भादूविप्रा
TRAI

TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Madhya Pradesh LSA

January 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 Madhya Pradesh License Service Area (LSA) during the month of January-2025 under the supervision of TRAI Regional Office (RO), Bhopal. Details of route / area covered during the IDT is as given below:

Sl. No	Drive test route	Type of route	Distance covered (KMs)	From date	To date
1	Jabalpur	City	223.0	29-Jan-25	30-Jan-25
2	Jabalpur	Inter Operator Calling	20.6	31-Jan-25	31-Jan-25
3	Jabalpur	Hotspot	10	31-Jan-25	01-Feb-25
4	Jabalpur	Walk Test	2.5	31-Jan-25	31-Jan-25
5	Raipur-Bilaspur-Raigarh	Highway	243.7	27-Jan-25	27-Jan-25

Table-1: Drive test summary

2.2 Drive test routes

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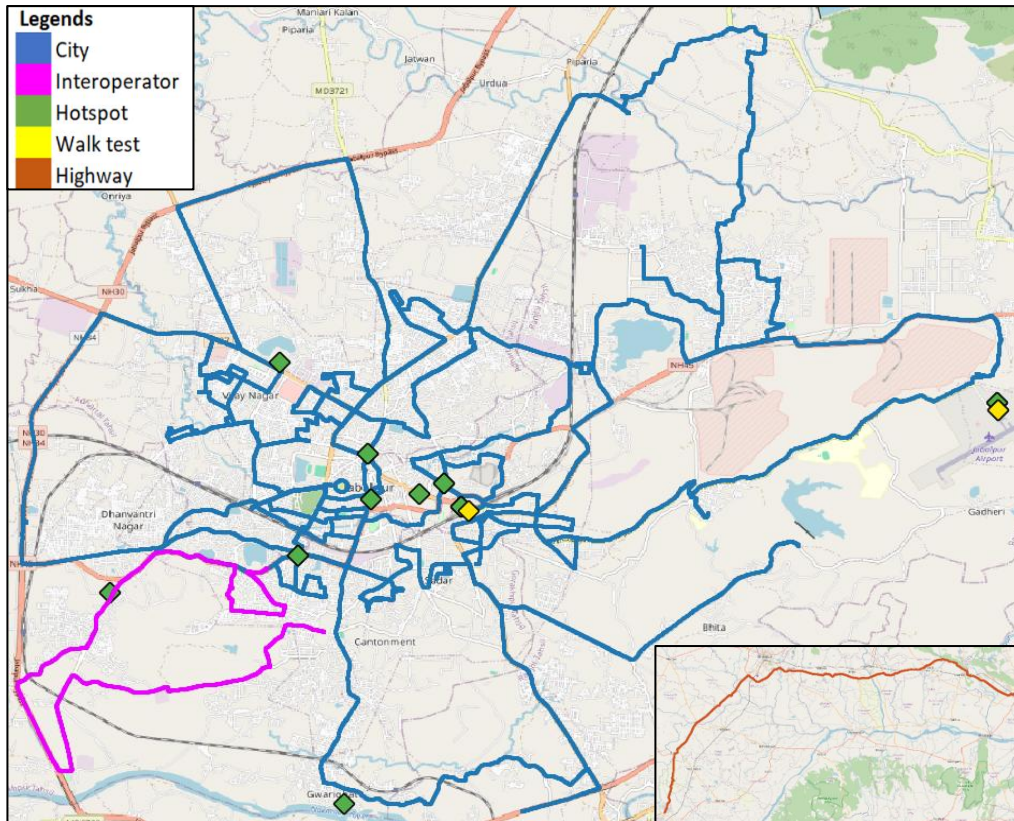
Figure-1: Drive test routes

2.3 Summary of areas covered

a) **City**- Nearby Vijay Nagar, Napier Town, Captainganj, Panagar, Dwarka nagar ward, Ghamapur, Jhanda Chowk, Ranjhi, Ghana, Polipathar, Rampur and Adarsh nagar etc.

b) **Hotspot**-
1. Civic Centre
2. Collectrate/Ghantaghar
3. Dashmesh Dwar
4. Gwarighat
5. High Court
6. ISBT, Jabalpur
7. Jabalpur Dumma Airport
8. Jabalpur Railway Station
9. Kamaniya Gate
10. Netaji Subhash Chandra Bose Medical College, Jabalpur

c) **Walk Test**
1. Jabalpur Airport
2. Jabalpur Railway Station

d) Highway

1. Raipur to Bilaspur to Raigarh passing through Simga, Nanghat, Saragaon and Masaniya.

2.4 Telecom service providers detected frequency bands

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

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

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

2.5 Performance against key QoS parameters

CSSR: Call setup success rate, **CST:** Call setup time, **DCR:** Drop call rate
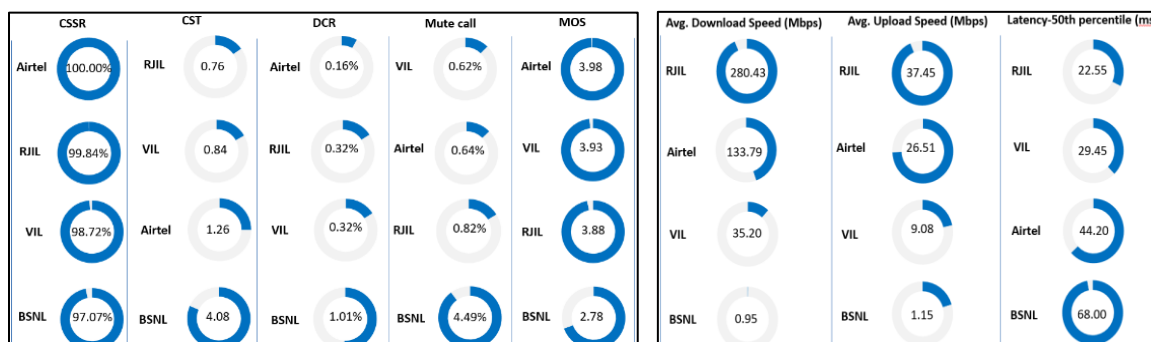
Summary-Voice services

Call Setup Success Rate: Airtel, RJIL, VIL & BSNL have 100.00%, 99.84%, 98.72% and 97.07% call setup success rate respectively in Auto-selection mode (5G/4G/3G/2G).

Call Setup Time: BSNL has taken comparatively longer time (4.08 seconds) to establish the voice call, whereas RJIL, VIL and Airtel call setup time is 0.76, 0.84 & 1.26 second respectively in Auto-selection mode (5G/4G/3G/2G).

Call Drop Rate: Overall BSNL's call drop rate (1.01%) is higher, while Airtel, RJIL and VIL have 0.16%, 0.32% and 0.32% respectively in Auto-selection mode (5G/4G/3G/2G).

Call Silence/Mute Rate: In packet switched network (4G/5G), VIL, Airtel, RJIL and BSNL have 0.62%, 0.64%, 0.82% & 4.49% silence call rate respectively.

Mean Opinion Score (MOS): Quality of speech of Airtel (3.98), VIL (3.93), RJIL (3.88) and BSNL (2.78) is having a MOS score <4.

Summary-Data services

Data Download performance (Dynamic): BSNL (0.95 Mbps) and VIL (35.20 Mbps) being on 4G as top technology, have comparatively lower data speeds respectively. While Airtel and RJIL have average download speed of 133.79 Mbps and 280.43 Mbps respectively.

Data Upload performance (Dynamic): BSNL (1.15 Mbps) and VIL (9.08 Mbps) being on 4G as top technology, have comparatively lower data speeds respectively. While Airtel and RJIL have average upload speed of 26.51 Mbps and 37.45 Mbps respectively.

QoS Performance Analysis-Madhya Pradesh LSA

3. QoS performance analysis-LSA level

3.1 Overview

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

3.2 Voice performance

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

Parameters	Service Provider		
	3G/2G network mode only		
	AIRTEL	BSNL	VIL
Call Attempts	460	485	467
Call Setup Success Rate %	98.91	93.81	99.36
Drop Call Rate %	0.00	2.42	0.22
Call Setup Time-Average (Second)	4.77	3.62	2.98
Handover Success Rate %	96.83	99.94	97.68

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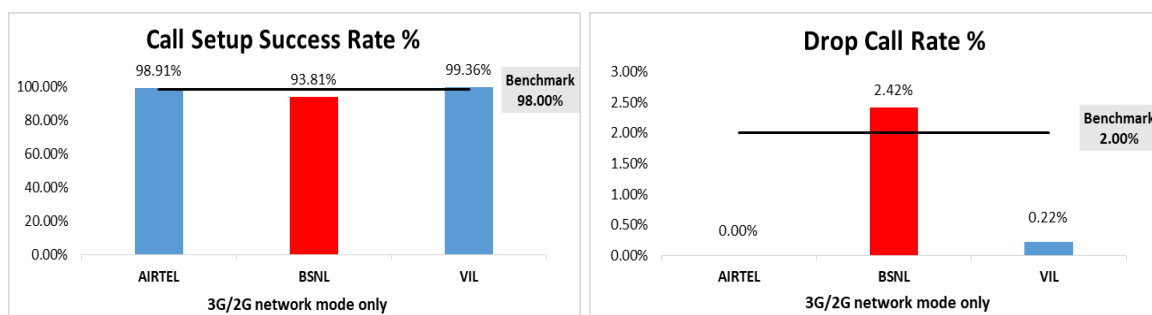
Figure-2: Call setup success rate and drop call rate performance.

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	158	NA
2G	649	98	516

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	615	615	626	625
Call Setup Success Rate %	100.00	97.07	99.84	98.72
Drop Call Rate %	0.16	1.01	0.32	0.32
Call Setup Time-Average (Second)	1.26	4.08	0.76	0.84
Handover Success Rate %	99.94	99.25	99.89	99.90

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

> **Note-**
> - BSNL handset is not latched on VoLTE when making a call on the switch number, causing the call fallback to 3G/2G (CSFB) or call initiation in 3G/2G.
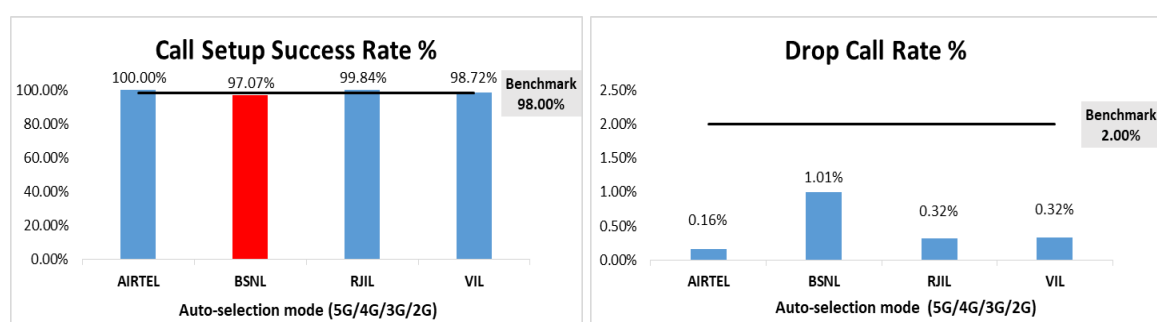

Figure-3: Performance for call setup success rate and drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	471	445	486	485
Number of silence call for >4 Sec	3	20	4	3
Silence Call Rate %	0.64	4.49	0.82	0.62
Number of silence instances for >4 Sec	3	22	5	5
Number of silence instances for >3 Sec	8	31	9	7
Number of silence instances for >2 sec	25	43	27	23
RTP Jitter (4G & 5G) in ms	4.58	3.30	7.88	8.05
Packet loss Rate Downlink %	0.70	4.47	0.31	0.99
Packet loss Rate Uplink %	0.67	NA	0.53	0.75

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

> **Note-**
> - NA- Uplink packet loss rate is not captured in BSNL, as call terminating handset is not latched on VoLTE during entire drive test, resulting in CSFB/3G/2G calls.

Number of unique cell Id's covered in Voice test- Technology wise				
Technology	**Service Provider**			
	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	0	NA	598	NA
4G	1298	275	1637	995
3G	NA	87	NA	NA
2G	1	353	NA	55

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 score values means: 5-Excellent, 4-Good, 3-Fair, 2-Poor, 1-Bad.

Speech Quality (MOS) distribution	**Service Provider**			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Total Number of MOS Samples for calls in table-6	3476	2901	3338	3344
Speech Quality (Average MOS Score)	3.98	2.78	3.88	3.93
Number of samples with MOS >=4 to <5 (Excellent)	2938	0	2305	2490
Number of samples with MOS >=3 to <4 (Good)	402	1507	809	527
Number of samples with MOS >=2 to <3 (Fair)	57	1030	160	137
Number of samples with MOS >=1 to <2 (Poor)	79	364	64	190
%age of samples with MOS >=4 to <5 (Excellent)	84.52%	0.00%	69.05%	74.46%
%age of samples with MOS >=3 to <4 (Good)	11.57%	51.95%	24.24%	15.76%
%age of samples with MOS >=2 to <3 (Fair)	1.64%	35.50%	4.79%	4.10%
%age of samples with MOS >=1 to <2 (Poor)	2.27%	12.55%	1.92%	5.68%

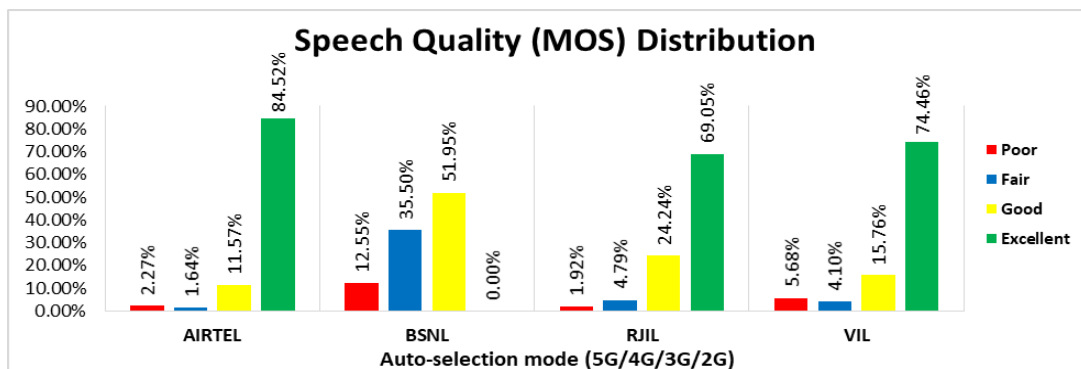**Table-8:** Summary of speech quality (MOS) samples.

Figure- 4: Distribution of samples in MOS score range.

(d) Inter-service provider voice call performance: To check the performance of inter-service provider call setup success rate, total 43 to 53 inter operator calls were attempted. The call setup success rate and call setup time observation are as below.

Call setup success rate %				
From Service Provider	**To Service Provider**			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
AIRTEL	NA	100.00	100.00	100.00
BSNL	90.91	NA	84.09	97.78
RJIL	100.00	83.72	NA	100.00
VIL	100.00	97.83	100.00	NA

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

> **Note**-
> - NA-Only Inter-operator calls were measured during test.

Call setup time average (seconds)				
From Service Provider	**To Service Provider**			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
AIRTEL	NA	3.03	2.16	2.91
BSNL	4.58	NA	7.80	5.47
RJIL	2.17	3.56	NA	2.00
VIL	2.14	1.62	2.78	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**	133.79	0.95	280.43	35.20
	80th Percentile	239.32	1.43	505.46	54.62
	20th Percentile	14.92	0.38	32.19	13.39
Upload Throughput (Mbits/s)	**Average**	26.51	1.15	37.45	9.08
	80th Percentile	53.60	2.28	65.98	12.63
	20th Percentile	3.62	0.00	5.58	2.48
Latency (ms)	**50th Percentile**	44.20	68.00	22.55	29.45

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

> **Note-**
> - Approximately 28% of upload sessions in RJIL are experiencing disconnections within 1 second of server connection, resulting in failed uploads. Results of those sessions are not accounted in average, 80th percentile and 20th percentile.
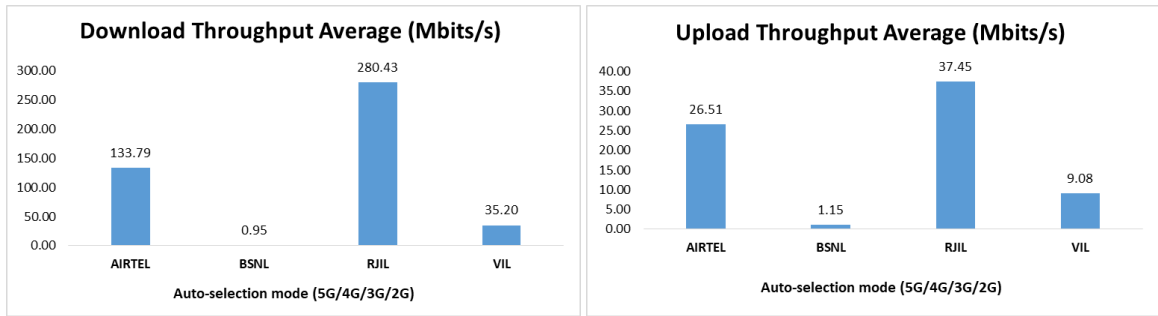
Figure- 5: Download and Upload throughput

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	754	NA
4G	1155	425	444	1065
3G	NA	61	NA	NA
2G	1	33	NA	27

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

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

Detailed QoS Performance Analysis

4. Detailed QoS performance analysis

4.1 Overview

This section covers analysis on performance of various categories of drives like City, Hotspots, Walk Tests & Highway for all telecom service providers, the results of drive tests conducted is shown individually for respective areas/locations.

4.2 City

Drive test has been conducted from 29th January 2025 to 30th January 2025 in Jabalpur. (Refer Table-1)
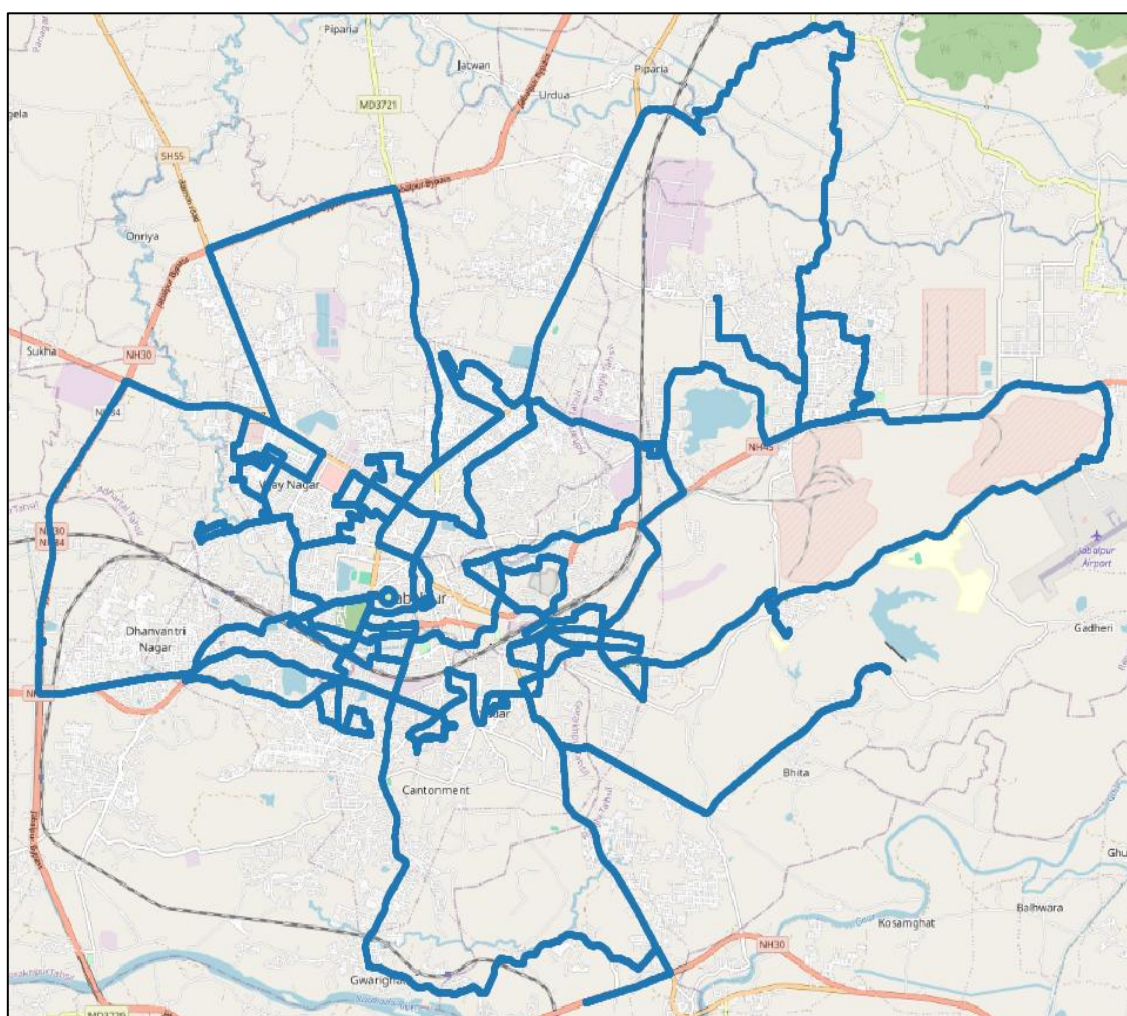
4.2.1 Drive test route

Figure- 6: Drive test routes

4.2.2 Areas covered

Nearby - Vijay Nagar, Napier Town, Captainganj, Panagar, Dwarka nagar ward, Ghamapur, Jhanda Chowk, Ranjhi, Ghana, Polipathar, Rampur and Adarsh nagar etc.

