



TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report
Rajasthan, Haryana, Delhi & Punjab LSA
January 2025

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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 performed on Railway route undertaken in Rajasthan, Haryana, Delhi and Punjab License Service Area (LSA) during the month January, 2025 under the supervision of TRAI Regional Office (RO), Jaipur. Details of route covered during the IDT is as given below:

S. No.	Drive test route	Type of route	Distance covered (KMs)	From date	To date
1	Jaipur Junction to Madhopur Punjab	Railway	803	9-Jan-2025	9-Jan-2025

Table-1: Drive test summary.

2.2 Drive test route

The map provides overview of drive test route indicating railway route drive as per the legend shown on the map

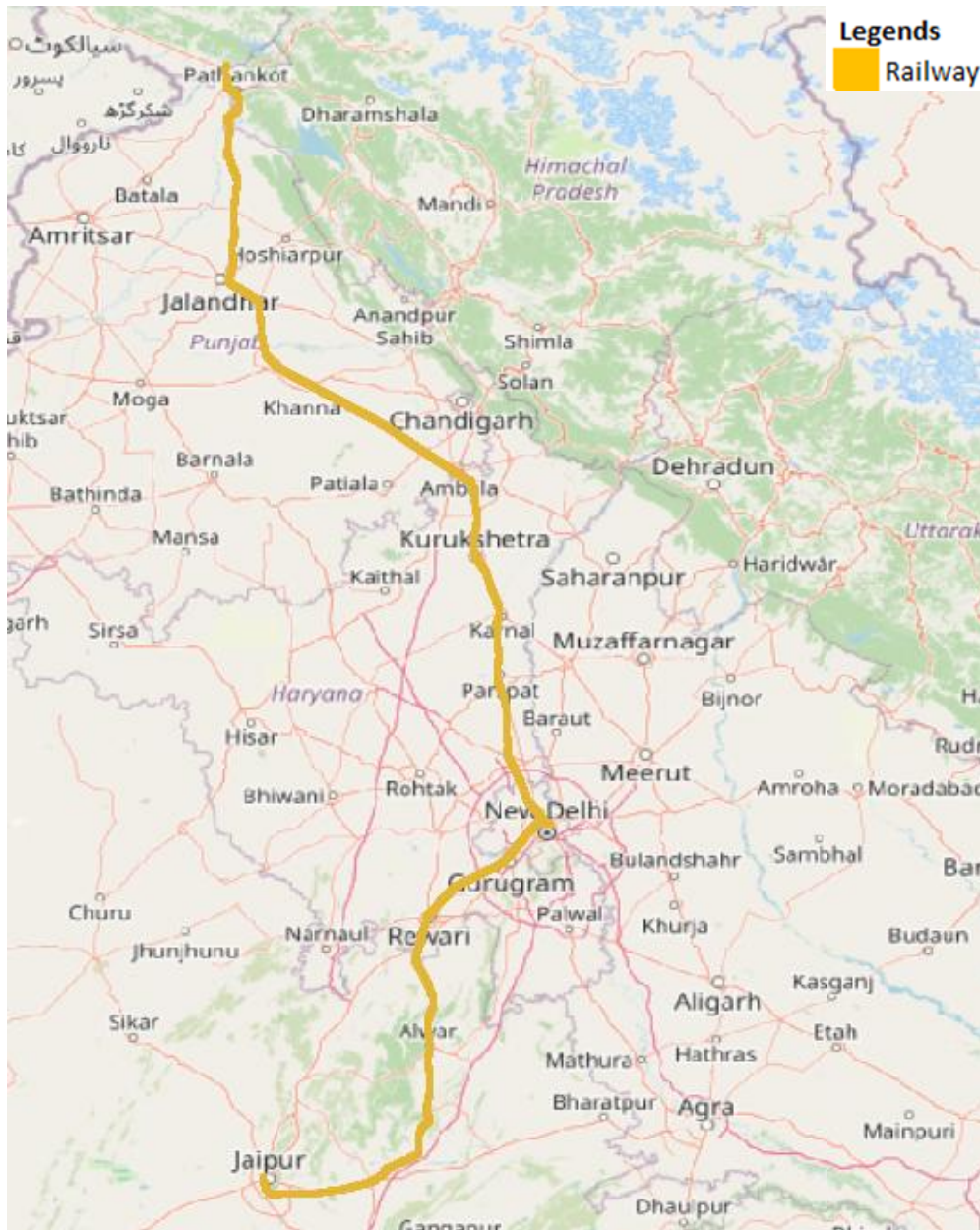


Figure-1: Drive test routes.

2.3 Summary of areas covered

- a) Railway Route-** Jaipur Junction to Madhopur Punjab Via Raigarh, Alwar, Rewari, Gurugram, Delhi, Panipat, Karnal, Kurukshetra, Ambala, Ludhiana, Jalandhar, Pathankot etc.

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	-
2	Bharti Airtel Ltd.	4G	850,900,1800,2100,2300
3	Bharti Airtel Ltd.	5G	3500
4	BSNL	2G	900
5	BSNL	3G	2100
6	BSNL	4G	700,2100
7	Reliance JIO Infocomm Ltd.	4G	850,1800,2300
8	Reliance JIO Infocomm Ltd.	5G	700,3500
9	Vodafone Idea Ltd.	2G	900,1800
10	Vodafone Idea Ltd.	4G	900,1800,2100,2500

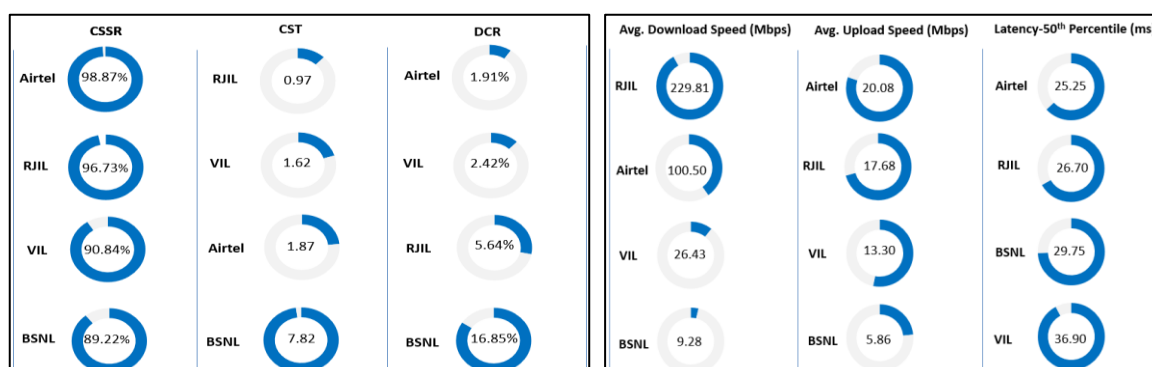
Table-2: Telecom service provider (TSP) covered in IDT.

Note-

- '-' Service provider doesn't observed services on respective technology.

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 98.87%, 96.73%, 90.84% & 89.22% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G).

Call Setup Time: BSNL has taken longer time (7.82 second) to establish the voice call, whereas Airtel, RJIL, & VIL call setup time is 1.87, 0.97 & 1.62 seconds respectively in auto-selection mode (5G/4G/3G/2G).

Call Drop Rate: Overall BSNL's call drop rate (16.85%) is higher, while Airtel, RJIL & VIL have 1.91%, 5.64% and 2.42% drop call rate respectively in auto-selection mode (5G/4G/3G/2G).

Summary-Data services

Data Download performance (Dynamic): BSNL (9.28 Mbps) and VIL (26.43 Mbps) both have 4G as top technology providers, have comparatively lower download speeds. While Airtel and RJIL have average download speed of 100.50 Mbps and 229.81 Mbps respectively.

Data Upload performance (Dynamic): BSNL (5.86 Mbps) and VIL (13.30 Mbps) both have 4G as top technology providers, have comparatively lower upload speeds. While Airtel and RJIL have average upload speed of 20.08 Mbps and 17.68 Mbps respectively.

QoS Performance Analysis- Rajasthan, Haryana, Delhi & Punjab 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 (Rajasthan, Haryana, Delhi and Punjab) by aggregating the results of drive tests conducted in the LSA (Rajasthan, Haryana, Delhi and Punjab) during the January-2025 covering railway. (Refer Table-1)

3.2 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	265	306	275	273
Call Setup Success Rate %	98.87	89.22	96.73	90.84
Drop Call Rate %	1.91	16.85	5.64	2.42
Call Setup Time-Average (Second)	1.87	7.82	0.97	1.62
Handover Success Rate %	99.91	98.48	99.90	99.79

Table-3: Summary of voice call performance in network auto-selection mode.

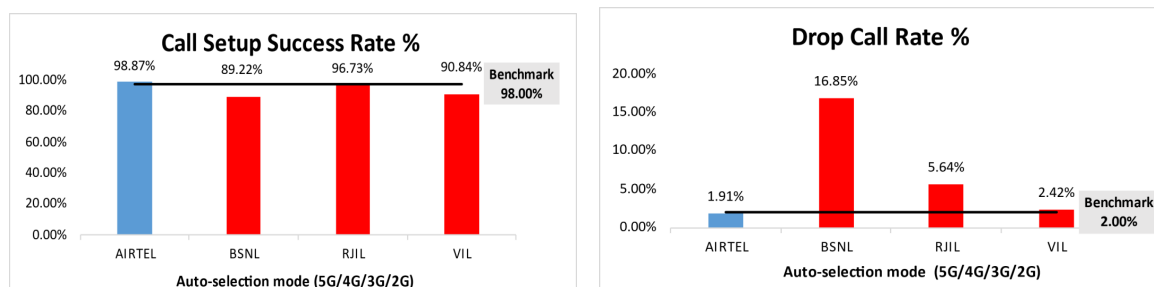


Figure-2: Performance for call setup success rate and drop call rate.

