भादूविप्रा
TRAI

TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

West Bengal LSA

July 2025

Contents

1. Introduction

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

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

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

2. Executive Summary (LSA)

2.1 Drive test details

This report covers the findings of the IDT undertaken in West Bengal License Service Area (LSA) during the month of July-2025 under the supervision of TRAI Regional Office (RO) Kolkata. Details of route / area covered during the IDT are as given below:

S. No	Drive test route	Type of route	Distance covered (KMs)	From date	To date
1	Bolpur Santiniketan to New Jalpaiguri	Railway	418.0	25-Jul-2025	25-Jul-2025

Table-1: Drive test summary

2.2 Drive test routes

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

Figure-1: Drive test routes

2.3 Summary of areas covered

a) Railway

Bolpur Santiniketan to New Jalpaiguri passing through Sainthia, Rampur Hat, New Farakka junction, Malda Town and Kishanganj.

2.4 Telecom service providers detected frequency bands

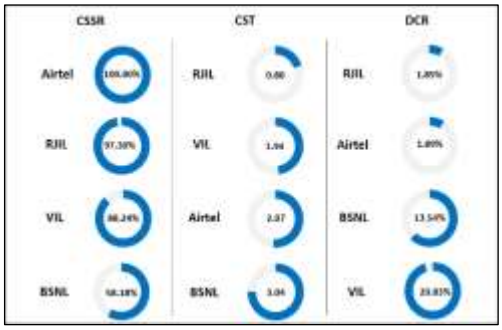
Technologies covered during the IDT and frequency bands in use are summarised in table below:

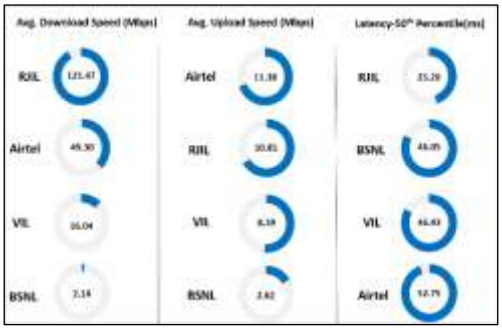
S.no.	Name of TSP	Technology	Frequency Bands (In MHz)
1	Bharti Airtel Ltd.	2G	900
2	Bharti Airtel Ltd.	4G	900,1800,2100,2300
3	Bharti Airtel Ltd.	5G	3500
4	BSNL	2G	900
5	BSNL	3G	2100
6	BSNL	4G	700,2100,2500
6	Reliance JIO Infocomm Ltd.	4G	850,1800,2300
7	Reliance JIO Infocomm Ltd.	5G	700,3500
8	Vodafone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

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

2.5 Performance against key QoS parameters

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





Summary-Voice services

Call Setup Success Rate: Airtel, BSNL, RJIL and VIL have 100.00%, 58.18%, 97.30% and 88.24% call setup success rate respectively in Auto-selection mode (5G/4G/3G/2G).

Call Setup Time: Airtel, BSNL, RJIL & VIL have call setup time of 2.07, 3.04, 0.80 and 1.94 seconds respectively in Auto-selection mode (5G/4G/3G/2G).

Drop Call Rate: Airtel, BSNL, RJIL and VIL have drop call rate 1.89%, 13.54%, 1.85% and 20.83% respectively in Auto-selection mode (5G/4G/3G/2G).

Summary-Data services

Data Download performance (Overall): Average download speed of Airtel (5G/4G) is 49.30 Mbps, BSNL (4G/3G/2G) is 2.14 Mbps, RJIL (5G/4G) is 121.47 Mbps and VIL (4G/2G) is 16.04 Mbps.

Data Upload performance (Overall): Average upload speed of Airtel (5G/4G) is 11.38 Mbps, BSNL (4G/3G/2G) is 2.62 Mbps, RJIL (5G/4G) is 10.81 Mbps and VIL (4G/2G) is 8.39 Mbps.

Latency (Overall): Airtel, BSNL, RJIL and VIL 50th percentile latency is 52.75 ms, 46.05 ms, 25.20 ms and 46.43 ms respectively.