4.2.3 Voice performance

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

Parameters	Service Provider 3G/2G network mode only		
	AIRTEL	BSNL	VIL
Call Attempts	368	370	369
Call Setup Success Rate %	98.91	99.73	99.19
Drop Call Rate %	0.00	1.36	0.27
Call Setup Time-Average (Second)	4.72	3.27	2.89
Handover Success Rate %	97.85	99.93	97.71

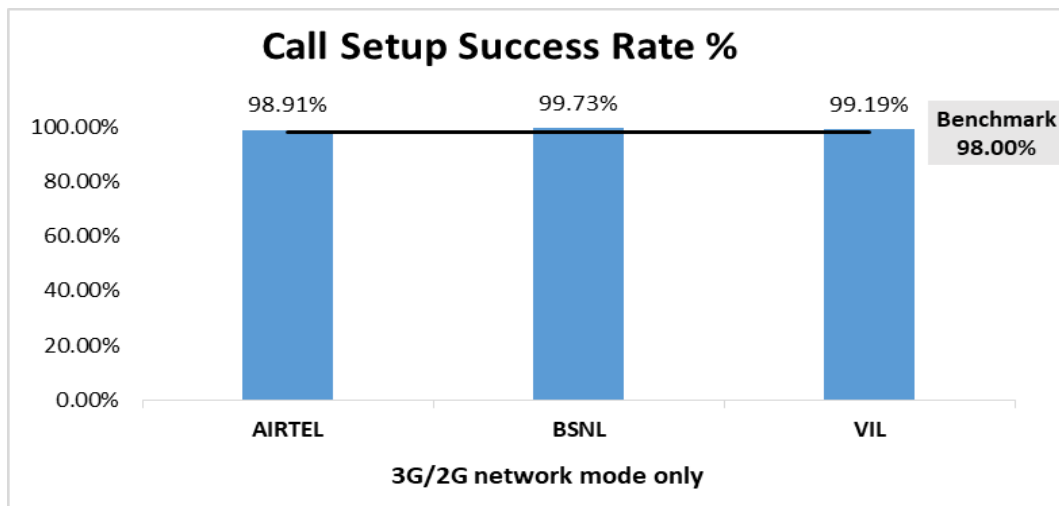**Table-13:** Summary of voice call performance in 3G/2G network mode only.

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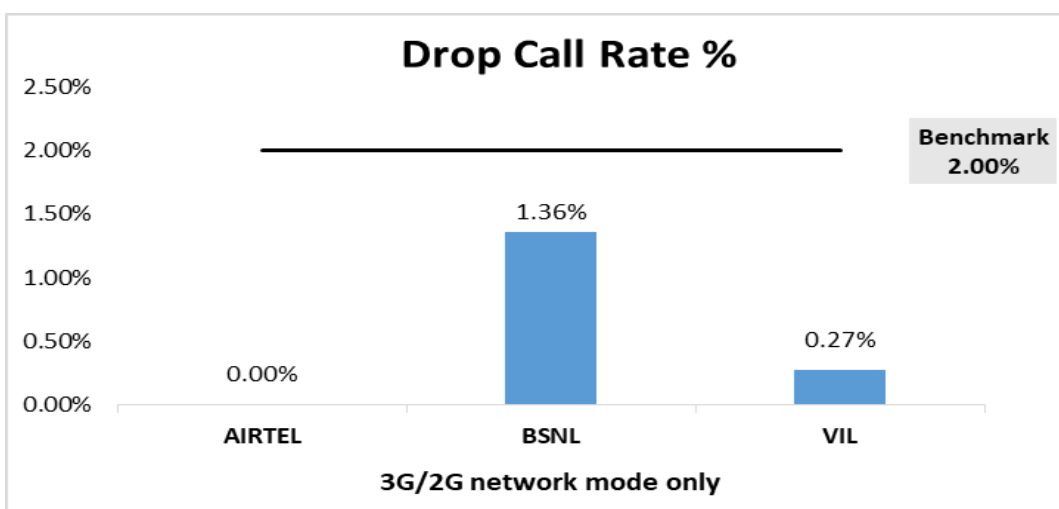
Figure-8: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	**BSNL**	**VIL**
3G	NA	92.26%	NA
2G	99.97%	7.74%	99.94%
Limited Service	0.03%	0.00%	0.06%

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

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

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

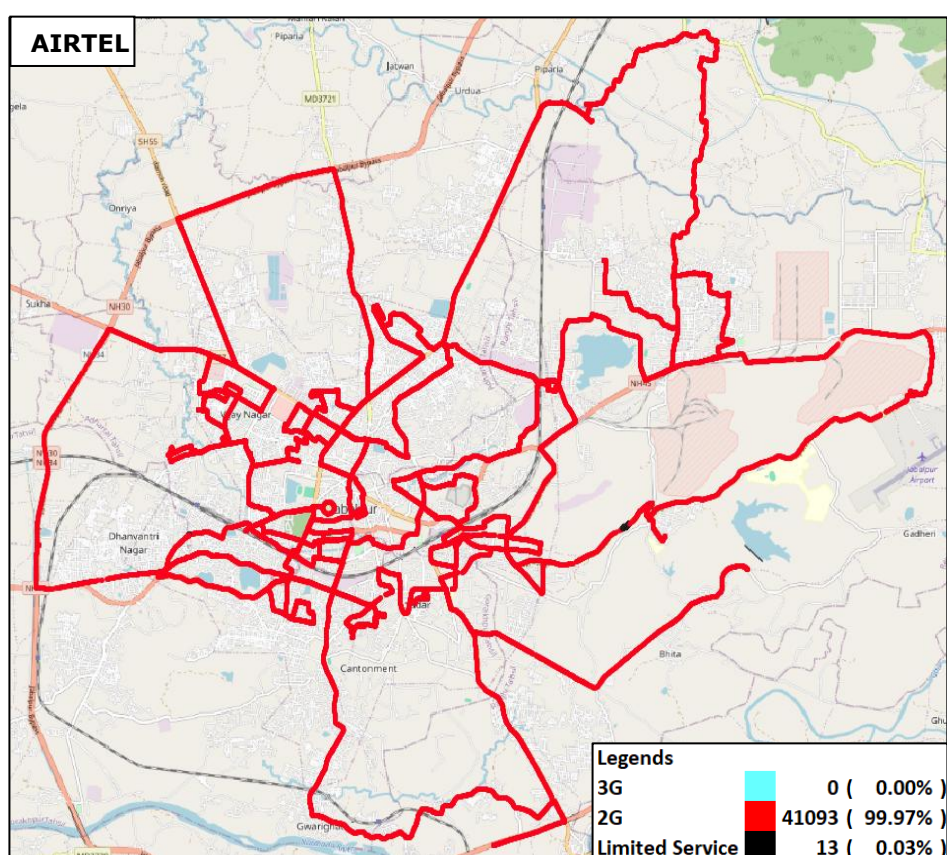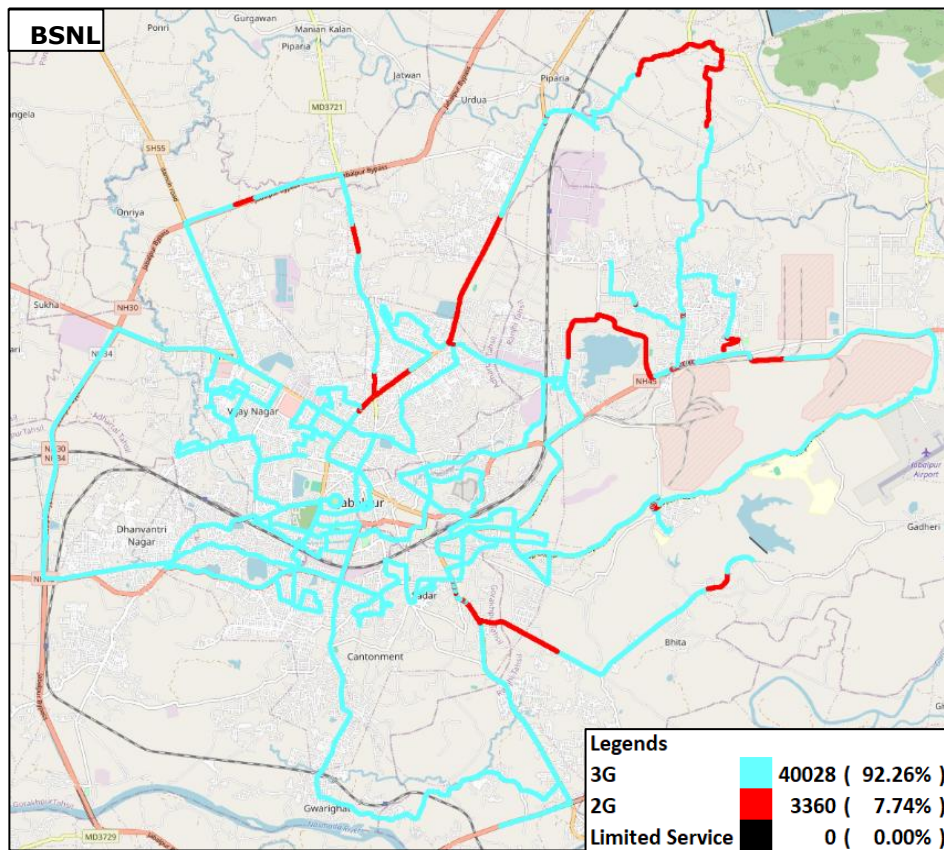**Figure-10:** Serving technology plots 3G/2G network mode –BSNL.
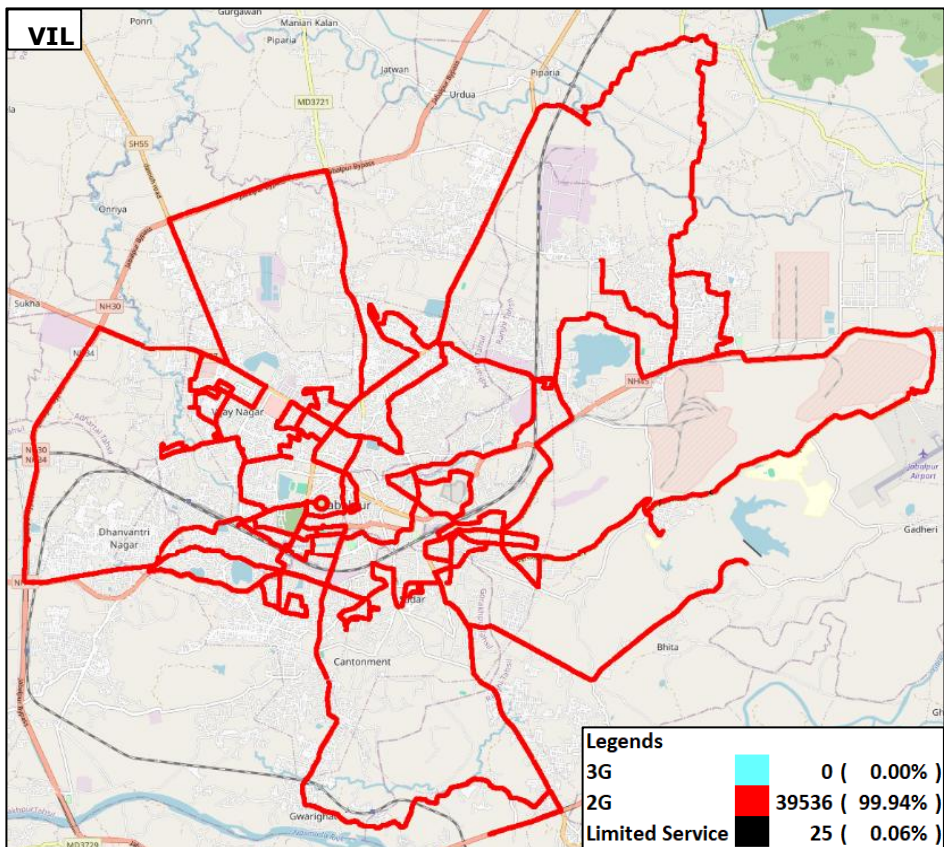

Figure-11: Serving technology plots 3G/2G network mode –VIL.

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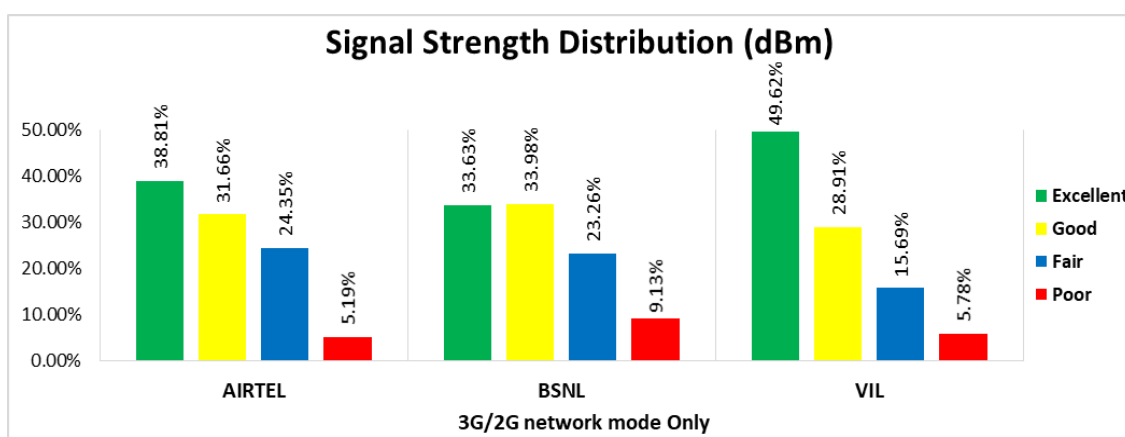

Figure-12: Signal strength distribution 3G/2G network mode only.

Observations:
- Airtel has 39% of samples falling in the excellent signal strength category.
- BSNL has 34% of samples falling in the excellent signal strength category.
- VIL has 50% 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	384	375	392	390
Call Setup Success Rate %	100.00	99.73	100.00	99.23
Drop Call Rate %	0.26	0.53	0.00	0.00
Call Setup Time Average (Second)	1.27	4.04	0.66	0.80
Handover Success Rate %	99.95	99.67	99.94	99.88

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

> **Note-**
> - BSNL handset is not latched on VoLTE when making a call on the switch number, causing the call fallback to 3G/2G (CSFB) or call initiation in 3G/2G.
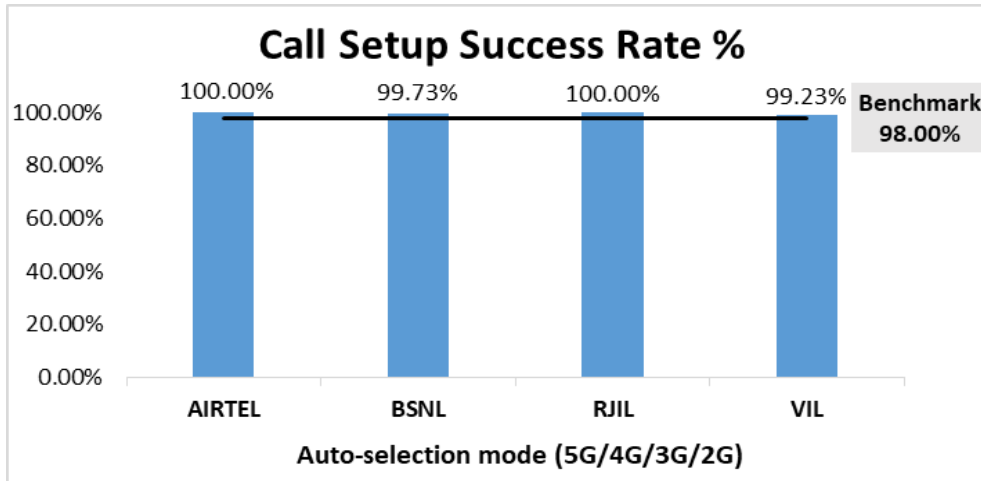
Figure-13: Performance for call setup success rate.
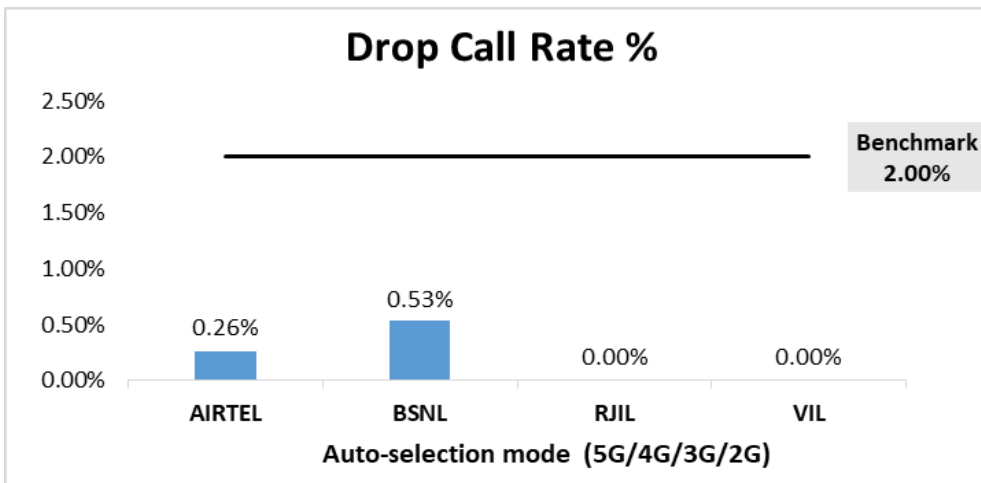
Figure-14: Performance for drop call rate.

Parameter	Service Provider			
	Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Established (within service provider Network)	374	358	387	377
Number of silence call for >4 Sec	2	15	3	2
Silence Call Rate %	0.53	4.19	0.78	0.53
Number of silence instances for >4 Sec	2	17	3	4
Number of silence instances for >3 Sec	6	25	6	5
Number of silence instances for >2 sec	19	32	17	15
RTP Jitter (4G & 5G) in ms	4.28	2.81	7.55	5.72
Packet loss Rate Downlink %	0.47	4.20	0.31	0.63
Packet loss Rate Uplink %	0.49	NA	0.49	0.60

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

Note-
- NA- Uplink packet loss rate is not captured in BSNL, as call terminating handset is not latched on VoLTE during entire drive test, resulting in CSFB/3G/2G calls.

(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 score 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	2236	1939	2136	2206
Speech Quality (Average MOS Score)	4.04	2.87	3.93	4.10
Number of samples with MOS >=4 to <5 (Excellent)	1987	0	1564	1844
Number of samples with MOS >=3 to <4 (Good)	201	1167	469	269
Number of samples with MOS >=2 to <3 (Fair)	20	575	76	49
Number of samples with MOS >=1 to <2 (Poor)	28	197	27	44
%age of samples with MOS >=4 to <5 (Excellent)	88.86%	0.00%	73.22%	83.59%
%age of samples with MOS >=3 to <4 (Good)	8.99%	60.19%	21.96%	12.19%
%age of samples with MOS >=2 to <3 (Fair)	0.89%	29.65%	3.56%	2.22%
%age of samples with MOS >=1 to <2 (Poor)	1.25%	10.16%	1.26%	1.99%

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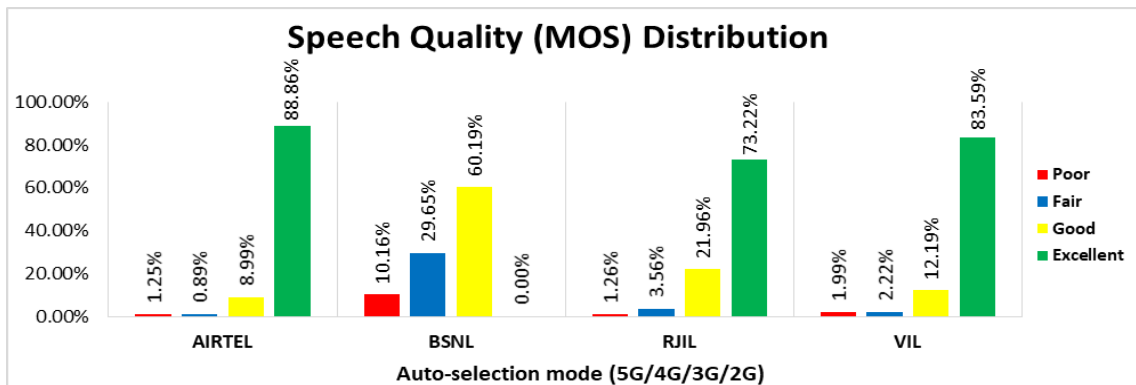
Figure-15: Distribution of samples in MOS score range.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	12.84%	NA	19.73%	NA
4G	87.16%	12.80%	80.24%	99.82%
3G	NA	34.80%	NA	NA
2G	0.00%	52.31%	NA	0.18%
Limited Service	0.00%	0.09%	0.03%	0.00%