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	840	NA
4G	2630	329	2268	1938
3G	NA	97	NA	NA
2G	0	393	NA	59

Table-4: Technology wise number of network cell id's latched during drive test.

Note-

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

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	100.50	9.28	229.81	26.43
	80th Percentile	181.51	15.04	381.85	43.38
	20th Percentile	15.27	2.37	51.45	9.05
Upload Throughput (Mbits/s)	Average	20.08	5.86	17.68	13.30
	80th Percentile	31.77	10.65	32.23	20.74
	20th Percentile	4.69	1.80	3.87	4.81
Latency (ms)	50th Percentile	25.25	29.75	26.70	36.90

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

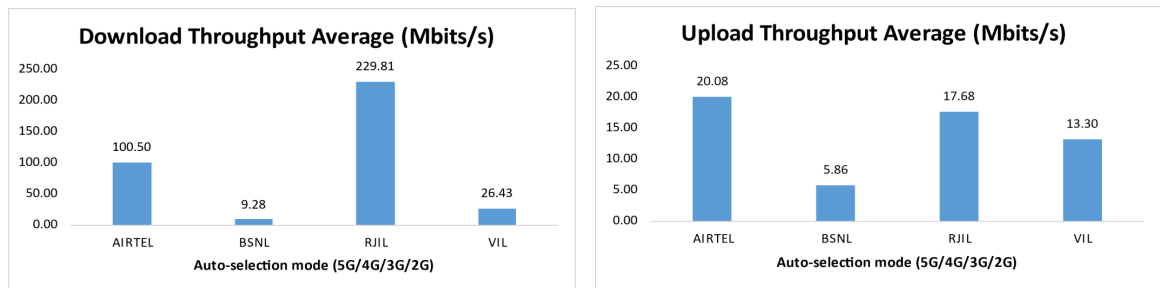


Figure- 3: Download and upload throughput.

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	1688	NA
4G	2686	565	284	2129
3G	NA	132	NA	NA
2G	0	25	NA	27

Table-6: Technology wise number of network cell id's latched during drive test.

Note-

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

Detailed QoS Performance Analysis

4. Detailed QoS performance analysis

4.1 Overview

This section covers analysis on performance of Railway route for all telecom service providers, the results of drive tests conducted is shown individually for respective route.

4.2 Railways

Drive test has been conducted on 9th January 2025 covering one railway route. (Refer Table-1)

4.2.1 Drive test route

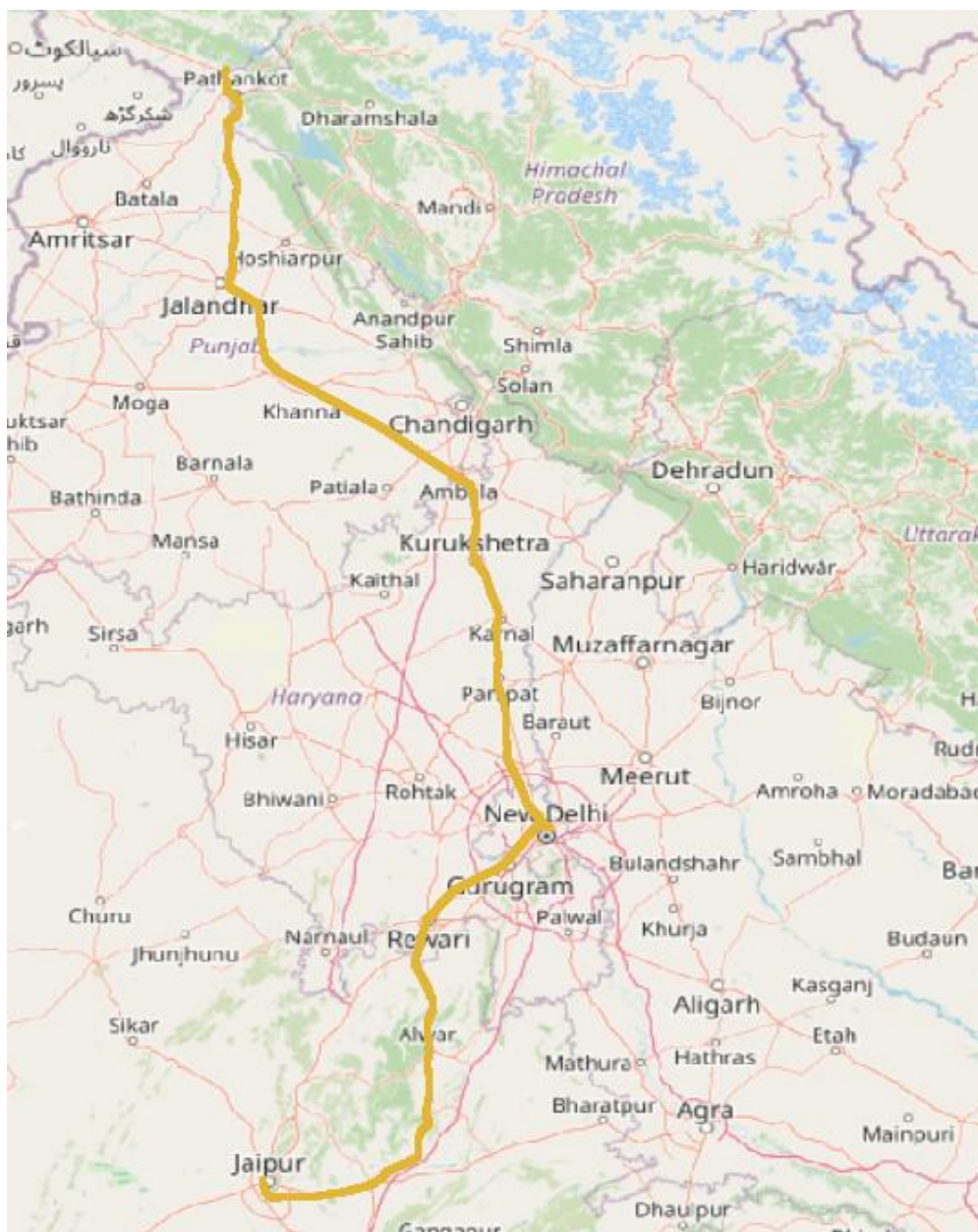


Figure-4: Drive test railway route.

4.2.2 Route Covered

- Jaipur Junction to Madhopur Punjab Via Raigarh, Alwar, Rewari, Gurugram, Delhi, Panipat, Karnal, Kurukshetra, Ambala, Ludhiana, Jalandhar, Pathankot etc.

4.2.3 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	265	306	275	273
Call Setup Success Rate %	98.87	89.22	96.73	90.84
Drop Call Rate %	1.91	16.85	5.64	2.42
Call Setup Time-Average (Second)	1.87	7.82	0.97	1.62
Handover Success Rate %	99.91	98.48	99.90	99.79

Table-7: Summary of voice call performance in network auto-selection mode.

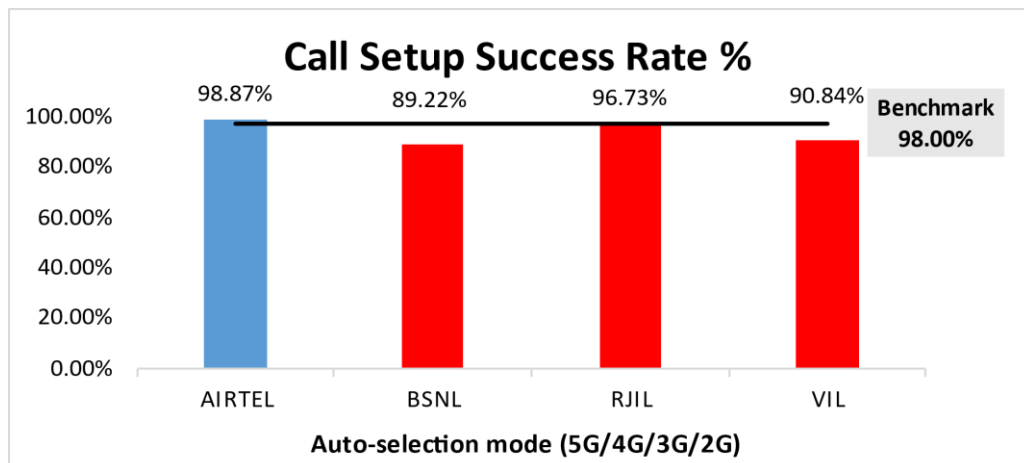


Figure-5: Performance for call setup success rate.

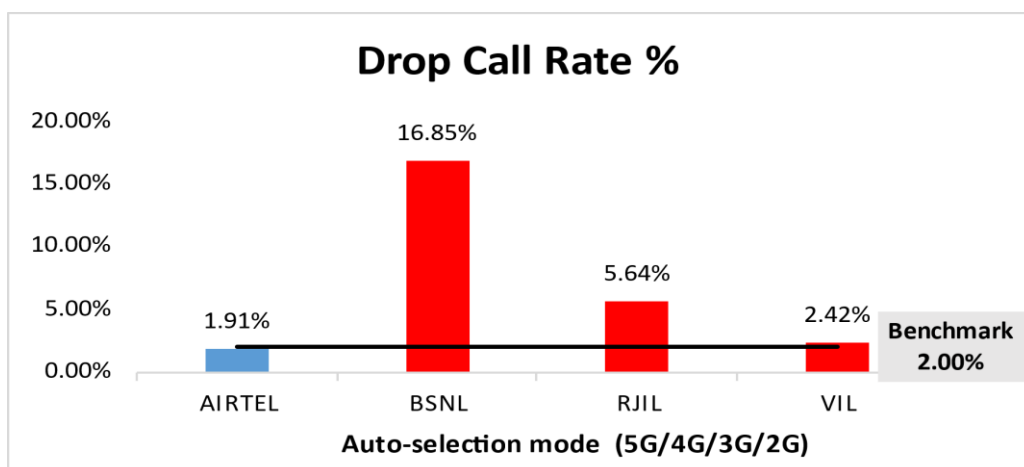


Figure-6: Performance for drop call rate.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	3.97%	NA	30.07%	NA
4G	96.03%	27.95%	69.88%	94.38%
3G	NA	25.33%	NA	NA
2G	0.00%	46.09%	NA	5.48%
Limited Service	0.00%	0.64%	0.05%	0.14%

Table-8: Time spent on technology during drive test.

