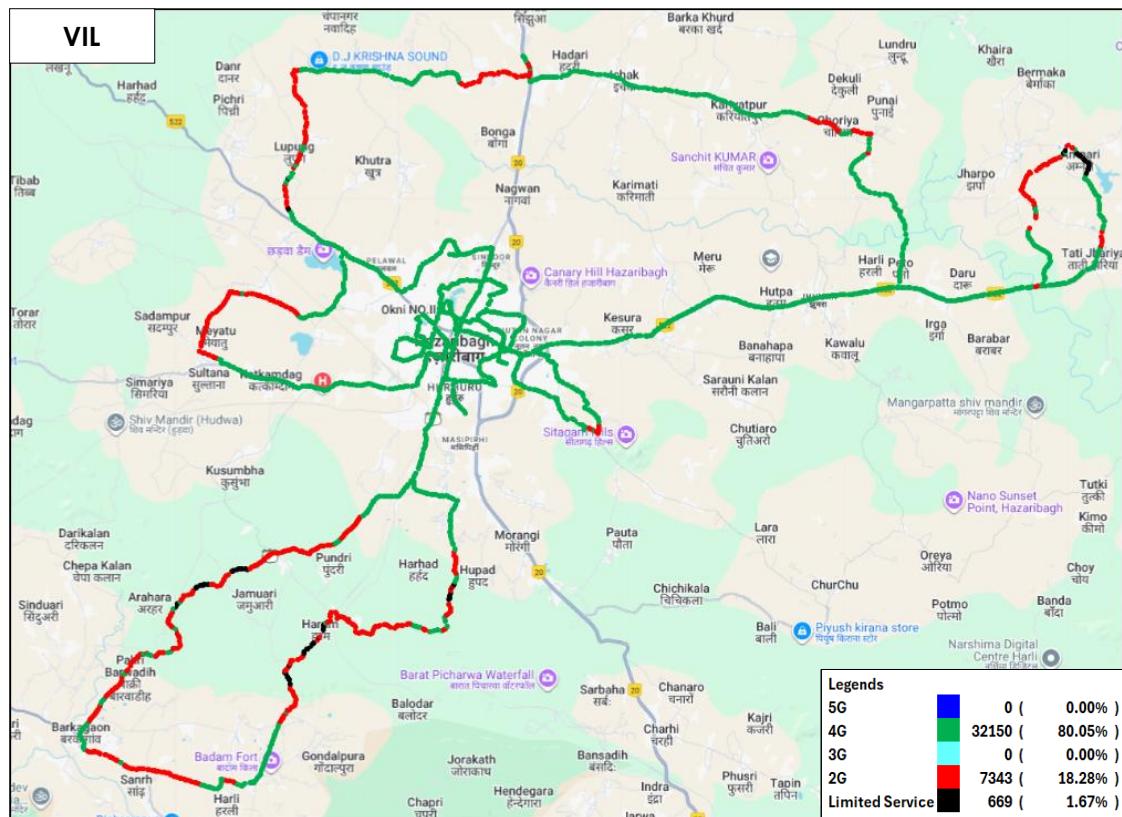
Figure-19: Serving technology plots in auto-selection mode (5G/4G/3G/2G) – VIL

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G). (Refer figure-61, 62, 63 & 64 for map view)

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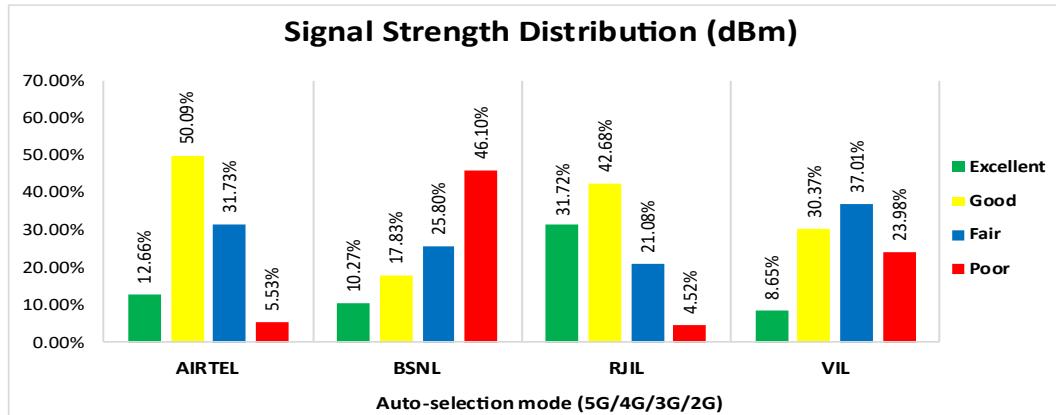
Figure-20: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:

- Airtel has 13% of samples falling in the excellent signal strength category.
- BSNL has 10% of samples falling in the excellent signal strength category.
- RJIL has 32% of samples falling in the excellent signal strength category.
- VIL has 9% 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	123.84	4.57	219.79	34.95
	80th Percentile	210.44	6.44	376.65	60.22
	20th Percentile	34.91	0.33	48.44	10.70
Upload Throughput (Mbits/s)	Average	23.16	2.25	25.45	10.94
	80th Percentile	39.29	2.88	48.17	19.74
	20th Percentile	4.73	1.22	2.91	2.28
Latency (ms)	50th Percentile	56.82	71.23	31.84	58.58

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

Download Throughput Average (Mbits/s)
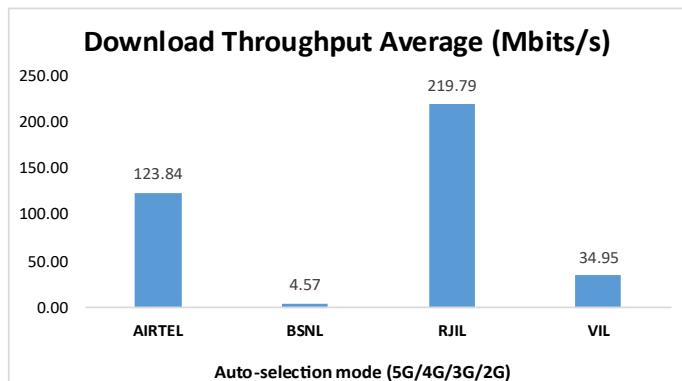
Figure- 21: Download throughput.

21

Upload Throughput Average (Mbits/s)
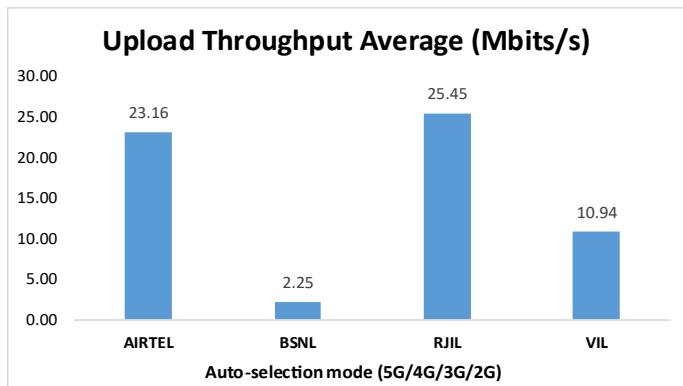
Figure- 22: Upload throughput.

4.3 Hotspots

Hotspot testing has been done on 22nd, 24th, 27th & 28th November 2025. Eighteen locations have been tested in Cities and adjoining areas of Hazaribagh District and Ranchi to Patna Highway (along NH-20, 19 and 22). (Refer Table-1)

4.3.1 Locations
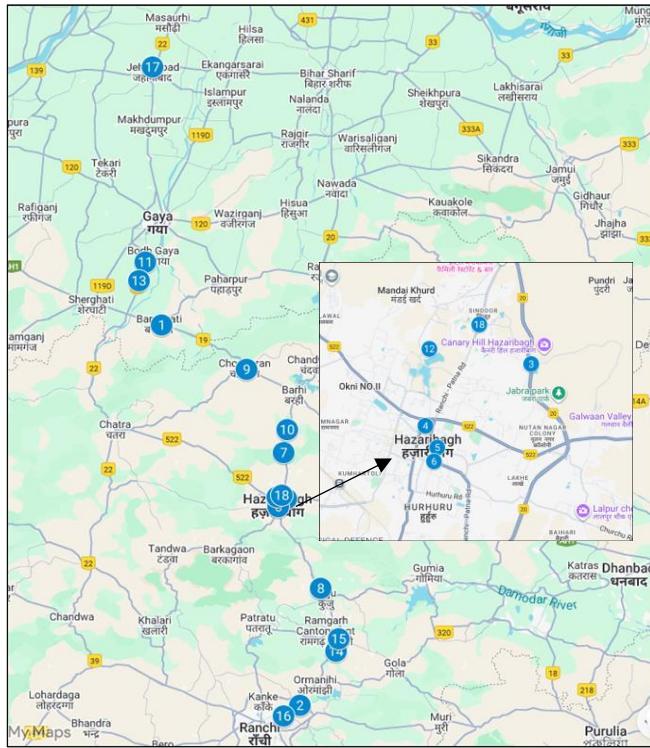
Figure- 23: Hotspot locations.

4.3.2 Hotspot covered

1. Barachatti Post Office, Tetariya Khurd, Bihar
2. Birla Institute of Technology, Mesra, Jharkhand
3. Canary Hill Hazaribagh, Jharkhand
4. Civil Court Hazaribagh, Jharkhand
5. Head Post Office, Hazaribagh, Jharkhand
6. Hazaribagh New Bus Stand, Hazaribagh, Jharkhand
7. Hazaribagh Wildlife Sanctuary, Hazaribagh, Jharkhand
8. Hesagarha Panchayat Bhawan, Kasikhap, Jharkhand
9. Kendua More Chauparan Bus Stand, Chouparan, Jharkhand
10. Maa Vindhyavashini College of Education, Karmatanr, Jharkhand
11. Main Gate IIMBG, Gaya, Bihar
12. New Buliding Sheikh Bhikhari Medical College, Hazaribagh, Jharkhand
13. Powergrid Co. of India Ltd. Gaya, Bhanwarbar, Bihar
14. Radha Govind University, Lalki Ghati, Jharkhand
15. Saheed Nirmal Mahto Chowk, Kothar, Jharkhand
16. Shivaji Chowk, Vijaynagar, Ranchi, Jharkhand
17. S.N Sinha College, Jehanabad, Bihar
18. Vinoba Bhave University, Hazaribagh, Jharkhand

4.3.3 Voice performance

Overall Voice Performance				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	180	180	180	180
Call Setup Success Rate %	100.00	91.67	100.00	93.89
Drop Call Rate %	0.00	1.82	0.00	2.37
Call Setup Time-Average (Second)	1.70	3.41	0.58	1.15

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

Barachatti Post Office, Tetariya Khurd, Bihar				
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)	1.60	2.55	0.58	0.83

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

Birla Institute of Technology, Mesra, Jharkhand				
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)	1.78	3.41	0.58	0.97

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

Canary Hill Hazaribagh, Jharkhand				
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)	1.78	5.43	0.51	1.04

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

Civil Court Hazaribagh, Jharkhand				
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)	1.68	3.65	0.63	0.86

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

Head Post Office, Hazaribagh, Jharkhand				
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)	1.66	3.96	0.57	0.98

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

Hazaribagh New Bus Stand, Hazaribagh, Jharkhand				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.59	3.55	0.57	0.95

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

Hazaribagh Wildlife Sanctuary, Hazaribagh, Jharkhand				
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	20.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.74	2.57	0.67	3.09

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

Hesagarha Panchayat Bhawan, Kasikhap, Jharkhand				
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)	1.65	2.31	0.58	1.08

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

Kendua More Chauparan Bus Stand, Chouparan, Jharkhand				
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	90.00
Drop Call Rate %	0.00	-	0.00	33.33
Call Setup Time-Average (Second)	1.69	-	0.56	1.08

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

Note- "-" Drop Call Rate & Call setup time has not been reported as all calls were failed at

Maa Vindhyavashini College of Education, Karmatanr, Jharkhand				
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	90.00
Drop Call Rate %	0.00	30.00	0.00	0.00
Call Setup Time-Average (Second)	1.76	2.03	0.57	3.15

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

Main Gate IIMBG, Gaya, Bihar				
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)	1.60	2.56	0.53	1.02

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

New Buliding Sheikh Bhikhari Medical College, Hazaribagh, Jharkhand				
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)	1.73	3.35	0.64	0.97

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

Powergrid Co. of India Ltd. Gaya, Bhanwarbar, Bihar				
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)	1.70	2.43	0.55	0.89

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

Radha Govind University, Lalki Ghati, Jharkhand				
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)	1.71	4.03	0.62	1.14

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

Saheed Nirmal Mahto Chowk, Kothar, Jharkhand				
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	90.00
Drop Call Rate %	0.00	0.00	0.00	11.11
Call Setup Time-Average (Second)	1.79	3.68	0.58	1.69

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

Shivaji Chowk, Vijaynagar, Ranchi, Jharkhand				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	70.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.67	3.65	0.55	0.89

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

S.N Sinha College, Jehanabad, Bihar				
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)	1.74	6.44	0.58	0.93

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

Vinoba Bhave University, Hazaribagh, Jharkhand				
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)	1.77	2.55	0.54	1.00

Table-38: 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)	104.43	5.14	192.39	36.45
Download Throughput 80th Percentile (Mbit/s)	191.94	7.51	382.11	66.11
Download Throughput 20th Percentile (Mbit/s)	14.01	2.83	5.80	8.69
Download Session Setup Success Rate %	100.00	78.89	100.00	80.00
Upload Throughput Average (Mbits/s)	26.70	4.24	23.51	13.86
Upload Throughput 80th Percentile (Mbit/s)	41.31	5.46	35.48	26.53
Upload Throughput 20th Percentile (Mbit/s)	3.53	1.24	3.01	2.68
Upload Session Setup Success Rate %	100.00	81.11	98.89	78.89
Web Browsing Delay (Second)	7.15	4.05	5.06	6.33
Youtube Initial Buffer Delay (Second)	1.80	2.38	1.29	1.73
Latency (ms) - 50th Percentile	59.12	64.18	37.29	62.13
Jitter (ms)	16.25	34.08	24.11	31.68
Packet Loss Rate%	16.68	32.20	12.60	26.73
Packet Loss Rate- 90th percentile	45.30	100.00	45.00	100.00

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

Barachatti Post Office, Tetariya Khurd, Bihar				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	158.98	1.06	1.07	28.11
Download Session Setup Success Rate %	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	41.74	10.83	37.60	20.54
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	4.58	3.01	3.93	5.99
Youtube Initial Buffer Delay (Second)	0.70	1.06	2.52	1.22
Latency (ms) - 50th Percentile	54.60	61.53	29.54	64.12
Jitter (ms)	7.49	3.10	2.56	3.94
Packet Loss Rate%	2.20	28.40	15.10	0.20

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

Birla Institute of Technology, Mesra, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	77.39	5.30	158.94	5.84
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	11.96	1.22	13.40	2.19
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	8.39	13.32	4.38	7.22
Youtube Initial Buffer Delay (Second)	0.97	8.04	0.76	3.40
Latency (ms) - 50th Percentile	73.45	73.68	65.57	57.99
Jitter (ms)	18.88	31.28	2.63	10.35
Packet Loss Rate%	32.80	17.00	18.60	1.10

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

Canary Hill Hazaribagh, Jharkhand				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	184.57	9.10	303.30	33.98
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	10.01	1.42	26.69	9.89
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	8.27	9.19	5.19	8.50
Youtube Initial Buffer Delay (Second)	1.04	-	0.75	1.81
Latency (ms) - 50th Percentile	79.63	69.07	37.57	61.34
Jitter (ms)	19.46	21.73	4.27	5.16
Packet Loss Rate%	47.10	5.60	0.50	0.10

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

Note-"-" Youtube tests were failed.

Civil Court Hazaribagh, Jharkhand				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	107.23	4.19	2.64	23.19
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	6.21	4.99	2.16	5.13
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	10.20	3.15	9.51	7.02
Youtube Initial Buffer Delay (Second)	3.87	2.30	-	1.15
Latency (ms) - 50th Percentile	60.58	68.25	67.40	61.06
Jitter (ms)	44.40	4.78	221.44	14.60
Packet Loss Rate%	17.50	2.30	17.90	0.90

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

Note-"-" Youtube tests were failed.

Head Post Office, Hazaribagh, Jharkhand				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	260.41	7.54	394.21	43.99
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	58.01	2.45	56.31	20.97
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	5.89	2.00	2.33	3.07
Youtube Initial Buffer Delay (Second)	1.85	2.90	0.84	1.32
Latency (ms)- 50th Percentile	42.33	59.99	29.37	64.13
Jitter (ms)	4.61	5.69	4.04	6.52
Packet Loss Rate%	1.40	1.00	0.60	0.40

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

Hazaribagh New Bus Stand, Hazaribagh, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	130.35	7.73	97.15	24.58
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	25.13	4.63	9.55	9.72
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	6.10	3.61	4.19	5.61
Youtube Initial Buffer Delay (Second)	0.83	2.15	1.00	1.55
Latency (ms) - 50th Percentile	46.99	59.43	33.24	61.68
Jitter (ms)	2.96	2.90	9.97	6.66
Packet Loss Rate%	38.80	28.90	30.40	29.20

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

Hazaribagh Wildlife Sanctuary, Hazaribagh, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	2.06	-	11.57	-
Download Session Setup Success Rate %	100.00	0.00	100.00	0.00
Upload Throughput Average (Mbits/s)	1.37	-	0.80	-
Upload Session Setup Success Rate %	100.00	0.00	100.00	0.00
Web Browsing Delay (Second)	7.40	-	14.92	-
Youtube Initial Buffer Delay (Second)	6.67	-	-	-
Latency (ms) - 50th Percentile	80.60	-	90.45	-
Jitter (ms)	40.59	-	70.54	-
Packet Loss Rate%	16.90	100.00	45.00	100.00

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

Note-"-" Respective tests were failed.

Hesagarha Panchayat Bhawan, Kasikhap, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	51.31	-	374.97	19.26
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	6.82	-	31.77	2.88
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	6.85	-	5.17	6.33
Youtube Initial Buffer Delay (Second)	1.88	-	0.79	1.29
Latency (ms) - 50th Percentile	59.31	76.89	500.06	67.29
Jitter (ms)	6.91	9.95	34.67	12.87
Packet Loss Rate%	0.20	99.20	48.40	1.70

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

Note-"-"Respective tests were failed.

Kendua More Chauparan Bus Stand, Chouparan, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	184.33	-	523.79	11.75
Download Session Setup Success Rate %	100.00	0.00	100.00	100.00
Upload Throughput Average (Mbits/s)	23.73	-	32.56	1.49
Upload Session Setup Success Rate %	100.00	0.00	100.00	100.00
Web Browsing Delay (Second)	5.47	-	4.85	9.06
Youtube Initial Buffer Delay (Second)	0.79	-	0.82	-
Latency (ms) - 50th Percentile	45.32	81.15	32.30	90.06
Jitter (ms)	5.75	3848.95	2.24	57.25
Packet Loss Rate%	0.40	99.70	0.00	36.50

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

Note-"-" Respective tests were failed.