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

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

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

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

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

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

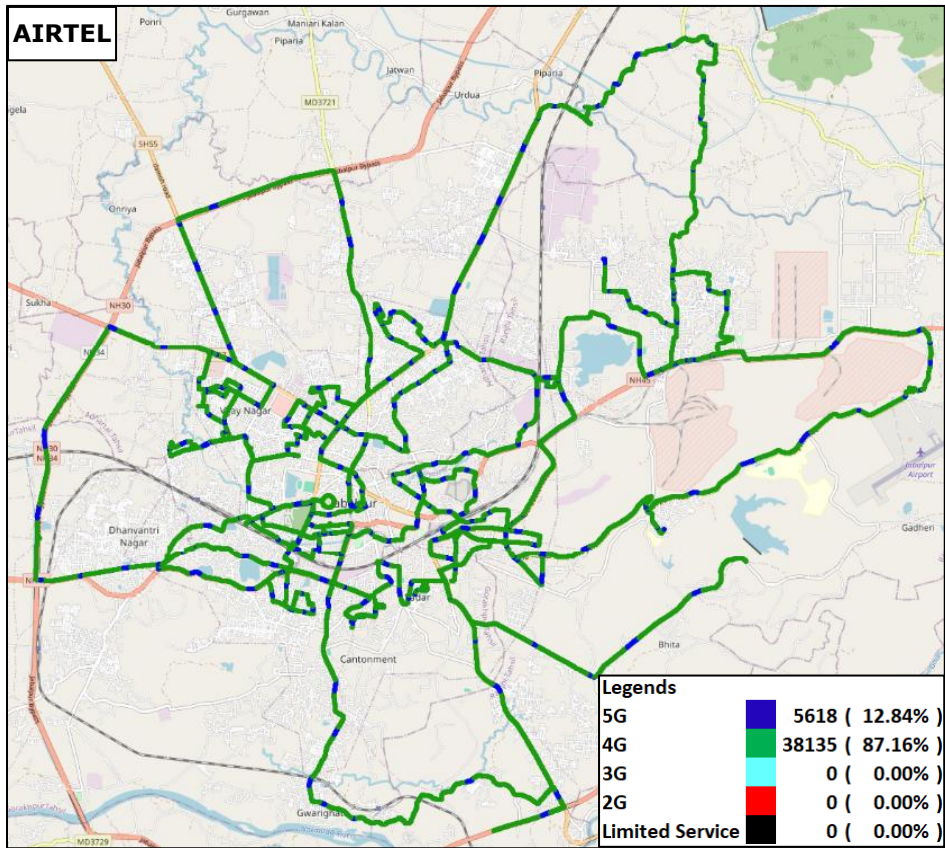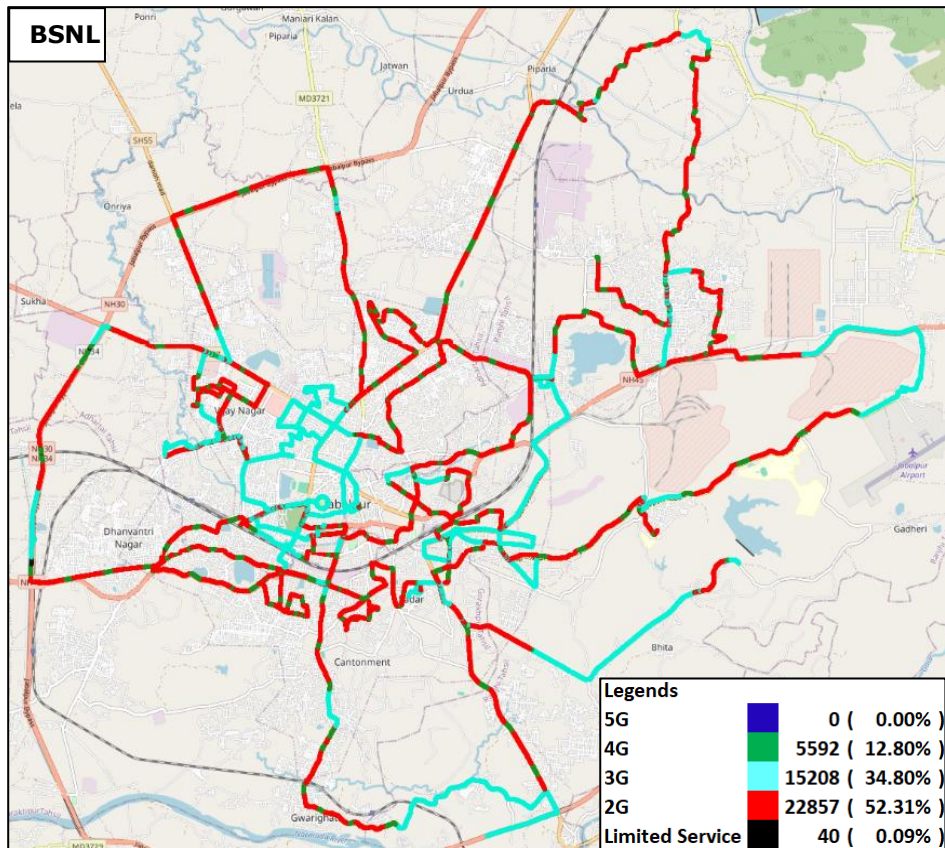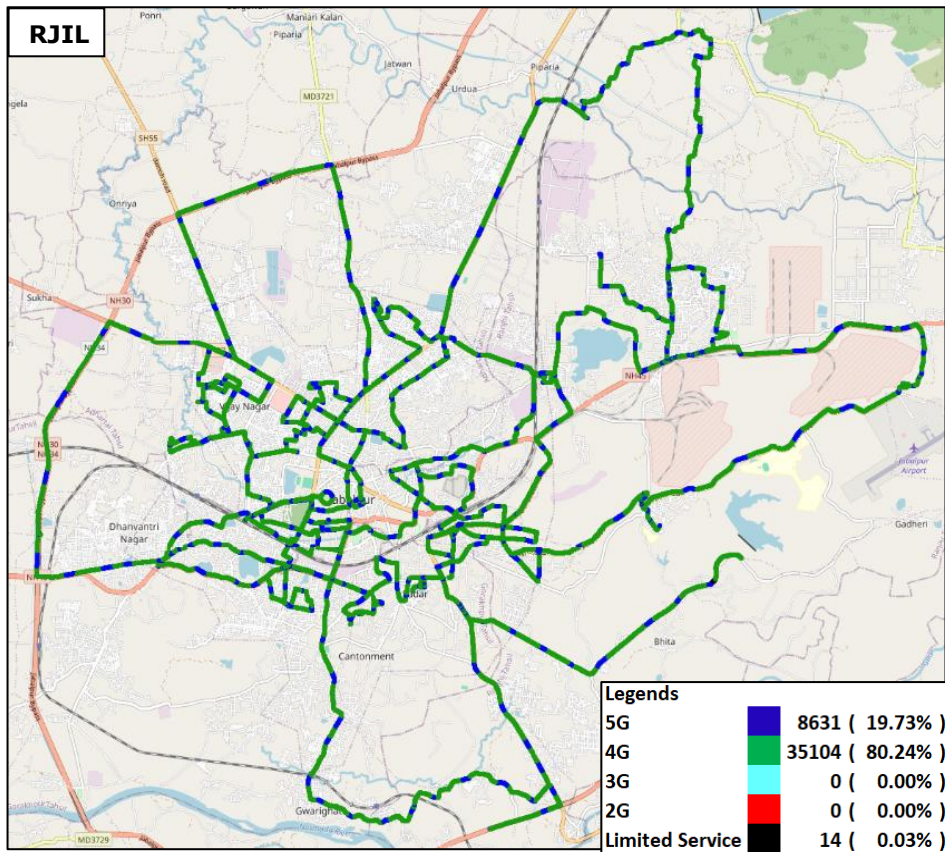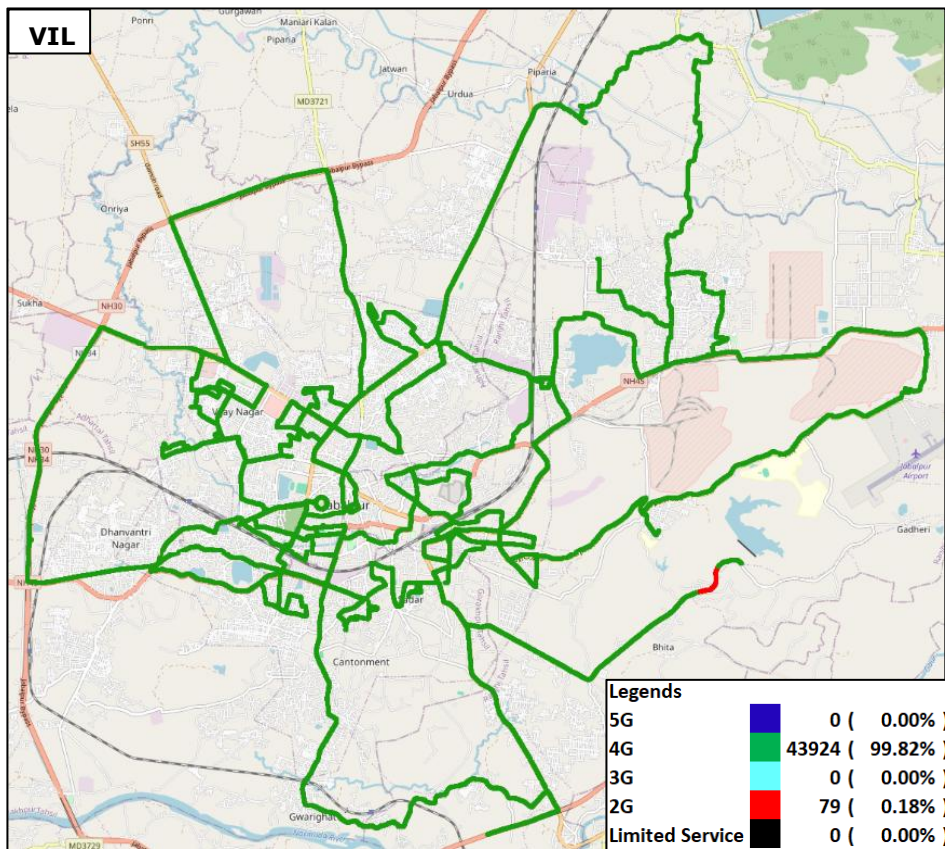**(g) Network Signal Strength Distribution:** The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G). (Refer figure-45, 46, 47 & 48 for map view)
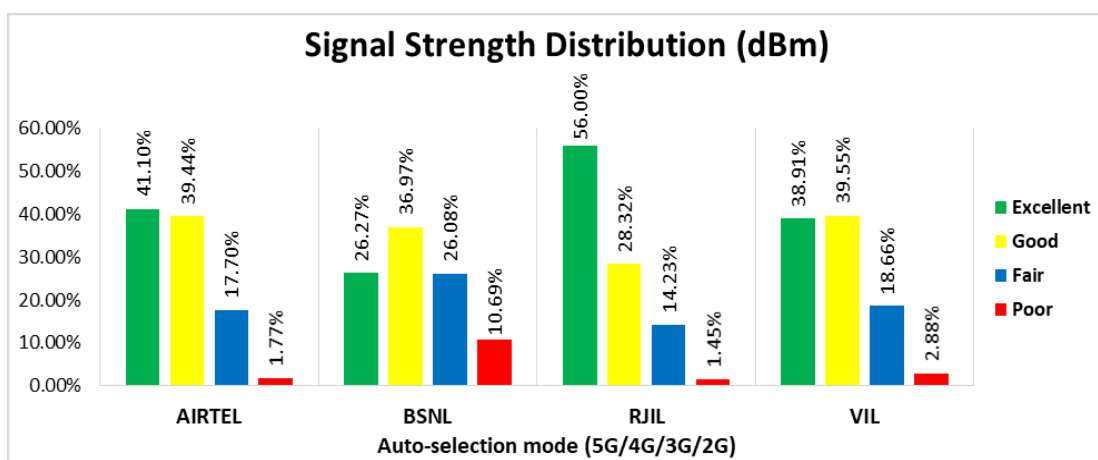
Figure-20: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:
- Airtel has 41% samples falling in the excellent signal strength category.
- BSNL has 26% samples falling in the excellent signal strength category.
- RJIL has 56% samples falling in the excellent signal strength category.
- VIL has 39% 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	167.73	1.03	349.44	36.89
	80th Percentile	264.28	1.47	568.99	58.50
	20th Percentile	47.80	0.49	110.90	15.79
Upload Throughput (Mbits/s)	Average	33.29	0.87	38.74	8.74
	80th Percentile	59.45	1.74	67.78	11.40
	20th Percentile	6.21	0.00	6.44	2.64
Latency (ms)	50th Percentile	45.55	67.50	22.25	29.05

Table-19: Summary of Data performance in network auto-selection mode.
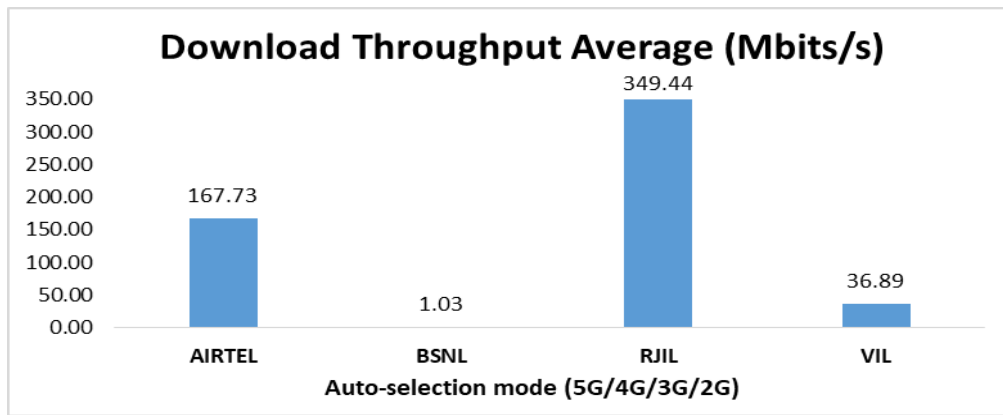
Figure- 21: Download throughput
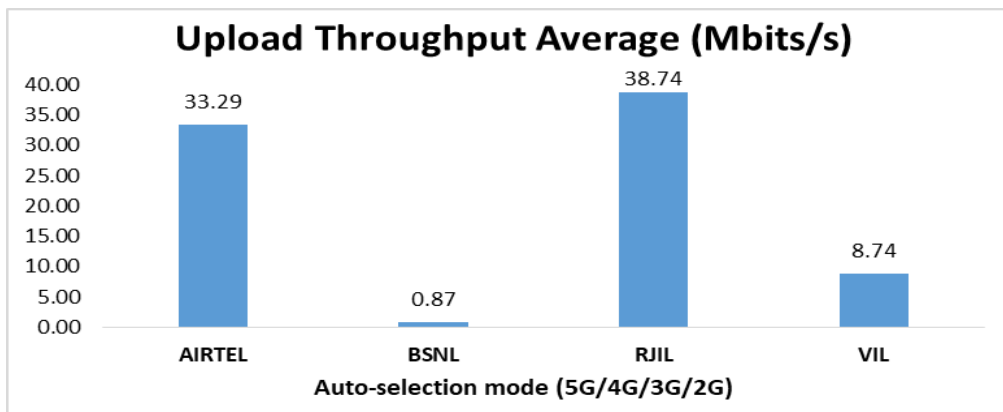
Figure- 22: Upload throughput

4.3 Hotspots

Hotspot testing have been done from 31st January to 01st February 2025. Ten locations have been tested in the city.

4.3.1 Locations

Figure- 23: Hotspot locations

4.3.2 Hotspot covered

1. Civic Centre
2. Collectrate/Ghantaghar
3. Dashmesh Dwar
4. Gwarighat
5. High Court
6. ISBT, Jabalpur
7. Jabalpur Dumma Airport
8. Jabalpur Railway Station
9. Kamaniya Gate
10. Netaji Subhash Chandra Bose Medical College, Jabalpur

4.3.3 Voice performance

Overall Voice Performance				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	100	100	100	100
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.22	4.38	0.60	0.69

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

Civic Centre				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.25	4.91	0.59	0.68

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

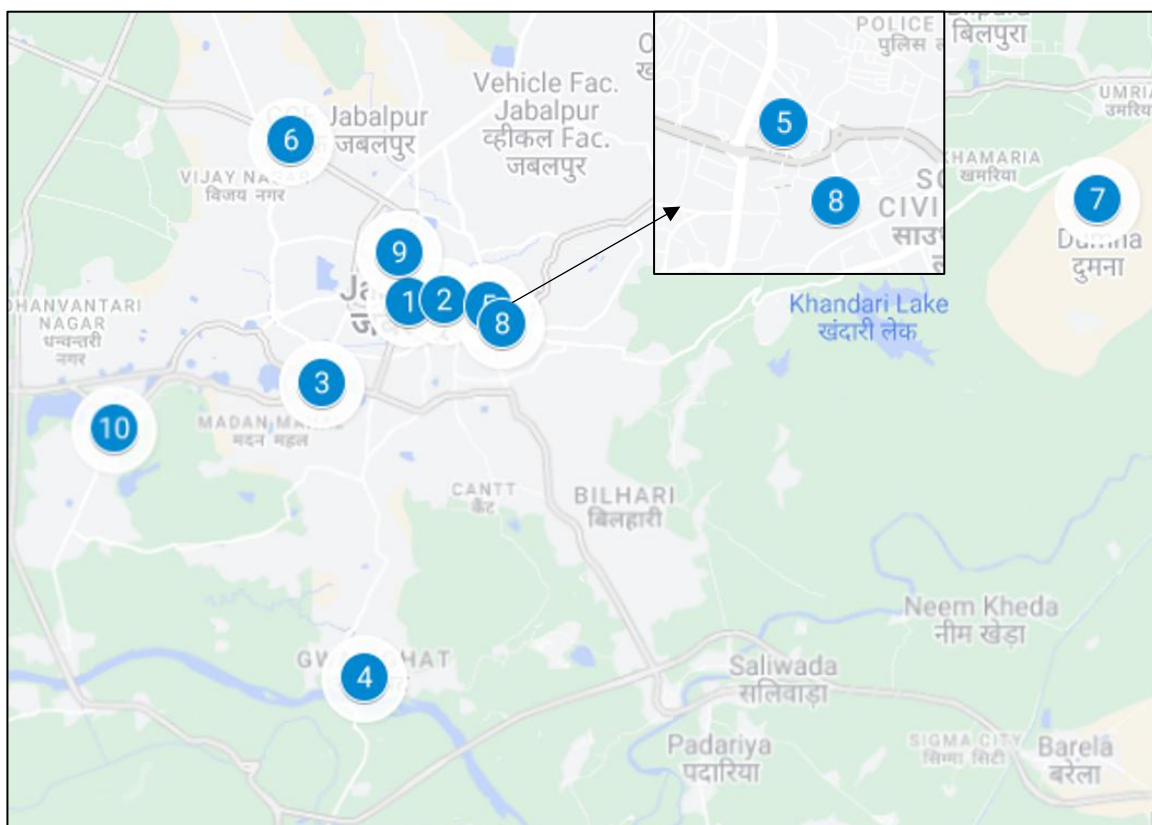| Collectrate/Ghantaghar				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.19	3.77	0.60	0.74

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

Dashmesh Dwar				
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)	1.18	4.68	0.69	0.75

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

Gwarighat				
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)	1.18	5.53	0.59	0.69

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

High Court				
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)	1.31	4.78	0.57	0.65

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

ISBT, Jabalpur				
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)	1.25	4.77	0.58	0.77

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

Jabalpur Dumma Airport				
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)	1.24	4.82	0.59	0.68

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

Jabalpur Railway Station				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	10	10	10	10
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.16	2.64	0.55	0.69

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

Kamaniya Gate				
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)	1.24	4.75	0.66	0.66

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

Netaji Subhash Chandra Bose Medical College, Jabalpur				
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)	1.17	3.11	0.59	0.64

Table-30: 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)	170.68	1.44	381.67	55.26
Download Throughput 80th Percentile (Mbit/s)	312.08	1.84	587.21	78.41
Download Throughput 20th Percentile (Mbit/s)	18.15	0.86	232.46	19.27
Download Session Setup Success Rate %	100.00	88.00	94.00	100.00
Upload Throughput Average (Mbits/s)	36.74	2.82	40.95	11.31
Upload Throughput 80th Percentile (Mbit/s)	69.85	4.25	66.11	14.13
Upload Throughput 20th Percentile (Mbit/s)	6.98	1.42	8.01	3.93
Upload Session Setup Success Rate %	100.00	88.00	100.00	100.00
Web Browsing Delay (Second)	2.66	3.49	2.86	6.67
Youtube Initial Buffer Delay (Second)	0.87	1.55	0.55	1.14
Latency (ms) - 50th Percentile	39.9	68.50	21.70	30.60
Jitter (ms)	4.87	6.05	7.77	10.67
Packet Loss Rate%	0.65	5.17	0.05	1.20
Packet Loss Rate- 90th percentile	1.18	7.05	0.12	2.24

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

Civic Centre				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	403.12	2.90	687.19	55.17
Download Session Setup Success Rate %	100.00	100.00	80.00	100.00
Upload Throughput Average (Mbits/s)	81.96	5.62	60.25	5.67
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.23	2.91	2.25	6.09
Youtube Initial Buffer Delay (Second)	0.58	0.84	0.53	0.69
Latency (ms)- 50th Percentile	47.40	60.00	21.00	31.05
Jitter (ms)	2.58	5.05	6.77	5.20
Packet Loss Rate%	0.00	0.40	0.00	0.40

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

Collectrate/Ghantaghar				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	62.11	1.06	596.49	14.86
Download Session Setup Success Rate %	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	19.65	2.96	38.27	3.63
Upload Session Setup Success Rate %	100.00	60.00	100.00	100.00
Web Browsing Delay (Second)	2.35	2.68	2.42	6.20
Youtube Initial Buffer Delay (Second)	0.57	0.73	0.57	2.19
Latency (ms) - 50th Percentile	30.70	69.00	22.43	35.85
Jitter (ms)	1.85	4.32	14.47	36.15
Packet Loss Rate%	0.20	5.60	0.10	2.10

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

Dashmesh Dwar				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	210.77	1.70	378.52	124.25
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	60.08	3.73	75.18	37.88
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.15	2.61	2.50	5.92
Youtube Initial Buffer Delay (Second)	0.62	0.84	0.52	0.56
Latency (ms) - 50th Percentile	46.15	69.00	21.30	26.35
Jitter (ms)	3.62	4.15	7.55	8.31
Packet Loss Rate%	0.00	2.60	0.00	0.90

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

Gwarighat				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	198.97	0.99	131.67	45.18
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	14.84	2.33	3.78	4.56
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.37	5.23	2.38	7.27
Youtube Initial Buffer Delay (Second)	0.61	1.13	0.57	0.75
Latency (ms) - 50th Percentile	37.30	68.50	22.00	36.00
Jitter (ms)	8.17	5.76	6.99	11.65
Packet Loss Rate%	0.00	6.80	0.00	0.80

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

High Court				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	109.11	0.71	355.15	75.38
Download Session Setup Success Rate %	100.00	60.00	80.00	100.00
Upload Throughput Average (Mbits/s)	24.70	1.70	15.92	4.47
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	2.82	4.02	2.29	7.02
Youtube Initial Buffer Delay (Second)	0.69	0.87	0.57	0.69
Latency (ms) - 50th Percentile	31.60	71.00	20.98	30.43
Jitter (ms)	2.27	4.51	8.07	4.23
Packet Loss Rate%	0.70	5.10	0.10	0.40

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

ISBT, Jabalpur				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	164.25	0.74	259.68	20.40
Download Session Setup Success Rate %	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	59.35	2.30	24.82	9.45
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.33	3.92	2.42	6.78
Youtube Initial Buffer Delay (Second)	0.57	3.75	0.56	1.84
Latency (ms) - 50th Percentile	32.10	67.00	21.15	32.80
Jitter (ms)	1.99	8.86	6.56	6.13
Packet Loss Rate%	0.00	6.90	0.00	0.90

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

Jabalpur Dumma Airport				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	5.51	1.14	3.23	13.62
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	2.97	1.54	1.06	2.19
Upload Session Setup Success Rate %	100.00	60.00	100.00	100.00
Web Browsing Delay (Second)	4.74	3.07	11.84	7.85
Youtube Initial Buffer Delay (Second)	3.78	1.06	-	1.87
Latency (ms) - 50th Percentile	38.15	55.50	33.65	35.30
Jitter (ms)	6.10	10.75	9.20	13.46
Packet Loss Rate%	0.80	6.70	0.30	3.50

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

Note-
- "-"All YouTube test were failed.