QoS Performance Analysis-
West Bengal LSA

3. QoS performance analysis-LSA level

3.1 Overview

This section provides summary of overall QoS performance of the telecom service provider's network in the LSA by aggregating the results of drive tests conducted in the LSA during the month of July-2025 covering railway route. (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	106	165	111	136
Call Setup Success Rate %	100.00	58.18	97.30	88.24
Drop Call Rate %	1.89	13.54	1.85	20.83
Call Setup Time-Average (Second)	2.07	3.04	0.80	1.94
Handover Success Rate %	99.71	98.28	99.96	99.72

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

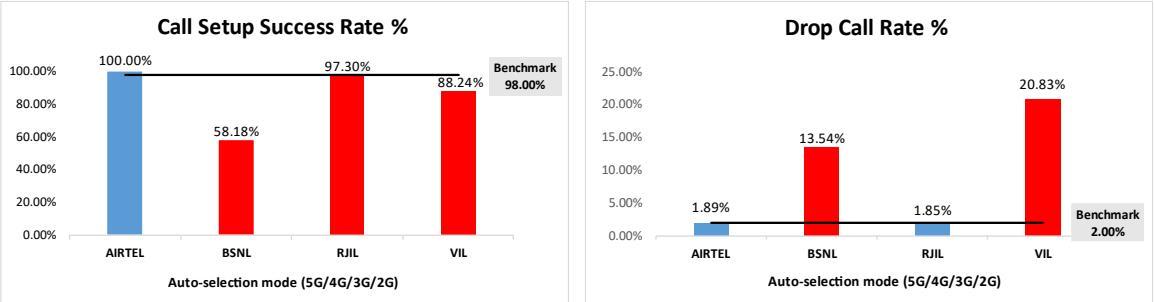


Figure-2: Performance for call setup success rate and drop call rate.

Number of unique cell Id's covered in Voice test- Technology wise				
Technology	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
5G	0	NA	203	NA
4G	1276	107	1066	511
3G	NA	36	NA	NA
2G	0	94	NA	59

Table-4: 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.

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	49.30	2.14	121.47	16.04
	80th Percentile	94.77	3.38	217.94	28.15
	20th Percentile	6.03	0.83	7.77	3.57
Upload Throughput (Mbits/s)	Average	11.38	2.62	10.81	8.39
	80th Percentile	16.97	3.83	19.89	13.69
	20th Percentile	3.17	1.14	2.23	2.79
Latency (ms)	50th Percentile	52.75	46.05	25.20	46.43

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

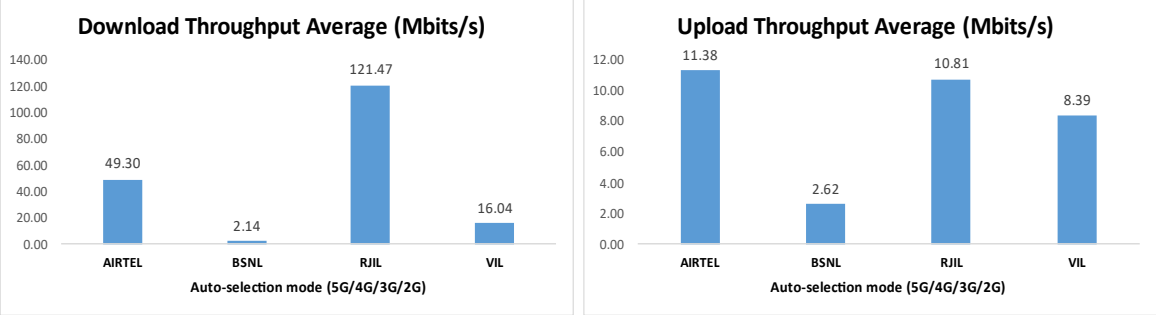


Figure-3: Download and Upload throughput

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	589	NA
4G	1230	155	489	517
3G	NA	66	NA	NA
2G	0	46	NA	74

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.
- 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 railway drive for all telecom service providers, the results of drive tests conducted are shown individually for respective areas/locations.

4.2 Railway

Drive test has been conducted on 25th July 2025 covering one railway route. (Refer Table-1)

4.2.1 Drive test route

Figure-4: Drive test route Railway

4.2.2 Routes Covered

Bolpur Santiniketan to New Jalpaiguri passing through Sainthia, Rampur Hat, New Farakka Jn, Malda Town and Kishanganj.