Note-

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

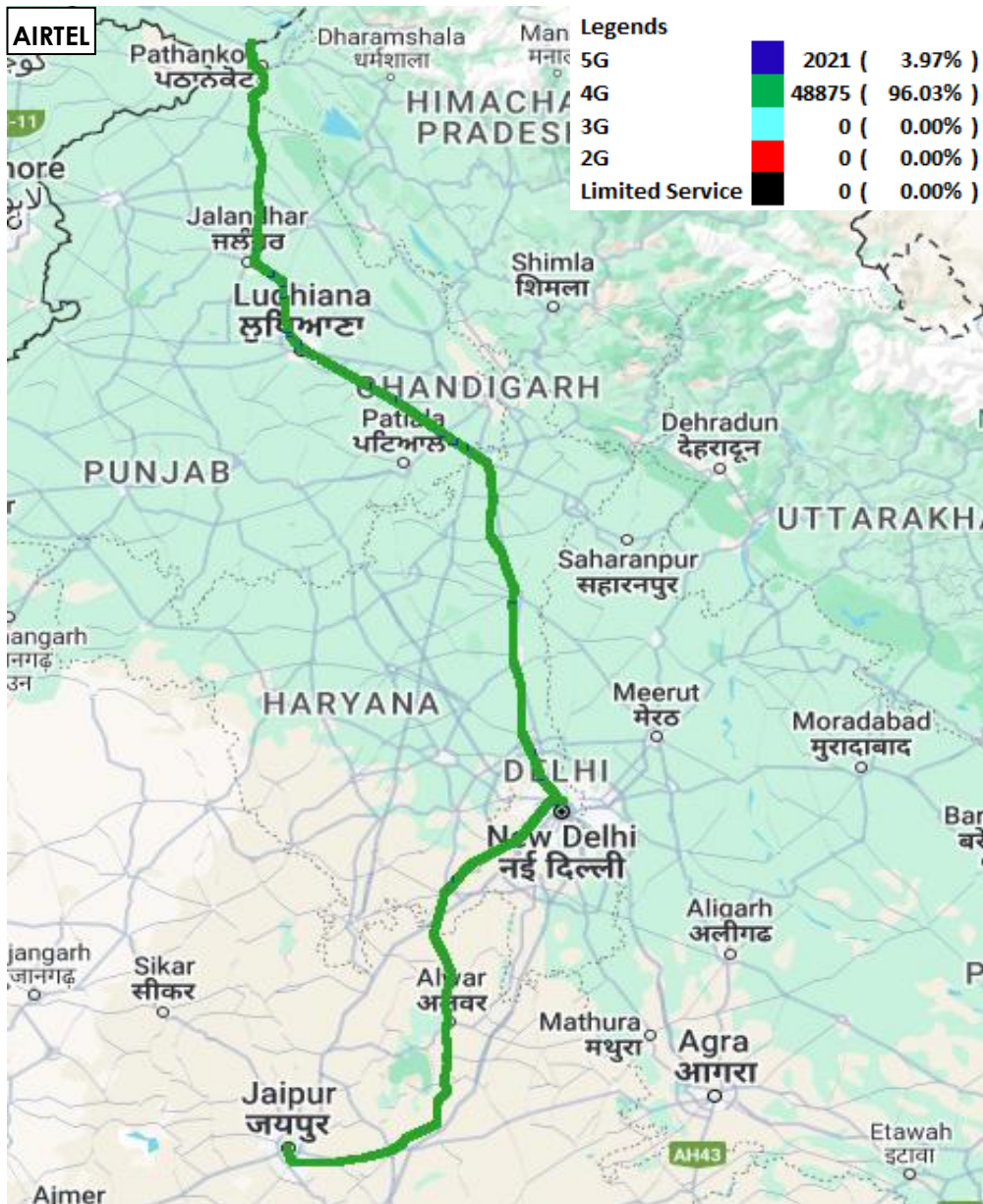


Figure-7: Serving technology plots auto-selection mode 5G/4G/3G/2G -AIRTEL

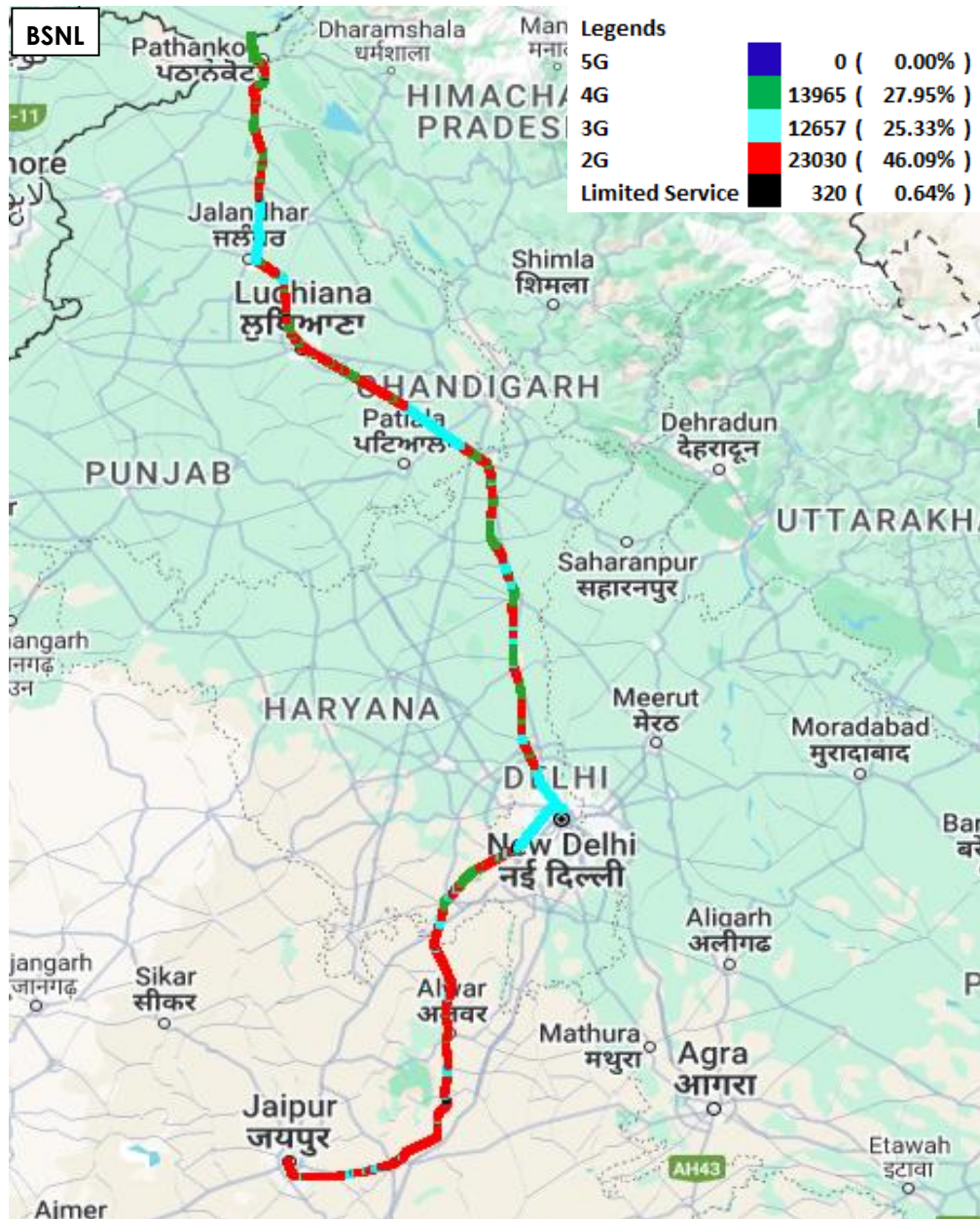


Figure-8: Serving technology plots auto-selection mode 5G/4G/3G/2G –BSNL.