Jabalpur Railway Station				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	131.25	1.76	347.40	77.31
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	6.21	4.17	48.52	11.86
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.90	2.87	2.17	7.99
Youtube Initial Buffer Delay (Second)	0.77	0.87	0.60	1.71
Latency (ms)- 50th Percentile	35.25	69.00	12.65	26.60
Jitter (ms)	14.36	3.63	4.32	8.30
Packet Loss Rate%	4.60	3.10	0.00	0.70

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

Kamaniya Gate				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	103.40	1.94	606.79	41.33
Download Session Setup Success Rate%	100.00	60.00	100.00	100.00
Upload Throughput Average (Mbits/s)	74.68	1.54	64.55	5.80
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00
Web Browsing Delay (Second)	2.33	3.35	2.28	4.94
Youtube Initial Buffer Delay (Second)	0.57	3.93	0.53	0.66
Latency (ms)- 50th Percentile	46.80	76.00	20.75	29.35
Jitter (ms)	2.36	5.38	6.84	5.01
Packet Loss Rate%	0.00	6.10	0.00	1.00

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

Netaji Subhash Chandra Bose Medical College, Jabalpur				
Parameters	**Service Provider**			
	Auto-Selection Mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	318.31	1.17	537.61	85.12
Download Session Setup Success Rate%	100.00	100.00	80.00	100.00
Upload Throughput Average (Mbits/s)	22.92	1.38	77.19	27.54
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	2.35	4.24	2.50	6.60
Youtube Initial Buffer Delay (Second)	0.57	2.41	0.53	0.60
Latency (ms)- 50th Percentile	43.20	75.50	22.35	25.45
Jitter (ms)	5.35	8.32	6.92	8.39
Packet Loss Rate%	0.20	8.40	0.00	1.30

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

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

Overall Data Performance				
Parameters	**Service Provider**			
	Auto-selection mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	34.57	1.51	34.17	51.45
Download Throughput 80th Percentile (Mbit/s)	53.67	1.81	50.03	83.83
Download Throughput 20th Percentile (Mbit/s)	8.77	1.04	14.81	18.15
Download Session Setup Success Rate %	100.00	85.00	98.33	100.00
Upload Throughput Average (Mbits/s)	8.53	3.05	7.27	11.88
Upload Throughput 80th Percentile (Mbit/s)	11.23	4.40	10.91	15.08
Upload Throughput 20th Percentile (Mbit/s)	5.12	2.01	3.95	4.27
Upload Session Setup Success Rate %	100.00	85.00	100.00	100.00

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

Civic Centre				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	53.19	3.21	84.09	75.94
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	11.72	5.87	11.49	10.03
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00

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

Collectrate/Ghantaghar				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	11.29	1.35	18.91	22.78
Download Session Setup Success Rate%	100.00	40.00	100.00	100.00
Upload Throughput Average (Mbits/s)	10.65	1.95	4.86	3.69
Upload Session Setup Success Rate %	100.00	60.00	100.00	100.00

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

Dashmesh Dwar				
Parameters	**Service Provider**			
	Auto-Selection Mode 4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	108.80	1.77	45.44	116.03
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	21.27	4.06	14.34	8.95
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00

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

Gwarighat				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	47.92	1.18	5.88	55.93
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	6.54	2.34	0.88	4.84
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00

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

High Court				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	13.89	1.47	35.47	15.62
Download Session Setup Success Rate%	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	7.34	2.89	6.32	8.97
Upload Session Setup Success Rate %	100.00	90.00	100.00	100.00

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

ISBT, Jabalpur				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	9.92	0.84	15.75	24.37
Download Session Setup Success Rate%	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	11.39	1.27	2.82	18.46
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00

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

Jabalpur Dumma Airport				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	9.68	0.80	4.68	19.90
Download Session Setup Success Rate%	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	1.67	1.80	4.32	5.87
Upload Session Setup Success Rate %	100.00	60.00	100.00	100.00

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

Jabalpur Railway Station				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	10.64	1.30	34.30	52.14
Download Session Setup Success Rate%	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	5.42	3.79	8.79	6.25
Upload Session Setup Success Rate %	100.00	90.00	100.00	100.00

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

Kamaniya Gate				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	92.93	1.70	56.62	86.80
Download Session Setup Success Rate%	100.00	80.00	80.00	100.00
Upload Throughput Average (Mbits/s)	6.49	1.79	4.87	39.49
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00

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

Netaji Subhash Chandra Bose Medical College, Jabalpur				
Parameters	**Service Provider**			
	Auto-Selection Mode (4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Download Throughput Average (Mbits/s)	32.04	1.32	43.57	80.12
Download Session Setup Success Rate%	100.00	80.00	100.00	100.00
Upload Throughput Average (Mbits/s)	7.09	2.57	13.39	20.76
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00

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

4.4 Walk Test

Walk Test has been conducted on 31st January 2025. Two locations have been tested in the city.
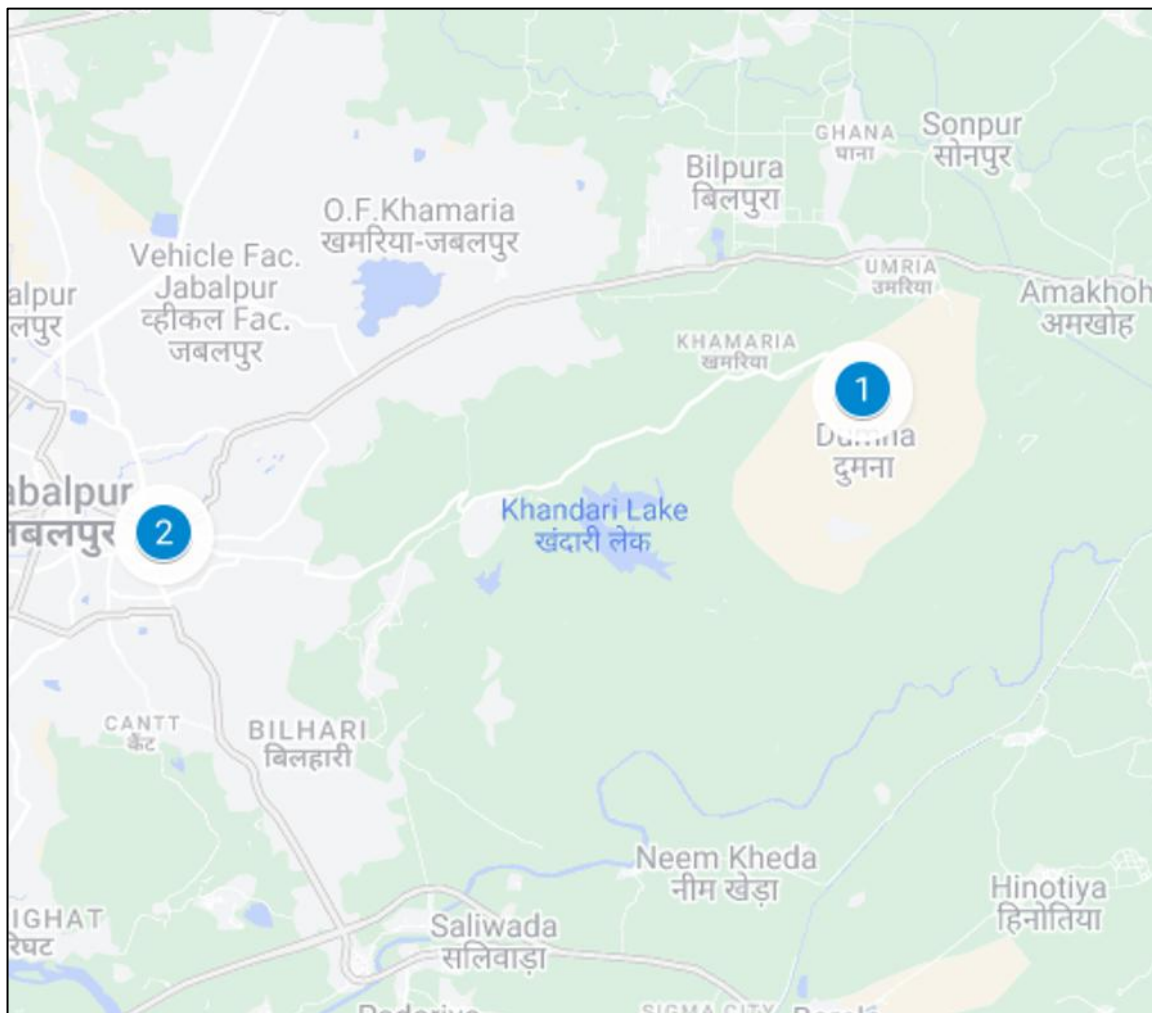
4.4.1 Drive test route

Figure-24: Walk Test locations.

4.4.2 Walk Test Covered

1. Jabalpur Airport
2. Jabalpur Railway Station

4.4.3 Voice Performance

Jabalpur Airport				
Parameters	**Service Provider**			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
Call Attempt	17	16	16	18
Call Setup Success Rate %	100.00	100.00	100.00	88.89
Drop Call Rate %	0.00	0.00	0.00	0.00
Call Setup Time-Average (Second)	1.38	3.00	0.93	1.10

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

Jabalpur Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	18	17	20	18
Call Setup Success Rate %	100.00	100.00	100.00	100.00
Drop Call Rate %	0.00	0.00	10.00	5.56
Call Setup Time-Average (Second)	1.19	4.67	0.58	0.75

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

4.4.4 Data Performance

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

Jabalpur Airport				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	19.11	1.01	-	10.32
Download Session Setup Success Rate %	100.00	74.07	0.00	92.86
Upload Throughput Average (Mbits/s)	3.63	1.00	-	1.44
Upload Session Setup Success Rate %	100.00	76.00	0.00	91.67
Latency (ms) - 50th Percentile	42.60	63.00	35.55	35.35

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

Note-
- "-"Download, Upload tests were failed.

Jabalpur Railway Station				
Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	113.17	0.86	79.67	36.71
Download Session Setup Success Rate %	95.24	78.26	65.00	100.00
Upload Throughput Average (Mbits/s)	23.75	1.98	34.36	7.66
Upload Session Setup Success Rate %	95.24	77.27	84.21	95.45
Latency (ms) - 50th Percentile	38.60	66.50	24.60	29.78

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

4.5 Highway

Drive test has been conducted on 27th January 2025 covering Highway routes. (refer Table-1)
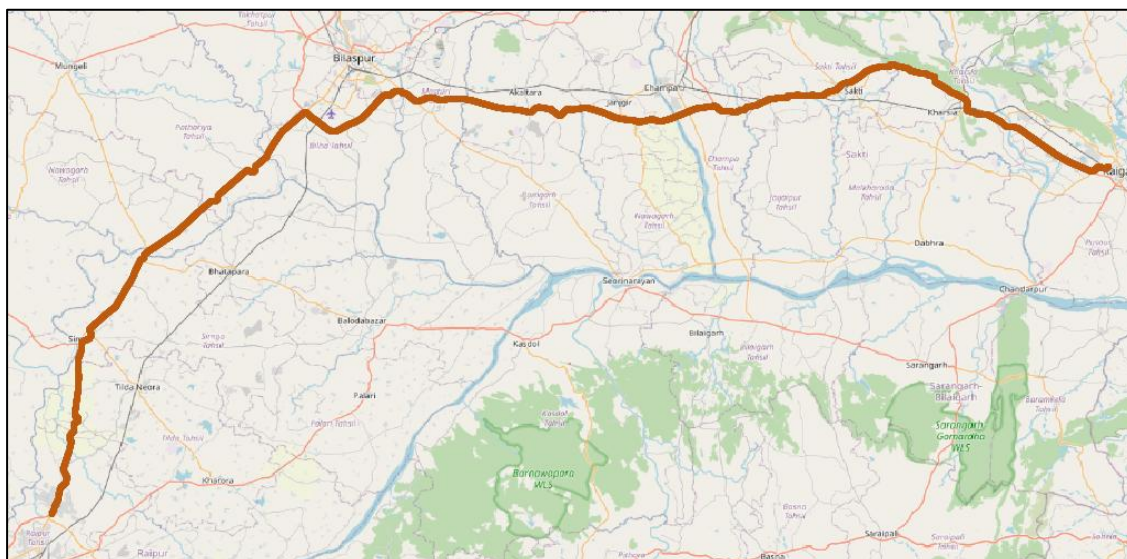
4.5.1 Drive test route

Figure-25: Drive test route highway

4.5.2 Routes Covered

Raipur to Bilaspur to Raigarh passing through Simga, Nanghat, Saragaon and Masaniya.

4.5.3 Voice Performance

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

Parameters	Service Provider		
	3G/2G network mode only		
	AIRTEL	BSNL	VIL
Call Attempts	92	115	98
Call Setup Success Rate %	98.91	74.78	100.00
Drop Call Rate %	0.00	6.98	0.00
Call Setup Time-Average (Second)	4.99	5.13	3.33
Handover Success Rate %	94.69	100.00	97.56

Table-57: Summary of voice call performance in 3G/2G network mode only.
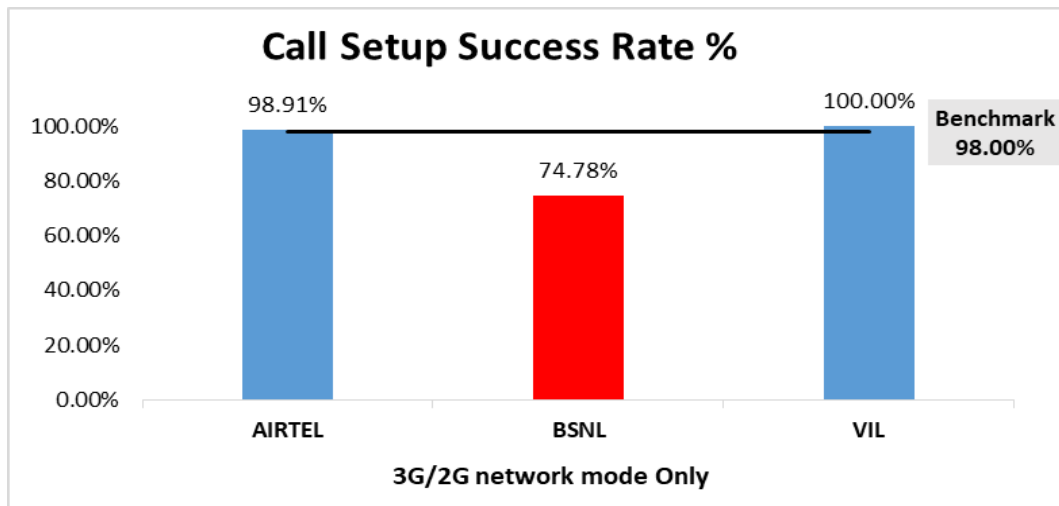
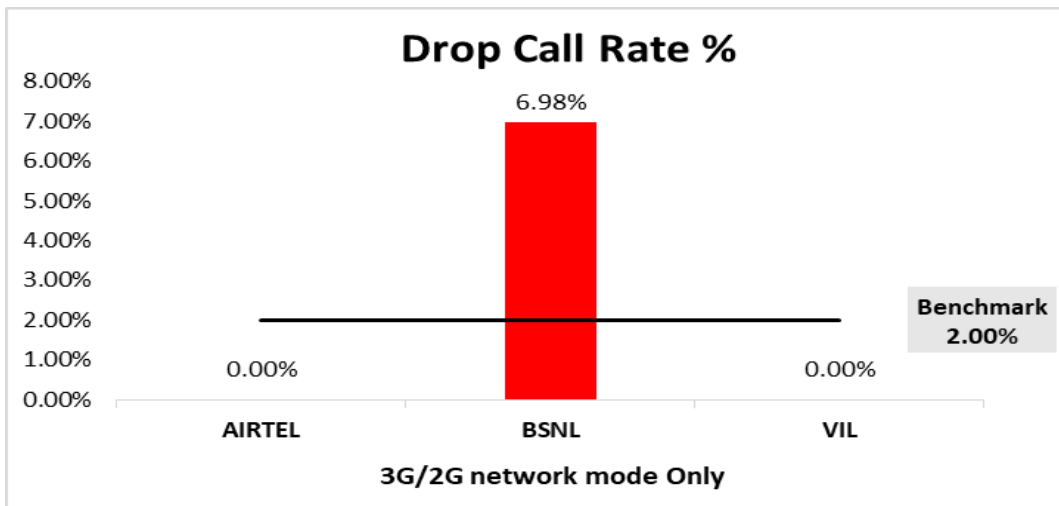**Figure-26:** Performance for call setup success rate.

Figure-27: Performance for drop call rate.

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

Technology	Service Provider		
	AIRTEL	**BSNL**	**VIL**
3G	NA	58.90%	NA
2G	99.98%	40.09%	99.98%
Limited Service	0.02%	1.01%	0.02%

Table-58: Time spent on technology during drive test 3G/2G network mode only.