Maa Vindhyavashini College of Education, Karmatanr, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	11.06	7.16	608.86	0.35
Download Session Setup Success Rate %	100.00	100.00	100.00	20.00
Upload Throughput Average (Mbits/s)	1.94	1.31	29.68	-
Upload Session Setup Success Rate %	100.00	100.00	100.00	0.00
Web Browsing Delay (Second)	4.89	6.23	4.93	-
Youtube Initial Buffer Delay (Second)	4.35	4.64	0.61	-
Latency (ms) - 50th Percentile	84.69	69.20	30.22	-
Jitter (ms)	24.10	6.51	2.38	-
Packet Loss Rate%	10.70	4.30	0.00	100.00

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

Note-"-" Upload, Browsing, Youtube & Ping tests were failed.

Main Gate IIMBG, Gaya, Bihar				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	196.48	7.44	68.86	11.07
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	85.49	2.49	3.92	4.61
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	9.07	2.93	5.43	4.64
Youtube Initial Buffer Delay (Second)	0.73	2.32	3.21	1.18
Latency (ms) - 50th Percentile	56.08	66.84	34.88	69.85
Jitter (ms)	4.18	38.86	4.49	237.09
Packet Loss Rate%	0.50	15.20	0.20	3.60

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

New Buliding Sheikh Bhikhari Medical College, Hazaribagh, Jharkhand				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	52.61	4.20	5.14	5.96
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	19.24	2.00	1.01	1.83
Upload Session Setup Success Rate %	100.00	100.00	80.00	100.00
Web Browsing Delay (Second)	9.70	4.82	9.25	4.64
Youtube Initial Buffer Delay (Second)	0.93	1.76	-	-
Latency (ms) - 50th Percentile	74.26	58.53	68.39	58.52
Jitter (ms)	20.65	2.63	24.38	43.18
Packet Loss Rate%	17.50	0.80	13.00	4.20

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

Note-"-" Youtube tests were failed.

Powergrid Co. of India Ltd. Gaya, Bhanwarbar, Bihar				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	52.19	3.94	7.11	94.16
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	26.60	10.60	16.93	27.62
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	5.64	1.86	4.43	4.91
Youtube Initial Buffer Delay (Second)	0.89	0.95	0.86	1.44
Latency (ms) - 50th Percentile	86.14	67.59	34.60	65.78
Jitter (ms)	25.81	2.77	2.95	6.98
Packet Loss Rate%	26.80	5.20	2.70	1.00

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

Radha Govind University, Lalki Ghati, Jharkhand				
Parameters	Service Provider			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	8.49	1.16	6.00	-
Download Session Setup Success Rate %	100.00	60.00	100.00	0.00
Upload Throughput Average (Mbits/s)	1.35	1.23	1.47	-
Upload Session Setup Success Rate %	100.00	80.00	100.00	0.00
Web Browsing Delay (Second)	10.34	3.51	5.91	-
Youtube Initial Buffer Delay (Second)	6.00	-	7.09	-
Latency (ms) - 50th Percentile	74.83	-	46.56	-
Jitter (ms)	24.99	-	7.28	-
Packet Loss Rate%	43.90	100.00	34.10	97.10

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

Note-"-" Tests were failed.

Saheed Nirmal Mahto Chowk, Kothar, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	10.51	5.34	36.30	0.00
Download Session Setup Success Rate %	100.00	100.00	100.00	20.00
Upload Throughput Average (Mbits/s)	2.70	12.16	33.06	0.00
Upload Session Setup Success Rate %	100.00	100.00	100.00	20.00
Web Browsing Delay (Second)	7.63	4.48	5.74	2.78
Youtube Initial Buffer Delay (Second)	4.86	1.62	1.05	-
Latency (ms) - 50th Percentile	57.85	68.64	37.45	-
Jitter (ms)	5.11	2.44	3.85	-
Packet Loss Rate%	5.50	0.40	0.20	100.00

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

Note-"-" Youtube & Ping tests were failed.

Shivaji Chowk, Vijaynagar, Ranchi, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	232.51	5.79	465.15	50.37
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	86.27	3.58	76.76	33.45
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	8.50	2.15	5.35	8.93
Youtube Initial Buffer Delay (Second)	2.86	1.58	0.64	3.98
Latency (ms) - 50th Percentile	43.12	59.67	43.83	69.18
Jitter (ms)	6.61	3.09	23.51	4.89
Packet Loss Rate%	0.60	1.00	0.10	1.30

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

S.N Sinha College, Jehanabad, Bihar				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	131.11	0.02	191.60	72.28
Download Session Setup Success Rate %	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	32.43	1.33	26.17	19.72
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	5.25	-	4.30	4.68
Youtube Initial Buffer Delay (Second)	0.82	-	0.93	1.21
Latency (ms) - 50th Percentile	45.17	72.78	23.89	55.15
Jitter (ms)	6.46	370.31	3.63	7.27
Packet Loss Rate%	0.00	70.10	0.00	1.10

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

Note-"-" Browse & Youtube tests failed.

Vinoba Bhave University, Hazaribagh, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	28.22	3.68	206.42	92.94
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	39.56	4.11	18.84	34.02
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	6.06	2.73	5.11	8.42
Youtube Initial Buffer Delay (Second)	0.81	3.83	0.80	1.81
Latency (ms) - 50th Percentile	70.88	59.65	35.80	58.12
Jitter (ms)	23.57	1.66	3.69	27.01
Packet Loss Rate%	37.50	0.50	0.00	2.80

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

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

Overall Data Performance					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	**Download Throughput Average (Mbits/s)**	132.94	-	237.78	-
	Upload Throughput Average (Mbits/s)	42.18	-	29.60	-
4G	**Download Throughput Average (Mbits/s)**	37.25	4.49	47.20	31.09
	Upload Throughput Average (Mbits/s)	9.72	6.14	11.97	12.26

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

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

Barachatti Post Office, Tetariya Khurd, Bihar					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	**Download Throughput Average (Mbits/s)**	102.96	-	0.93	-
	Upload Throughput Average (Mbits/s)	64.21	-	42.20	-
4G	**Download Throughput Average (Mbits/s)**	11.62	3.37	4.98	22.14
	Upload Throughput Average (Mbits/s)	8.63	12.62	11.70	21.98

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

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

Birla Institute of Technology, Mesra, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	**Download Throughput Average (Mbits/s)**	99.25	-	59.45	-
	Upload Throughput Average (Mbits/s)	17.81	-	11.68	-
4G	**Download Throughput Average (Mbits/s)**	18.30	6.69	21.59	17.67
	Upload Throughput Average (Mbits/s)	4.33	2.85	7.04	9.06

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

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

Canary Hill Hazaribagh, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	162.99	-	391.40	-
	Upload Throughput Average (Mbits/s)	34.91	-	32.94	-
4G	Download Throughput Average (Mbits/s)	27.36	10.67	21.08	31.68
	Upload Throughput Average (Mbits/s)	14.04	2.95	2.58	13.91

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

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

Civil Court Hazaribagh, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	127.27	-	1.52	-
	Upload Throughput Average (Mbits/s)	8.36	-	2.44	-
4G	Download Throughput Average (Mbits/s)	42.84	3.59	81.83	29.76
	Upload Throughput Average (Mbits/s)	2.76	2.04	9.99	12.16

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

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

Head Post Office, Hazaribagh, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	303.79	-	444.00	-
	Upload Throughput Average (Mbits/s)	54.91	-	20.33	-
4G	Download Throughput Average (Mbits/s)	49.10	12.69	19.22	30.07
	Upload Throughput Average (Mbits/s)	9.47	11.76	2.09	20.61

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

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

Hazaribagh New Bus Stand, Hazaribagh, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	176.34	-	209.74	-
	Upload Throughput Average (Mbits/s)	30.70	-	15.42	-
4G	Download Throughput Average (Mbits/s)	31.65	6.81	9.70	26.37
	Upload Throughput Average (Mbits/s)	9.46	2.64	2.05	5.07

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

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

Hazaribagh Wildlife Sanctuary, Hazaribagh, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	-	-	0.96	-
	Upload Throughput Average (Mbits/s)	-	-	-	-
4G	Download Throughput Average (Mbits/s)	11.88	1.14	4.74	-
	Upload Throughput Average (Mbits/s)	4.73	1.22	1.50	-

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

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

Hesagarha Panchayat Bhawan, Kasikhap, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	-	-	446.16	-
	Upload Throughput Average (Mbits/s)	-	-	32.03	-
4G	Download Throughput Average (Mbits/s)	28.87	0.83	95.73	24.37
	Upload Throughput Average (Mbits/s)	2.42	1.08	21.49	6.49

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

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

Kendua More Chauparan Bus Stand, Chouparan, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	124.40	-	594.03	-
	Upload Throughput Average (Mbits/s)	45.64	-	34.94	-
4G	Download Throughput Average (Mbits/s)	33.95	-	147.04	22.97
	Upload Throughput Average (Mbits/s)	20.04	-	23.03	3.60

Table-67: Overall Summary of 5G only & 4G only data download & upload speed.

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

Maa Vindhyavashini College of Education, Karmatanr, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	-	-	582.52	-
	Upload Throughput Average (Mbits/s)	-	-	36.75	-
4G	Download Throughput Average (Mbits/s)	20.40	4.12	137.33	2.94
	Upload Throughput Average (Mbits/s)	2.19	3.67	15.62	1.25

Table-68: Overall Summary of 5G only & 4G only data download & upload speed.

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

Main Gate IIMBG, Gaya, Bihar					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	212.81	-	49.51	-
	Upload Throughput Average (Mbits/s)	82.09	-	5.16	-
4G	Download Throughput Average (Mbits/s)	40.51	4.06	20.36	14.90
	Upload Throughput Average (Mbits/s)	24.53	17.26	4.76	6.23

Table-69: Overall Summary of 5G only & 4G only data download & upload speed.

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

New Buliding Sheikh Bhikhari Medical College, Hazaribagh, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	65.91	-	0.57	-
	Upload Throughput Average (Mbits/s)	19.71	-	1.62	-
4G	Download Throughput Average (Mbits/s)	21.64	4.40	8.79	6.11
	Upload Throughput Average (Mbits/s)	19.25	8.12	1.81	2.87

Table-70: Overall Summary of 5G only & 4G only data download & upload speed.

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

Powergrid Co. of India Ltd. Gaya, Bhanwarbar, Bihar					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	39.24	-	56.19	-
	Upload Throughput Average (Mbits/s)	29.02	-	21.68	-
4G	Download Throughput Average (Mbits/s)	97.43	3.87	33.84	81.05
	Upload Throughput Average (Mbits/s)	19.98	13.24	6.49	26.67

Table-71: Overall Summary of 5G only & 4G only data download & upload speed.

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

Radha Govind University, Lalki Ghati, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	-	-	81.40	-
	Upload Throughput Average (Mbits/s)	-	-	3.70	-
4G	Download Throughput Average (Mbits/s)	15.94	0.72	2.30	18.23
	Upload Throughput Average (Mbits/s)	2.05	1.22	1.51	2.65

Table-72: Overall Summary of 5G only & 4G only data download & upload speed.

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

Saheed Nirmal Mahto Chowk, Kothar, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	-	-	231.62	-
	Upload Throughput Average (Mbits/s)	6.97	-	24.60	-
4G	Download Throughput Average (Mbits/s)	2.63	0.21	49.57	6.66
	Upload Throughput Average (Mbits/s)	4.12	6.22	28.62	1.43

Table-73: Overall Summary of 5G only & 4G only data download & upload speed.

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

Shivaji Chowk, Vijaynagar, Ranchi, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	268.01	-	316.05	-
	Upload Throughput Average (Mbits/s)	83.23	-	79.82	-
4G	Download Throughput Average (Mbits/s)	87.84	4.19	53.04	32.97
	Upload Throughput Average (Mbits/s)	5.76	5.47	43.46	20.73

Table-74: Overall Summary of 5G only & 4G only data download & upload speed.

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

S.N Sinha College, Jehanabad, Bihar					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	Download Throughput Average (Mbits/s)	117.61	-	218.67	-
	Upload Throughput Average (Mbits/s)	75.64	-	28.37	-
4G	Download Throughput Average (Mbits/s)	98.96	1.46	52.76	41.18
	Upload Throughput Average (Mbits/s)	14.35	1.27	11.60	16.93

Table-75: Overall Summary of 5G only & 4G only data download & upload speed.

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

Vinoba Bhave University, Hazaribagh, Jharkhand					
Parameters		**Service Provider**			
		AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	**Download Throughput Average (Mbits/s)**	21.09	-	275.28	-
	Upload Throughput Average (Mbits/s)	14.41	-	92.82	-
4G	**Download Throughput Average (Mbits/s)**	29.61	3.75	85.60	87.23
	Upload Throughput Average (Mbits/s)	6.88	6.55	20.14	30.19

Table-76: Overall Summary of 5G only & 4G only data download & upload speed.

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

4.4 Walk Test

Walk test has been conducted on 26th November and 27th November 2025. Two locations have been tested in the Hazaribagh city. (Refer Table-1)

4.4.1 Walk test locations
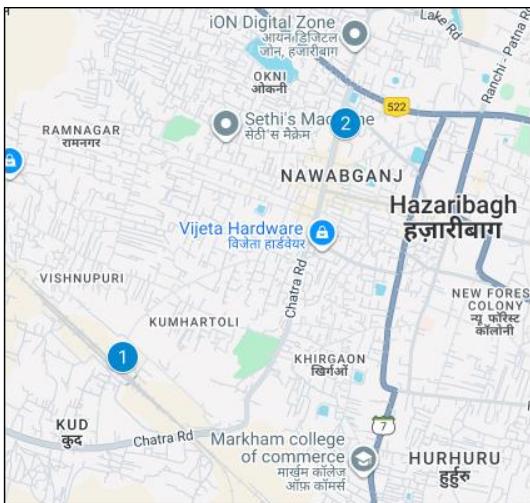
Figure-24: Walk test locations.

4.4.2 Walk test covered

1. Hazaribagh Town Railway Station, Jharkhand
2. Sadar Hospital Hazaribagh, Jharkhand

4.4.3 Voice performance

i) Hazaribagh Town Railway Station, Jharkhand

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

Hazaribagh Town Railway Station, Jharkhand				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	11	12	12	11
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)	1.66	3.90	0.51	0.92
Handover Success Rate %	100.00	100.00	100.00	100.00

Table-77: Summary of Voice performance in network auto-selection mode (5G/4G/3G/2G).
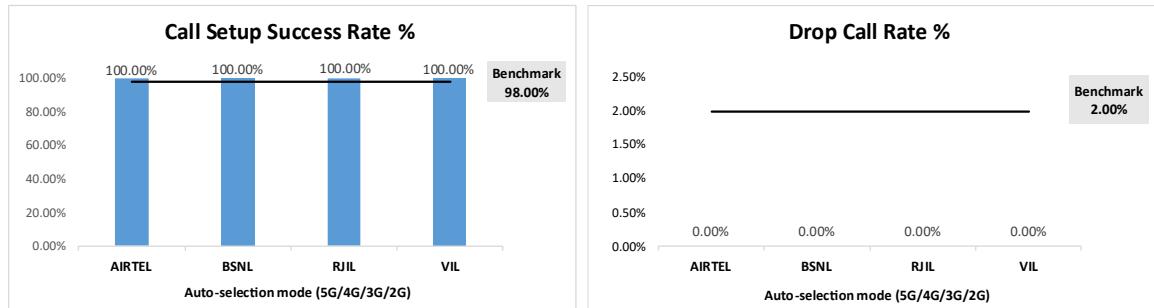
Figure- 25: Performance for call setup success rate and drop call rate.

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

Hazaribagh Town Railway Station, Jharkhand				
Technology	**Service Provider**			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	4.71%	NA	100.00%	NA
4G	95.29%	13.12%	0.00%	100.00%
3G	NA	0.00%	NA	NA
2G	0.00%	86.88%	NA	0.00%
Limited service	0.00%	0.00%	0.00%	0.00%

Table-78: Time spent on technology during walk test.

(c) Network Signal Strength distribution: The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G).
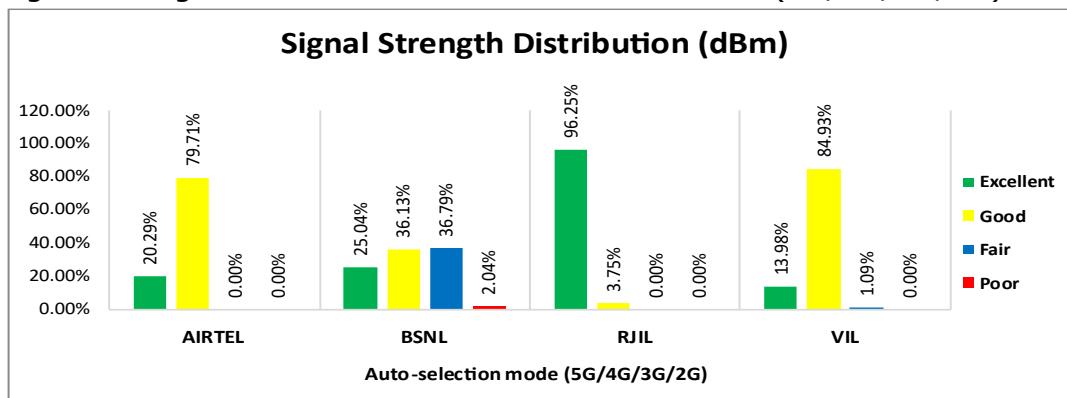
Figure-26: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

ii) Sadar Hospital Hazaribagh, Jharkhand

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

Sadar Hospital Hazaribagh, Jharkhand				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	12	11	12	12
Call Setup Success Rate %	100.00	100.00	100.00	91.67
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	1.67	2.79	0.58	0.94
Handover Success Rate %	100.00	100.00	100.00	100.00

Table-79: Summary of Voice performance in network auto-selection mode (5G/4G/3G/2G).
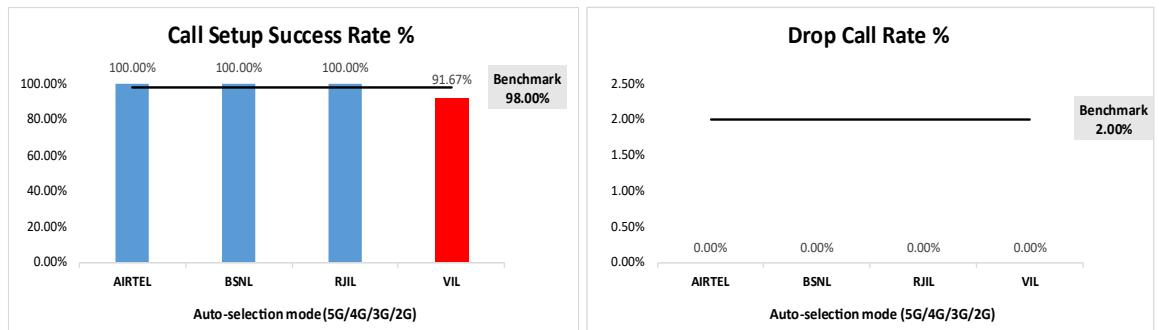
Figure- 27: Performance for call setup success rate and drop call rate.