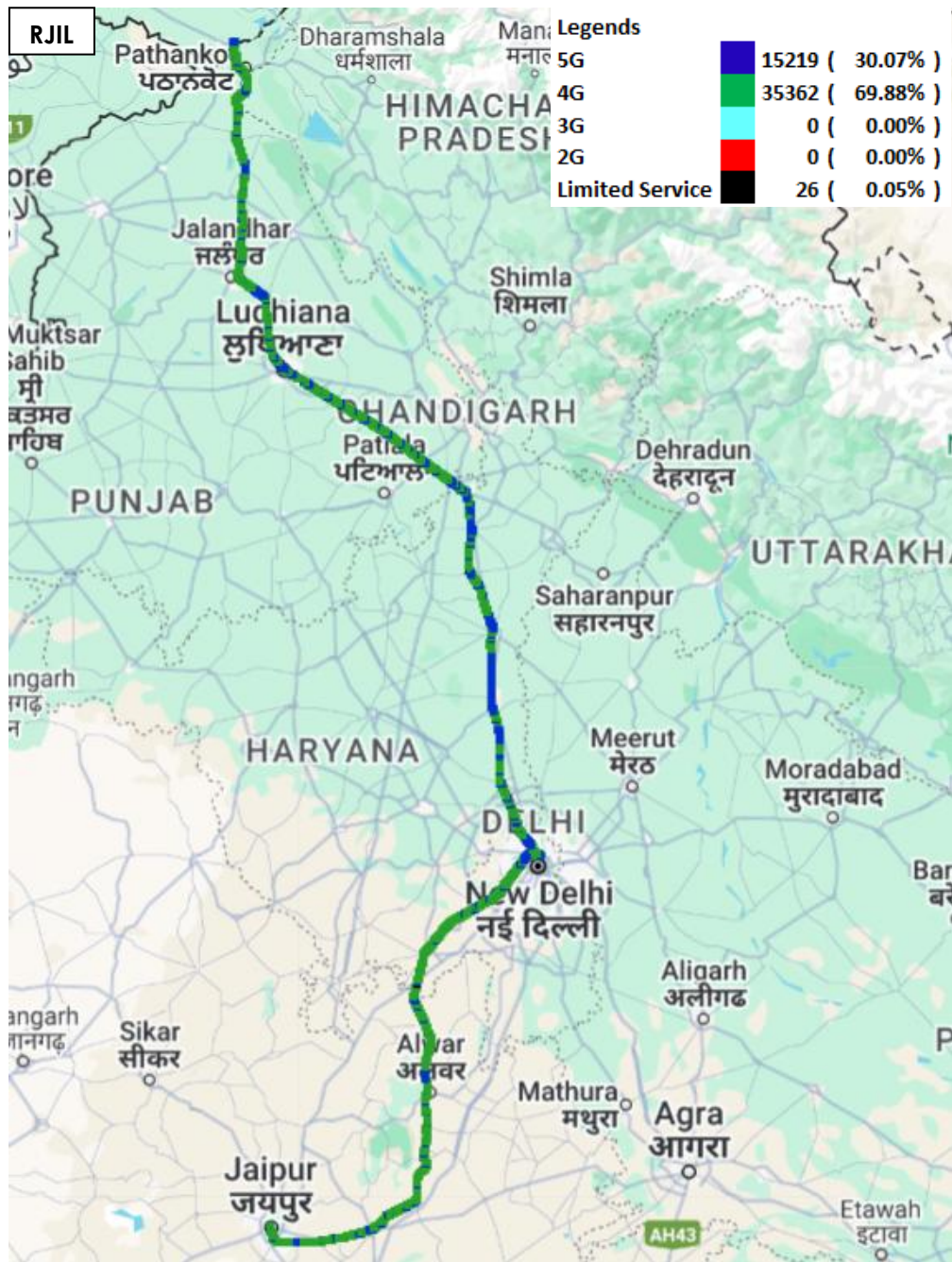


Figure-9: Serving technology plots auto-selection mode 5G/4G/3G/2G –RJIL.

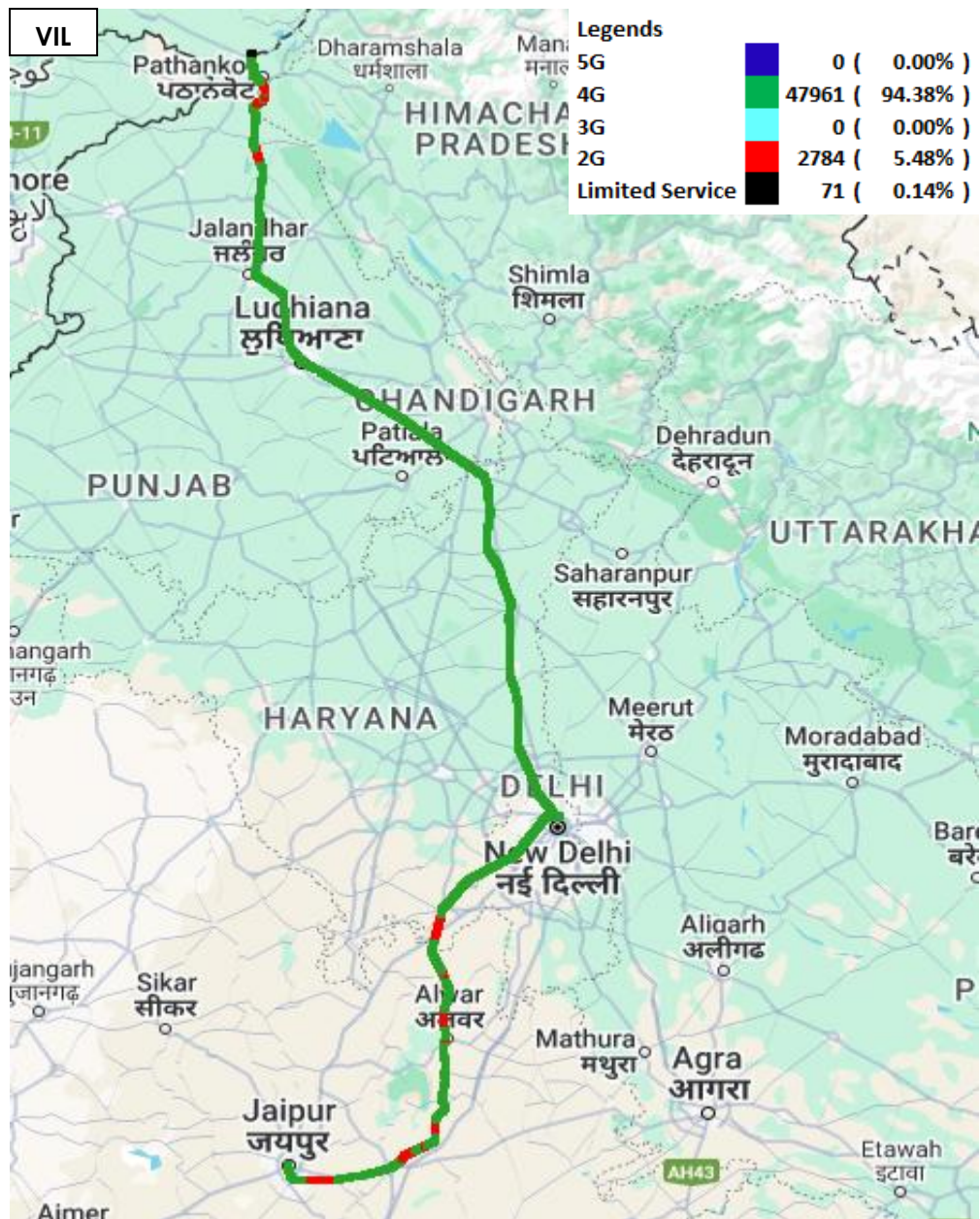


Figure-10: Serving technology plots auto-selection mode 5G/4G/3G/2G – VIL.

(c) Network Signal Strength distribution: The following chart provide signal strength distribution for auto-selection mode (5G/4G/3G/2G) (Refer figure-14, 15, 16 & 17 for map view)

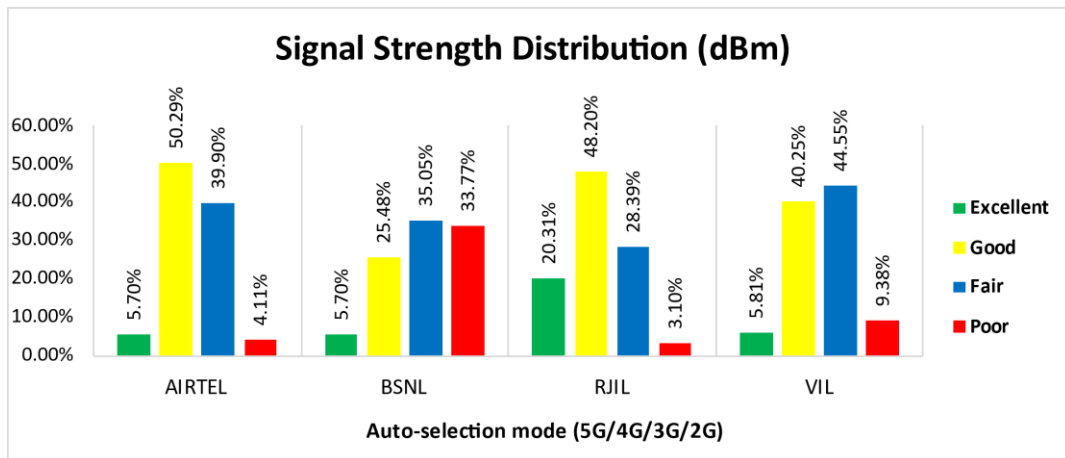


Figure-11: Signal strength distribution for auto-selection mode 5G/4G/3G/2G.

Observations:

- Airtel has 6% of samples falling in the excellent signal strength category.
- BSNL has 6% of samples falling in the excellent signal strength category.
- RJIL has 20% of samples falling in the excellent signal strength category.
- VIL has 6% 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	100.50	9.28	229.81	26.43
	80th Percentile	181.51	15.04	381.85	43.38
	20th Percentile	15.27	2.37	51.45	9.05
Upload Throughput (Mbits/s)	Average	20.08	5.86	17.68	13.30
	80th Percentile	31.77	10.65	32.23	20.74
	20th Percentile	4.69	1.80	3.87	4.81
Latency (ms)	50th Percentile	25.25	29.75	26.70	36.90

Table-9: Summary of Data performance in network auto-selection mode (5G/4G/3G/2G).