Note-
• NA- Service provider doesn't provide services in respective technology.
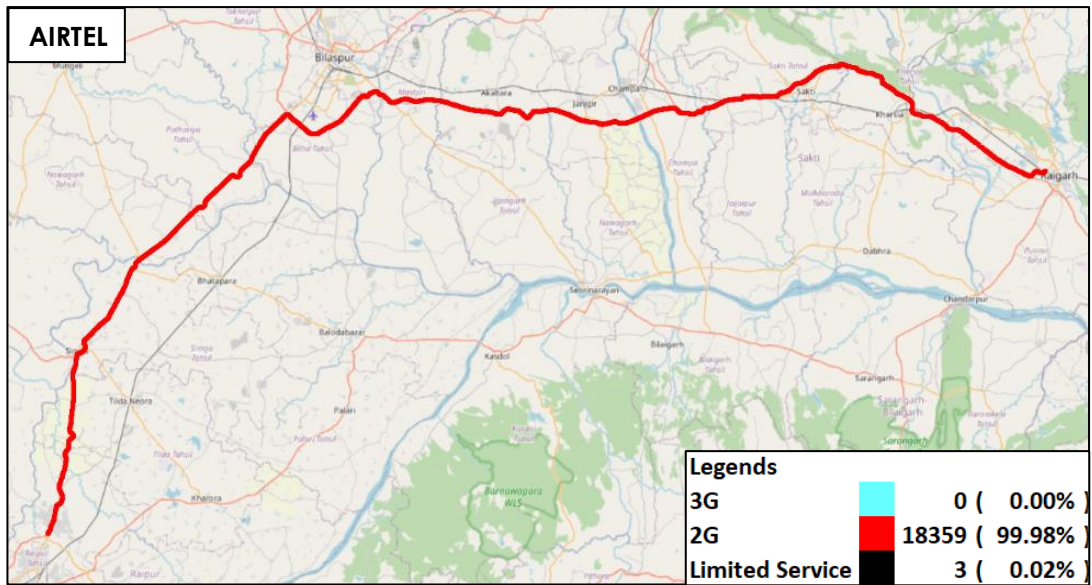
Figure-28: Serving technology plots 3G/2G network mode – AIRTEL.
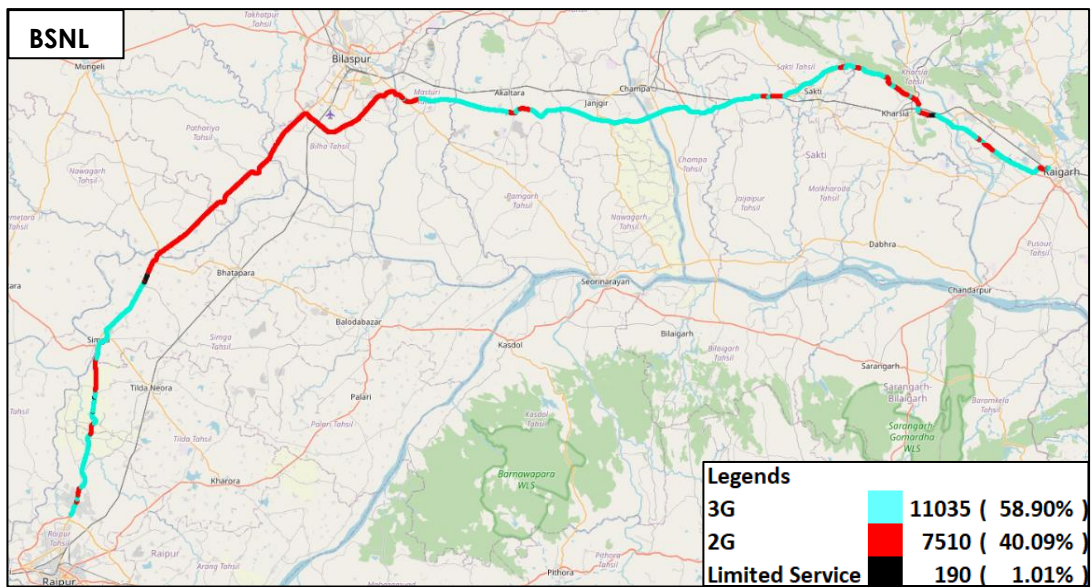
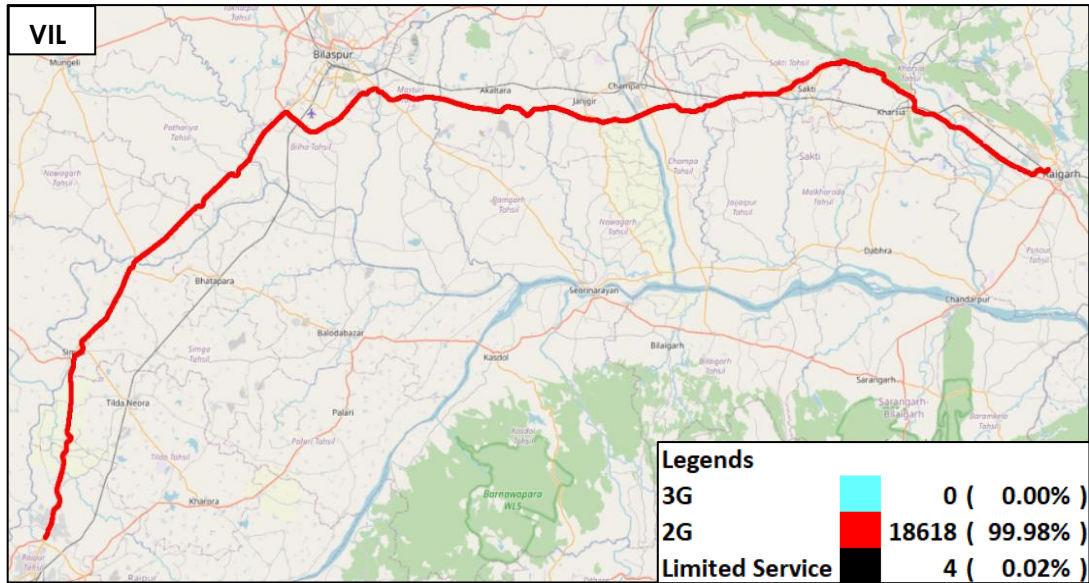**Figure-29:** Serving technology plots 3G/2G network mode – BSNL.

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

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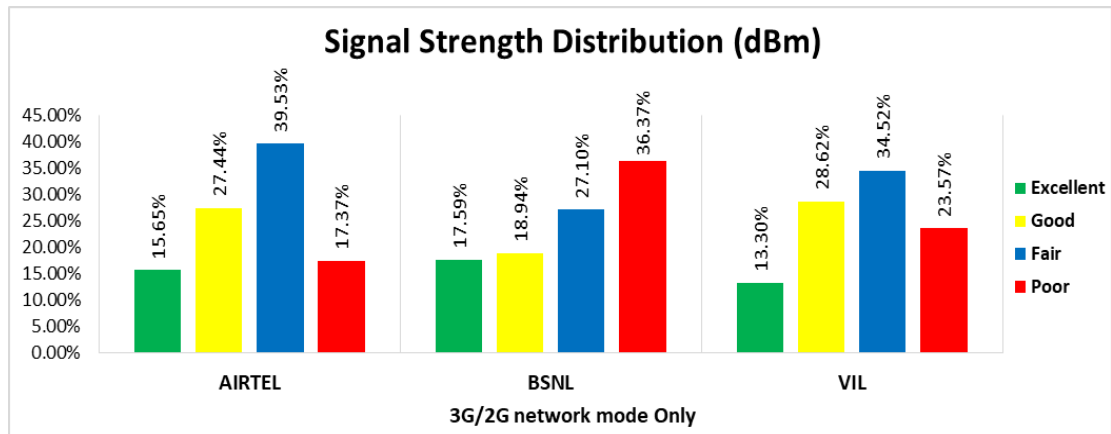

Figure-31: Signal strength distribution 3G/2G network mode only.

Observations:
- Airtel has 16% of samples falling in the excellent signal strength category.
- BSNL has 18% of samples falling in the excellent signal strength category.
- VIL has 13% 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	96	107	98	99
Call Setup Success Rate %	100.00	84.11	98.98	96.97
Drop Call Rate %	0.00	4.44	0.00	1.04
Call Setup Time Average (Second)	1.24	4.02	1.32	1.10
Handover Success Rate %	99.93	97.81	99.82	100.00

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

> **Note-**
> - BSNL handset is not latched on VoLTE when making a call on the switch number, causing the call fallback to 3G/2G (CSFB) or call initiation in 3G/2G.
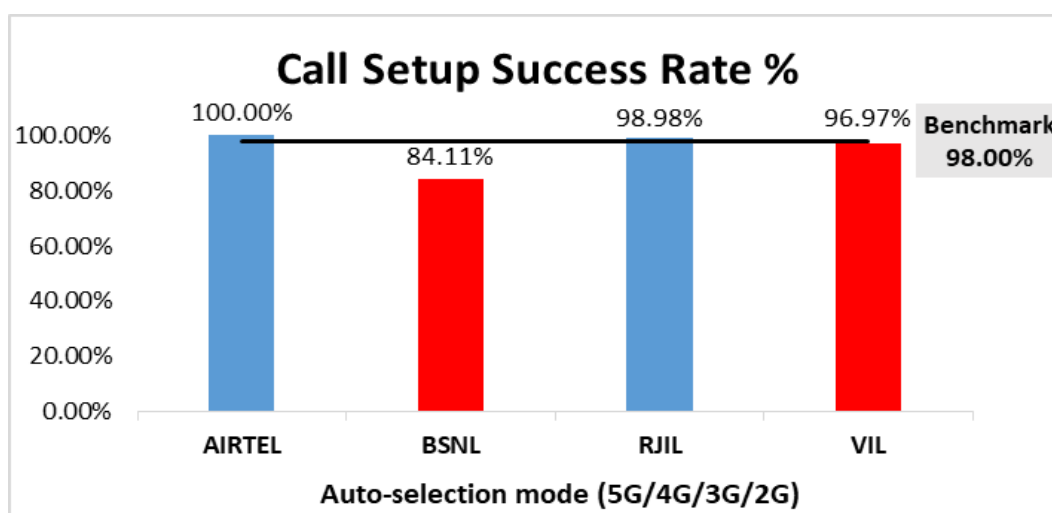

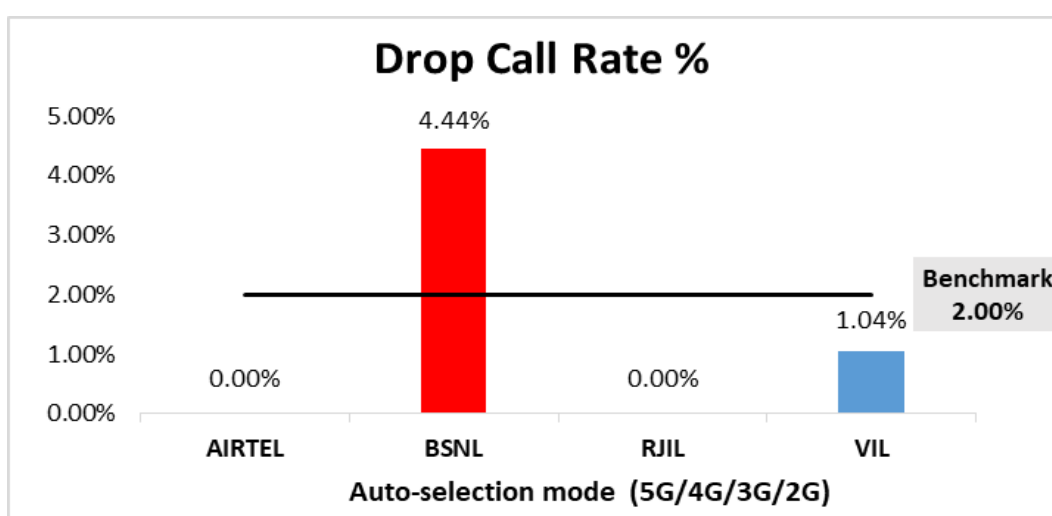**Figure-32:** Performance for call setup success rate.

Figure-33: Performance for drop call rate.

Parameter	Service Provider Mobile-to-Mobile (5G/4G - Open Mode)			
	AIRTEL	BSNL	RJIL	VIL
Call Established (within service provider Network)	97	87	99	108
Number of silence call for >4 Sec	1	5	1	1
Silence Call Rate %	1.03	5.75	1.01	0.93
Number of silence instances for >4 Sec	1	5	2	1
Number of silence instances for >3 Sec	2	6	3	2
Number of silence instances for >2 sec	6	11	10	8
RTP Jitter (4G & 5G) in ms	5.19	5.81	8.54	13.47
Packet loss Rate Downlink %	1.59	6.00	0.33	2.13
Packet loss Rate Uplink %	1.31	NA	0.71	1.23

Table-60: Summary of silence instances & packet loss rate for mobile to mobile call.

Note-
- NA- Uplink packet loss rate is not captured in BSNL, as call terminating handset is not latched on VoLTE during entire drive test, resulting in CSFB/3G/2G calls.

(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 score 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-60	1240	962	1202	1138
Speech Quality (Average MOS Score)	3.87	2.61	3.80	3.59
Number of samples with MOS >=4 to <5 (Excellent)	951	0	741	646
Number of samples with MOS >=3 to <4 (Good)	201	340	340	258
Number of samples with MOS >=2 to <3 (Fair)	37	455	84	88
Number of samples with MOS >=1 to <2 (Poor)	51	167	37	146
%age of samples with MOS >=4 to <5 (Excellent)	76.69%	0.00%	61.65%	56.77%
%age of samples with MOS >=3 to <4 (Good)	16.21%	35.34%	28.29%	22.67%
%age of samples with MOS >=2 to <3 (Fair)	2.98%	47.30%	6.99%	7.73%
%age of samples with MOS >=1 to <2 (Poor)	4.11%	17.36%	3.08%	12.83%

Table-61: Summary of speech quality (MOS) samples.
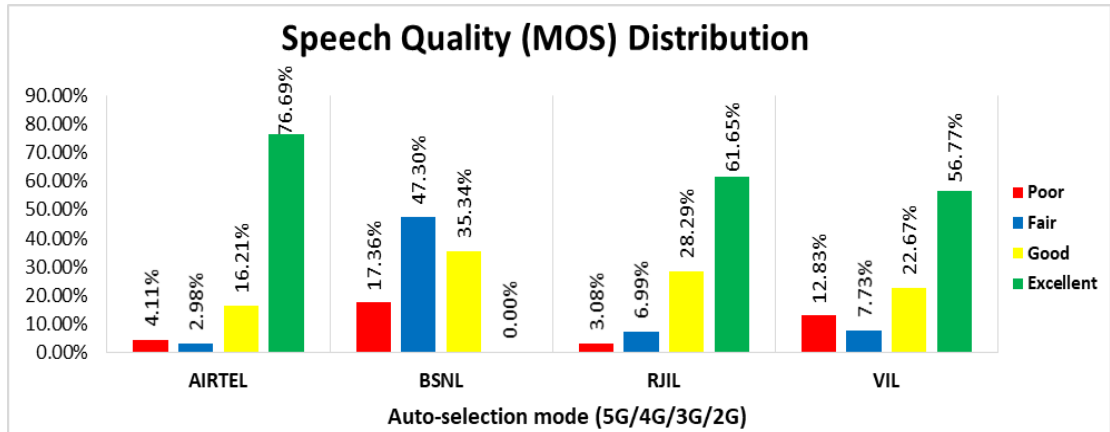
Figure-34: Distribution of samples in MOS score range.

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

Technology	Service Provider			
	AIRTEL	**BSNL**	**RJIL**	**VIL**
5G	8.76%	NA	9.70%	NA
4G	91.24%	5.60%	90.30%	81.48%
3G	NA	32.51%	NA	NA
2G	0.00%	60.58%	NA	18.52%
Limited Service	0.00%	1.31%	0.00%	0.00%

Table-62: Time spent on technology during drive test.

> **Note-**
> - RJIL does not have 3G/2G network.
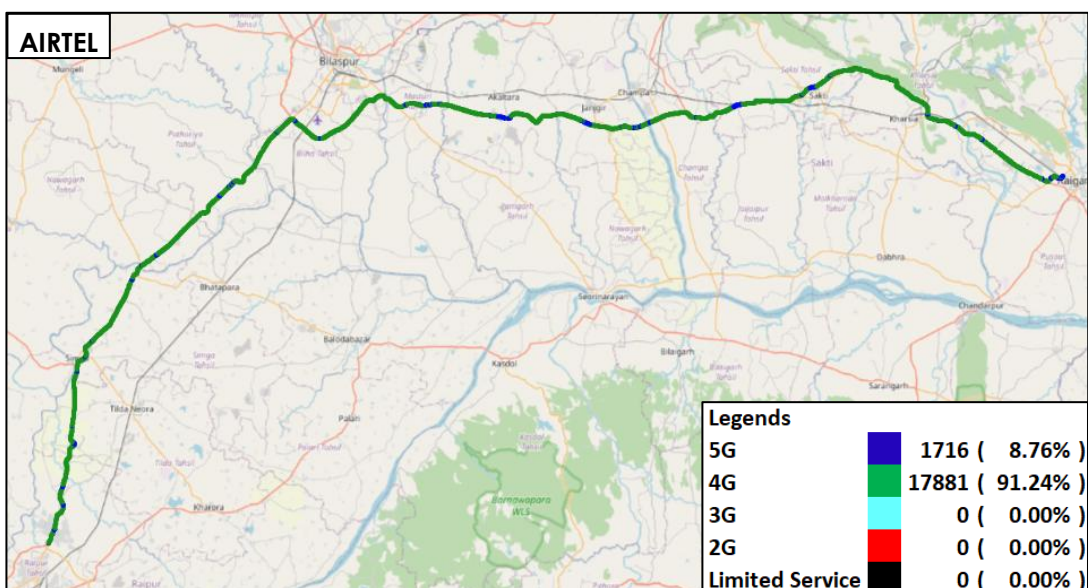> - NA- Service provider doesn't provide services in respective technology.

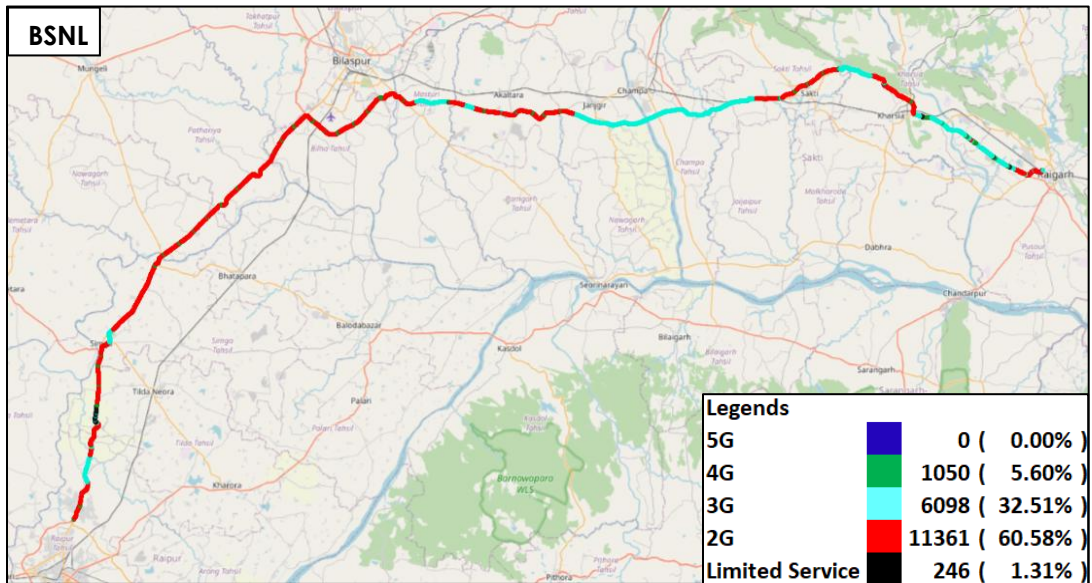**Figure-35:** Serving technology plots in auto-selection mode (5G/4G/3G/2G) –AIRTEL.

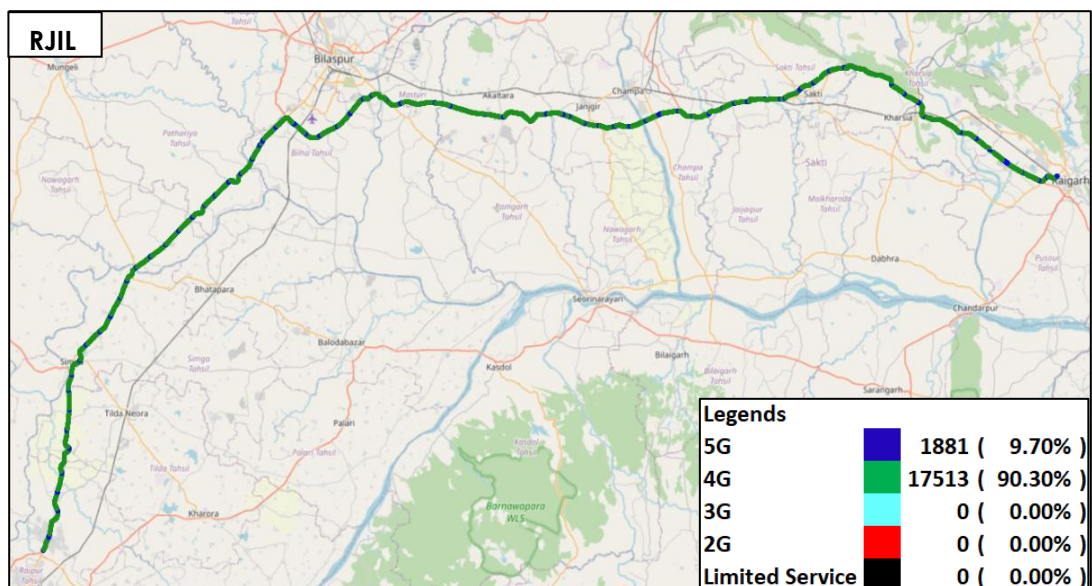**Figure-36:** Serving technology plots in auto-selection mode (5G/4G/3G/2G) –BSNL.