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

Sadar Hospital Hazaribagh, Jharkhand				
Technology	**Service Provider**			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	9.83%	NA	90.27%	NA
4G	90.17%	4.80%	9.73%	100.00%
3G	NA	17.01%	NA	NA
2G	0.00%	78.19%	NA	0.00%
Limited service	0.00%	0.00%	0.00%	0.00%

Table-80: Time spent on technology during walk test.

(c) Network Signal Strength distribution: The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G).
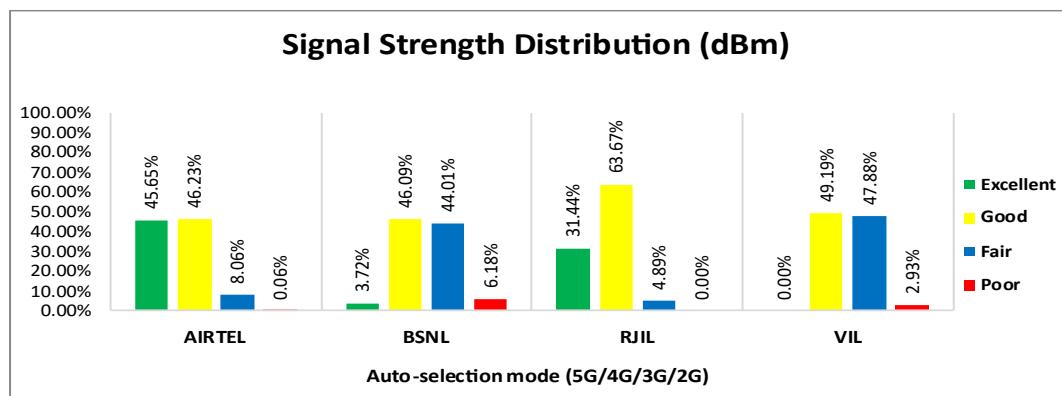
Figure-28: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

4.4.4 Data performance

i) Hazaribagh Town Railway Station, Jharkhand
(a) Data Parameters (Auto-selection mode- 5G/4G/3G/2G)

Hazaribagh Town Railway Station, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	236.98	4.17	541.31	25.66
Download Throughput 80th Percentile	285.68	5.67	582.14	31.23
Download Throughput 20th Percentile	210.32	2.39	476.82	19.69
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	61.63	4.74	84.07	18.45
Upload Throughput 80th Percentile	71.63	6.53	92.65	24.14
Upload Throughput 20th Percentile	47.53	2.61	72.00	12.61
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Latency (ms)-50th Percentile	47.62	61.04	30.35	60.85

Table-81: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).
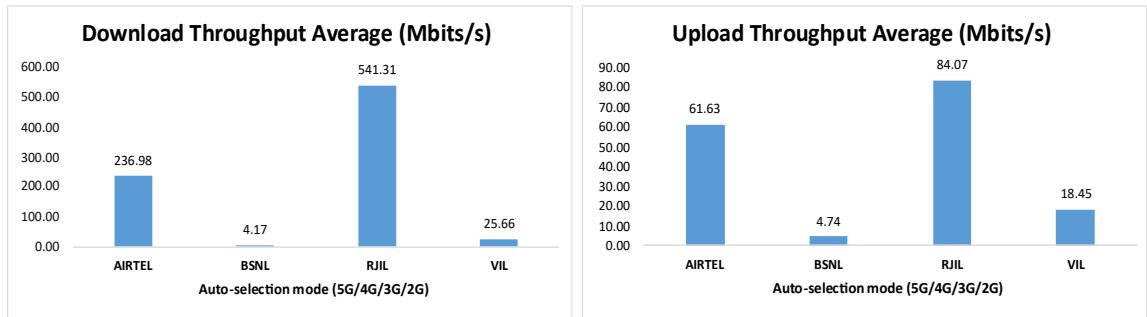
Figure- 29: Download and Upload throughput.

ii) Sadar Hospital Hazaribagh, Jharkhand
(a) Data Parameters (Auto-selection mode- 5G/4G/3G/2G)

Sadar Hospital Hazaribagh, Jharkhand				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	129.52	0.02	179.73	44.98
Download Throughput 80th Percentile	167.03	0.03	229.25	51.16
Download Throughput 20th Percentile	84.76	0.02	144.90	38.75
Download Session Setup Success Rate %	100.00	25.00	100.00	100.00
Upload Throughput Average (Mbits/s)	46.38	1.47	18.81	12.21
Upload Throughput 80th Percentile	55.27	1.24	23.13	16.15
Upload Throughput 20th Percentile	32.44	1.22	13.34	9.14
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Latency (ms)-50th Percentile	50.73	369.83	28.48	73.18

Table-82: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).
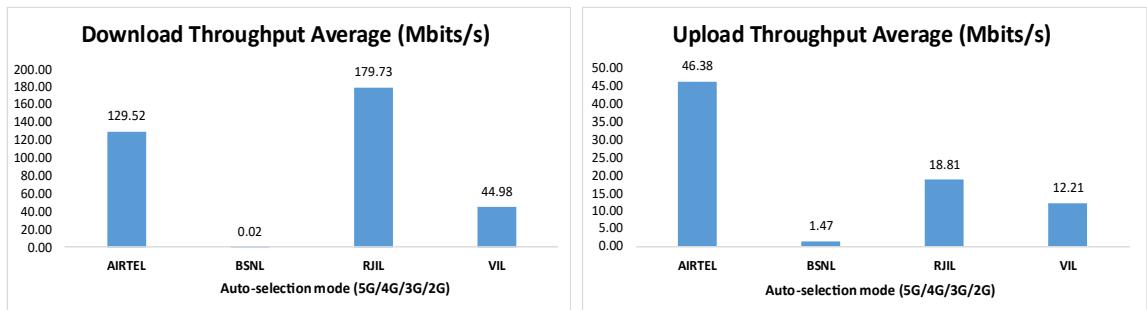
Figure- 30: Download and Upload throughput.

4.5 Highway

Drive test has been conducted on 21st November and 22nd November 2025 covering one Highway route Ranchi to Patna (along NH- 20, 19 and 22). (Refer Table-1)

4.5.1 Drive test route
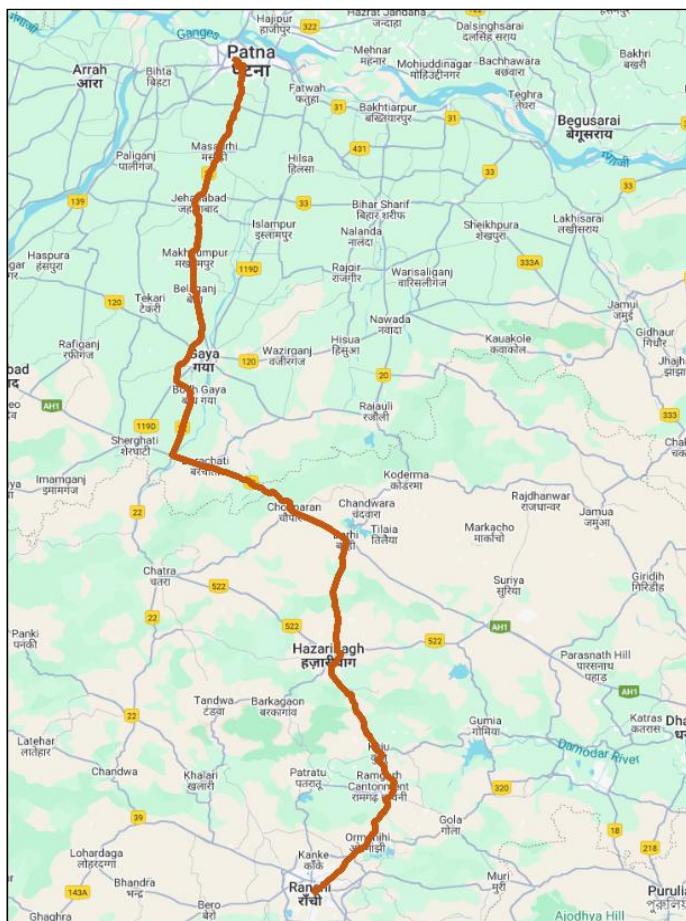
Figure-31: Drive test route Highway.

4.5.2 Routes Covered

Ranchi to Patna (along NH- 20, 19 and 22) passing through Hazaribagh, Barahi, Barachati, Bodhgaya and Jehanabad etc.

4.5.3 Voice performance

(a) Voice Call Performance in 3G/2G network mode only: 3G/2G network mode testing has been done to reflect 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	137	179	194
Call Setup Success Rate %	99.27	71.51	92.78
Drop Call Rate %	0.00	10.16	32.22
Call Setup Time-Average (Second)	5.80	2.88	3.52
Handover Success Rate %	99.75	88.20	96.81

Table-83: Summary of voice call performance in 3G/2G network mode only.
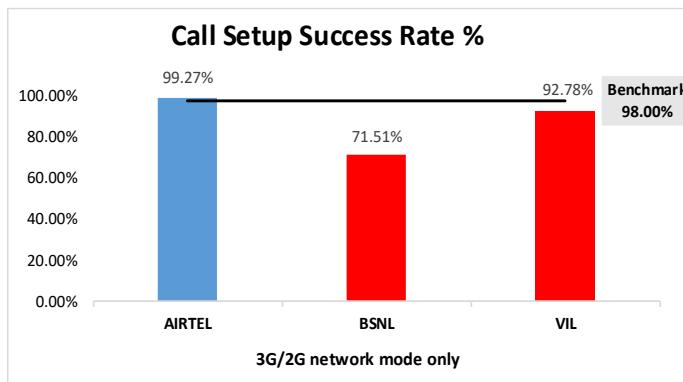
Figure-32: Performance for call setup success rate.
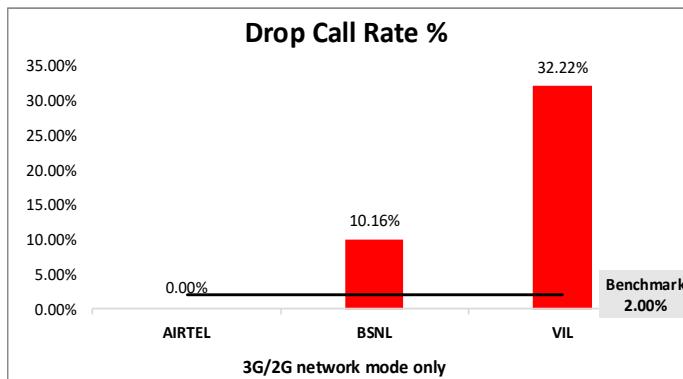
Figure-33: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	**BSNL**	**VIL**
3G	NA	13.33%	NA
2G	99.95%	85.05%	99.18%
Limited Service	0.05%	1.62%	0.82%

Table-84: Time spent on technology during drive test 3G/2G network mode only.
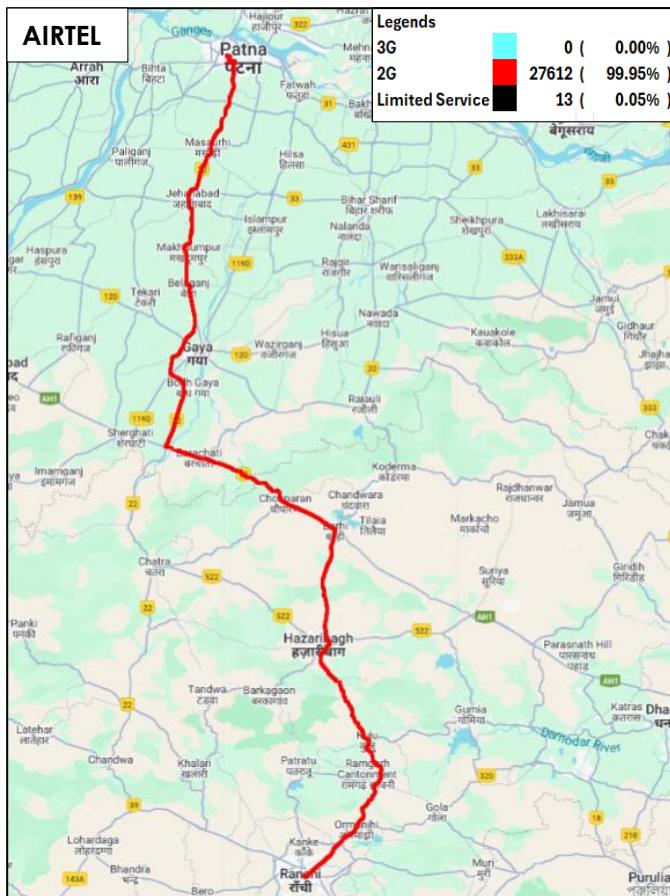
Figure-34: Serving technology plots 3G/2G network mode – AIRTEL
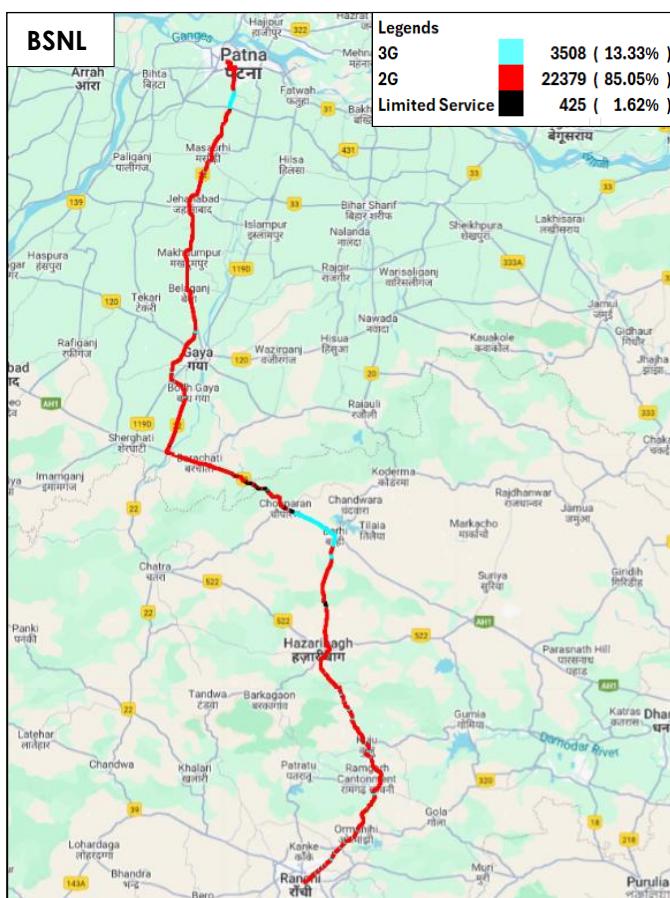
Figure-35: Serving technology plots 3G/2G network mode – BSNL
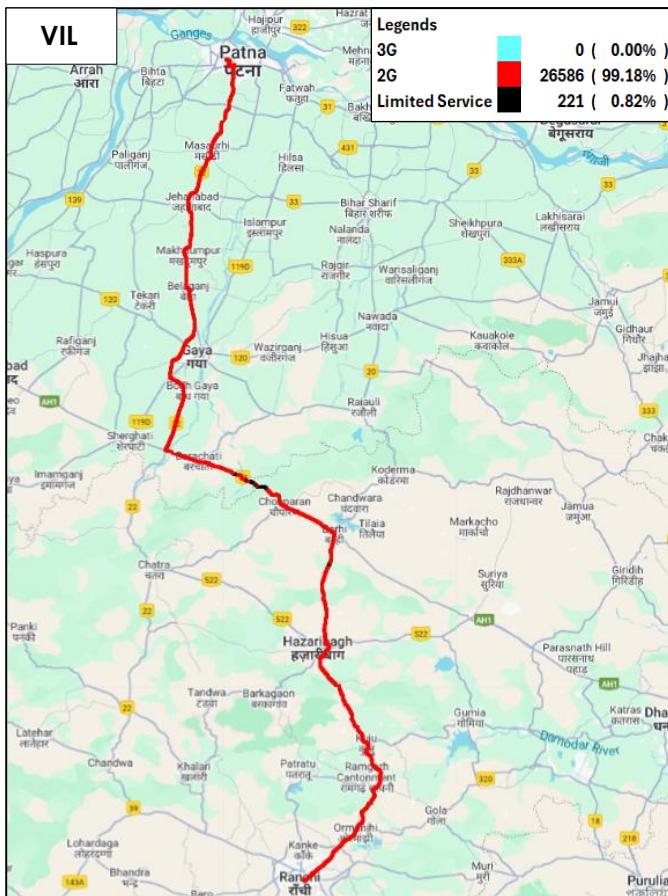
Figure 36: Serving technology plots 3G/2G network mode –VIL

(c) Network Signal Strength Distribution: The following chart represents signal strength distribution for 3G/2G network mode only. (Refer figure-65, 66 & 67 for map view)
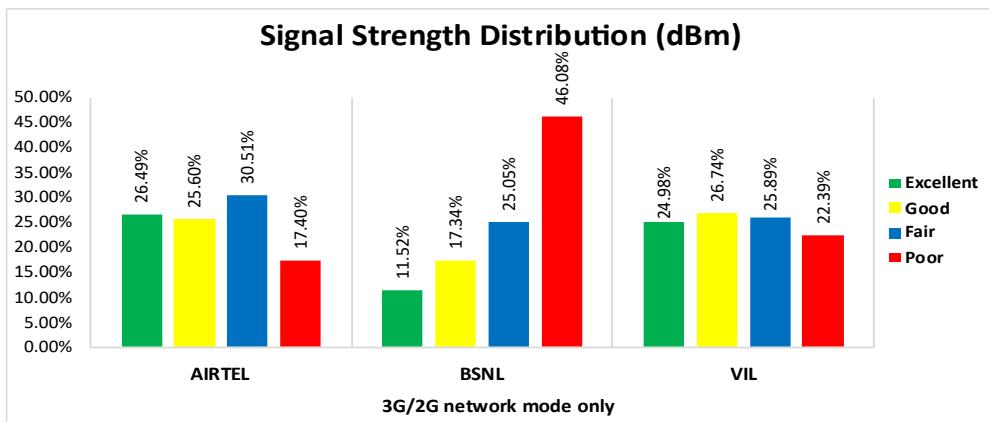
Figure-37: Signal strength distribution 3G/2G network mode only.