4.3.3 Voice Performance

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

Parameters	Service Provider			
	Auto-selection mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Call Attempts	106	165	111	136
Call Setup Success Rate %	100.00	58.18	97.30	88.24
Drop Call Rate %	1.89	13.54	1.85	20.83
Call Setup Time-Average (Second)	2.07	3.04	0.80	1.94
Handover Success Rate %	99.71	98.28	99.96	99.72

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

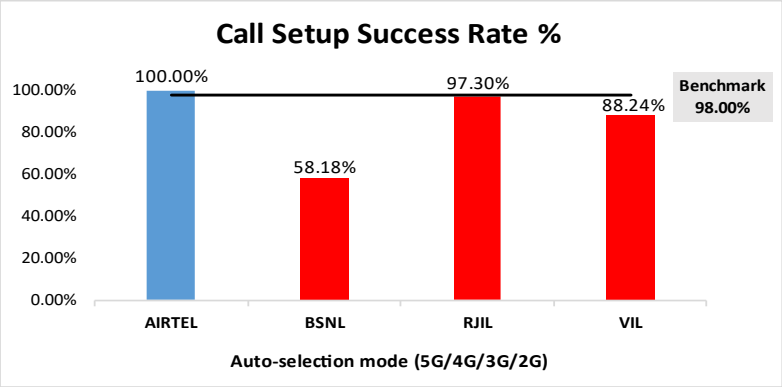


Figure-5: Performance for call setup success rate.

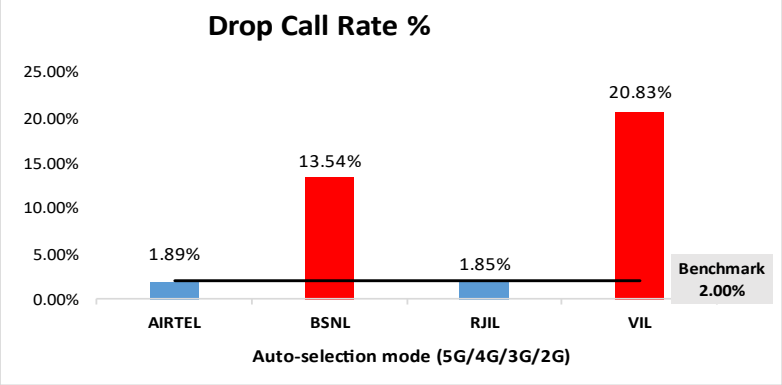


Figure-6: Performance for drop call rate.

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

Technology	Service Provider			
	AIRTEL	BSNL	RJIL	VIL
5G	2.90%	NA	10.67%	NA
4G	97.00%	31.91%	89.09%	76.11%
3G	NA	29.72%	NA	NA
2G	0.03%	31.05%	NA	21.11%
Limited Service	0.06%	7.32%	0.24%	2.78%