Legends (BSNL):

Technology	Count	Percentage
5G	0	0.00%
4G	1050	5.60%
3G	6098	32.51%
2G	11361	60.58%
Limited Service	246	1.31%

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

Legends (RJIL):

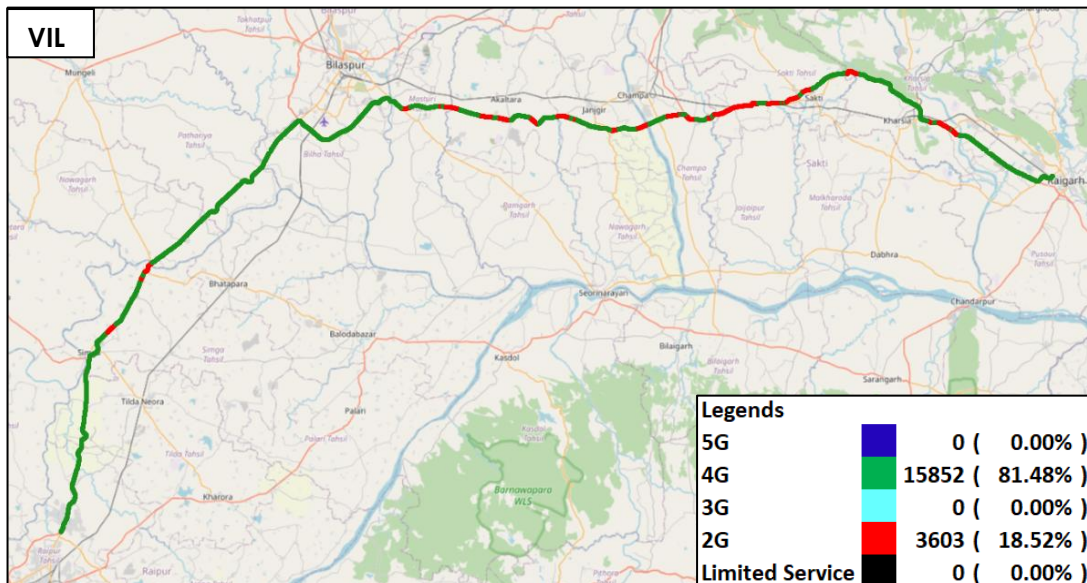| Technology	Count	Percentage
5G	1881	9.70%
4G	17513	90.30%
3G	0	0.00%
2G	0	0.00%
Limited Service	0	0.00%

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

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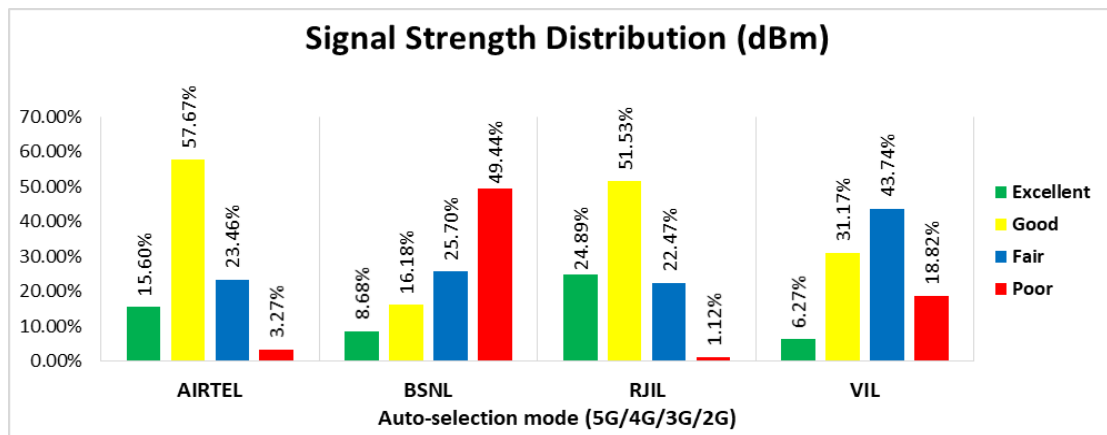

Figure-39: Signal strength distribution auto-selection mode 5G/4G/3G/2G

Observations:

- Airtel has 16% of samples falling in the excellent signal strength category.
- BSNL has 9% of samples falling in the excellent signal strength category.
- RJIL has 25% of samples falling in the excellent signal strength category.
- VIL has 6% 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	59.89	0.53	170.67	26.23
	80th Percentile	92.95	0.92	298.62	41.13
	20th Percentile	7.06	0.04	11.07	7.58
Upload Throughput (Mbits/s)	Average	10.63	1.45	8.46	9.98
	80th Percentile	15.94	2.33	11.98	16.10
	20th Percentile	2.05	0.48	1.46	2.04
Latency (ms)	50th Percentile	53.00	73.00	23.50	27.35

Table-63: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

> **Note-**
> - Approximately 89% of upload sessions in RJIL are experiencing disconnections within 1 second of server connection, resulting in failed uploads. Results of those sessions are not accounted in average, 80th percentile and 20th percentile.
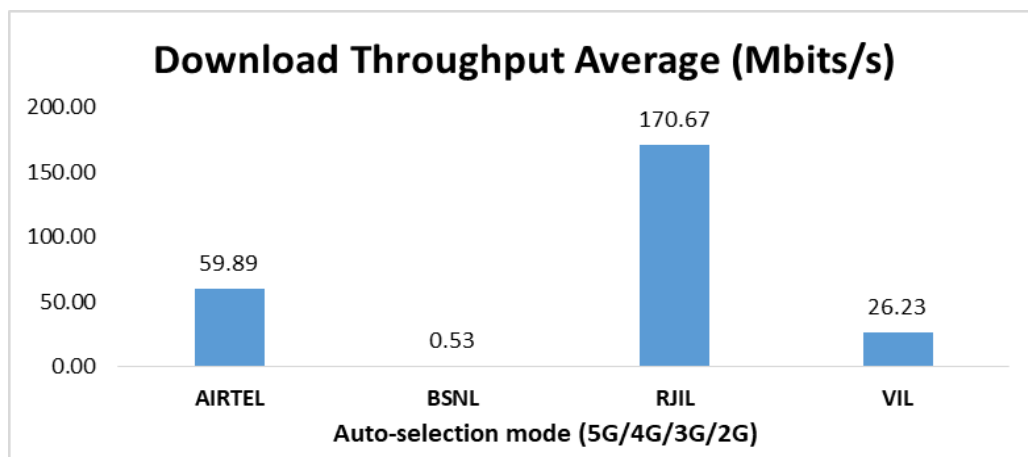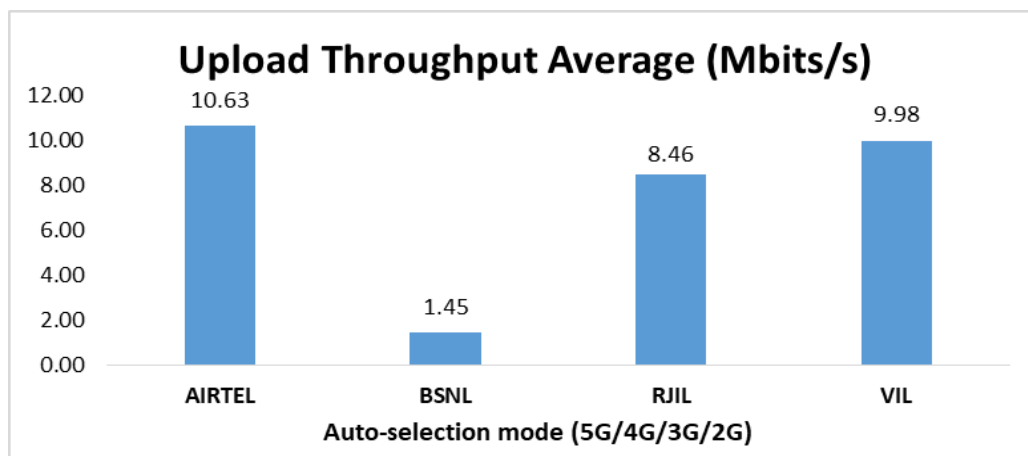

Figure-40: Download throughput

Figure-41: Upload throughput

5. Voice & Data Key findings

5.1 Overall Voice

1. **Call Setup Success Rate:**
   a) Airtel, BSNL and VIL have 98.91%, 93.81% and 99.36% call setup success rate respectively in 3G/2G network mode. (refer table-3)

   b) Airtel, BSNL, RJIL and VIL have 100.00%, 97.07%, 99.84% and 98.72% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G). (refer table-5)

   c) Airtel has 100% call setup success rate while calling on peer service provider's network, while BSNL, RJIL & VIL have block call rate for inter-operator calls. (refer table-9)

2. **Call Setup Time**:
   a) Airtel has taken comparatively longer time (4.77 second) to establish the voice call, whereas BSNL and VIL call setup time is 3.62 & 2.98 seconds respectively in 3G/2G network mode. (refer table-3)

   b) BSNL has taken comparatively longer time (4.08 second) to establish the voice call, whereas Airtel, RJIL & VIL call setup time is 1.26, 0.76 & 0.84 seconds respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)

3. **Call Silence/Mute Rate**: In packet switched network (4G/5G), BSNL, RJIL, Airtel and VIL have 4.49%, 0.82%, 0.64% & 0.62% silence call rate respectively. Further BSNL has higher RTP packet loss rate in downlink (4.47%) compared to VIL (0.99%), Airtel (0.70%) and RJIL (0.31%). In uplink the RTP packet loss rate is higher for VIL (0.75%) compared to Airtel (0.67%) and RJIL (0.53%). (refer table-6)

4. **Call Drop Rate**:
   a) Overall Airtel's, BSNL's & VIL's drop call rate 0.00%, 2.42% and 0.22% respectively in 3G/2G network mode. (refer table-3)

   b) Overall Airtel, BSNL, RJIL & VIL have 0.16%, 1.01%, 0.32% and 0.32% drop call rate respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-5)

5.2 Overall Data

1. **Data download and upload performance (Dynamic i.e. while moving):**
   a) BSNL (0.95 Mbps) and VIL (35.20 Mbps) being on 4G as top technology, have comparatively lower data speeds respectively. While Airtel and RJIL have average download speed of 133.79 Mbps and 280.43 Mbps respectively. (refer table-11)

   b) BSNL (1.15 Mbps) and VIL (9.08 Mbps) being on 4G as top technology, have comparatively lower data speeds respectively. While Airtel and RJIL have average upload speed of 26.51 Mbps and 37.45 Mbps respectively. (refer table-11)

2. **Data download and upload performance (static i.e. while stationary):**
   a) At Hotspots, RJIL has better 5G QoS performance comparatively, with average download speed of 381.67 Mbps. (refer table-31)

   b) At Hotspots, RJIL has better 5G QoS performance comparatively, with average upload speed of 40.95 Mbps. (refer table-31)

3. **Data session setup success rate (static i.e. while stationary):**
   a) Airtel, BSNL, RJIL and VIL have 100.00%, 88.00%, 94.00% and 100.00% download session setup success rate respectively. (refer table-31)

   b) Airtel, RJIL & VIL have 100.00% while BSNL have 88.00% upload session setup success rate respectively. (refer table-31)

5.3 Operator wise Key Findings

1. Airtel:
Voice

- 98.91% call setup success rate and 0.00% call drop rate have been observed in 3G/2G network mode. Performance is well within the benchmark of 98.00% & 2.00% respectively for LSA, city and highway drive. (refer table-3, 13 & 57)

- 100.00% call setup success rate and 0.16% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for LSA. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-5)

- 100.00% call setup success rate and 0.26% drop call rate have been observed for 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 for auto-selection mode (5G/4G/3G/2G) for all hotspot locations. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for all walk both locations. (refer table-53 & 54)

- 98.91% 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-57)

- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for highway drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-59)

Data

- Airtel has 133.79 Mbps average download throughput & 26.51 Mbps average upload throughput across measured routes for LSA. (refer table-11)

- Airtel has 167.73 Mbps average download throughput & 33.29 Mbps average upload throughput across measured routes for city drive. (refer table-19)

- Collectrate/Ghantaghar and Jabalpur Dumma Airport have less download speed (less than 100 Mbps) out of total 10 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-33 & 38)

- Collectrate/Ghantaghar, Gwarighat, Jabalpur Dumma Airport and Jabalpur Railway Station hotspot have less upload speed (less than 20 Mbps) out of total 10 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table- 33, 35, 38 & 39)

- ISBT Jabalpur and Jabalpur Dumma Airport have less download speed (less than 10 Mbps) out of total 10 Hotspots for auto-selection mode (4G/3G/2G). (refer table-48 & 49)

- Jabalpur Dumma Airport hotspot has less upload speed (less than 2 Mbps) out of total 10 Hotspots for auto-selection mode (4G/3G/2G). (refer table- 49)

- Jabalpur Airport has less download (less than 100 Mbps) & Upload speed (less than 20 Mbps) out of total 2 walk test locations. (refer table-55)

- Airtel has 59.89 Mbps average download throughput & 10.63 Mbps average upload throughput across measured routes for highway drive. (refer table-63)

2. BSNL:
Voice
- 93.81% call setup success rate and 2.42% call drop rate have been observed in 3G/2G network mode. Performance is not meeting the benchmark of 98.00% & 2.00% respectively for LSA drive. (refer table-3)

- 99.73% call setup success rate and 1.36% call drop rate have been observed in 3G/2G network mode. Performance is well within the benchmark of 98.00% respectively for city drive. (refer table-13)

- 97.07% call setup success rate and 1.01% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is not meeting the benchmark of 98.00% for call setup success rate for LSA. (refer table-5)

- 99.73% call setup success rate and 0.53% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is meeting the benchmark of 98.00% & 2.00% respectively for city drive. (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. (refer table-20)

- 100.00% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G) for both walk test locations. (refer table-53 & 54)

- 74.78% call setup success rate and 6.98% call drop rate have been observed in 3G/2G network mode. Performance is not meeting the benchmark of 98.00% & 2% respectively for highway drive. (refer table-57)

- 84.11% call setup success rate and 4.44% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is not meeting the benchmark of 98.00% & 2.00% respectively for highway drive. (refer table-59)

Data
- BSNL has 0.95 Mbps average download throughput & 1.15 Mbps average upload throughput across measured routes for LSA. (refer table-11)

- BSNL has 1.03 Mbps average download throughput & 0.87 Mbps average upload throughput across measured routes for city drive. (refer table-19)

- All Hotspots have less download speed (less than 10 Mbps) for auto-selection mode (5G/4G/3G/2G) (refer table- 32 to 41) and auto-selection mode (4G/3G/2G). (refer table-43 to 52)

- High Court, Jabalpur Dumma Airport, Kamaniya Gate and Netaji Subhash Chandra Bose Medical College Jabalpur hotspots have less upload speeds (less than 2 Mbps) out of total 10 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-36, 38, 40, & 41)

- Collectrate/Ghantaghar, ISBT Jabalpur, Jabalpur Dumma Airport and Kamaniya Gate have less upload speeds (less than 2 Mbps) out of total 10 Hotspots for auto-selection mode (4G/3G/2G). (refer table-44, 48, 49 & 51)

- Jabalpur Airport and Jabalpur Railway Station have less download (less than 10 Mbps) & upload speed (less than 2 Mbps) for both walk test locations. (refer table-55 & 56)

- BSNL has 0.53 Mbps average download throughput & 1.45 Mbps average upload throughput across measured routes for highway drive. (refer table-63)

3. RJIL:
Voice
- 99.84% call setup success rate and 0.32% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is well within the benchmark of 98.00% & 2.00% respectively for LSA. (refer table-5)

- 100.00% call setup success rate and 0.00% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is well within the benchmark of 98.00% & 2.00% respectively for city drive. (refer table-15)

- 100.00% call setup success rate and 0.00% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. (refer table-20)

- At Jabalpur Railway Station 10.00% call drop rate has been observed for auto-selection mode (5G/4G/3G/2G). Performance is not within the benchmark of 2.00% at this walk test location. (refer table-54)

- 98.98% call setup success rate and 0.00% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is well within the benchmark of 98.00% & 2.00% respectively for highway drive. (refer table-59)

Data

- RJIL has 280.43 Mbps average download speed & 37.45 Mbps average upload speed across measured routes in LSA. (refer table-11)

- RJIL has 349.44 Mbps average download speed & 38.74 Mbps average upload speed across measured routes in city drive. (refer table-19)

- Jabalpur Dumma Airport hotspot has less download speed (less than 100 Mbps) out of total 10 Hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-38)

- Gwarighat, High Court and Jabalpur Dumma Airport have less upload speed (less than 20 Mbps) out of total 10 hotspots for auto-selection mode (5G/4G/3G/2G). (refer table-35, 36 & 38)

- Gwarighat and Jabalpur Dumma Airport have less download speed (less than 10 Mbps) out of total 10 hotspots for auto-selection mode (4G/3G/2G). (refer table- 46 and 49)

- Gwarighat has less upload speed (less than 2 Mbps) out of total 10 hotspots for auto-selection mode (4G/3G/2G). (refer table-46)

- Jabalpur Airport and Jabalpur Railway Station have less download speed (less than 100 Mbps) at both walk test locations. (refer table-55 & 56)

- Jabalpur Airport has less upload speed (less than 20 Mbps) out of 2 walk test locations. (refer table- 55)

- RJIL has 170.67 Mbps average download speed & 8.46 Mbps average upload speed across measured routes in highway drive. (refer table-63)

4. VIL:
Voice

- 99.36% call setup success rate and 0.22% call drop rate have been observed in 3G/2G network mode. Performance is meeting the benchmark of 98.00% & 2.00% respectively for LSA. (refer table-3)

- 99.19% call setup success rate and 0.27% call drop rate have been observed in 3G/2G network mode. Performance is meeting the benchmark of 98.00% & 2.00% respectively for city drive. (refer table-13)

- 98.72% call setup success rate and 0.32% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G). Performance is meeting the benchmark of 98.00% & 2.00% respectively for LSA. (refer table-5)

- 99.23% call setup success rate and 0.00% call drop rate have been observed for auto-selection mode (5G/4G/3G/2G). Performance is meeting the benchmark of 98.00% & 2.00% respectively for city drive. (refer table-15)

- 100.00% call setup success rate and 0.00% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G) for all hotspot locations. (refer table-20)

- 88.89% call setup success rate has been observed in auto-selection mode (5G/4G/3G/2G) at Jabalpur Airport walk test location. (refer table- 53)

- 5.56% call drop rate has been observed in auto-selection mode (5G/4G/3G/2G) at Jabalpur Railway Station walk test location. (refer table-54)

- 100.00% call setup success rate and 0.00% call drop rate have been observed in 3G/2G network mode. Performance is well within the benchmark of 98.00% & 2% respectively for highway drive. (refer table-57)

- 96.97% call setup success rate and 1.04% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is not meeting the benchmark of 98.00% for call setup success rate for highway drive. (refer table-59)

Data
- VIL has 35.20 Mbps average download speed & 9.08 Mbps average upload speed across measured routes in LSA. (refer table-11)

- VIL has 36.89 Mbps average download speed & 8.74 Mbps average upload speed across measured routes in city drive. (refer table-19)

- Jabalpur Airport has less upload speed (less than 2 Mbps) out of total 2 walk test locations. (refer table-55)

- VIL has 26.23 Mbps average download speed & 9.98 Mbps average upload speed across measured routes in highway drive. (refer table-63)

6. Annexure

6.1 Route wise coverage map

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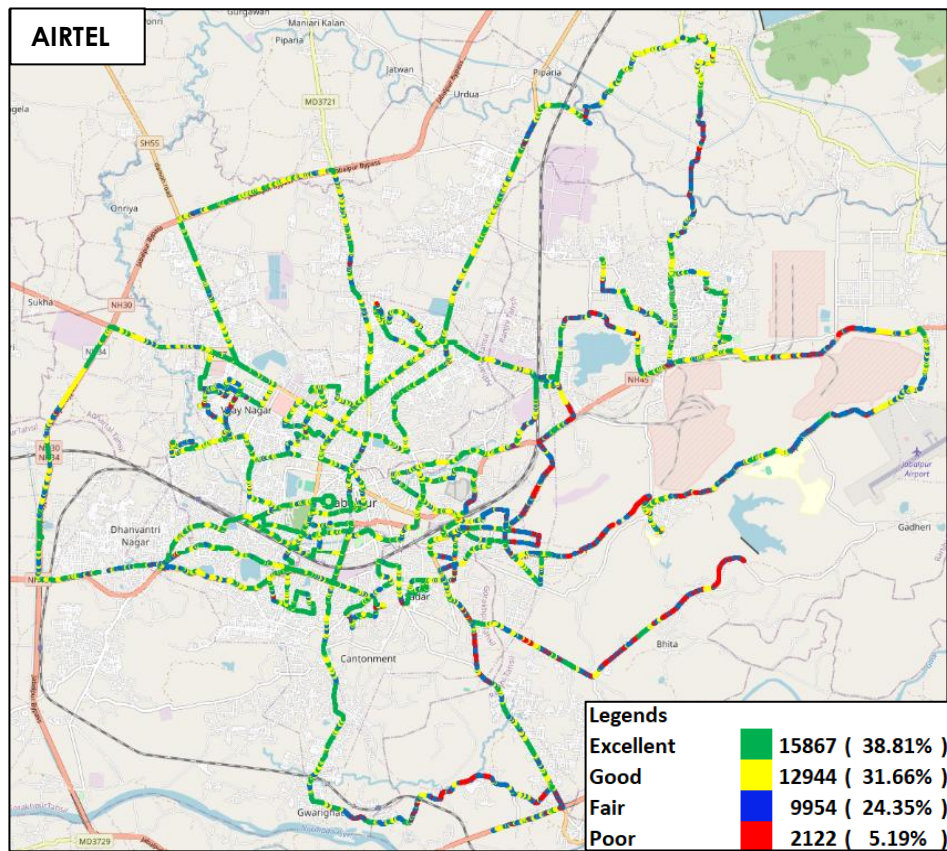
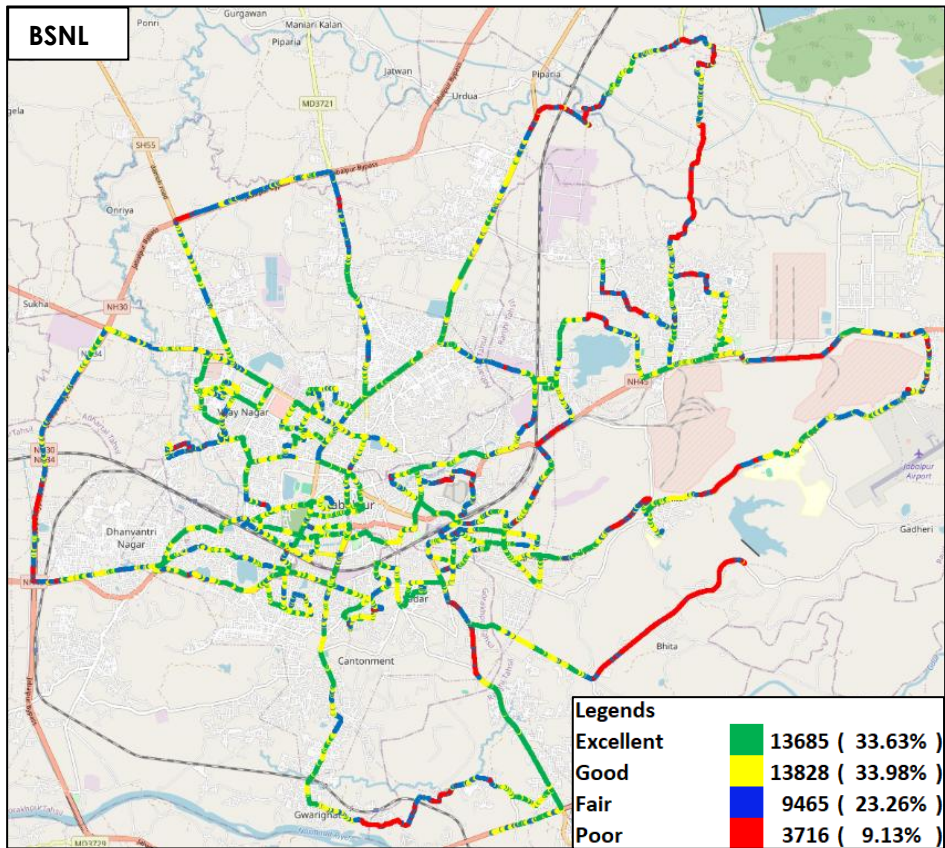**Figure-42:** Signal strength 3G/2G network mode – AIRTEL.