Observations:

- Airtel has 26% of samples falling in the excellent signal strength category.
- BSNL has 12% of samples falling in the excellent signal strength category.
- VIL has 25% 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	144	167	145	174
Call Setup Success Rate %	100.00	79.04	100.00	82.18
Drop Call Rate %	0.00	9.09	0.00	9.09
Call Setup Time Average (Second)	1.72	3.32	0.71	1.88
Handover Success Rate %	100.00	87.19	99.79	99.76

Table-85: Summary of voice call performance in network auto-selection mode.
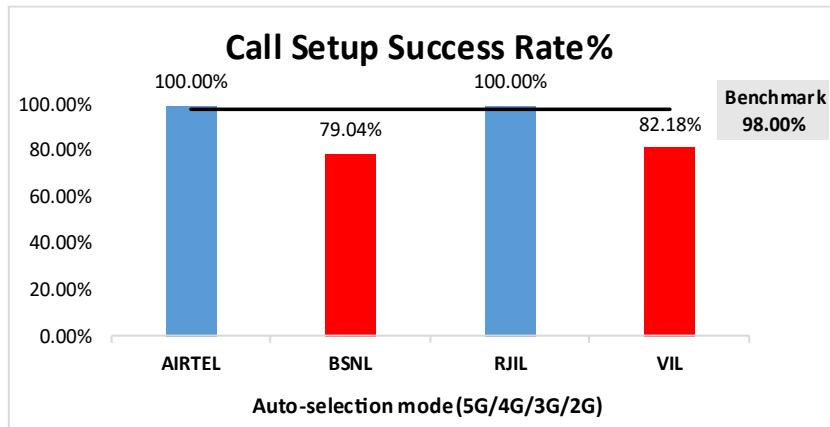
**Figure-38:** Performance for call setup success rate.
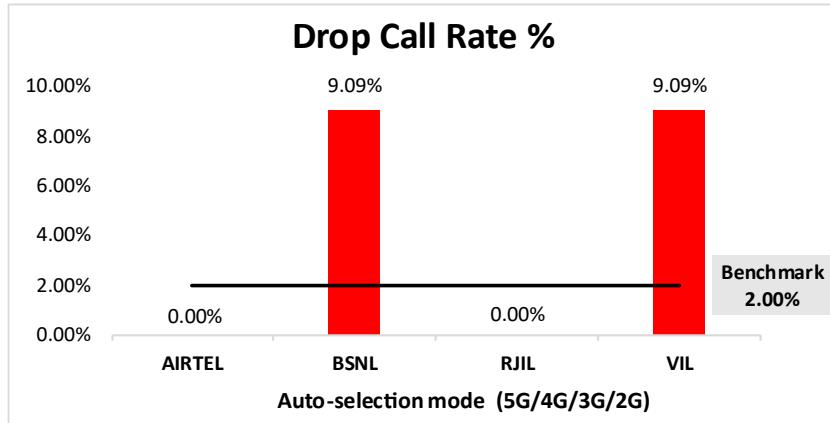
Figure-39: Performance for drop call rate.

Parameter	Service Provider Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	125	146	130	118
Number of silence call for >4 Sec	4	NA	2	8
Silence Call Rate %	3.20	NA	1.54	6.78
Number of silence instances for >4 Sec	4	NA	3	10
Number of silence instances for >3 Sec	10	NA	7	32
Number of silence instances for >2 sec	21	NA	14	86
RTP Jitter (4G & 5G) in ms	5.99	NA	16.32	13.45
Packet loss Rate Downlink %	1.02	NA	2.11	2.20
Packet loss Rate Uplink %	1.05	NA	1.98	2.25

Table-86: Summary of silence instances & packet loss rate for mobile to mobile call.

Note-
- NA- Due to unavailability of packet switched (VoLTE & VoNR) network in BSNL silence instances are not captured.

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

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

Speech Quality (MOS) distribution	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
Total Number of MOS Samples for calls in table-86	1553	1474	1515	1367
Speech Quality (Average MOS)	3.96	2.75	4.40	4.44
Number of samples with MOS >=4 to <5 (Excellent)	1247	0	1305	1199
Number of samples with MOS >=3 to <4 (Good)	238	738	106	81
Number of samples with MOS >=2 to <3 (Fair)	32	453	32	30
Number of samples with MOS >=1 to <2 (Poor)	36	283	72	57
%age of samples with MOS >=4 to <5 (Excellent)	80.30%	0.00%	86.14%	87.71%
%age of samples with MOS >=3 to <4 (Good)	15.33%	50.07%	7.00%	5.93%
%age of samples with MOS >=2 to <3 (Fair)	2.06%	30.73%	2.11%	2.19%
%age of samples with MOS >=1 to <2 (Poor)	2.32%	19.20%	4.75%	4.17%

Table-87: Summary of speech quality (MOS) samples.
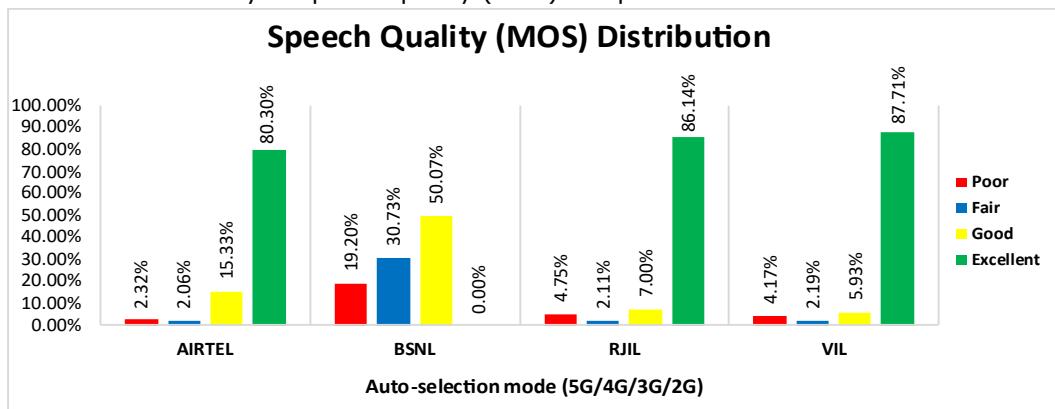
Figure-40: Distribution of samples in MOS range.

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

Technology	Service Provider			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	4.02%	NA	42.27%	NA
4G	95.98%	7.39%	57.70%	77.74%
3G	NA	6.66%	NA	NA
2G	0.00%	83.83%	NA	20.06%
Limited Service	0.00%	2.12%	0.03%	2.20%

Table-88: Time spent on technology during drive test.

> **Note-**
> - NA- Service provider doesn't provide services in respective technology.
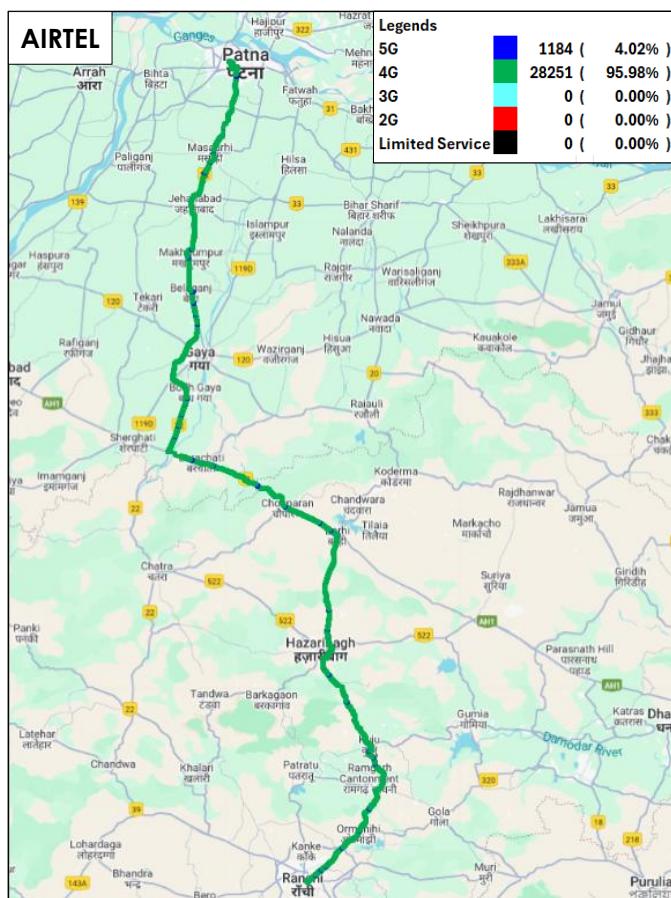
Figure-41: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-AIRTEL
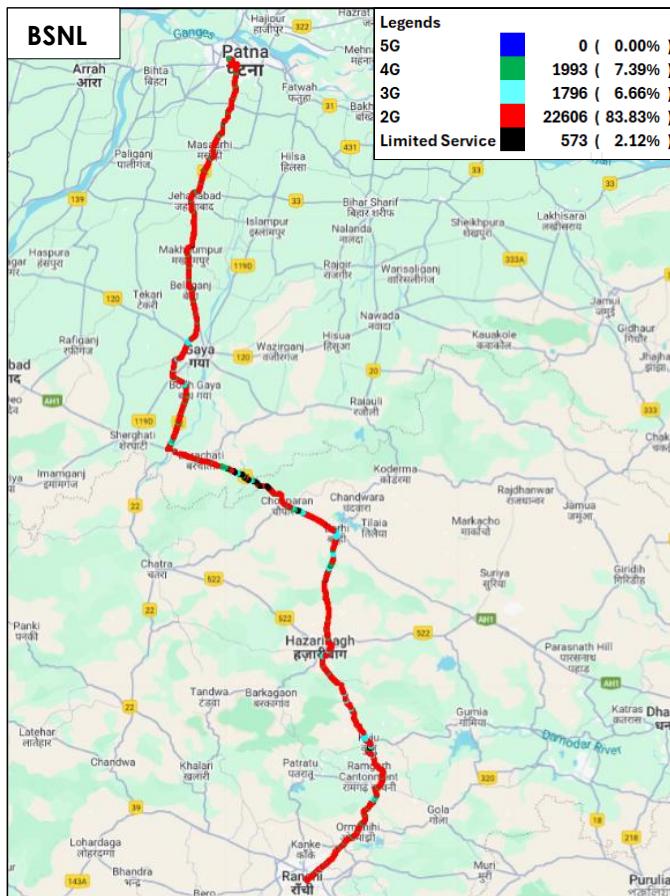
Figure-42: Serving technology plots in auto-selection mode (5G/4G/3G/2G) - BSNL (4G being rolled out)

Figure-43: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-RJIL
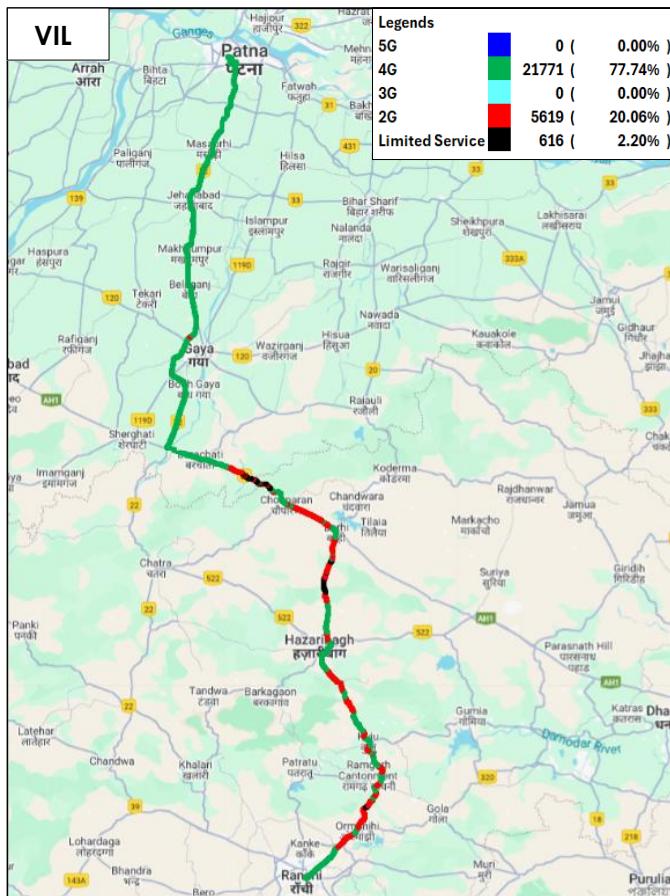
Figure-44: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-VIL

(g) Network Signal Strength Distribution: The following chart provides signal strength distribution for auto-selection mode (5G/4G/3G/2G). (Refer figure-68, 69, 70 & 71 for map view)
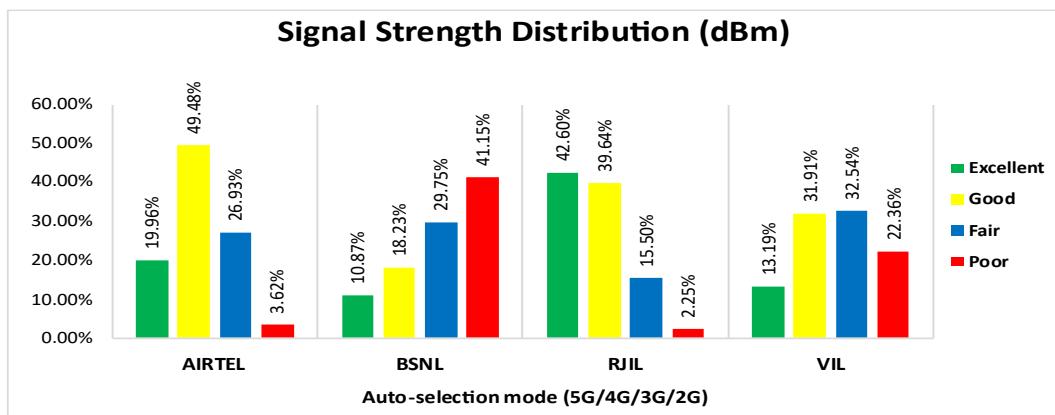
Figure-45: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:

- Airtel has 20% of samples falling in the excellent signal strength category.
- BSNL has 11% of samples falling in the excellent signal strength category.
- RJIL has 43% of samples falling in the excellent signal strength category.
- VIL has 13% of samples falling in the excellent signal strength category.

4.5.4 Data performance

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

Parameters		Service Provider			
		Auto-selection mode (5G/4G/3G/2G)			
		AIRTEL	BSNL	RJIL	VIL
Download Throughput (Mbits/s)	Average	97.28	3.73	207.27	29.76
	80th Percentile	168.07	5.03	367.55	46.99
	20th Percentile	26.47	0.36	35.06	10.83
Upload Throughput (Mbits/s)	Average	25.47	3.07	21.94	13.17
	80th Percentile	43.23	4.00	41.48	23.04
	20th Percentile	6.21	1.22	2.94	3.22
Latency (ms)	50th Percentile	44.98	60.19	27.51	47.14

Table-89: Summary of Data performance in network auto-selection mode.
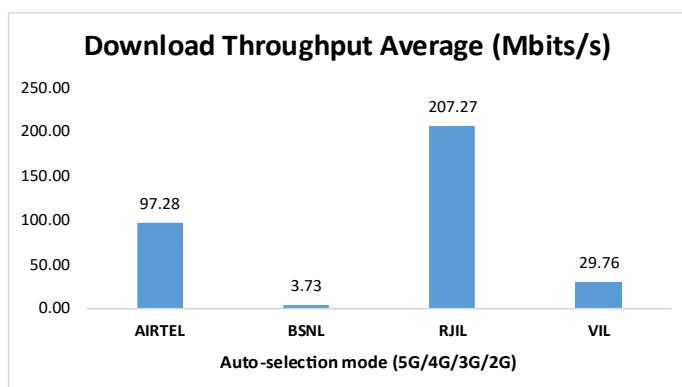
Figure 46: Download throughput.
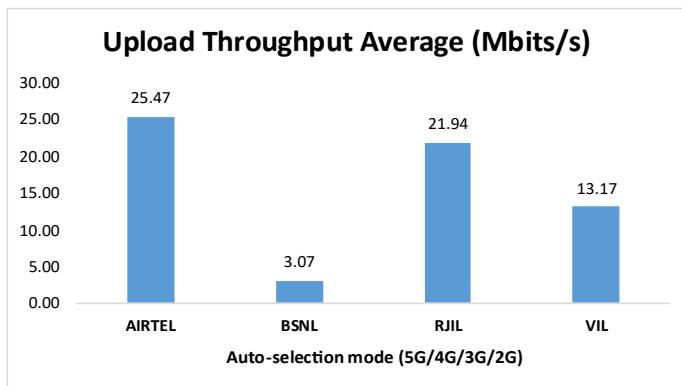
Figure-47: Upload throughput.

4.6 Railway

Drive test has been conducted on 20th November 2025 covering one Railway route Patna to Ranchi. (Refer Table-1)

4.6.1 Drive test route
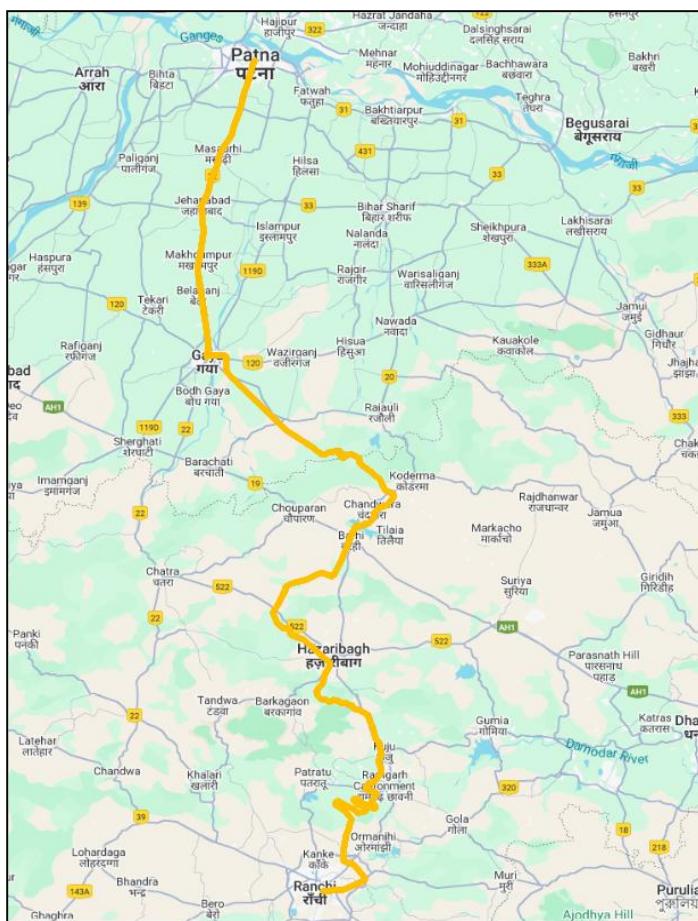
Figure-48: Drive test route railway.

4.6.2 Routes Covered

Patna to Ranchi passing through Jehanabad, Gaya Junction, Koderma Town, Hazaribagh Town, Barkakhana Junction and Mesra.