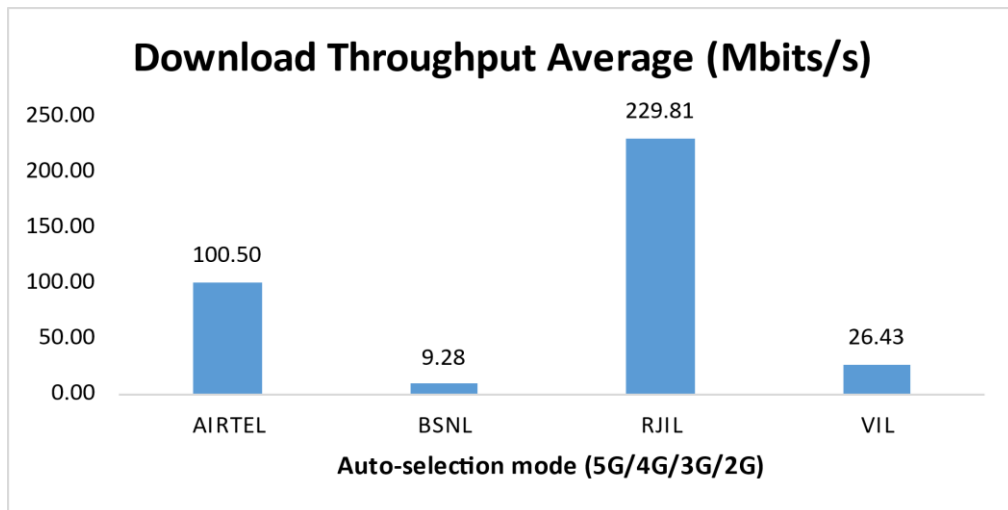


Figure-12: Download throughput.

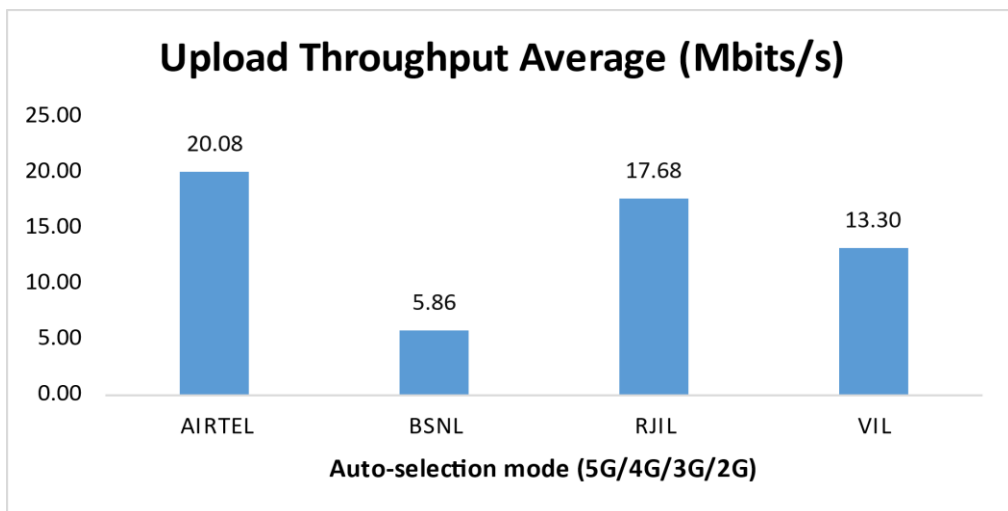


Figure-13: Upload throughput.

5. Voice & Data Key findings

5.1 Overall Voice

1. Call Setup Success Rate:

- a) Airtel, BSNL, RJIL and VIL have 98.87%, 89.22%, 96.73% and 90.84% call setup success rate respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-3 & 7)

2. Call Setup Time:

- a) BSNL has taken longer time (7.82 second) to establish the voice call, whereas Airtel, RJIL & VIL call setup time is 1.87, 0.97 & 1.62 seconds respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-3 & 7)

3. Call Drop Rate:

- a) Overall BSNL call drop rate (16.85%) is higher, while RJIL, VIL and Airtel have 5.64%, 2.42% and 1.91% drop call rate respectively in Auto-selection mode (5G/4G/3G/2G). (refer table-3 & 7)

5.2 Overall Data

1. Data download and upload performance (Dynamic i.e. while moving) :

- a) BSNL (9.28 Mbps) and VIL (26.43 Mbps) both have 4G as top technology providers, have comparatively lower download speeds. While Airtel and RJIL have average download speed of 100.50 Mbps and 229.81 Mbps respectively. (refer table-5 & 9)
- b) BSNL (5.86 Mbps) and VIL (13.30 Mbps) both have 4G as top technology providers, have comparatively lower upload speeds. While Airtel and RJIL have average upload speed of 20.08 Mbps and 17.68 Mbps respectively. (refer table-5 & 9)

5.3 Operator wise Key Findings

1. Airtel:

Voice

- 98.87% call setup success rate and 1.91% drop call rate have been observed for auto-selection mode (5G/4G/3G/2G). Performance is well within the benchmark of 98% and 2.00% respectively, across the route. (refer table-3 & 7)

Data

- Airtel has average download throughput of 100.50 Mbps and average upload throughput of 20.08 Mbps, across the route. (refer table-5 & 9)
- Airtel's latency is 25.25 ms across the measured route, well within the benchmark of 75 ms. (refer table- 5 & 9)

2. BSNL:

Voice

- 89.22% call setup success rate and 16.85% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is not meeting the

benchmark of 98% and 2.00% respectively, across the route. (refer table -3 & 7)

Data

- BSNL has 9.28 Mbps average download throughput & 5.86 Mbps average upload throughput, across the route. (refer table – 5 & 9)
- BSNL's latency is 29.75 ms across the measured route, well within the benchmark of 75 ms. (refer table- 5 & 9)

3. RJIL:

Voice

- 96.73% call setup success rate and 5.64% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is not meeting the benchmark of 98% and 2.00% respectively, across the route. (refer table -3 & 7)

Data

- RJIL has 229.81 Mbps average download speed & 17.68 Mbps average upload throughput, across the route. (refer table -5 & 9)
- RJIL's latency is 26.70 ms across the measured route, well within the benchmark of 75 ms. (refer table- 5 & 9)

4. VIL:

Voice

- 90.84% call setup success rate and 2.42% call drop rate have been observed in auto-selection mode (5G/4G/3G/2G). Performance is not meeting the benchmark of 98% and 2.00% respectively, across the route. (refer table -3 & 7)

Data

- VIL has 26.43 Mbps average download speed & 13.30 Mbps average upload throughput, across the route. (Refer to table -5 & 9)
- VIL's latency is 36.90 ms across the measured route, well within the benchmark of 75 ms. (refer table- 5 & 9)

6. Annexure

6.1 Route wise coverage map

6.1.1 Railway Route (Jaipur Junction to Madhopur Punjab)

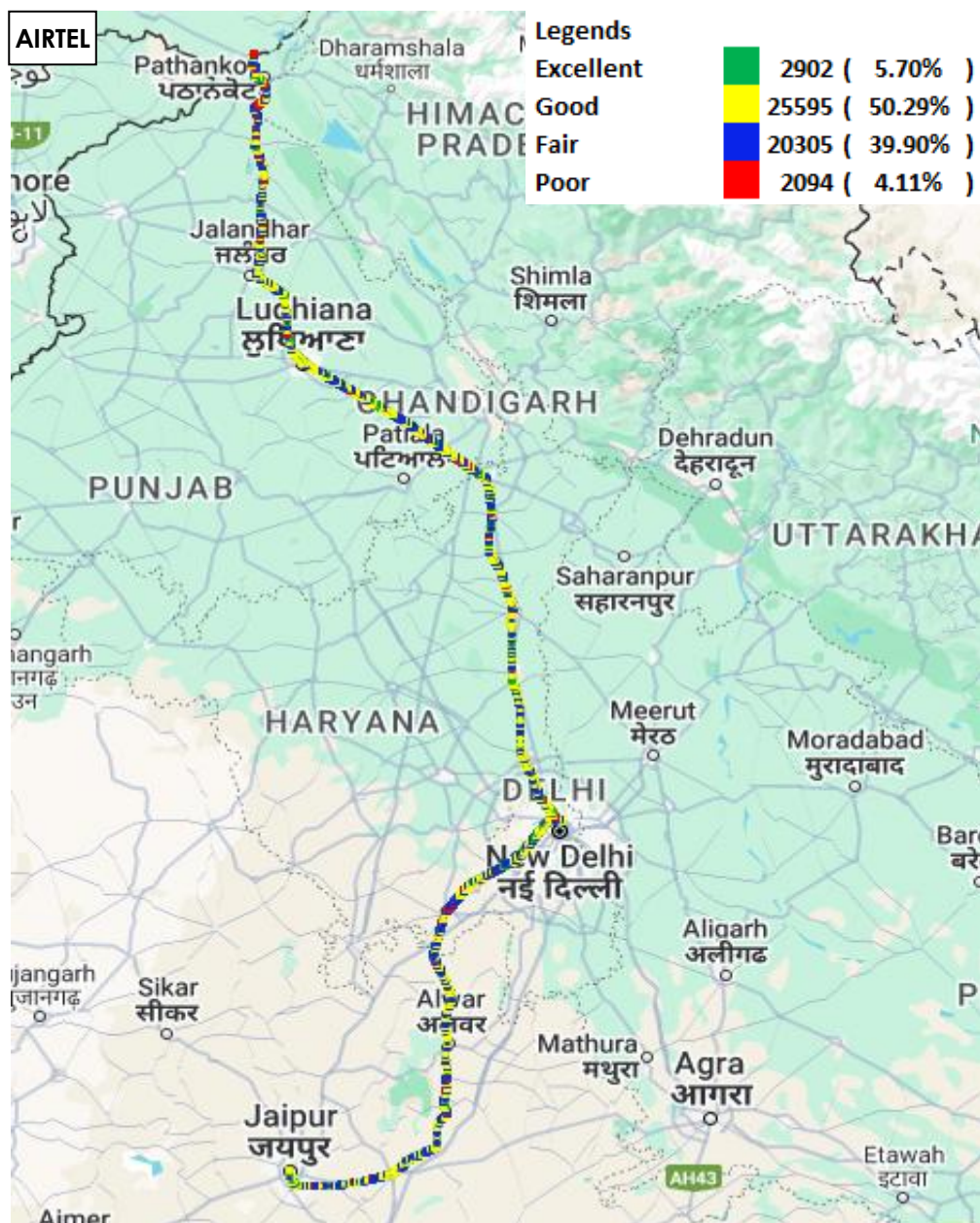


Figure-14: Signal strength auto-selection mode 5G/4G/3G/2G – AIRTEL.