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

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

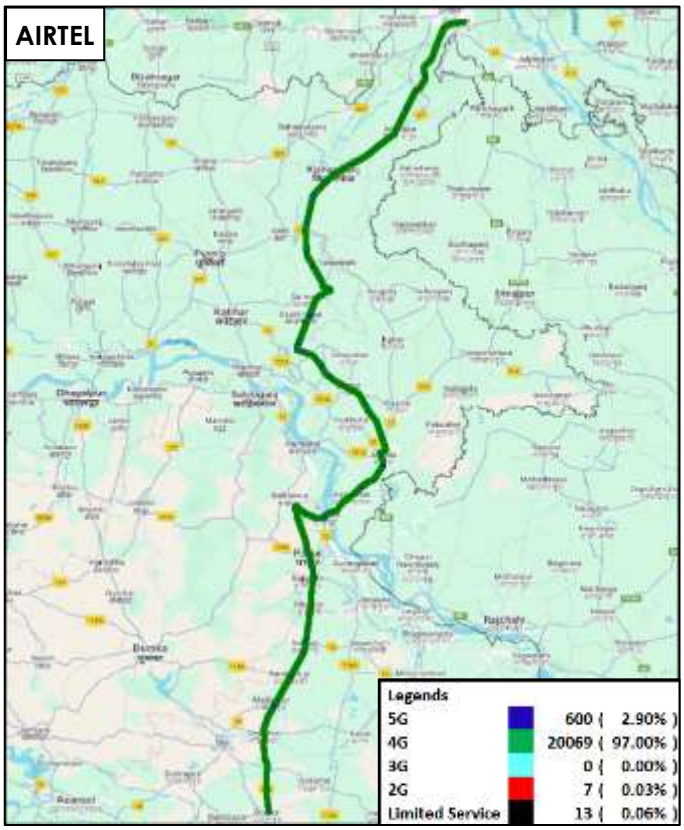


Figure-7: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-AIRTEL

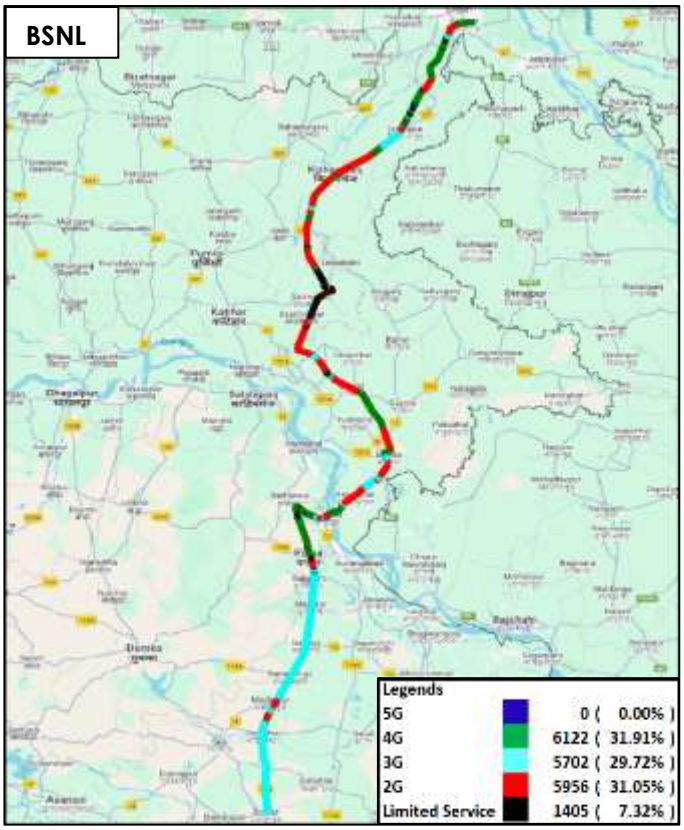


Figure-8: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-BSNL

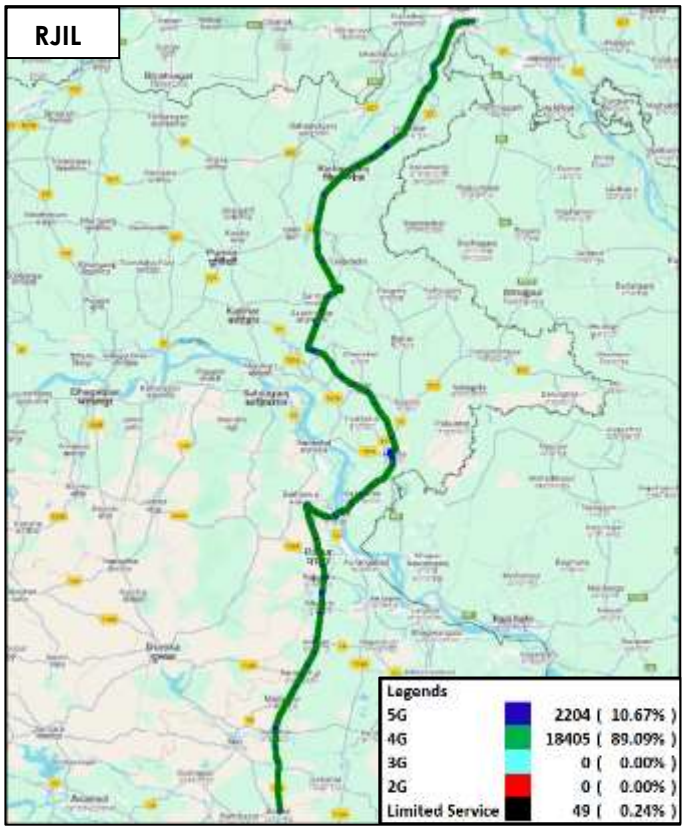


Figure-9: Serving technology plots in auto-selection mode (5G/4G/3G/2G)-RJIL.