4.6.3 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	135	360	121	175
Call Setup Success Rate %	81.48	14.72	95.87	59.43
Drop Call Rate %	1.82	11.32	4.31	23.08
Call Setup Time Average (Second)	1.99	2.73	1.12	2.04
Handover Success Rate %	99.94	95.92	99.89	99.81

Table-90: Summary of voice call performance in network auto-selection mode.
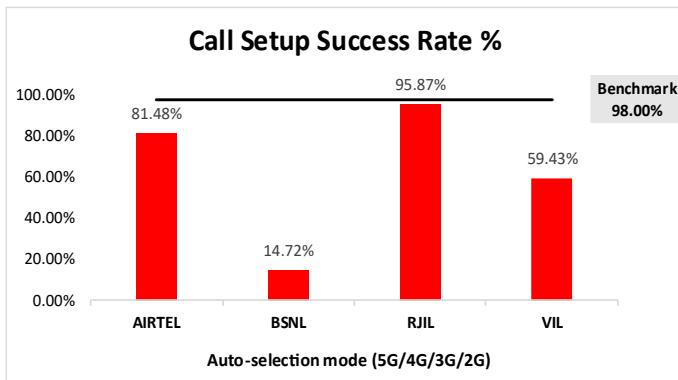
Figure-49: Performance for call setup success rate.
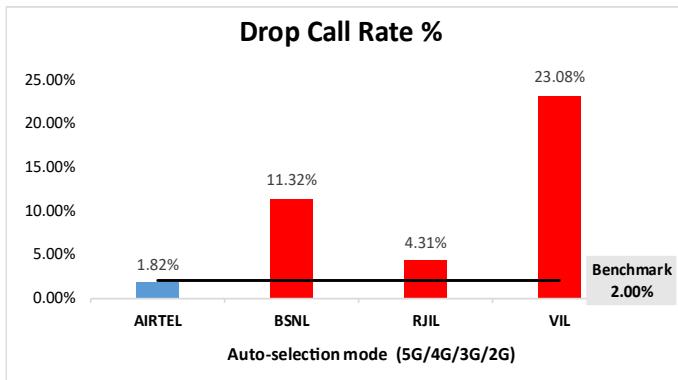
Figure-50: Performance for drop call rate.

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

Technology	Service Provider			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	3.65%	NA	25.34%	NA
4G	90.39%	23.16%	73.86%	62.72%
3G	NA	15.32%	NA	NA
2G	0.20%	47.02%	NA	25.92%
Limited Service	5.76%	14.51%	0.79%	11.36%

Table-91: Time spent on technology during drive test.

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

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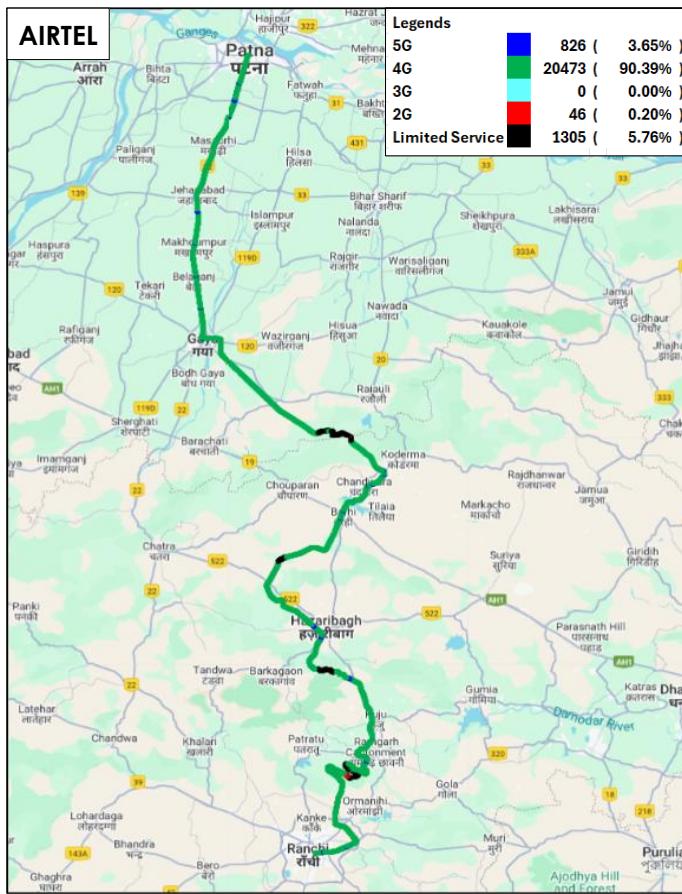
Figure-51: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-AIRTEL
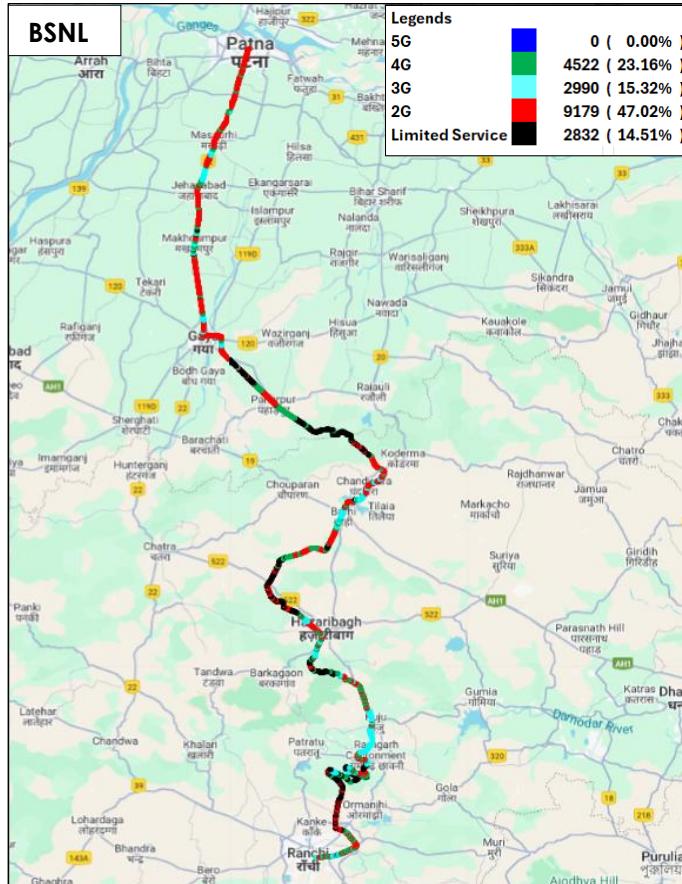
Figure-52: Serving technology plots in auto-selection mode (5G/4G/3G/2G) - BSNL (4G being rolled out)
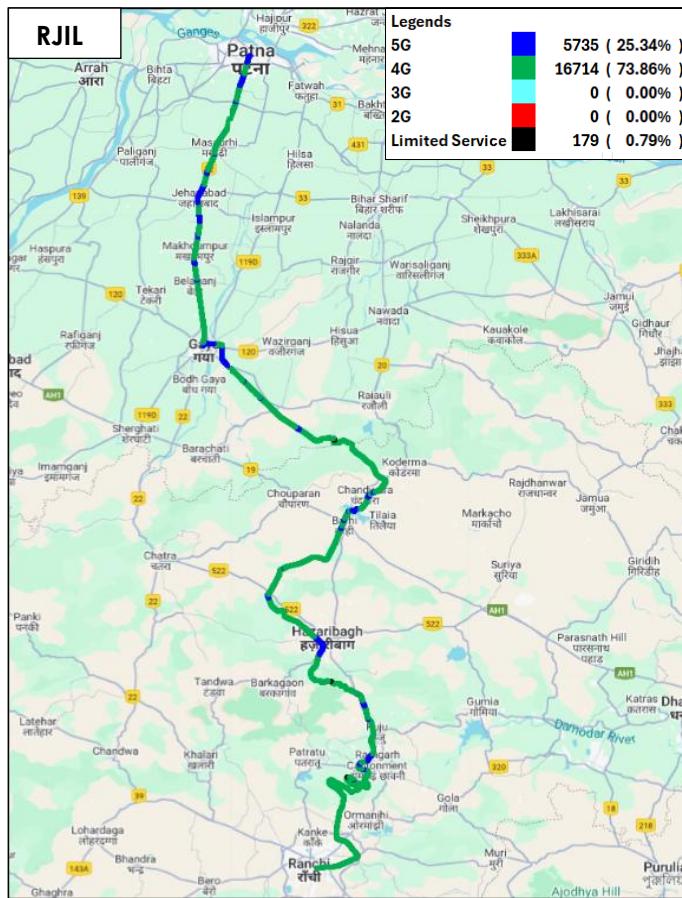
Figure-53: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-RJIL
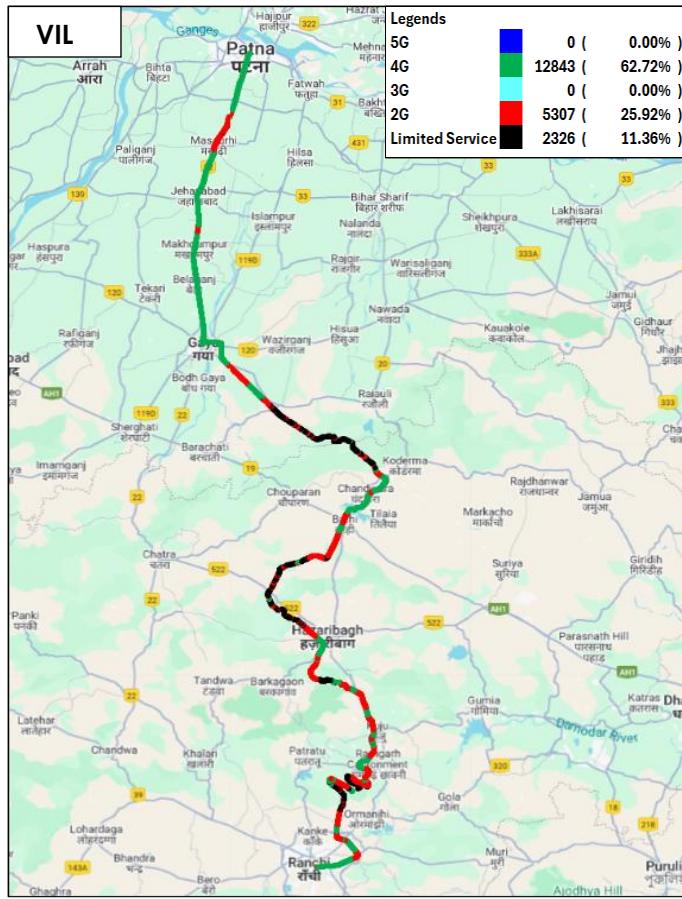
Figure-54: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-VIL

(c) Network Signal Strength Distribution: The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G). (Refer figure-72, 73, 74 & 75 for map view)
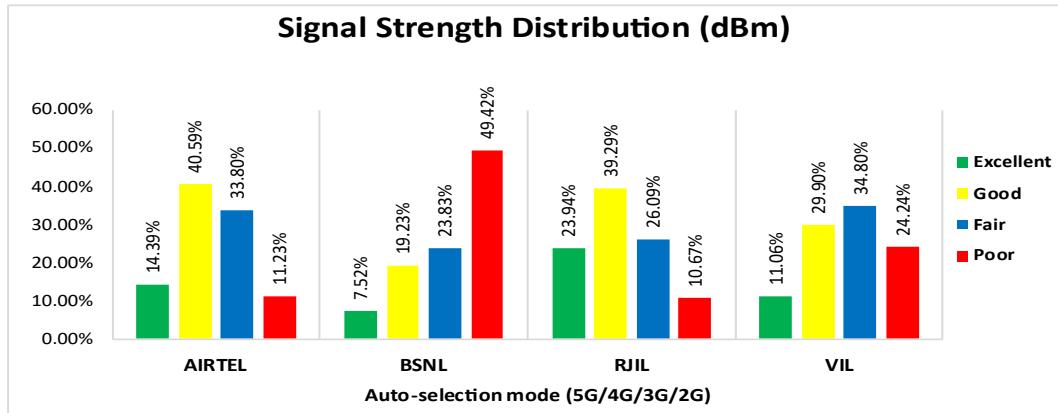
Figure-55: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:
- Airtel has 14% of samples falling in the excellent signal strength category.
- BSNL has 8% of samples falling in the excellent signal strength category.
- RJIL has 24% of samples falling in the excellent signal strength category.
- VIL has 11% of samples falling in the excellent signal strength category.

4.6.4 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	59.14	2.95	96.52	25.28
	80th Percentile	113.67	4.40	165.21	36.50
	20th Percentile	7.75	0.77	6.10	12.23
Upload Throughput (Mbits/s)	Average	17.65	3.24	15.40	11.12
	80th Percentile	24.21	4.64	29.81	16.75
	20th Percentile	2.42	1.23	1.62	3.44
Latency (ms)	50th Percentile	60.40	64.60	33.96	62.60

Table-92: Summary of Data performance in network auto-selection mode.
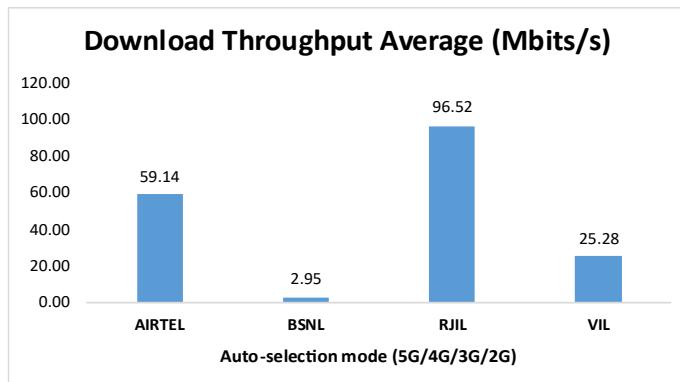
Figure-56: Download throughput.

Upload Throughput Average (Mbits/s)

	AIRTEL	BSNL	RJIL	VIL
	17.65	3.24	15.40	11.12

Auto-selection mode (5G/4G/3G/2G)
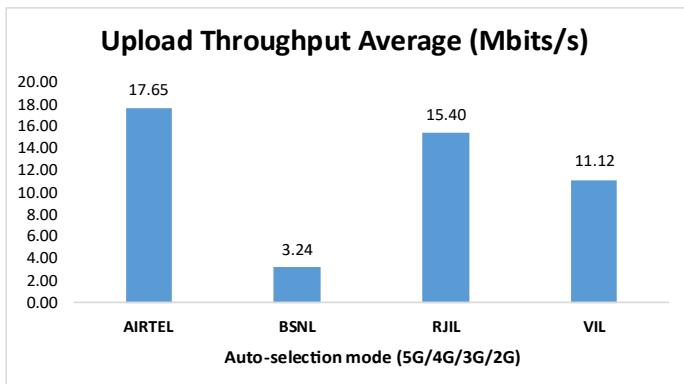
Figure-57: Upload throughput.

5. Voice & Data Key findings

5.1 Overall Voice

1. **Call Setup Success Rate:**
   a) Airtel, BSNL and VIL have 99.51%, 74.56% and 92.66% call setup success rate respectively in 3G/2G network mode. (refer table-3)

   b) Airtel, BSNL, RJIL and VIL have 96.93%, 57.80%, 99.21% and 82.99% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

   c) Airtel, BSNL & 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 BSNL whereas call blocking was observed when calling RJIL. (refer table-9)

2. **Call Setup Time**:
   a) Airtel, BSNL and VIL call setup time is 5.79, 3.02 & 3.36 seconds respectively in 3G/2G network mode. (refer table-3)

   b) Airtel, BSNL, RJIL & VIL call setup time is 1.74, 3.29, 0.76 & 1.73 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, RJIL & VIL have 1.98%, 1.44% & 7.89% silence call rate respectively. Further Airtel, RJIL & VIL downlink RTP packet loss is 0.69%, 1.24%, and 2.86% respectively. In uplink Airtel, RJIL & VIL RTP packet loss is 0.66%, 1.13% & 3.23% respectively. (refer table-6)

4. **Drop Call Rate**:
   a) Airtel, BSNL and VIL drop call rate 0.00%, 7.14% and 41.48% respectively in 3G/2G network mode. (refer table-3)

   b) Airtel, BSNL, RJIL and VIL drop call rate 0.27%, 6.79%, 0.79% and 8.73% 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 105.58 Mbps, 4.04 Mbps, 199.26 Mbps and 32.09 Mbps respectively. (refer table-11)

   b) Airtel, BSNL, RJIL and VIL average upload speeds are 24.47 Mbps, 2.93 Mbps, 23.54 Mbps and 12.14 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 104.43 Mbps, 5.14 Mbps, 192.39 Mbps and 36.45 Mbps respectively. (refer table-39)

   b) Airtel, BSNL, RJIL and VIL average upload speeds are 26.70 Mbps, 4.24 Mbps, 23.51 Mbps and 13.86 Mbps respectively. (refer table-39)

3. **Data session setup success rate (static i.e. while stationary):**
   a) Airtel, BSNL, RJIL and VIL have 100.00%, 78.89%, 100.00% and 80.00% download session setup success rate respectively. (refer table-39)

   b) Airtel, BSNL, RJIL and VIL have 100.00%, 81.11%, 98.89% and 78.89% upload session setup success rate. (refer table-39)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 99.51% call setup success rate and 0.00% drop call rate have been observed in 3G/2G network mode for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-3)

- 96.63% call setup success rate and 0.27% 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% for call setup success rate. (refer table-5)

- 99.64% call setup success rate and 0.00% drop call rate have been observed in 3G/2G network mode for city drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-13)

- 99.65% call setup success rate and 0.00% 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)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-77 & 79)

- 99.27% call setup success rate and 0.00% drop call rate have been observed in 3G/2G network mode for Highway drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-83)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Highway drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-85)

- 81.48% call setup success rate and 1.82% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Railway drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-90)

Data

- Airtel has 105.58 Mbps average download speed & 24.47 Mbps average upload speed for LSA. (refer table-11)

- Airtel has 123.84 Mbps average download speed & 23.16 Mbps average upload speed across measured routes for city drive. (refer table-19)

- Birla Institute of Technology Mesra-Jharkhand, Hazaribagh Wildlife Sanctuary Hazaribagh-Jharkhand, Hesagarha Panchayat Bhawan Kasikhap-Jharkhand, Maa Vindhyavashini College of Education Karmatanr- Jharkhand, New Buliding Sheikh Bhikhari Medical College Hazaribagh-Jharkhand, Powergrid Co. of India Ltd. Gaya Bhanwarbar- Bihar, Radha Govind University Lalki Ghati- Jharkhand, Saheed Nirmal Mahto Chowk Kothar- Jharkhand and Vinoba Bhave University Hazaribagh- Jharkhand have less download speed (less than 100 Mbps) out of total 18 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-41, 46, 47, 49, 51, 52, 53, 54 & 57)