Legends		
Excellent		13685 (33.63%)
Good		13828 (33.98%)
Fair		9465 (23.26%)
Poor		3716 (9.13%)

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

Legends		
Excellent		18852 (49.62%)
Good		10983 (28.91%)
Fair		5960 (15.69%)
Poor		2196 (5.78%)
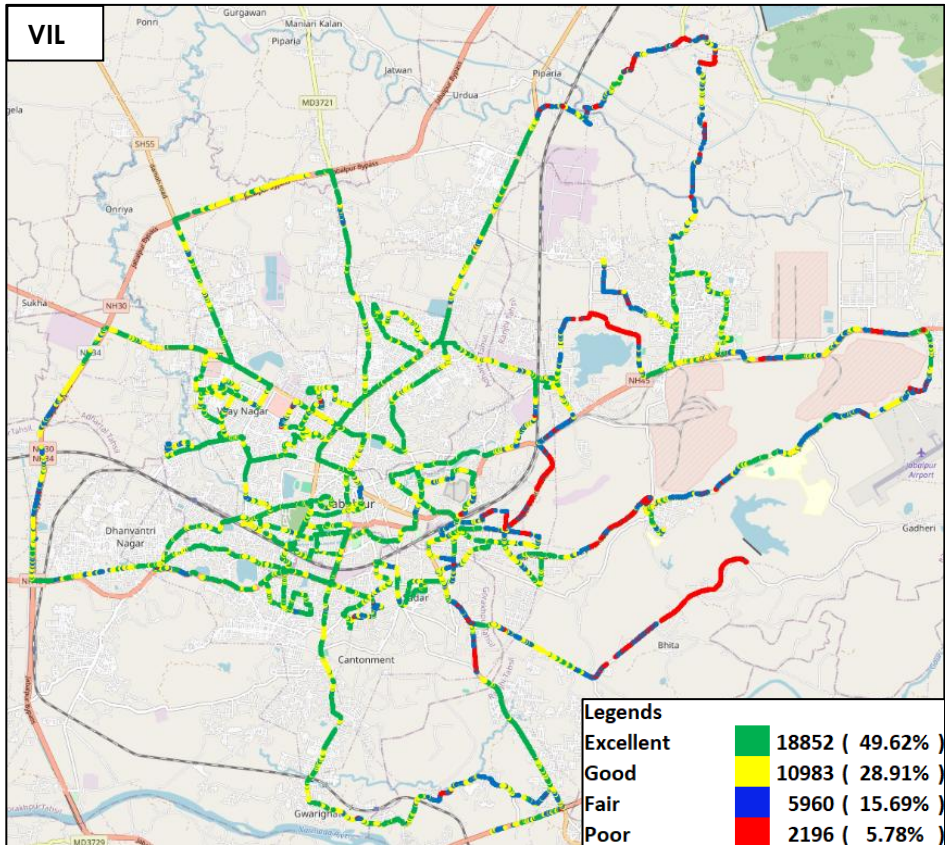
Figure-44: Signal strength 3G/2G network mode – VIL.
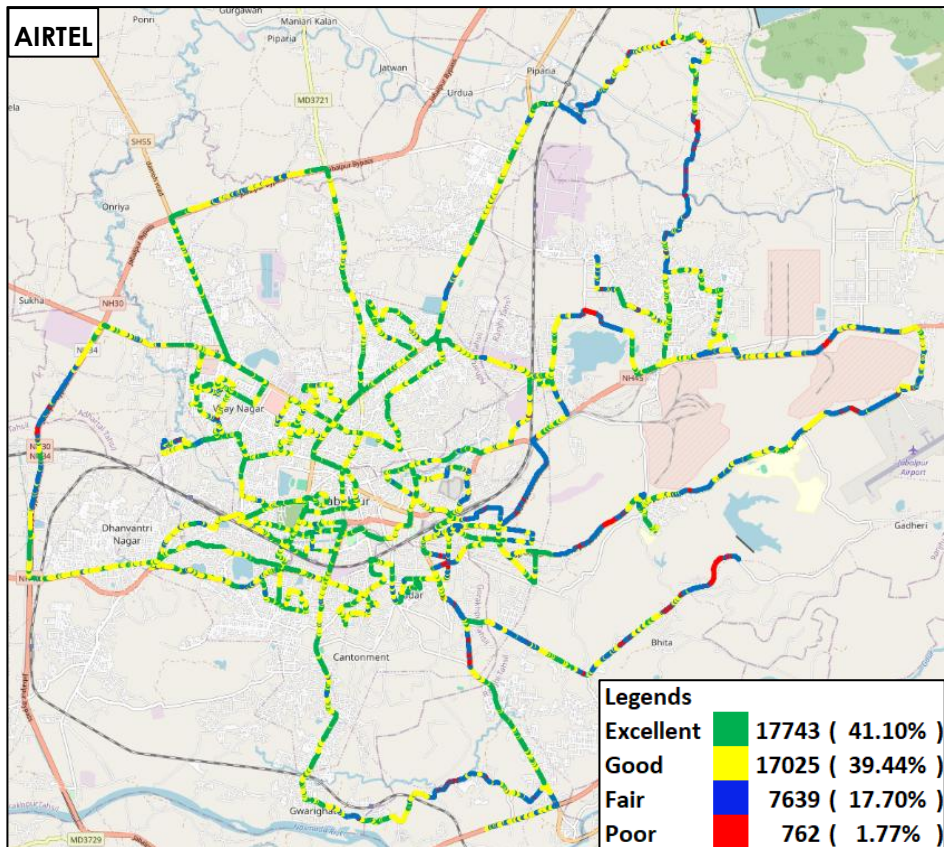
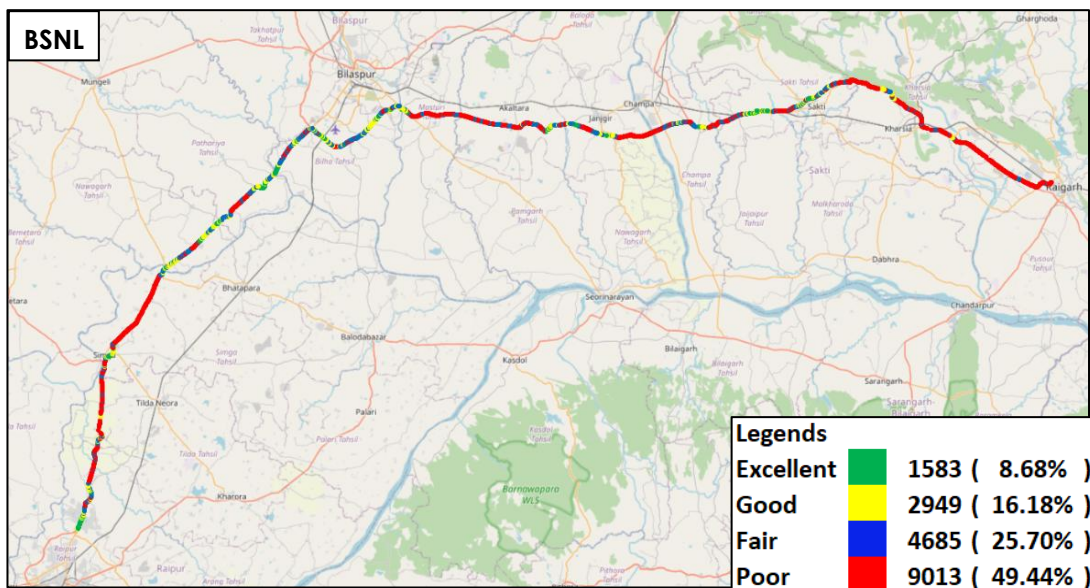**Figure-45:** Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL.
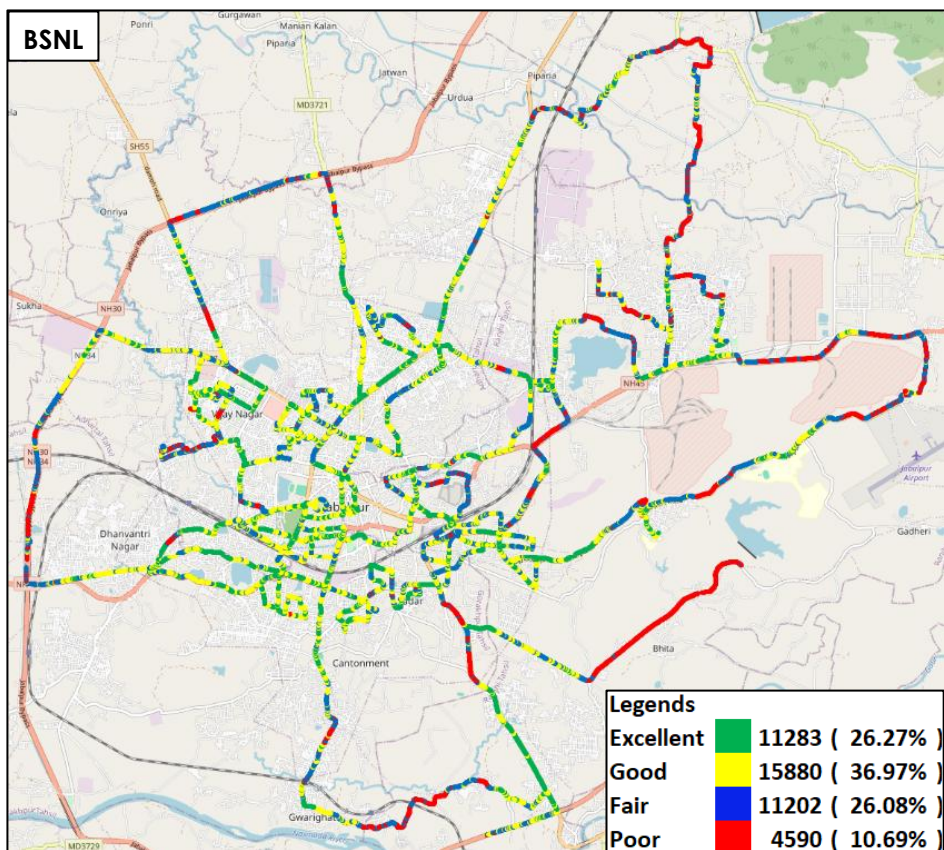
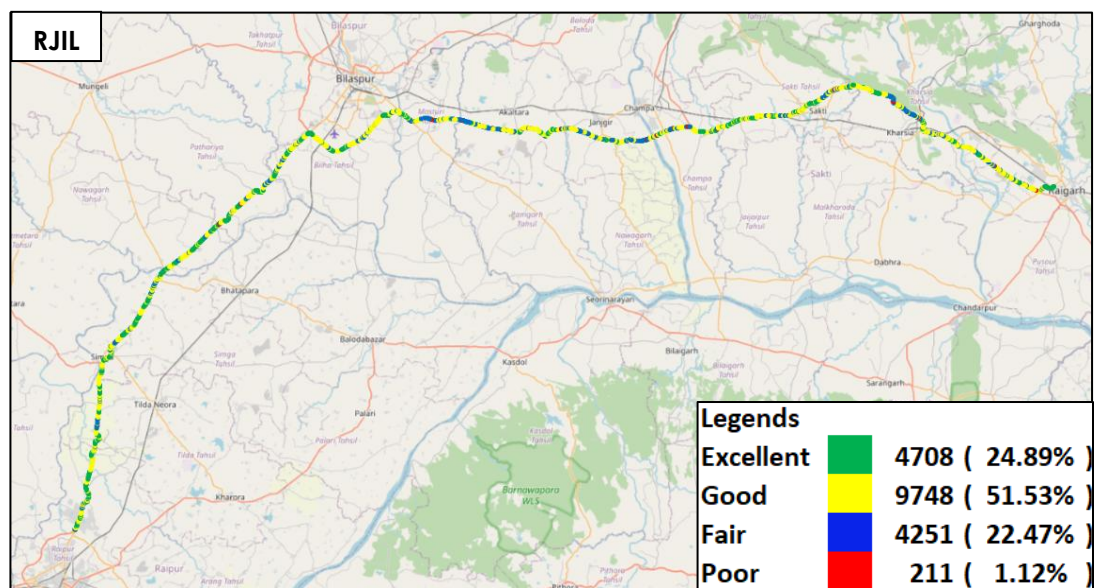**Figure-46:** Signal strength auto-selection mode 5G/4G/3G/2G – BSNL.
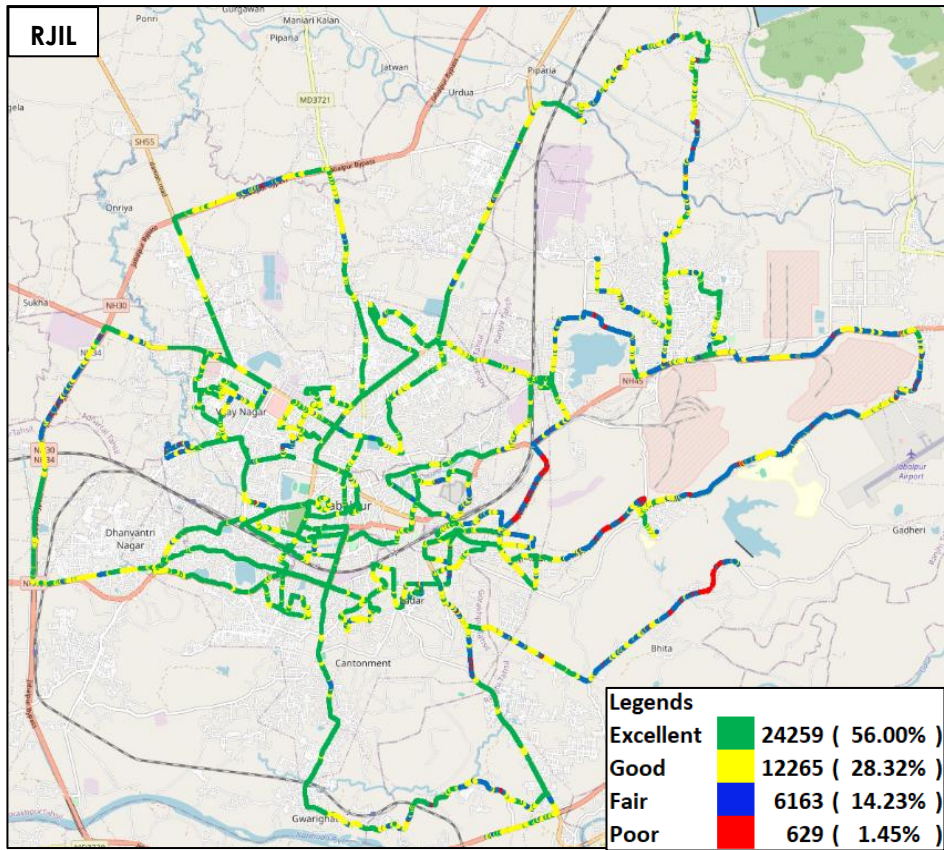
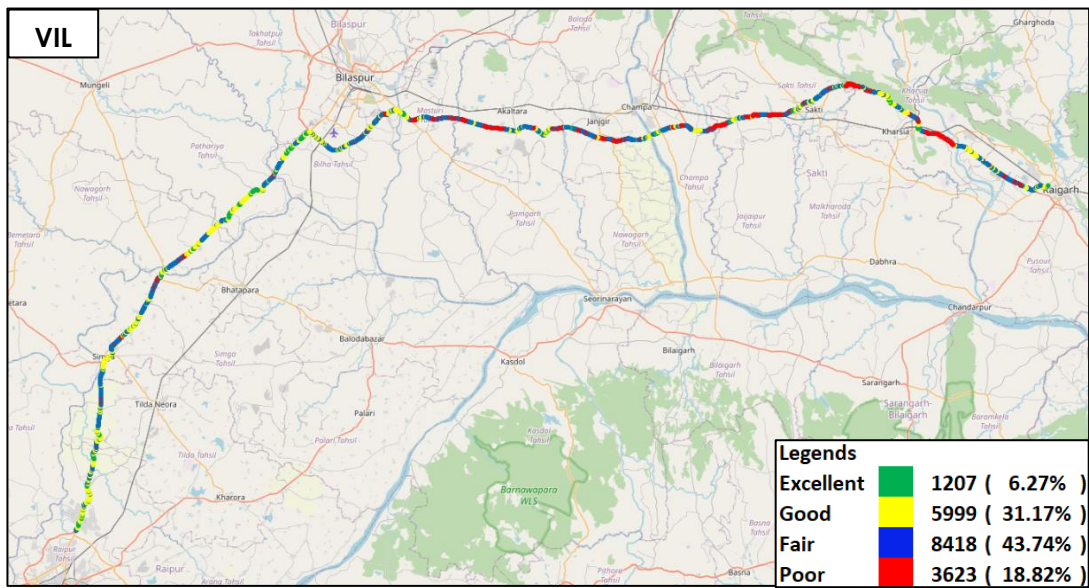**Figure-47:** Signal strength auto-selection mode 5G/4G/3G/2G – RJIL.
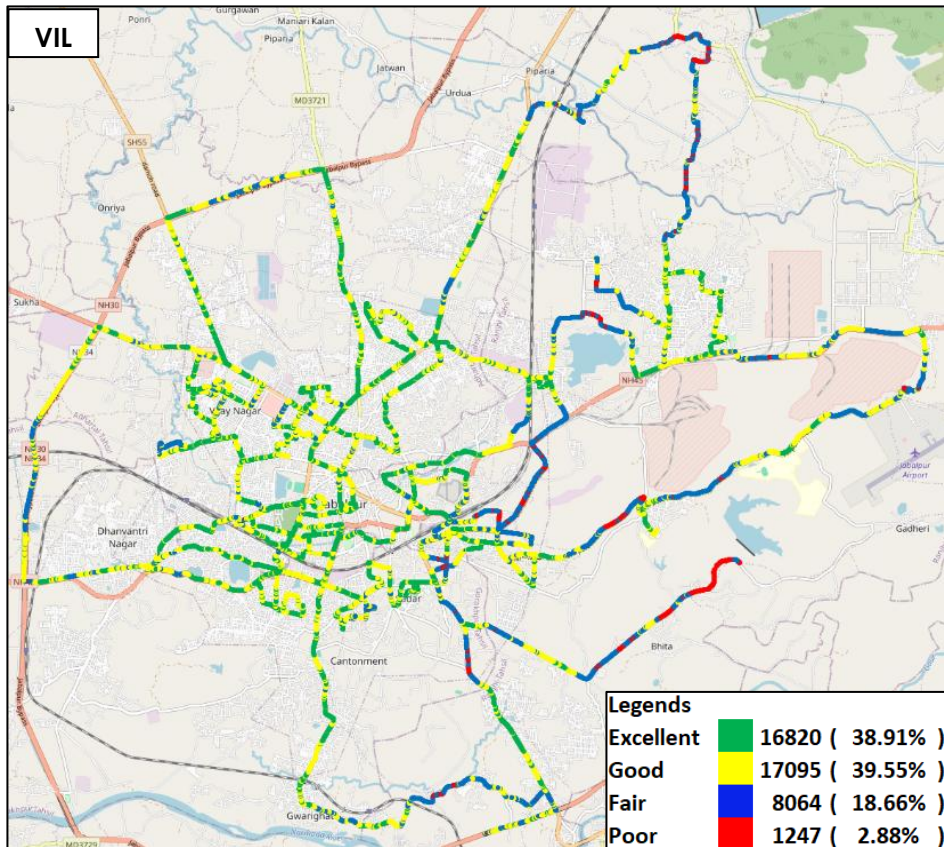
Figure-48: Signal strength auto-selection mode 5G/4G/3G/2G – VIL.