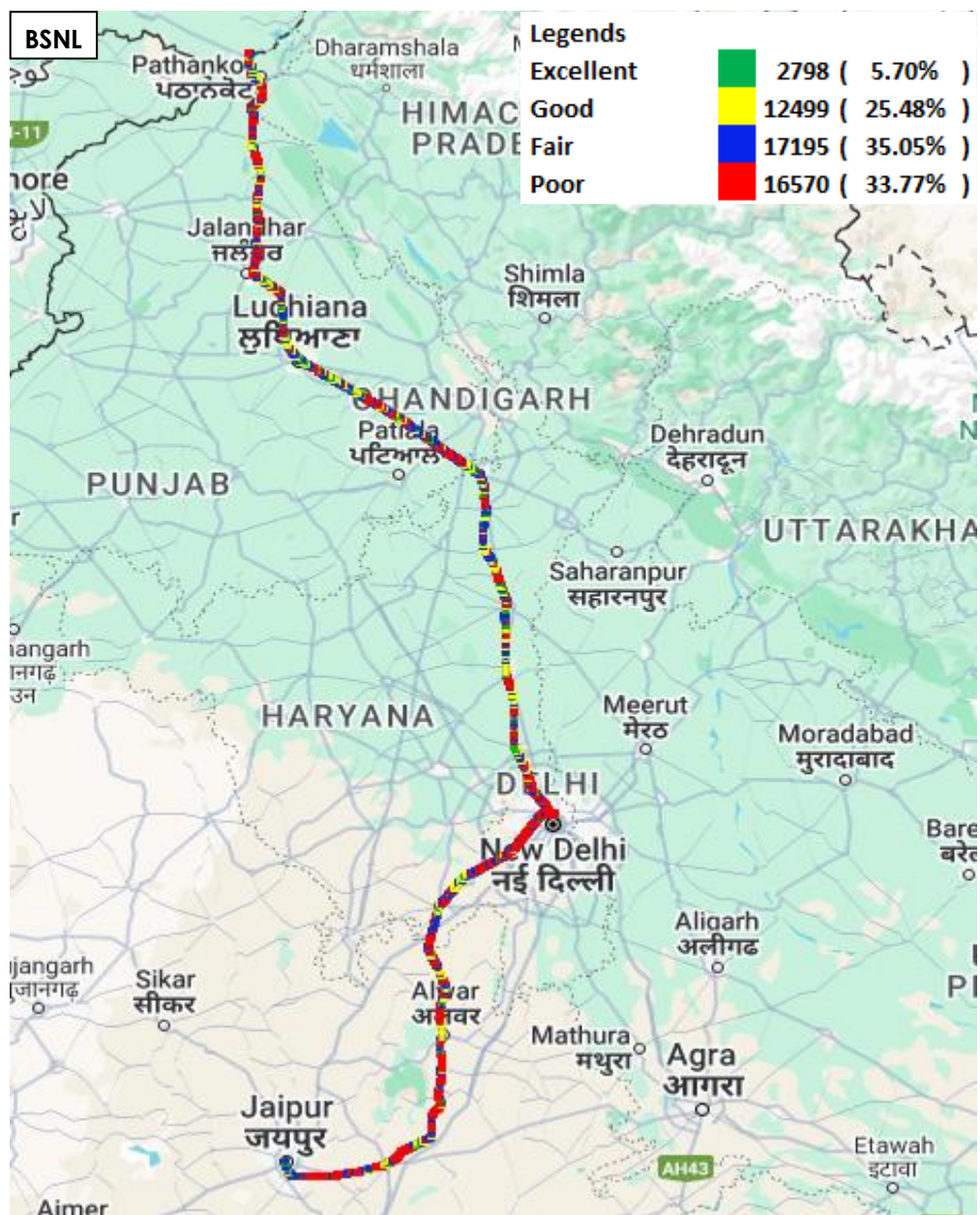


Figure-15: Signal strength auto-selection mode 5G/4G/3G/2G – BSNL.

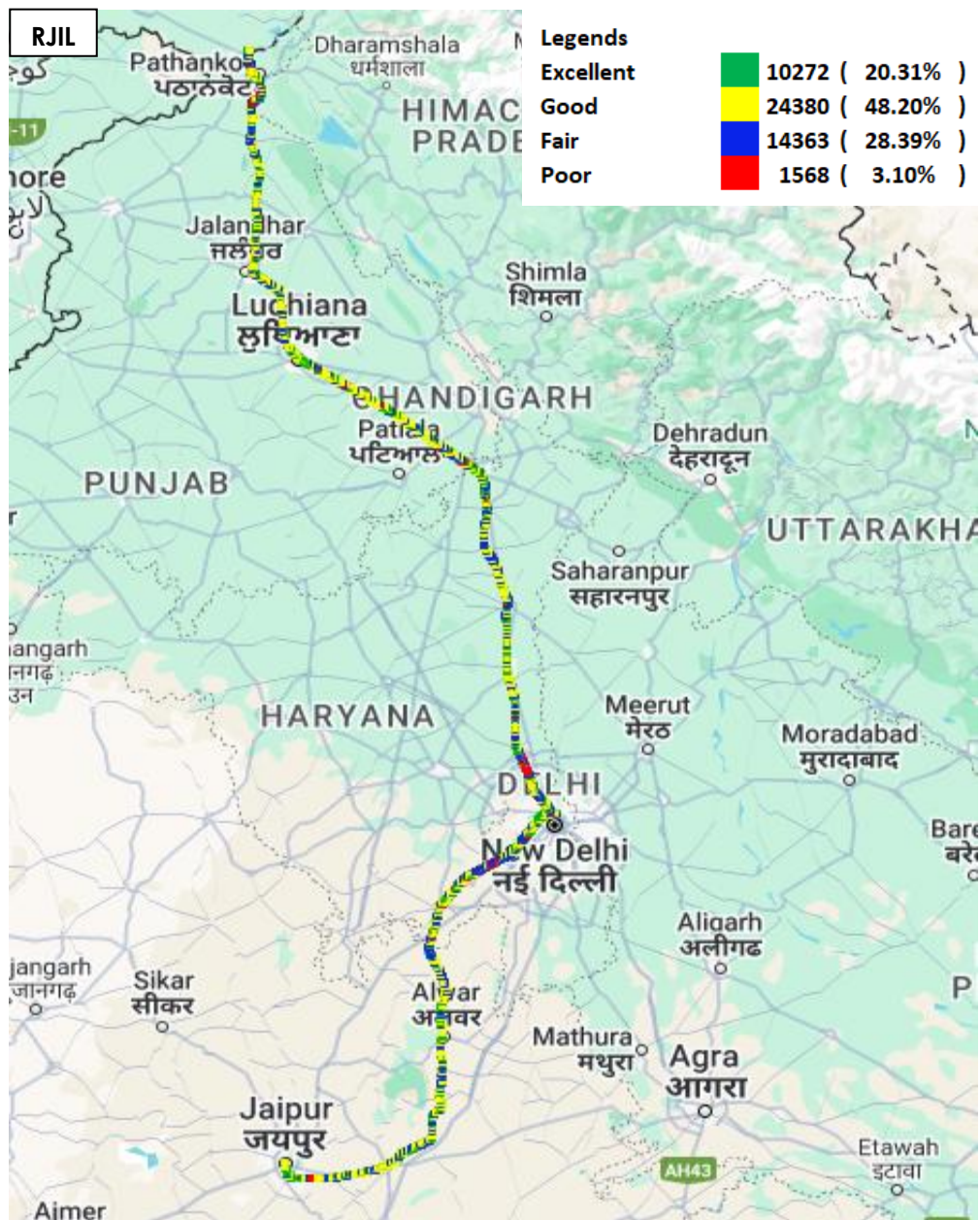


Figure-16: Signal strength auto-selection mode 5G/4G/3G/2G – RJIL.