- Birla Institute of Technology Mesra- Jharkhand, Canary Hill Hazaribagh-Jharkhand, Civil Court Hazaribagh- Jharkhand, Hazaribagh Wildlife Sanctuary Hazaribagh- Jharkhand, Hesagarha Panchayat Bhawan Kasikhap- Jharkhand, Maa Vindhyavashini College of Education Karmatanr- Jharkhand, New Buliding Sheikh Bhikhari Medical College Hazaribagh- Jharkhand, Radha Govind University Lalki Ghati- Jharkhand and Saheed Nirmal Mahto Chowk Kothar-Jharkhand have less upload speed (less than 20 Mbps) out of total 18 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table- 41, 42, 43, 46, 47, 49, 51, 53 & 54)

- Airtel has 97.28 Mbps average download speed & 25.47 Mbps average upload speed across measured routes for Highway drive. (refer table-89)

- Airtel has 59.14 Mbps average download speed & 17.65 Mbps average upload speed across measured routes for Railway drive. (refer table-92)

2. BSNL:
Voice
- 74.56% call setup success rate and 7.14% drop call rate have been observed in 3G/2G network mode for LSA and city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3)

- 57.80% call setup success rate and 6.79% 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)

- 76.22% call setup success rate and 5.60% drop call rate have been observed in 3G/2G network mode for city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)

- 72.14% call setup success rate and 8.54% 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)

- 91.67% call setup success rate and 1.82% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-77 & 79)

- 71.51% call setup success rate and 10.16% drop call rate have been observed in 3G/2G network mode for Highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-83)

- 79.04% call setup success rate and 9.09% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-85)

- 14.72% call setup success rate and 11.32% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Railway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-90)

Data
- BSNL has 4.04 Mbps average download speed & 2.93 Mbps average upload speed for LSA. (refer table-11)

- BSNL has 4.57 Mbps average download speed & 2.25 Mbps average upload speed across measured routes for city drive. (refer table-19)

- All hotspot locations have less download speed (less than 10 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table- 40 to 57)

- Birla Institute of Technology Mesra- Jharkhand, Canary Hill Hazaribagh- Jharkhand, Hazaribagh Wildlife Sanctuary Hazaribagh-Jharkhand, Hesagarha Panchayat Bhawan Kasikhap- Jharkhand, Kendua More Chauparan Bus Stand Chouparan- Jharkhand, Maa Vindhyavashini College of Education Karmatanr- Jharkhand, Radha Govind University Lalki Ghati- Jharkhand and S.N Sinha College Jehanabad- Bihar have less upload speed (less than 2 Mbps) out of total 18 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table- 41, 42, 46, 47, 48, 49, 53 & 56)

- Both Walk test locations have less download speed (less than 10 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table- 81 & 82)

- Sadar Hospital Hazaribagh, Jharkhand Walk test location has less upload speed (less than 2 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table- 82)

- BSNL has 3.73 Mbps average download speed & 3.07 Mbps average upload speed across measured routes for Highway drive. (refer table-89)

- BSNL has 2.95 Mbps average download speed & 3.24 Mbps average upload speed across measured routes for Railway drive. (refer table-92)

3. RJIL:
Voice
- 99.21% call setup success rate and 0.79% 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)

- 99.66% call setup success rate and 0.34% 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)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for both walk test locations. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-77 & 79)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Highway drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-85)

- 95.87% call setup success rate and 4.31% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Railway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-90)

Data
- RJIL has 199.26 Mbps average download speed & 23.54 Mbps average upload speed for LSA. (refer table-11)

- RJIL has 219.79 Mbps average download speed & 25.45 Mbps average upload speed across measured routes for city drive. (refer table-19)

- Barachatti Post Office Tetariya Khurd- Bihar, Civil Court Hazaribagh- Jharkhand, Hazaribagh New Bus Stand Hazaribagh- Jharkhand, Hazaribagh Wildlife Sanctuary Hazaribagh- Jharkhand, Main Gate IIMBG Gaya- Bihar, New Buliding Sheikh Bhikhari Medical College Hazaribagh- Jharkhand, Powergrid Co. of India Ltd. Gaya Bhanwarbar- Bihar, Radha Govind University Lalki Ghati- Jharkhand and Saheed Nirmal Mahto Chowk Kothar- Jharkhand have less download speed (less than 100 Mbps) out of total 18 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table- 40, 43, 45, 46, 50, 51, 52, 53 & 54)

- Birla Institute of Technology Mesra- Jharkhand, Civil Court Hazaribagh- Jharkhand, Hazaribagh New Bus Stand Hazaribagh- Jharkhand, Hazaribagh Wildlife Sanctuary Hazaribagh- Jharkhand, Main Gate IIMBG Gaya- Bihar, New Buliding Sheikh Bhikhari Medical College Hazaribagh- Jharkhand, Powergrid Co. of India Ltd. Gaya Bhanwarbar- Bihar, Radha Govind University Lalki Ghati- Jharkhand and Vinoba Bhave University Hazaribagh- Jharkhand have less upload speed (less than 20 Mbps) out of total 18 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table-41, 43, 45, 46, 50, 51, 52, 53 & 57)

- Sadar Hospital Hazaribagh, Jharkhand Walk test location has less upload speed (less than 20 Mbps) for auto-selection mode (5G/4G/3G/2G). (refer table- 82)

- RJIL has 207.27 Mbps average download speed & 21.94 Mbps average upload speed across measured routes for Highway drive. (refer table-89)

- RJIL has 96.52 Mbps average download speed & 15.40 Mbps average upload speed across measured routes for Railway drive. (refer table-92)

4. VIL:
Voice

- 92.66% call setup success rate and 41.48% drop call rate have been observed in 3G/2G network mode for LSA. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3)

- 82.99% call setup success rate and 8.73% 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)

- 92.60% call setup success rate and 45.52% drop call rate have been observed in 3G/2G network mode for city drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-13)

- 89.31% call setup success rate and 7.75% 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)

- 93.89% call setup success rate and 2.37% 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-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Hazaribagh Town Railway Station, Jharkhand walk test location. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-77)

- 91.67% call setup success rate and 0.00% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) at Sadar Hospital Hazaribagh, Jharkhand walk test location. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-79)

- 92.78% call setup success rate and 32.22% drop call rate have been observed in 3G/2G network mode for Highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-83)

- 82.18% call setup success rate and 9.09% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Highway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-85)

- 59.43% call setup success rate and 23.08% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for Railway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-90)

Data
- VIL has 32.09 Mbps average download speed & 12.14 Mbps average upload speed for LSA. (refer table-11)

- VIL has 34.95 Mbps average download speed & 10.94 Mbps average upload speed across measured routes for city drive. (refer table-19)

- Birla Institute of Technology Mesra- Jharkhand, Hazaribagh Wildlife Sanctuary Hazaribagh- Jharkhand, Maa Vindhyavashini College of Education Karmatanr- Jharkhand, New Buliding Sheikh Bhikhari Medical College Hazaribagh- Jharkhand, Radha Govind University Lalki Ghati- Jharkhand and Saheed Nirmal Mahto Chowk Kothar- Jharkhand have less download speed (less than 10 Mbps) out of total 18 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table- 41, 46, 49, 51, 53 & 54)

- Hazaribagh Wildlife Sanctuary Hazaribagh- Jharkhand, Kendua More Chauparan Bus Stand Chouparan- Jharkhand, Maa Vindhyavashini College of Education Karmatanr- Jharkhand, New Buliding Sheikh Bhikhari Medical College Hazaribagh- Jharkhand, Radha Govind University Lalki Ghati- Jharkhand and Saheed Nirmal Mahto Chowk Kothar- Jharkhand have less upload speed (less than 2 Mbps) out of total 18 hotspot locations for auto-selection mode (5G/4G/3G/2G). (refer table- 46, 48, 49, 51, 53 & 54)

- VIL has 29.76 Mbps average download speed & 13.17 Mbps average upload speed across measured routes for Highway drive. (refer table- 89)

- VIL has 25.28 Mbps average download speed & 11.12 Mbps average upload speed across measured routes for Railway drive. (refer table- 92)

6. Annexure

6.1 Route wise coverage map

6.1.1 City
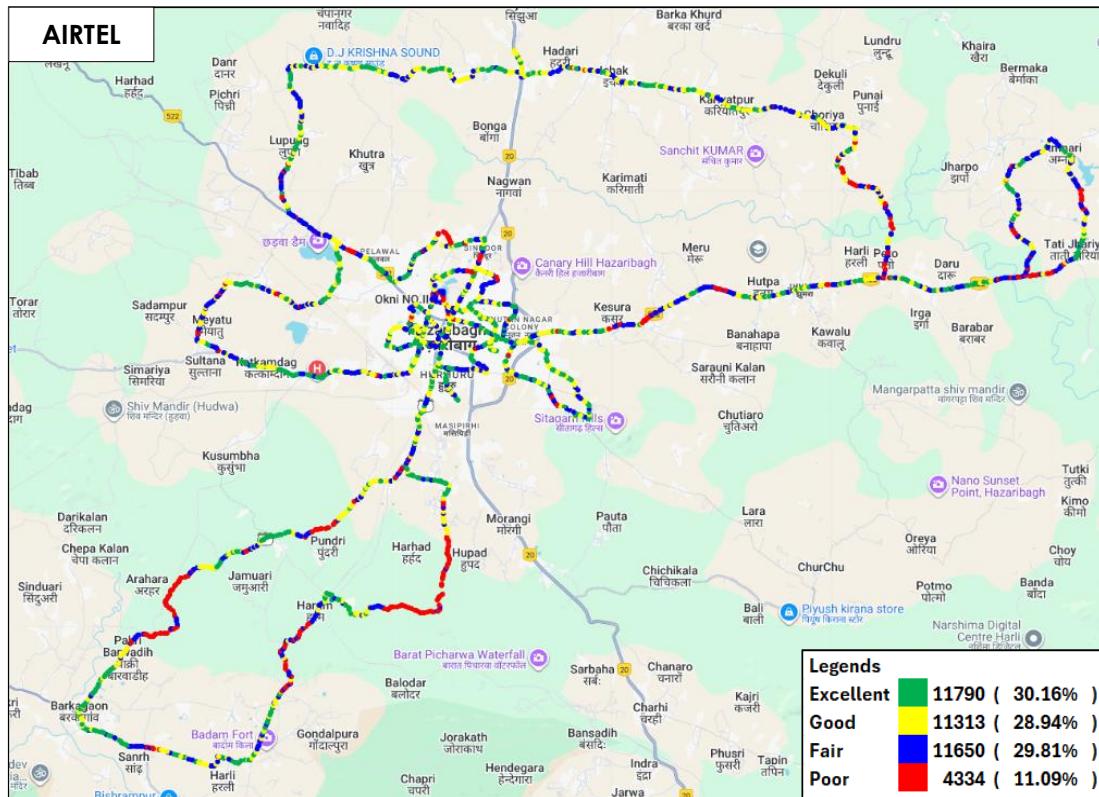
**Figure-58:** Signal strength 3G/2G network mode – AIRTEL
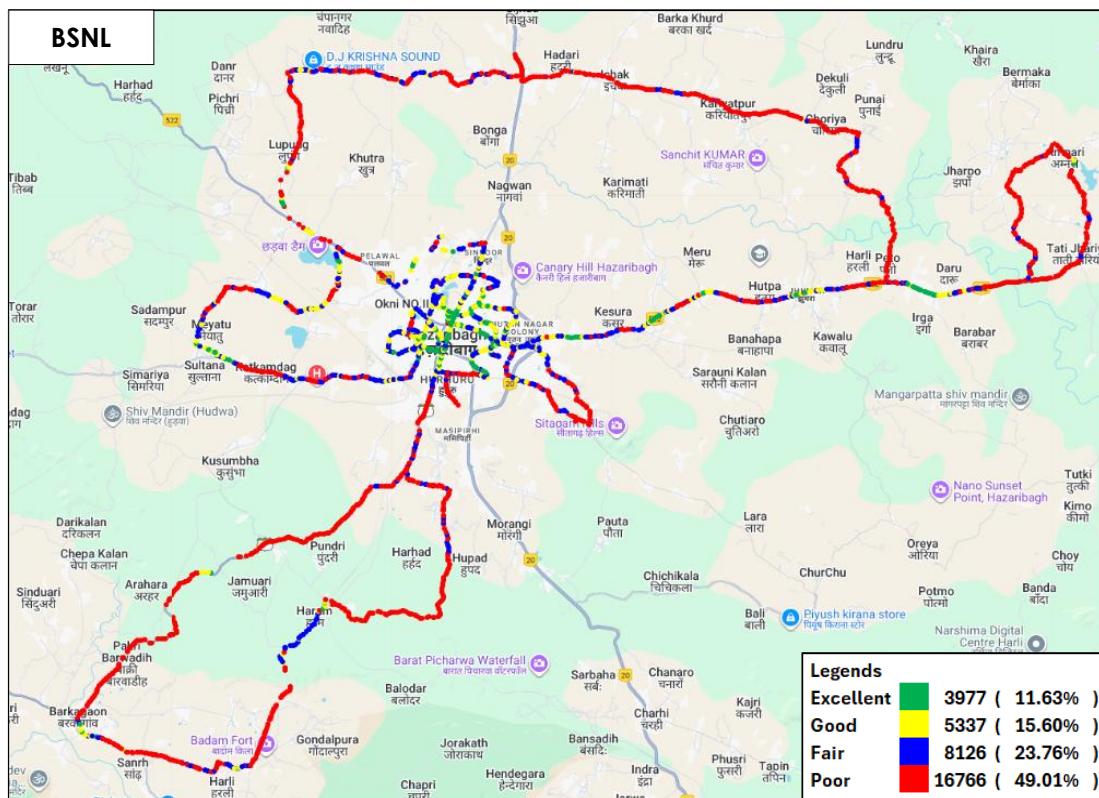
**Figure-59:** Signal strength 3G/2G network mode – BSNL
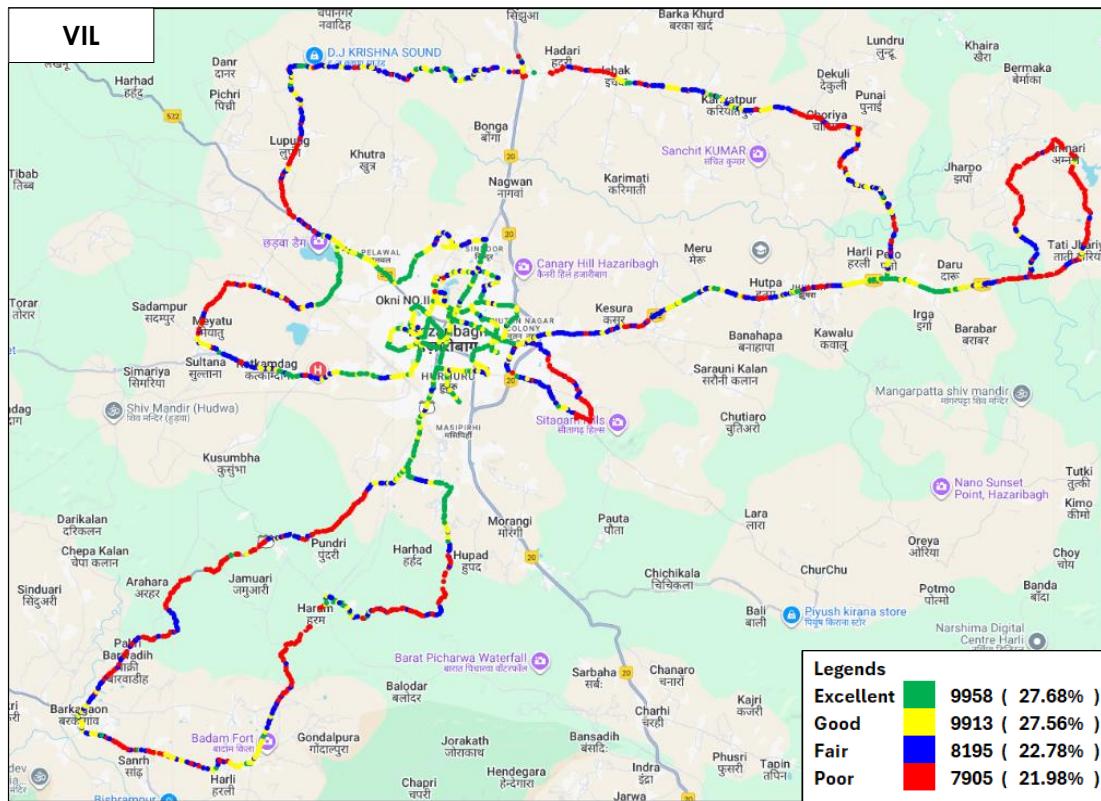
Figure-60: Signal strength 3G/2G network mode – VIL
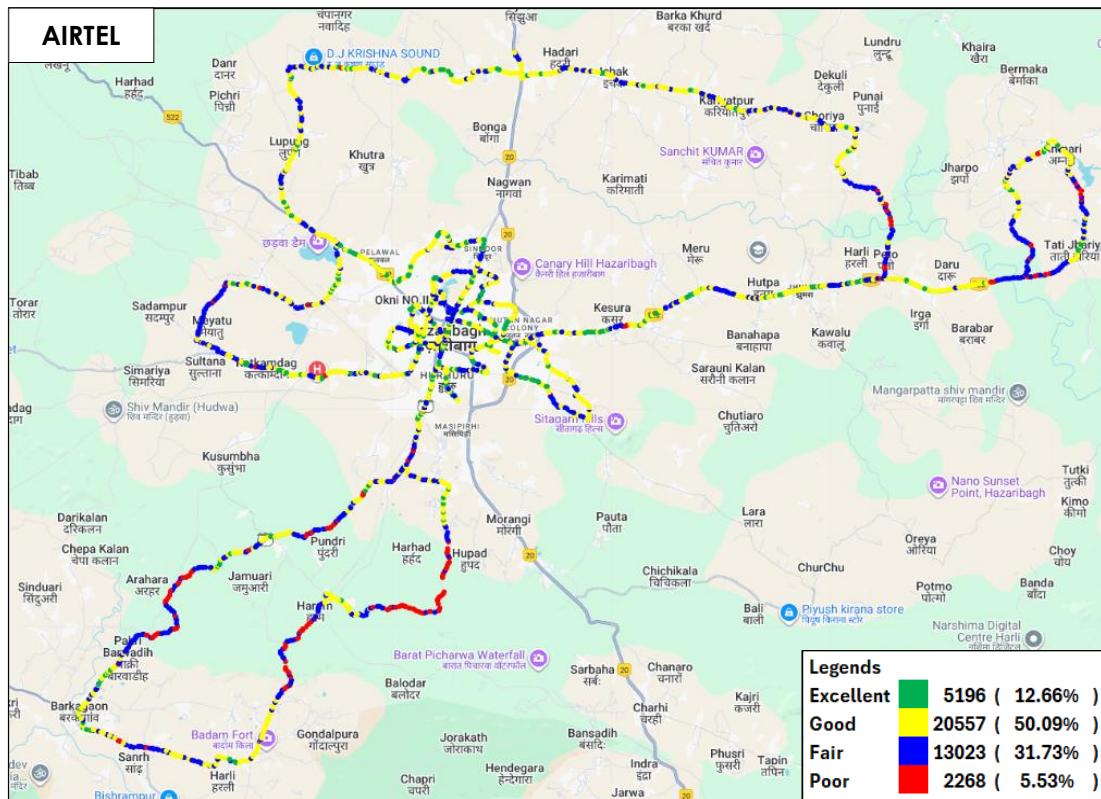
Figure-61: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL
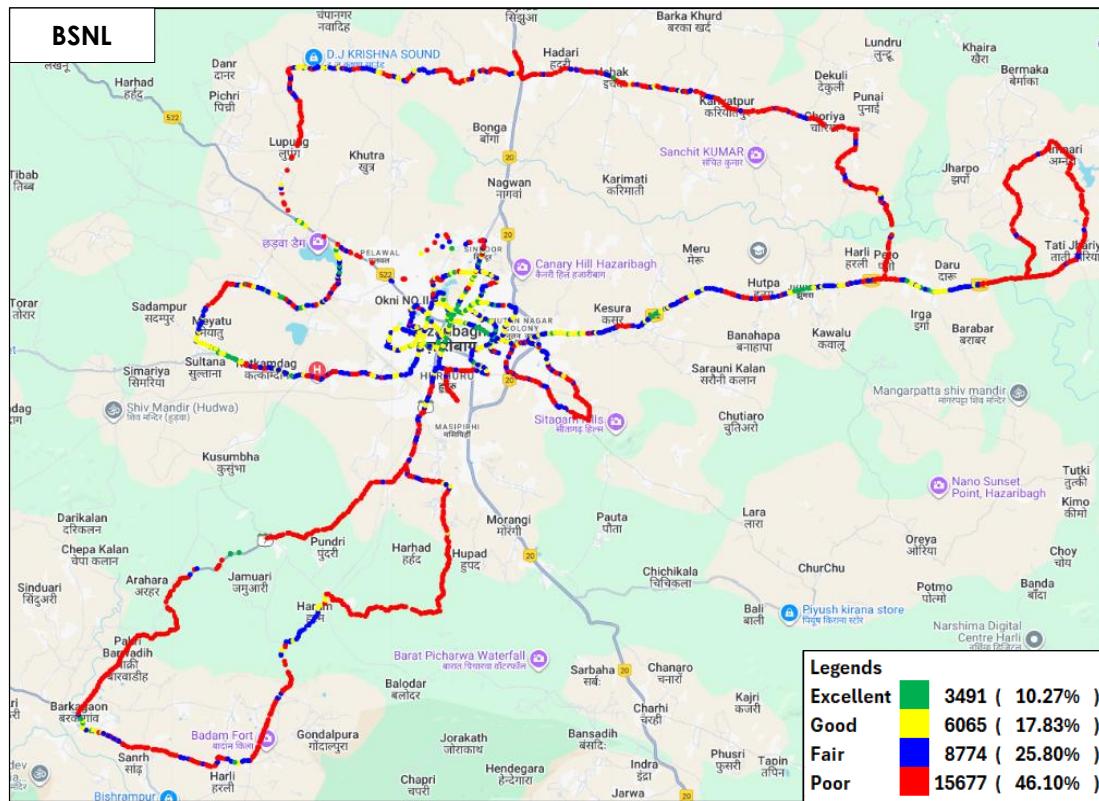
**Figure-62:** Signal strength auto-selection mode 5G/4G/3G/2G – BSNL (4G being rolled out)
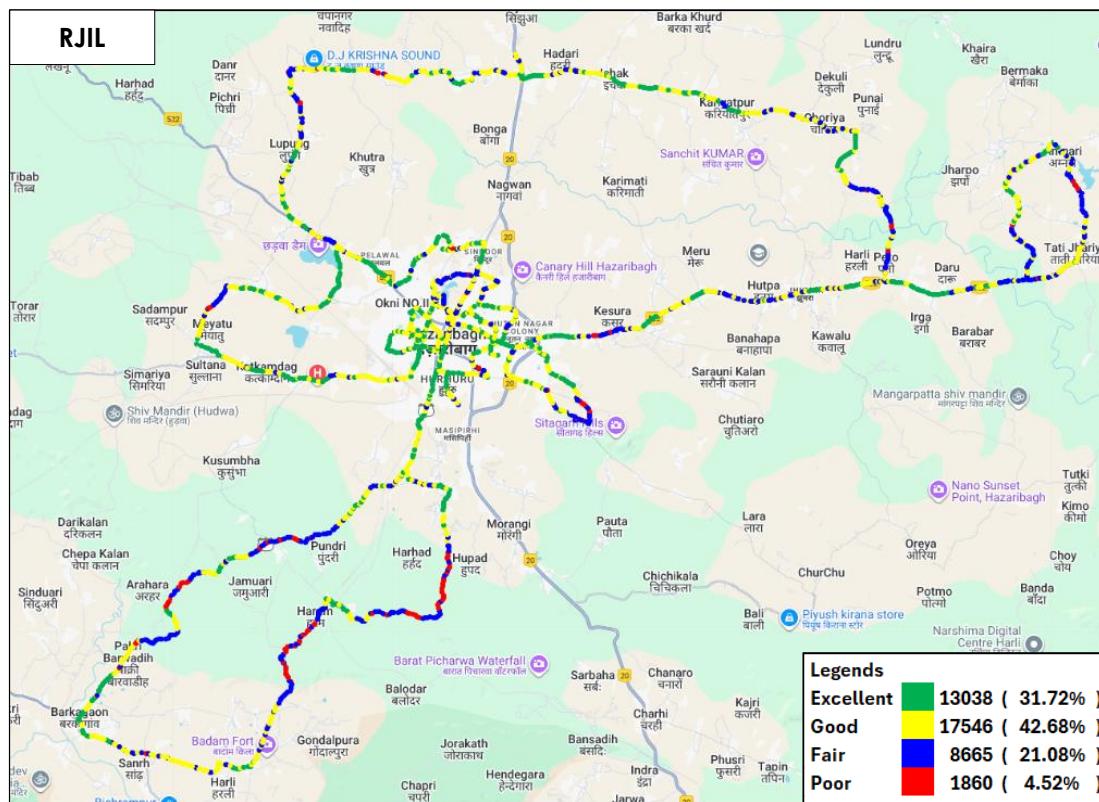
Figure-63: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL
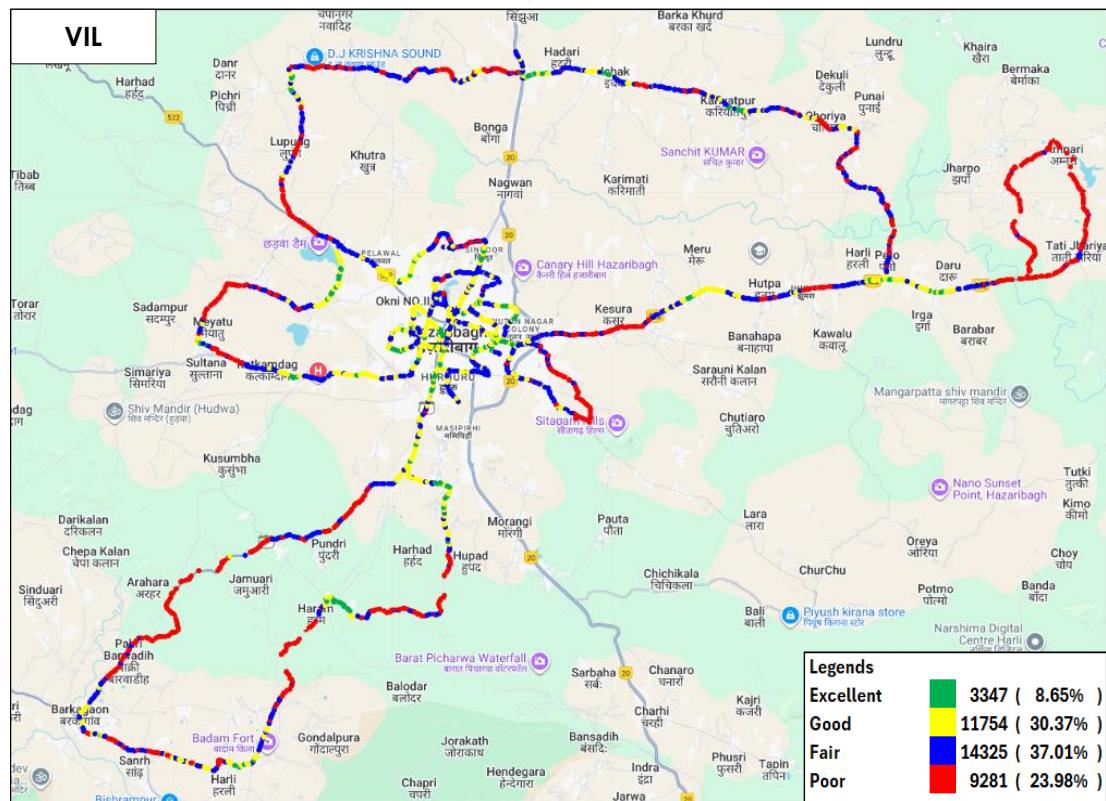
Figure-64: Signal strength auto-selection mode 5G/4G/3G/2G – VIL