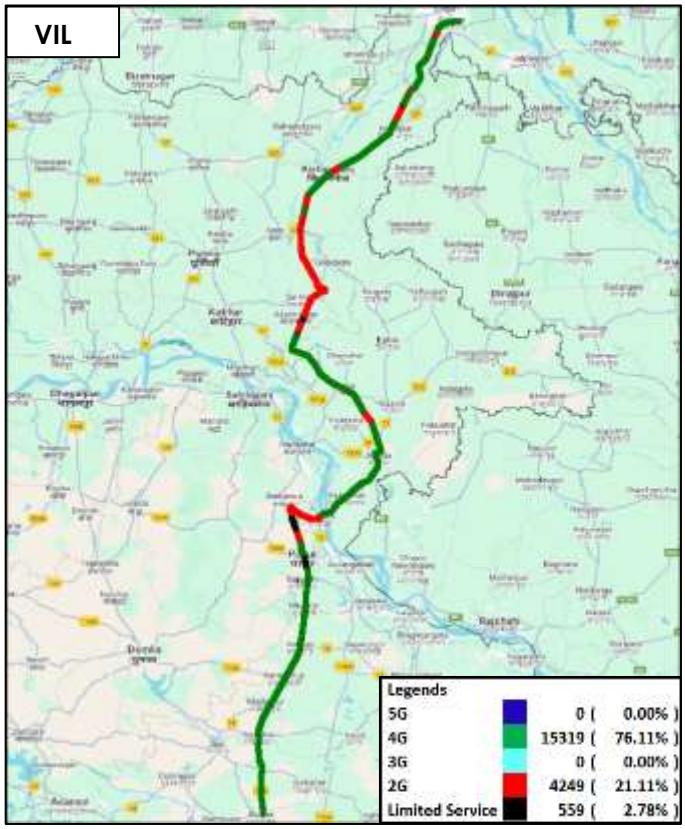


Figure-10: Serving technology plots in auto-selection mode (5G/4G/3G/2G) -VIL.

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

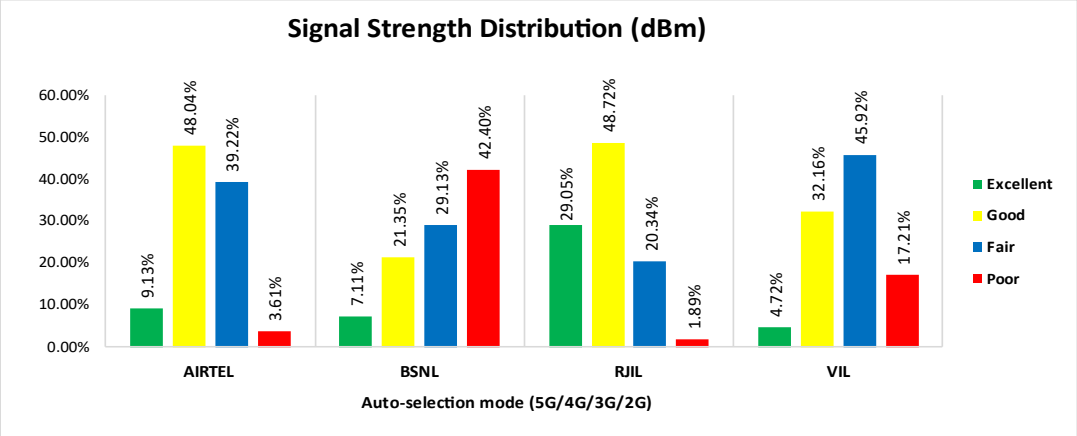


Figure-11: Signal strength distribution auto-selection mode 5G/4G/3G/2G.

Observations:

- Airtel has 9% of samples falling in the excellent signal strength category.
- BSNL has 7% of samples falling in the excellent signal strength category.
- RJIL has 29% of samples falling in the excellent signal strength category.
- VIL has 5% of samples falling in the excellent signal strength category.

4.3.4 Data Performance

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

Parameters		Service Provider			
		Auto-selection mode (5G/4G/3G/2G)			
		AIRTEL	BSNL	RJIL	VIL
Download Throughput (Mbits/s)	Average	49.30	2.14	121.47	16.04
	80th Percentile	94.77	3.38	217.94	28.15
	20th Percentile	6.03	0.83	7.77	3.57
Upload Throughput (Mbits/s)	Average	11.38	2.62	10.81	8.39
	80th Percentile	16.97	3.83	19.89	13.69
	20th Percentile	3.17	1.14	2.23	2.79
Latency (ms)	50th Percentile	52.75	46.05	25.20	46.43