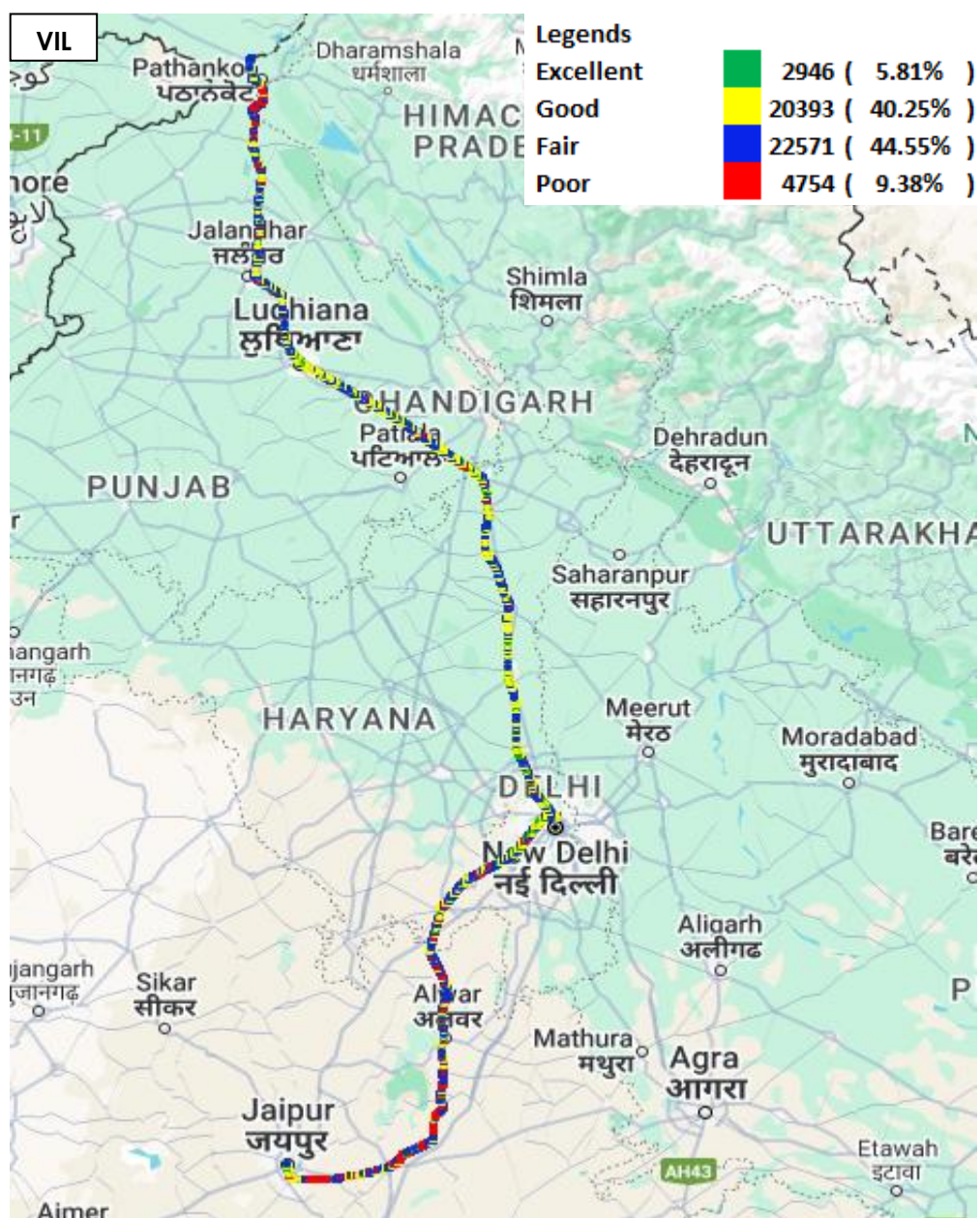


Figure-17: Signal strength auto-selection mode 5G/4G/3G/2G – VIL.

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	<ul style="list-style-type: none"> • 3G/2G auto mode- switch Call • 5G/4G/3G/2G auto mode- switch Call • 5G/4G MOS Call 	30 Sec
Call Duration		180 Sec
Wait/ Guard Time		15 Sec

Table-10: 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.
- All values are taken up to two decimal places with round off.

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 top popular websites- 20 sec timeout (Only at Hotspot)
Latency		25 count- Dynamic 1000 count- Hotspot Payload- 42 bytes

Table-11: Data test detail.

Note-

- 5 Data iteration to be done at each hotspot location.
- Min. 5 iteration to be made during the walk test. Iteration count will be increased based on walk test distance.
- Ping test performed only once at hotspot location.
- Youtube & Web browsing test 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.

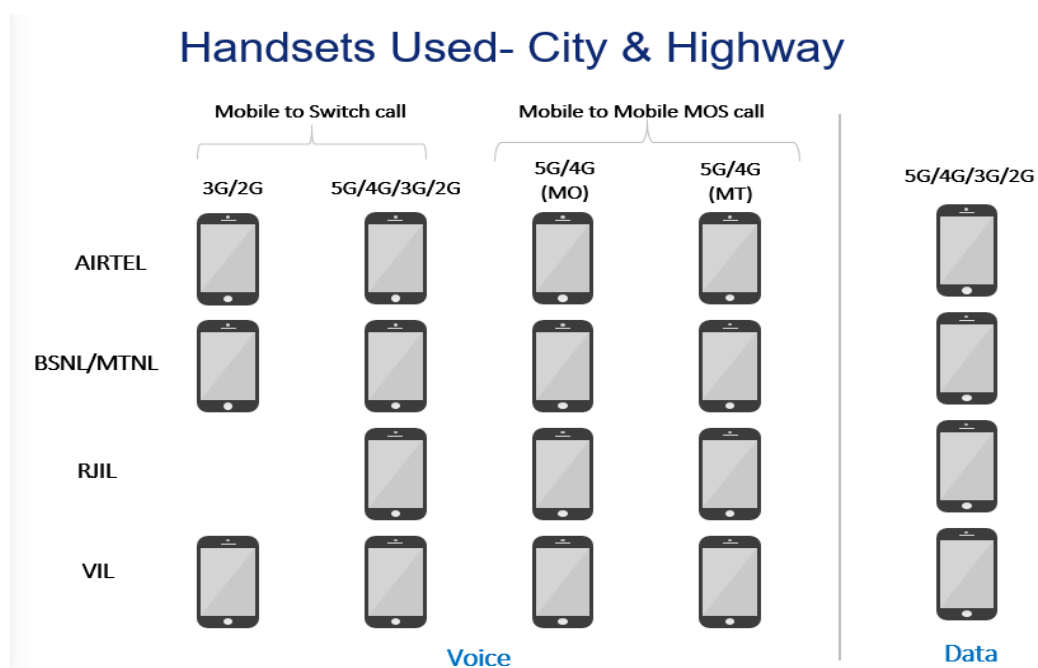


Figure-18: Number of handsets used in city & highway drive.

MO: Mobile originating

MT: Mobile terminating

Handsets Used- Railway/Metro/Walk Test & Hotspot

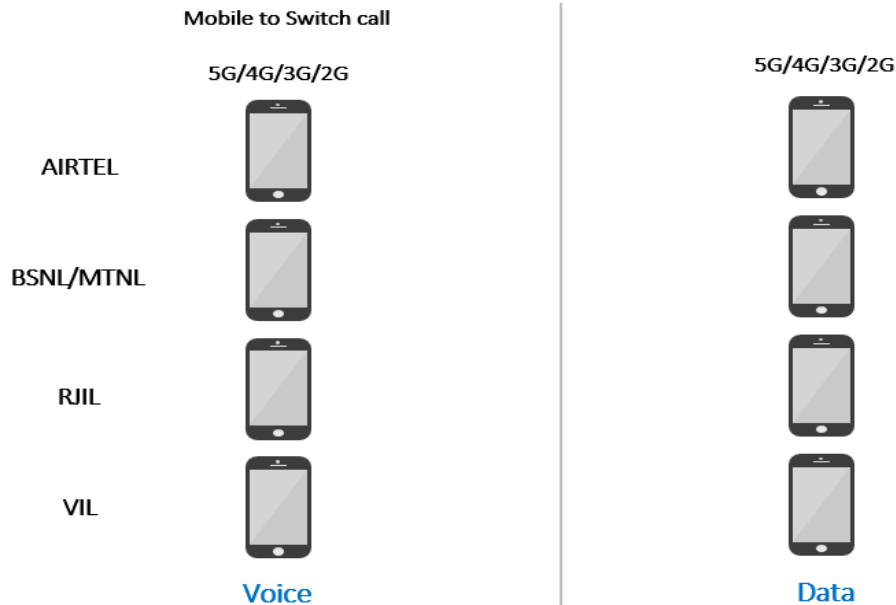


Figure-19: Number of handsets used in railway/metro/walktest/hotspot

7.1.2 Drive test Methodology

(a) Dynamic voice testing (on the move)

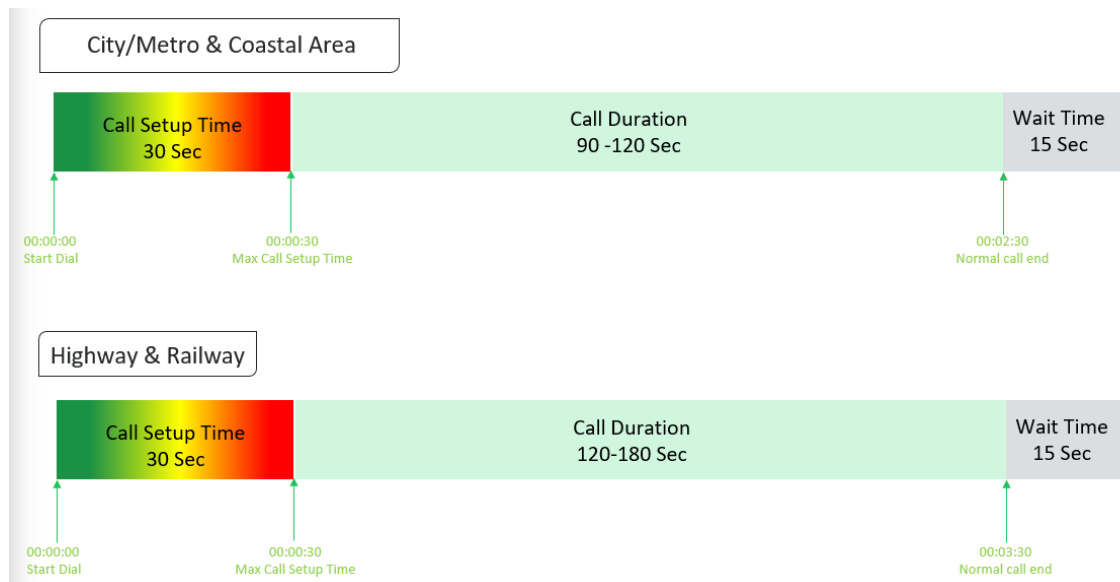


Figure-20: Voice test script for city/railway/metro/highway & coastal area.