6.1.2 Highway

i) Ranchi to Patna (along NH- 20, 19 and 22)
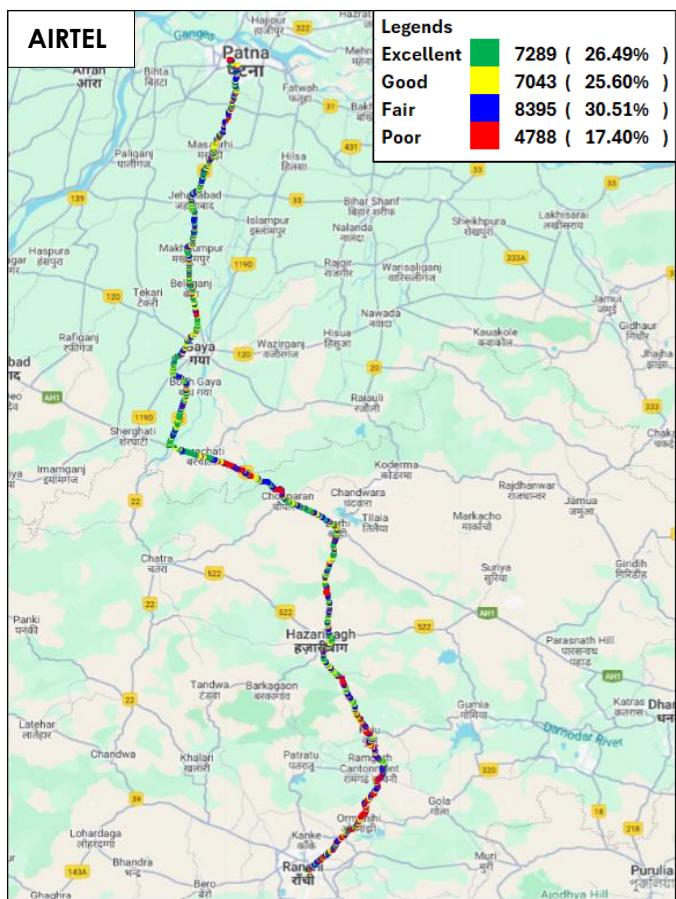
Figure-65: Signal strength 3G/2G network mode – AIRTEL

Figure-66: Signal strength 3G/2G network mode – BSNL

Figure-67: Signal strength 3G/2G network mode – VIL
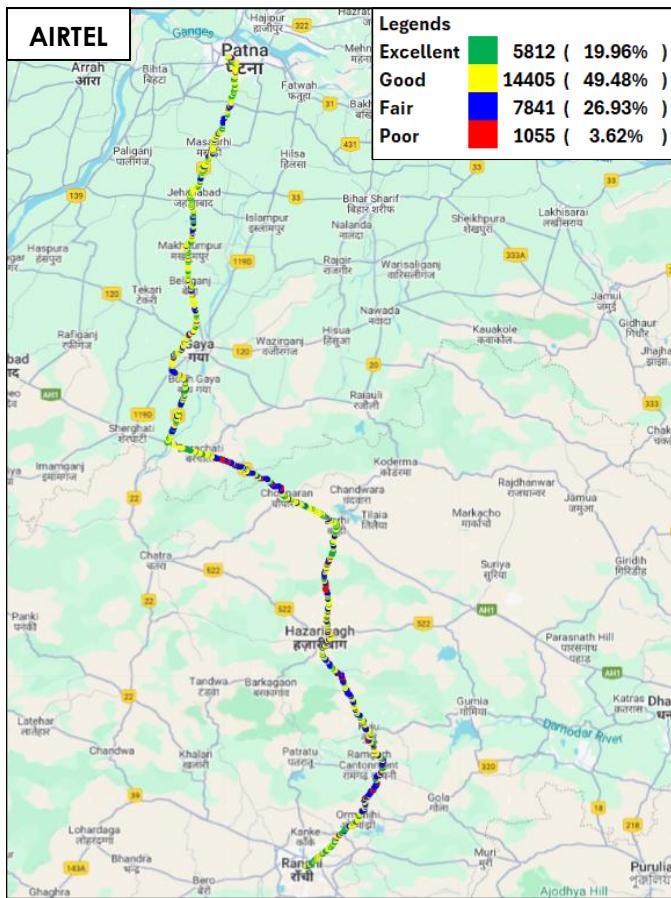
Figure-68: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL
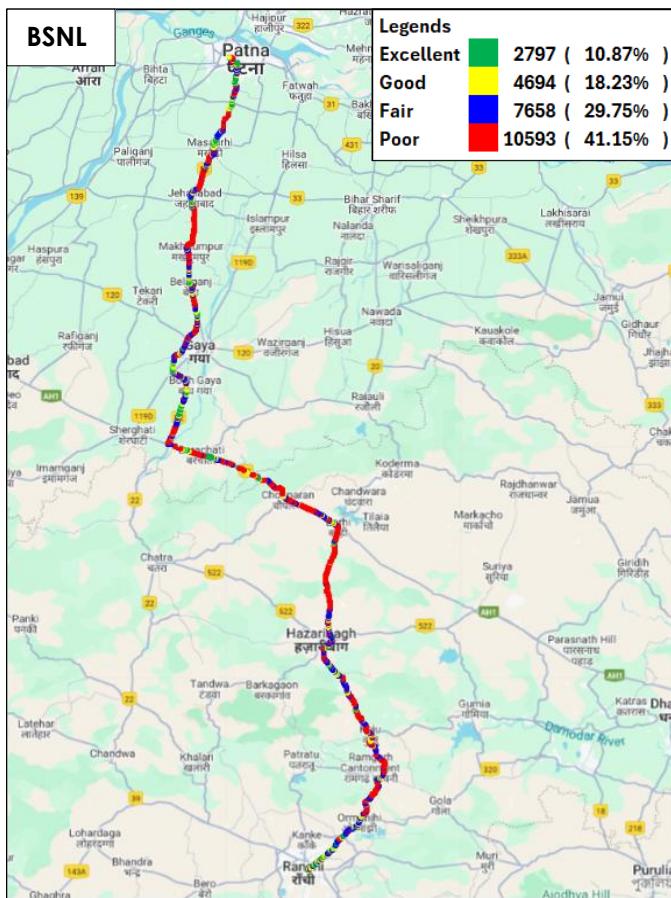
Figure-69: Signal strength auto-selection mode 5G/4G/3G/2G – BSNL (4G being rolled out)
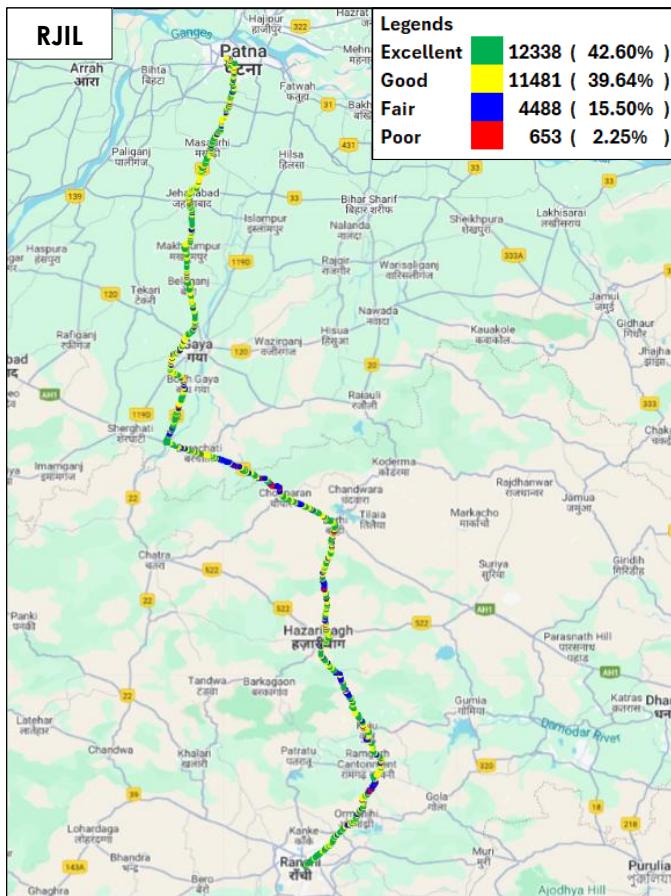
Figure-70: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL
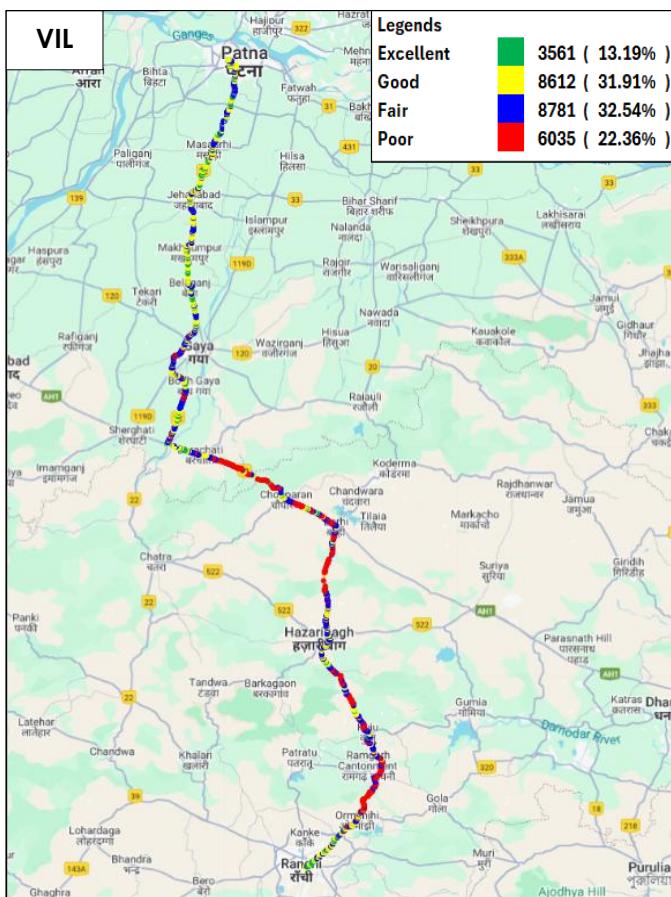
Figure-71: Signal strength auto-selection mode 5G/4G/3G/2G – VIL