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

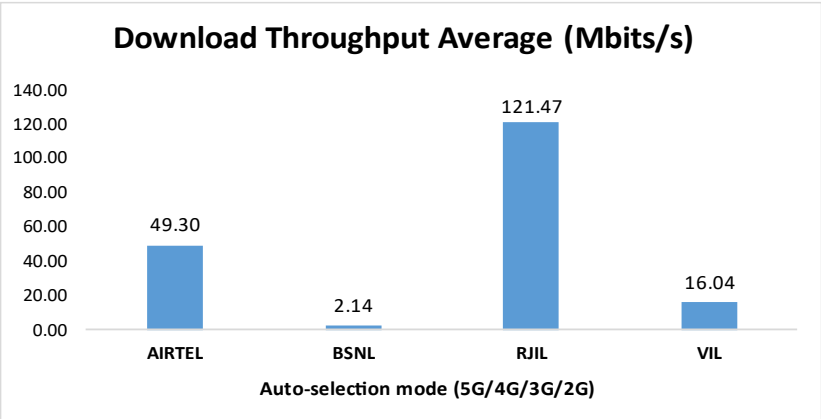


Figure-12: Download throughput

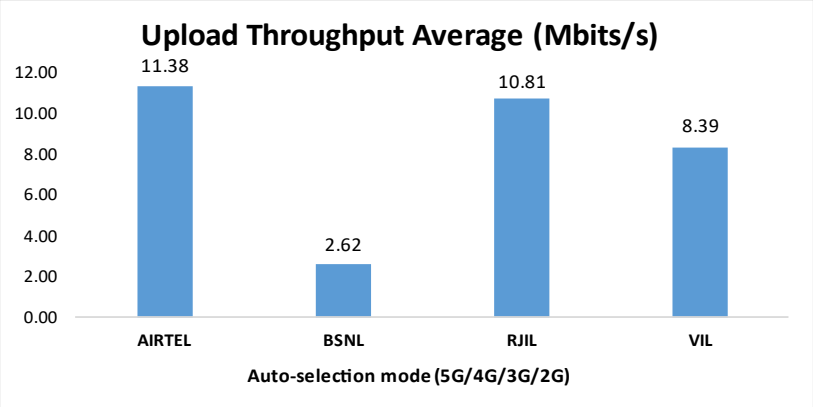


Figure-13: Upload throughput

5. Voice & Data Key findings

5.1 Overall Voice

1. **Call Setup Success Rate:**
   a) Airtel, BSNL, RJIL and VIL have 100.00%, 58.18%, 97.30% and 88.24% call setup success rate respectively in auto-selection mode (5G/4G/3G/2G). (refer table-3)

2. **Call Setup Time**:
   a) Airtel, BSNL, RJIL & VIL call setup time is 2.07, 3.04, 0.80 & 1.94 seconds respectively in auto-selection mode (5G/4G/3G/2G). (refer table-3)

3. **Drop Call Rate**:
   a) Airtel, BSNL, RJIL and VIL drop call rate 1.89%, 13.54%, 1.85% and 20.83% respectively in auto-selection mode (5G/4G/3G/2G). (refer table-3)

5.2 Overall Data

1. **Data download and upload performance (Overall i.e. LSA):**
   a) Airtel, BSNL, RJIL and VIL average download speeds are 49.30 Mbps, 2.14 Mbps, 121.47 Mbps and 16.04 Mbps respectively. (refer table-5)

   b) Airtel, BSNL, RJIL and VIL average upload speeds are 11.38 Mbps, 2.62 Mbps, 10.81 Mbps and 8.39 Mbps respectively. (refer table-5)

5.3 Operator wise Key Findings

1. **Airtel:**

Voice

- 100.00% call setup success rate and 1.89% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for railway drive. Performance is well within the benchmark of 98.00% & 2.00% respectively. (refer table-3 & 7)

Data

- Airtel has 49.30 Mbps average download speed & 11.38 Mbps average upload speed across the measured routes for railway drive. (refer table-5 & 9)

2. **BSNL:**

Voice

- 58.18% call setup success rate and 13.54% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for railway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3 & 7)

Data

- BSNL has 2.14 Mbps average download speed & 2.62 Mbps average upload speed across measured routes for railway drive. (refer table-5 & 9)

3. **RJIL:**

Voice

- 97.30% call setup success rate and 1.85% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for railway drive. Performance is not meeting the benchmark of 98.00% for call setup success rate. (refer table-3 & 7)