- 15 sec wait time is applied after locking 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-21: Voice test script for walktest/hotspot.

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

(c) Dynamic Data (internet) test

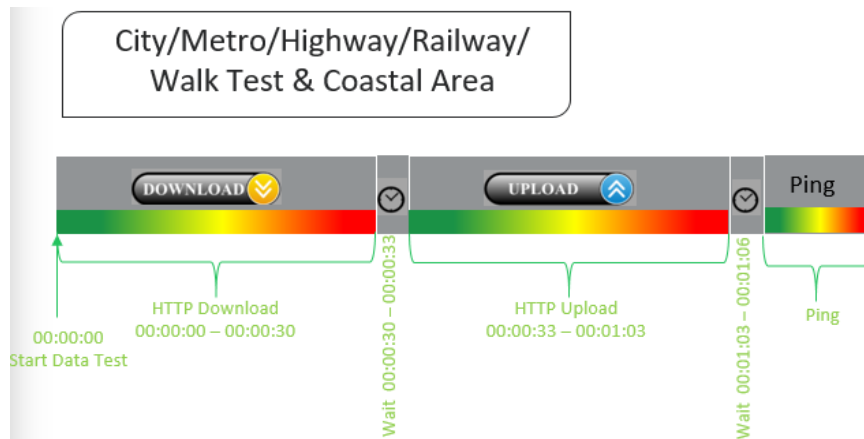


Figure-22: Data test script used in city/metro/railway/highway & coastal area.

(d) Static Data(internet) testing

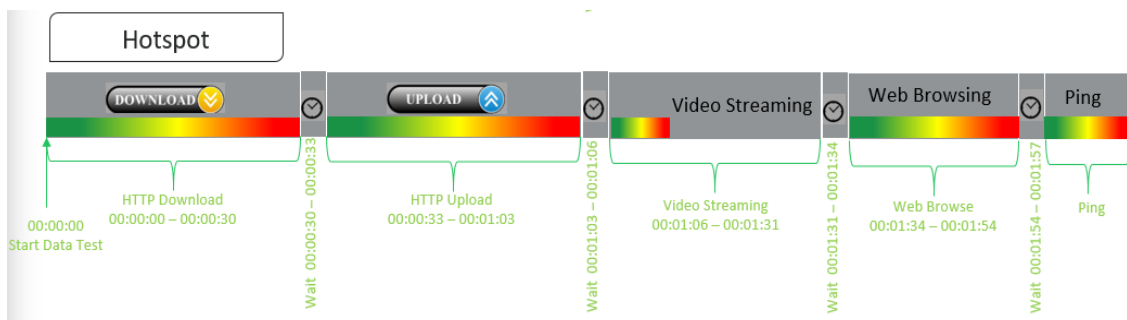


Figure-23: Data test script used at hotspot/walk test.

- 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.

7.2 Appendix-II

7.2.1 Network Performance Parameters for Voice call

Parameter Name	Definition
Call Setup Success Rate	<p>(i) Call Setup Success Rate is defined as the ratio of Established Calls to Call Attempts. 'Established Calls' mean the following events have happened in call setup:</p> <ul style="list-style-type: none"> (a) Call attempt is made (b) The signaling channel is allocated (c) The call is routed to the outwards path of the terminating network (d) An alert signal is received by caller in the form of ring back tone, busy tone, or an announcement. <p>CSSR = (Total Call Established/ Total Call Attempt) *100</p> <p>As per QoS Regulation 2024 benchmark value is >=98%</p>
Call Drop Rate	<p>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</p> <p>Call Drop Rate = (Total Call Drop/Total Call Established) *100</p> <p>As per QoS Regulation 2024 benchmark value is <=2%</p>
Call Setup Time	<p>Time taken from call initiate to call alerting/ringing.</p> <p>Call Setup Time = T2- T1</p> <p>T2- Ringing (VoLTE/VoNR) & Alerting (for WCDMA & GSM), T1- Invite (VoLTE/VoNR) & CM Service Request (for WCDMA & GSM)</p>
Voice Quality (MOS)	<p>Voice quality in mobile networks is measured with algorithms based on ITU-T P.863 (POLQA). The grading for Voice quality has been given as;</p> <p>Excellent: MOS ≥ 4 and < 5 Good : MOS ≥ 3 and < 4 Fair : MOS ≥ 2 and < 3 Poor : MOS ≥ 1 and < 2</p>
Handover Success Rate	<p>Handover Success Rate = Count of successful handovers (All Technology Handover combined) / Total count of Handover Attempt (All Technology Handover combined) *100</p> <p>Handover type which are considered- 2G Inter & Intra cell, 3G Soft & IRAT, 4G Inter & Intra frequency & SRVCC, 5G Inter & Intra frequency & 5G to 4G handovers.</p>
Silence Call	<p>A call which has ≥ 4 sec continuous RTP gap is considered as a Silence Call.</p> <p>Silence call rate = (count of silence call / Total calls established) *100</p> <p>If a call observes multiple silence count ≥ 4 sec in a particular established call it has been taken as one silent event.</p>
Jitter	<p>The inter arrival jitter is the difference in the relative transit time for two packets. The relative transit time is the difference between a packet's Real-time Transport Protocol (RTP) timestamp and the receiver's clock at the time of arrival, measured in the same units. If S_i is the RTP timestamp from packet i, and R_i is the time of arrival in RTP timestamps units for packet i, then for two packets i and j the inter-arrival jitter D can be expressed as:</p> <p>$D(i,j) = (R_j - R_i) - (S_j - S_i)$</p>

	The interarrival jitter is calculated continuously as each data packet i is received from source SSRC_n, using this difference D for that packet and the previous packet i-1 in order of arrival (not necessarily in sequence), according to the formula J(i) = J(i-1) + (D(i-1,i) - J(i-1))/16 or 8																																		
Downlink Packet Drop Rate	Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call originating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE)																																		
Uplink Packet Drop Rate	Number of RTP (Real-time Transport Protocol) Packets lost divided by total RTP packet received (against each source_SSRC and sequence number) at call terminating handset. This KPI is calculated from MOS call for packet call only (VoNR/VoLTE).																																		
Signal Strength	Signal strength is the signal power level received by the wireless user. <table><tr><th rowspan="2">Parameter Name</th><th rowspan="2">Technology</th><th colspan="4">Signal Strength (dBm)</th></tr><tr><th>Excellent</th><th>Good</th><th>Fair</th><th>Poor</th></tr><tr><td>Rx Level</td><td>GSM</td><td>0 to ≥ -65</td><td><-65 to ≥ -75</td><td><-75 to ≥ -85</td><td><-85 to min</td></tr><tr><td>RSCP</td><td>WCDMA</td><td>0 to ≥ -70</td><td><-70 to ≥ -80</td><td><-80 to ≥ -90</td><td><-90 to min</td></tr><tr><td>RSRP</td><td>LTE</td><td>0 to ≥ -80</td><td><-80 to ≥ -95</td><td><-95 to ≥ -110</td><td><-110 to min</td></tr><tr><td>SS_RSRP</td><td>NR</td><td>0 to ≥ -80</td><td><-80 to ≥ -95</td><td><-95 to ≥ -110</td><td><-110 to min</td></tr></table>	Parameter Name	Technology	Signal Strength (dBm)				Excellent	Good	Fair	Poor	Rx Level	GSM	0 to ≥ -65	<-65 to ≥ -75	<-75 to ≥ -85	<-85 to min	RSCP	WCDMA	0 to ≥ -70	<-70 to ≥ -80	<-80 to ≥ -90	<-90 to min	RSRP	LTE	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min	SS_RSRP	NR	0 to ≥ -80	<-80 to ≥ -95	<-95 to ≥ -110	<-110 to min
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Table-12: Network performance parameter and definition voice.

7.2.2 Network Performance Parameters Data tests

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

Upload Session Setup Success Rate	(total upload session established (successfully connected to server)/ total upload session attempt)*100. This KPI need to report for Hotspot only.
Web Page Download Time	<p>Web browsing test is used to measure performance in terms of opening a web/HTTP page.</p> <p>Time taken to open the web page successfully is considered as web browsing delay/web page download time.</p>
Video Streaming Delay	The Video streaming delay is time taken from start of video transfer to First video frame displayed in player.
Latency	<p>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.</p> <p>The Latency is measured in milliseconds (ms).</p> <p>To calculate the one-way latency we just do half of the round-trip time. 50th percentile of one-way latency has been reported.</p>
Jitter	<p>Measure of variation in time in arrival of packets from a source to destination</p> <p>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</p> <p>$IPDV(i) = D(i) - D(i-1)$ then Stdvs of IPDV is considered as jitter.</p>
Packet Loss Rate	<p>Number of packets lost out of total packet transferred during test. Packet loss rate = (Total packet lost / Total packet sent) *100</p> <p>* Packet delay (using ping) >90 ms considered as packet loss and included in packet loss rate.</p> <p>* Packet loss rate is calculated based on ICMP</p>

Table-13: 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.