6.1.3 Railway

i) Patna to Ranchi
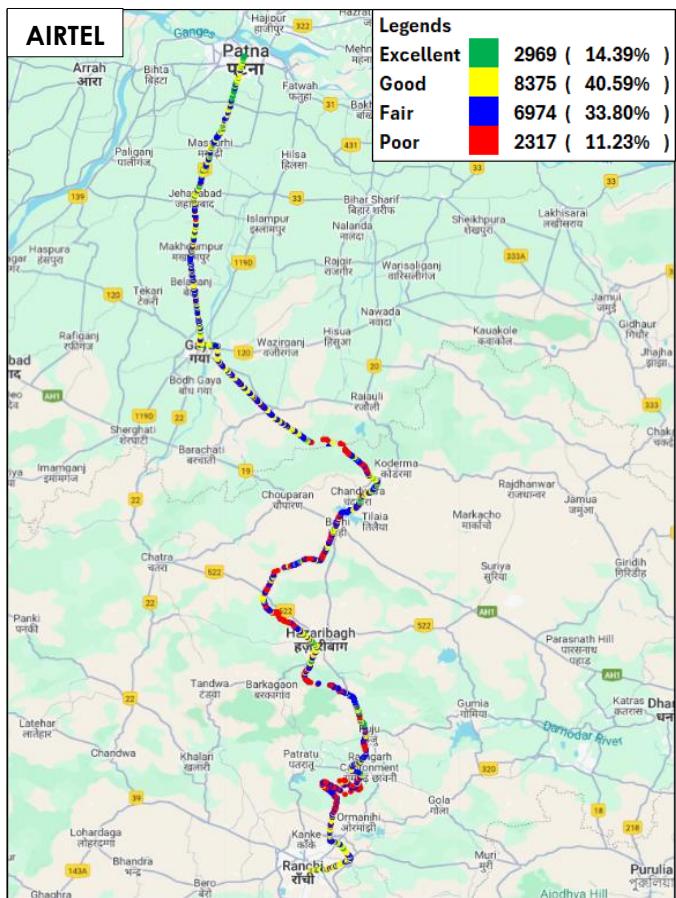
Figure-72: Signal strength auto-selection mode 5G/4G/3G/2G –AIRTEL

Figure-73: Signal strength auto-selection mode 5G/4G/3G/2G – BSNL (4G being rolled out)
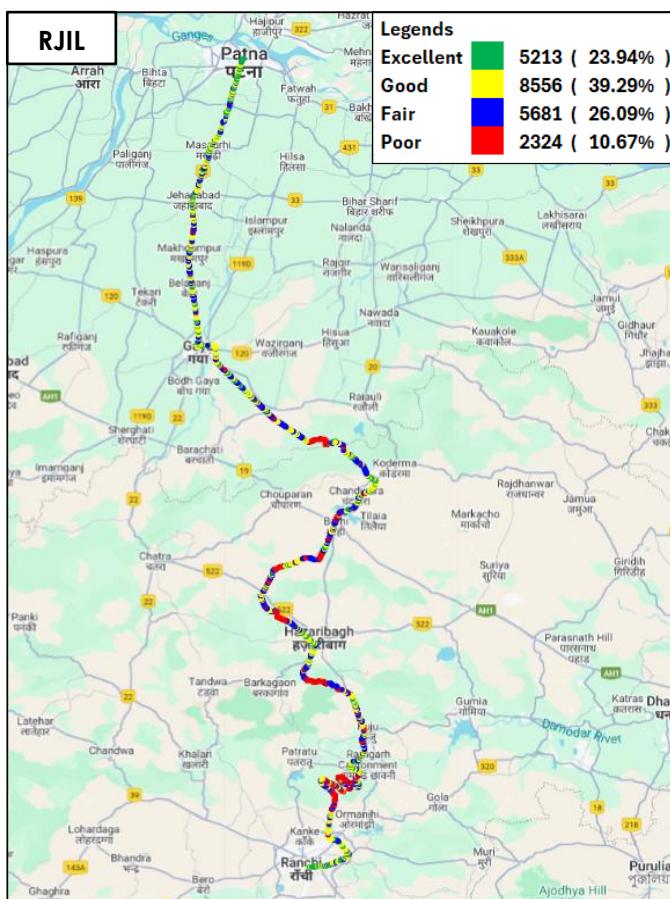
Figure-74: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL
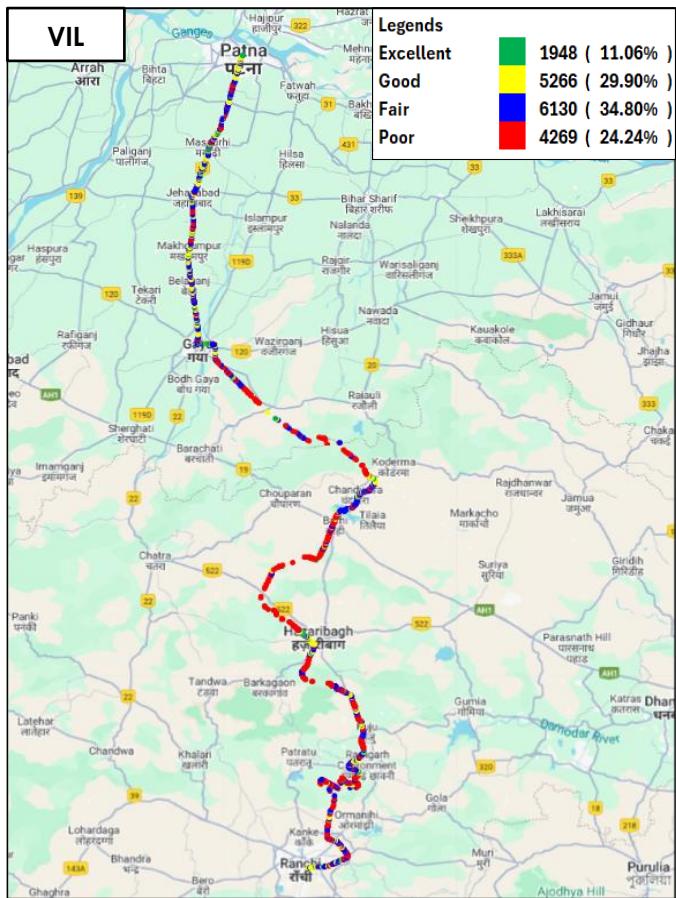
Figure-75: Signal strength auto-selection mode 5G/4G/3G/2G – VIL

7. Appendix

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

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

7.1 Appendix-I

7.1.1 Drive test setup

Voice Call		
Call details	**Technology**	**Detail**
Call Setup Timeout	• 3G/2G auto mode- switch Call • 5G/4G/3G/2G auto mode- switch Call • 5G/4G MOS Call	30 Sec
Call Duration		120/180 Sec
Wait/ Guard Time		15 Sec

Table-93: 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	5G/4G/3G/2G Auto Mode	500 MB File- 30 Sec Timeout, (Multithread 3- TCP Connection at a time)
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- 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-94: 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
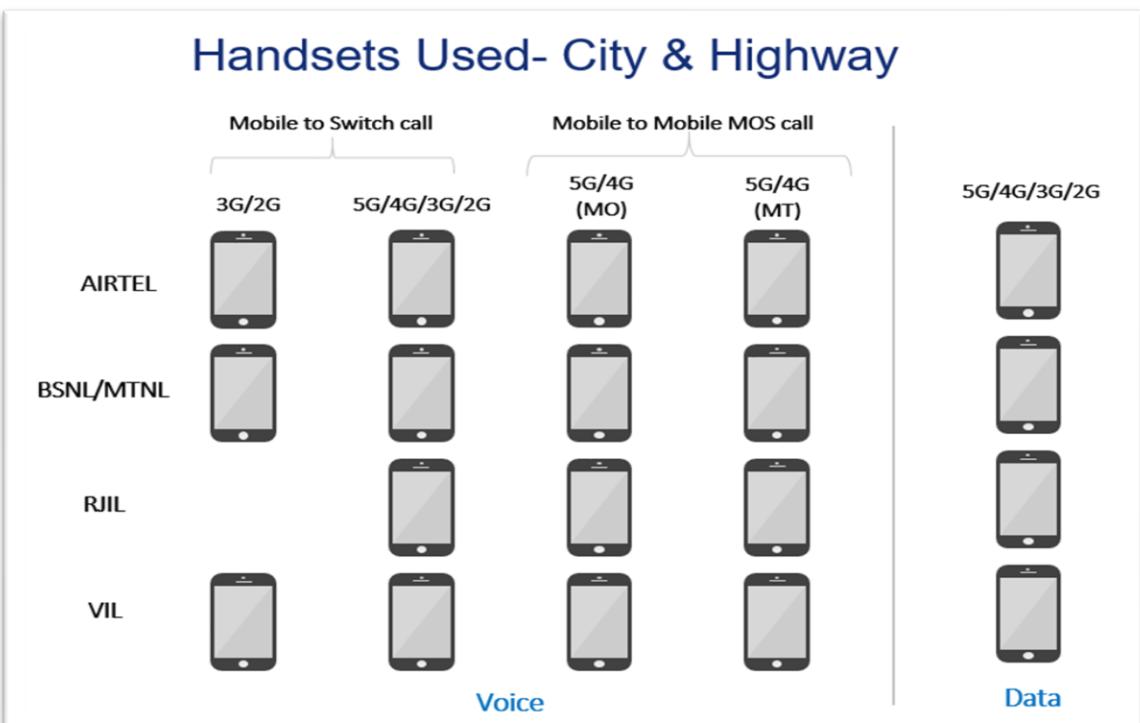
Figure-76: Number of handsets used in city & highway drive.
MO: Mobile originating
MT: Mobile terminating

Handsets Used- Railway/Metro/Walk Test/ Hotspot & Coastal Area
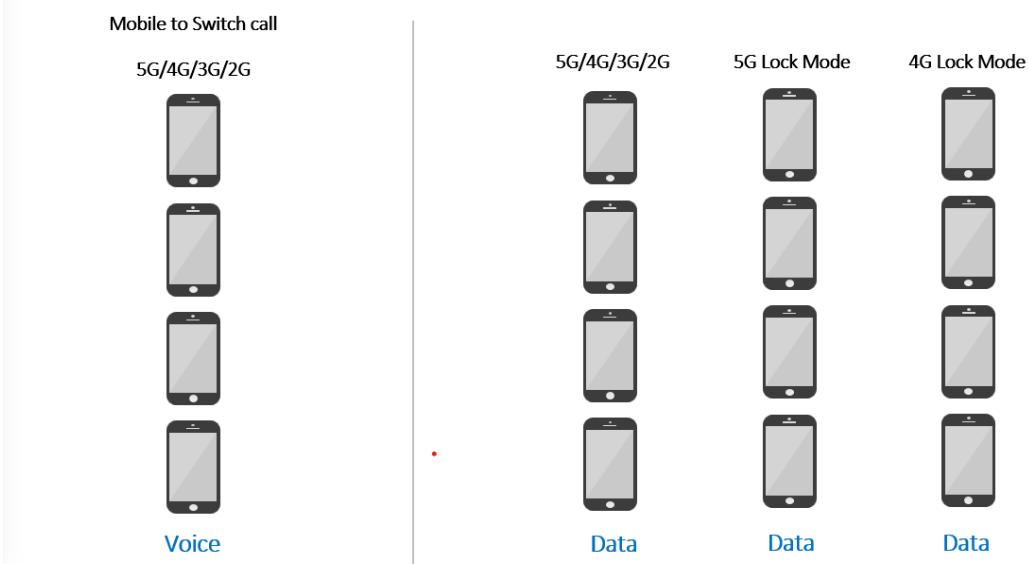
Figure-77: Number of handsets used in railway/metro/walktest/hotspot & coastal area.

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)
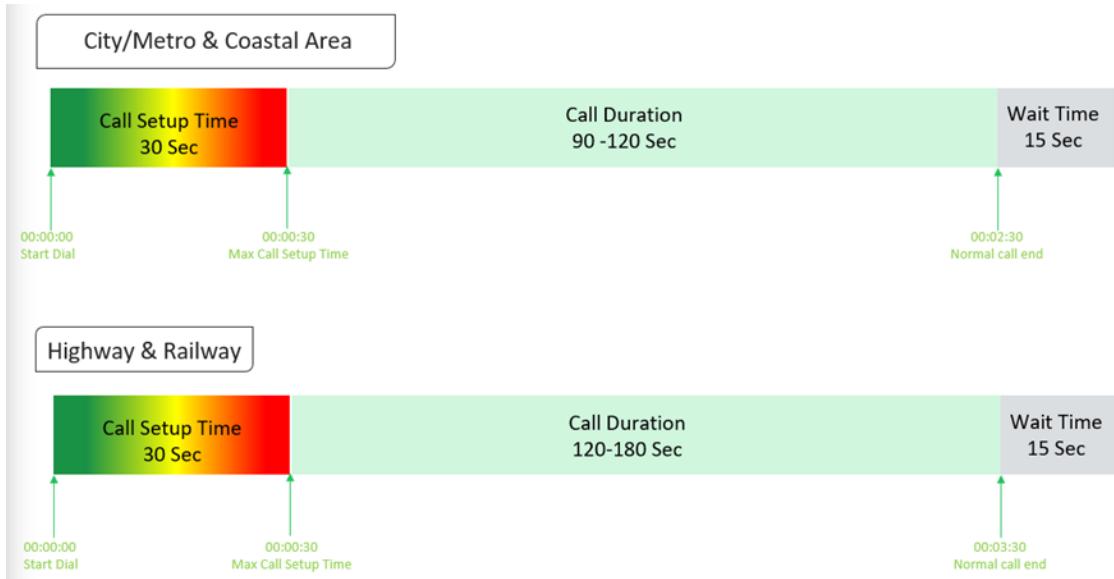
Figure-78: Voice test script for city/railway/metro/highway & coastal area.

- 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-79: 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
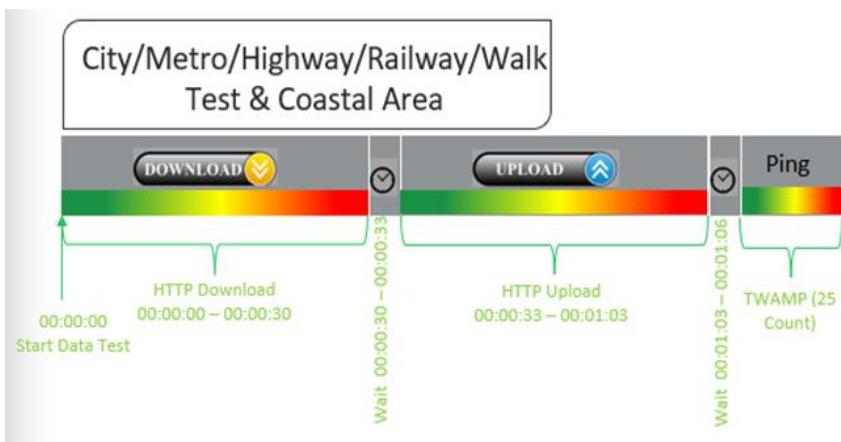
Figure-80: Data test script used in city/metro/railway/highway/walk test & coastal area.

(d) Static Data(internet) testing
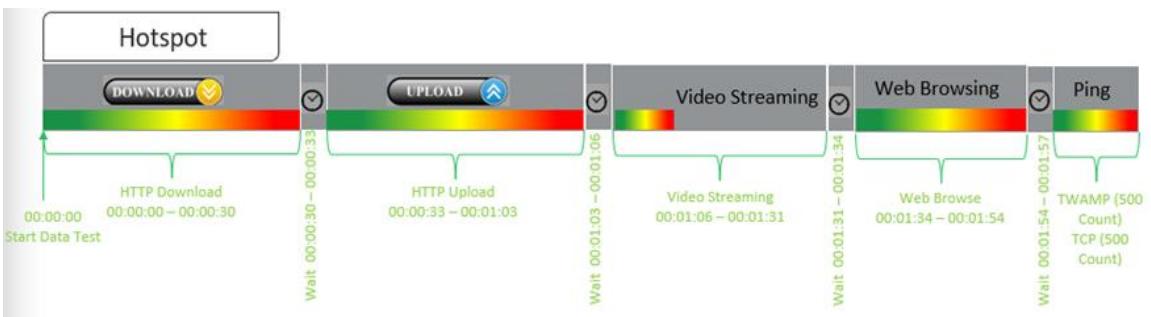
Figure-81: Data test script used at hotspot.

- 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	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 Drop Call Rate = (Total Drop Call/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 $\geq$ 4 sec continuous RTP gap is considered as a Silence Call. Silence call rate = (count of silence call / Total calls established) *100 If a call observes multiple silence count >=4 sec in a particular established call it has been taken as one silent event.

Jitter	The inter arrival jitter is the difference in the relative transit time for two packets. The relative transit time is the difference between a packet's Real-time Transport Protocol (RTP) timestamp and the receiver's clock at the time of arrival, measured in the same units. If 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**
Downlink Packet Drop Rate	Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call originating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE)
Uplink Packet Drop Rate	Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call terminating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE).
Signal Strength	Signal strength is the signal power level received by the wireless user. *(see table below)*

Parameter Name	Technology	Signal Strength (dBm)			
		Excellent	Good	Fair	Poor
Rx Level	GSM	0 to $\geq$ -65	<-65 to $\geq$ -75	<-75 to $\geq$-85	<-85 to min
RSCP	WCDMA	0 to $\geq$ -70	<-70 to $\geq$ -80	<-80 to $\geq$ -90	<-90 to min
RSRP	LTE	0 to $\geq$ -80	<-80 to $\geq$ -95	<-95 to $\geq$-110	<-110 to min
SS_RSRP	NR	0 to $\geq$ -80	<-80 to $\geq$ -95	<-95 to $\geq$-110	<-110 to min

Table-95: 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 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-96: 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.