Data

- RJIL has 121.47 Mbps average download speed & 10.81 Mbps average upload speed across measured routes for railway drive. (refer table-5 & 9)

4. VIL:

Voice

- 88.24% call setup success rate and 20.83% drop call rate have been observed in auto-selection mode (5G/4G/3G/2G) for railway drive. Performance is not meeting the benchmark of 98.00% & 2.00% respectively. (refer table-3 & 7)

Data

- VIL has 16.04 Mbps average download speed & 8.39 Mbps average upload speed across measured routes for railway drive. (refer table-5 & 9)

6. Annexure

6.1 Route wise coverage map

6.1.1 Railway

i) Bolpur Santiniketan to New Jalpaiguri

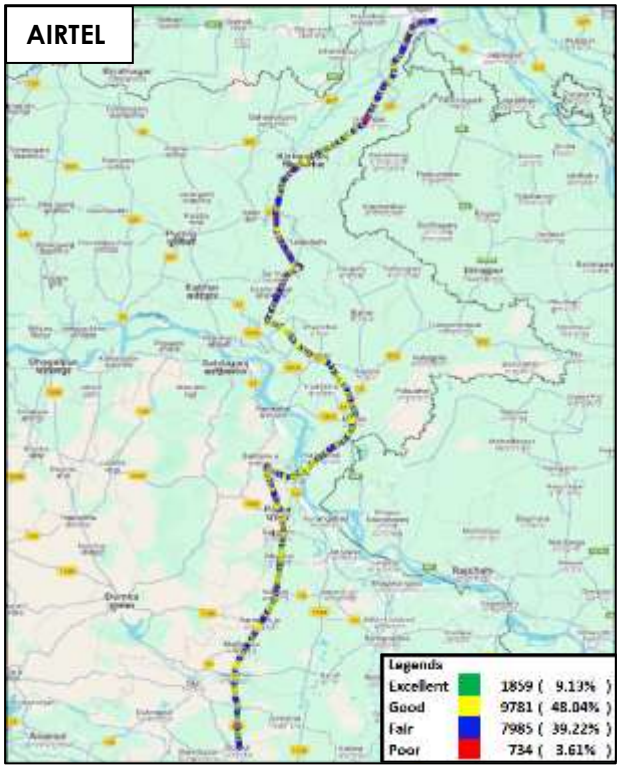


Figure-14: Signal strength auto-selection mode 5G/4G/3G/2G –AIRTEL

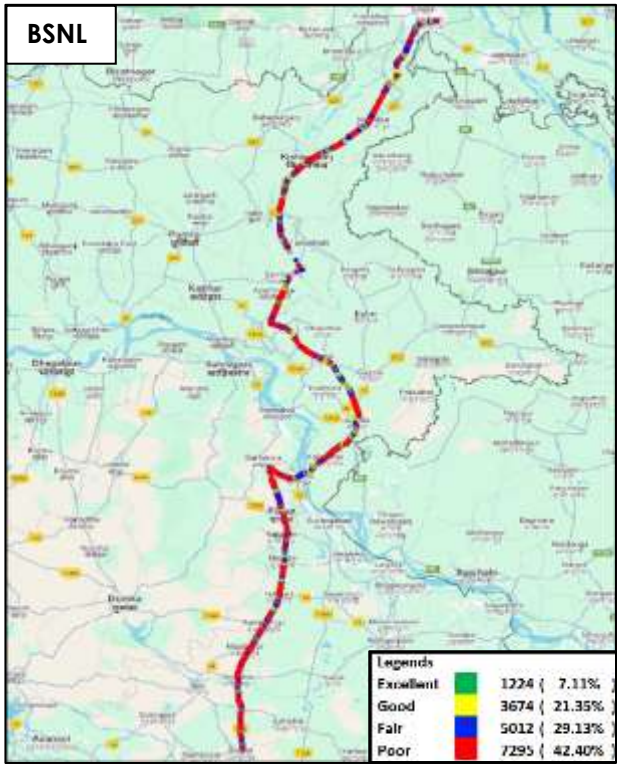


Figure-15: Signal strength auto-selection mode 5G/4G/3G/2G (4G network being rolled out) –BSNL