6.1.2 Highway
i) Raipur to Bilaspur to Raigarh
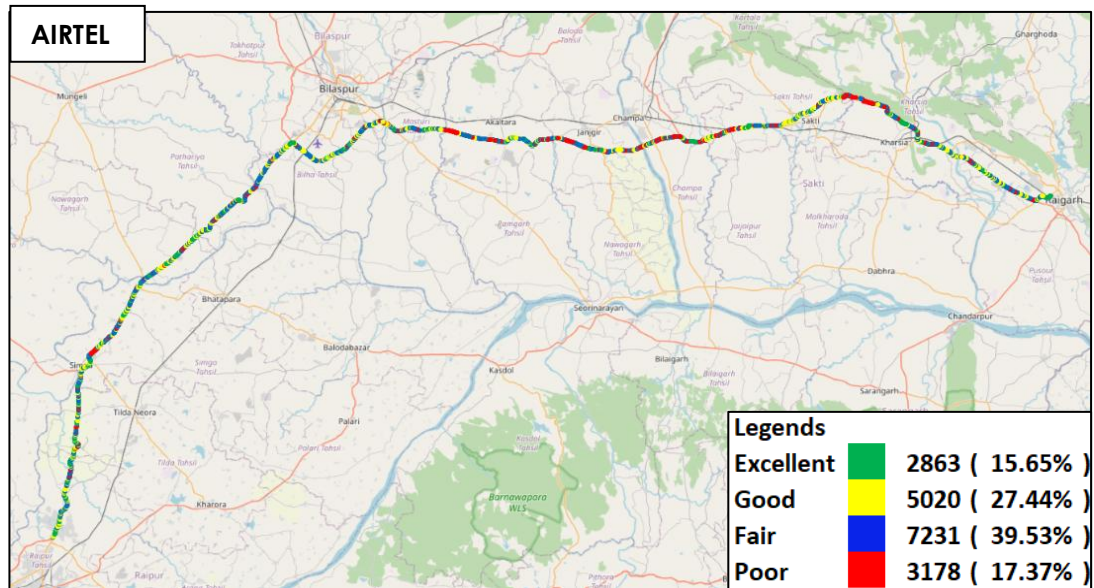
Figure-49: Signal strength 3G/2G network mode – AIRTEL.
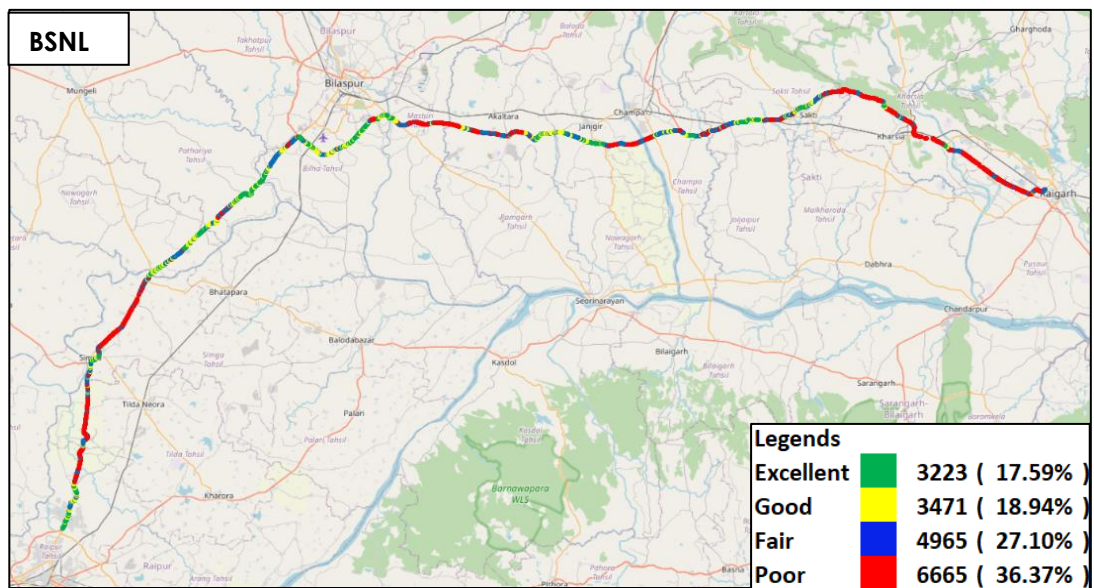
Figure-50: Signal strength 3G/2G network mode – BSNL.

Legends		
Excellent		2467 (13.30%)
Good		5309 (28.62%)
Fair		6404 (34.52%)
Poor		4372 (23.57%)
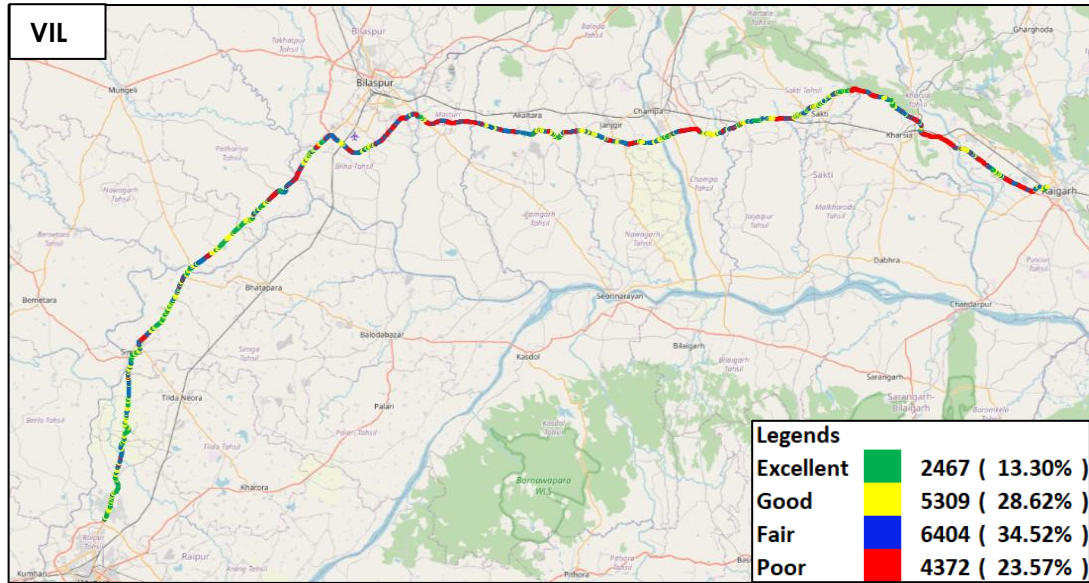
Figure-51: Signal strength 3G/2G network mode – VIL.

Legends		
Excellent		3035 (15.60%)
Good		11216 (57.67%)
Fair		4562 (23.46%)
Poor		636 (3.27%)
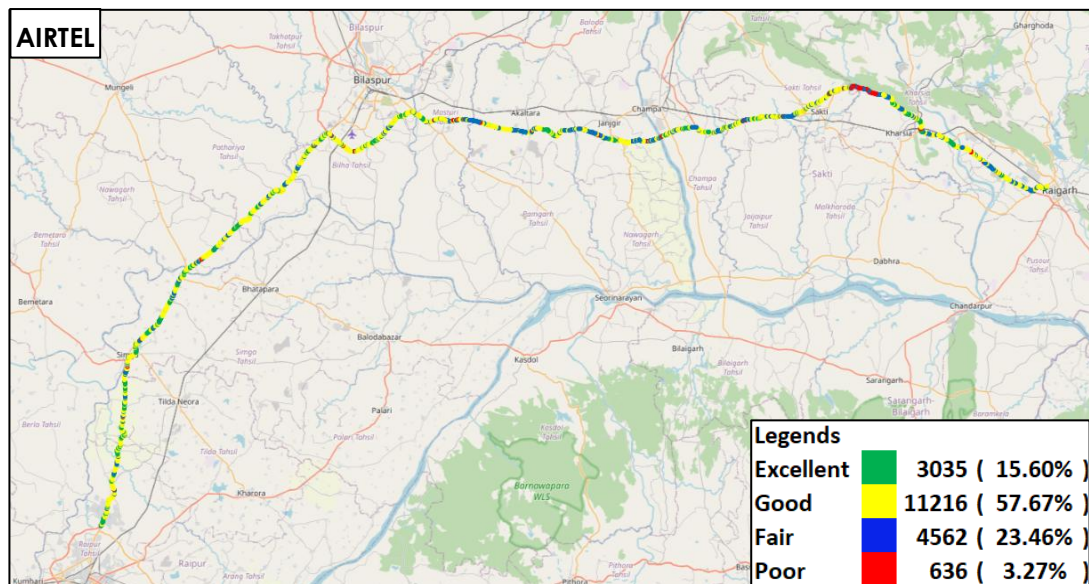
Figure-52: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL.

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

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

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

7. Appendix

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

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

7.1 Appendix-I
7.1.1 Drive test setup

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

Table-64: 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.
> - 5G/4G/3G/2G auto mode MOS call were made in BSNL as BSNL don't have VoLTE & VoNR network availability.

Data Test		
Test Type	**Technology**	**Detail**
HTTP/FTP Download	5G/4G/3G/2G Auto Mode	500 MB File- 30 Sec Timeout, (Multithread 3- TCP Connection at a time)
HTTP/FTP Upload		250 MB File- 30 Sec Timeout, (Multithread 3- TCP Connection at a time)
YouTube Streaming		20 Sec Video & 25 sec Timeout (Only at Hotspot)

Web Browsing		3 popular websites (www.google.co.in, www.amazon.co.in, www.facebook.co.in) 20 sec timeout (only at Hotspot)
Latency		25 count- Dynamic 1000 count- Hotspot Payload- 42 bytes in all drive

Table-65: Data test detail

Note–
- 5 Data iteration to be done at each hotspot location.
- Minimum 5 iteration to be made during the walk test. Iteration count will be increased based on walk test distance.
- Ping test to be performed only once at hotspot location.
- Youtube & Web browsing test to be performed at static location only.
- All values are taken up to two decimal places with round off.
- Download and upload testing has been done on FTP server for Airtel, BSNL & RJIL. (Airtel, BSNL & RJIL not provided HTTP server)
- VIL download and upload testing is done on HTTP Server.
- Download & Upload test performed at hotspot in 4G/3G/2G auto-selection also.
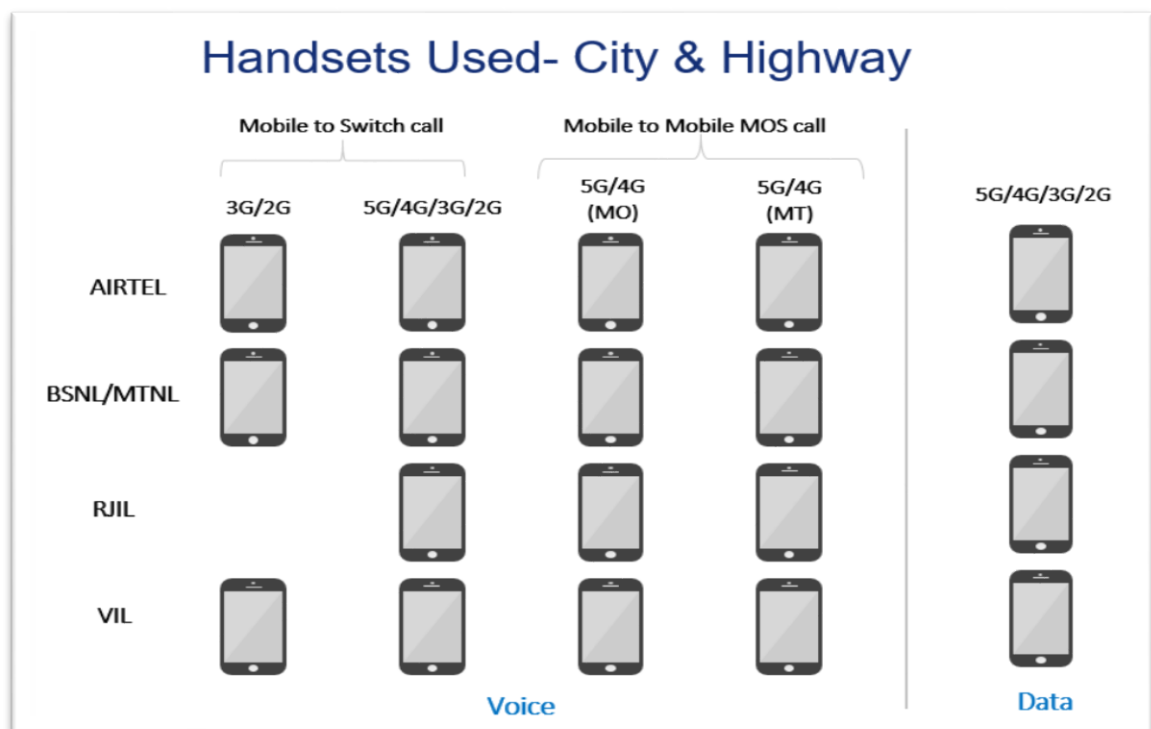
Figure-56: Number of handsets used in city & highway drive

MO: Mobile originating
MT: Mobile terminating
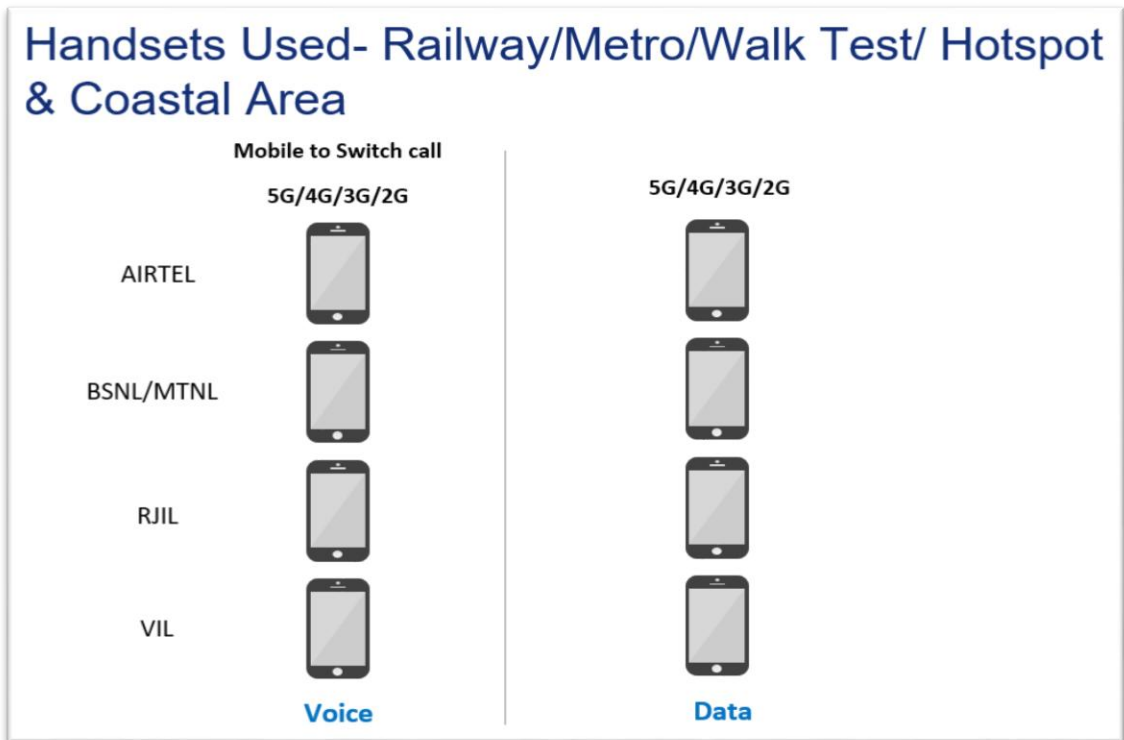
Figure-57: Number of handsets used in railway/metro/walktest/hotspot & coastal area

7.1.2 Drive test Methodology
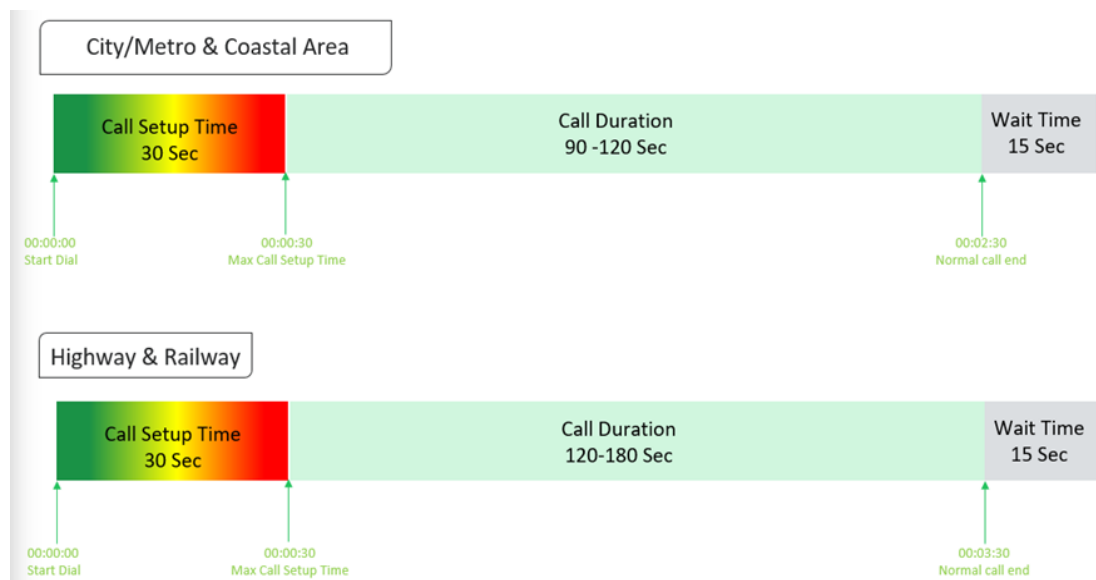
(a) Dynamic voice testing (on the move)

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

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

(b) Hotspot voice testing

Figure-59: Voice test script for walktest/hotspot

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

(c) Dynamic Data (internet) test
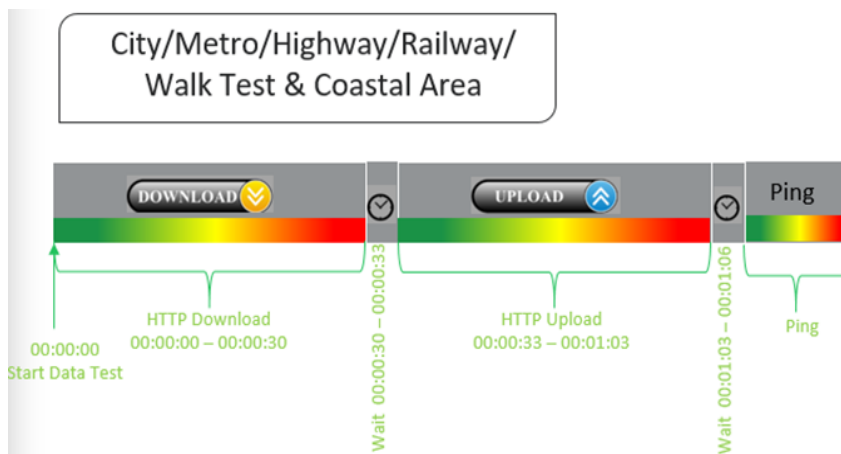
Figure-60: Data test script used in city/metro/railway/highway/walk test & coastal area
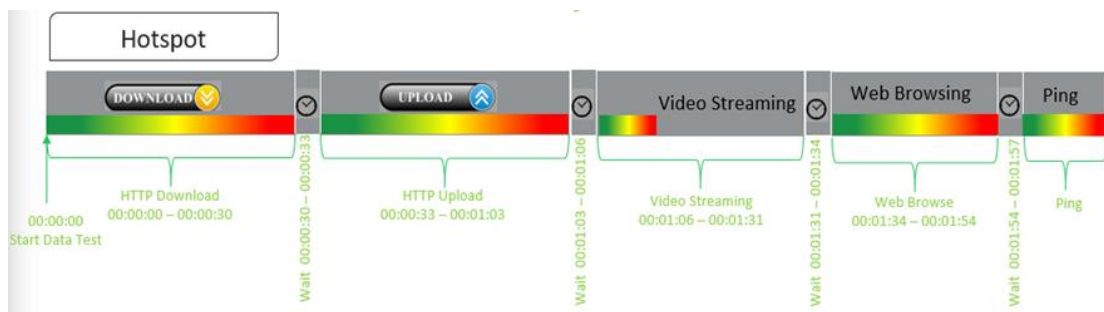
(d) Static Data(internet) testing

Figure-61: Data test script used at hotspot

- 5 Data iteration done at each hotspot location.
- Min. 5 iteration made during the walk test.
- Web browsing duration mentioned above is for one web site only.
- Only 1 ping iteration (with 1000 Count) done at hotspot location.
- Download & Upload test performed at hotspot in 4G/3G/2G auto-selection also.

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%**
Call Drop Rate	Call drop represents the service provider network's ability to maintain a call once it has been successfully established. This parameter shall include both incoming calls and outgoing calls which, once they have been established and have an assigned traffic channel/ bearer, are dropped, or interrupted before their normal completion by the user, the cause of the early termination being within the service provider's network Call Drop Rate = (Total Call Drop/Total Call Established) *100 As per QoS Regulation 2024 benchmark value is **<=2%**
Call Setup Time	Time taken from call initiate to call alerting/ringing. Call Setup Time = T2- T1 T2- Ringing (VoLTE/VoNR) & Alerting (for WCDMA & GSM), T1- Invite (VoLTE/VoNR) & CM Service Request (for WCDMA & GSM)
Voice Quality (MOS)	Voice quality in mobile networks is measured with algorithms based on ITU-T P.863 (POLQA). The grading for Voice quality has been given as: Excellent: MOS $\geq$ 4 and < 5 Good : MOS $\geq$ 3 and < 4 Fair : MOS $\geq$ 2 and < 3 Poor : MOS $\geq$ 1 and < 2
Handover Success Rate	Handover Success Rate = Count of successful handovers (All Technology Handover combined) / Total count of Handover Attempt (All Technology Handover combined) *100 Handover type which are considered- 2G Inter & Intra cell, 3G Soft & IRAT, 4G Inter & Intra frequency & SRVCC, 5G Inter & Intra frequency & 5G to 4G handovers.
Silence Call	A call which has $\geq$ 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 $J(i) = J(i-1) + (|D(i-1,i)| - J(i-1))/16 \text{ or } 8$
Downlink Packet Drop Rate	Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call originating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE)
Uplink Packet Drop Rate	Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call terminating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE).
Signal Strength	Signal strength is the signal power level received by the wireless user. *table below*

Signal Strength table:

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

Table-66: 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	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	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	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-67: 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.