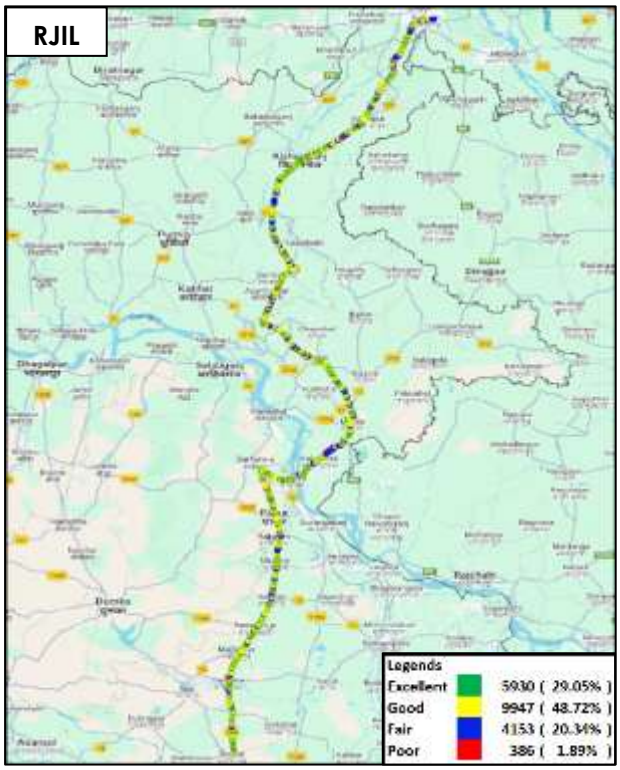


Figure-16: Signal strength auto-selection mode 5G/4G/3G/2G -RJIL

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	• 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.

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.irctc.co.in, www.sbi.co.in) 20 sec timeout (only at Hotspot)

Latency		25 count- Dynamic 1000 count- Hotspot Payload- 512 bytes in all drive

Table-11: 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.

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

MO: Mobile originating

MT: Mobile terminating

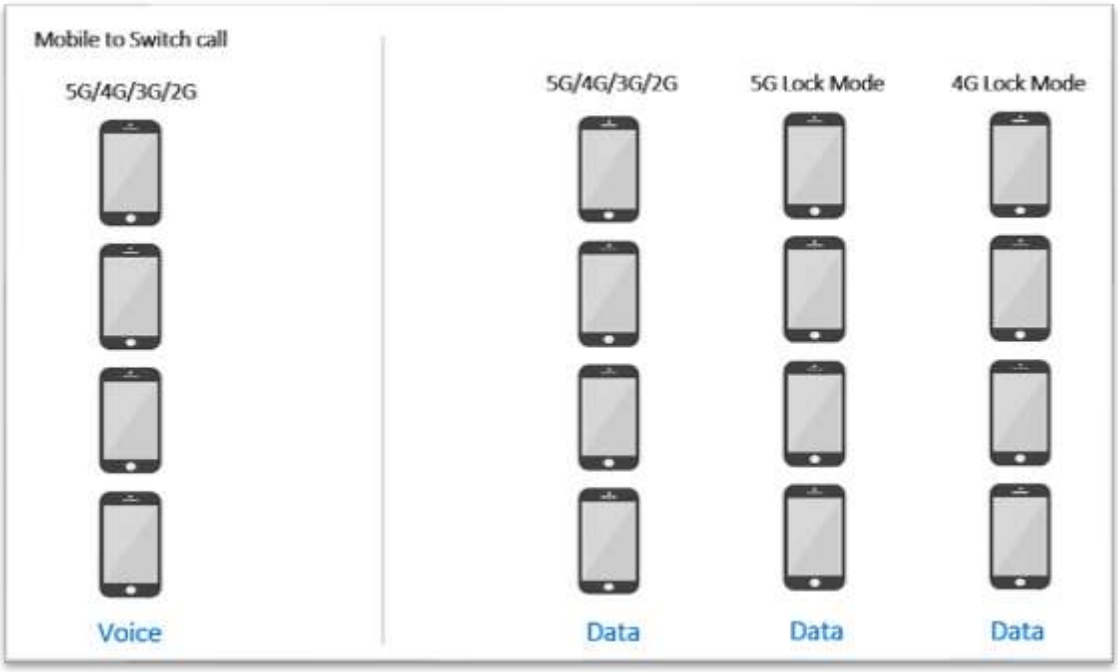


Figure-19: Number of handsets used in railway/metro/walktest/hotspot/ coastal area

Note- 5G & 4G Lock mode testing has been performed at hotspot locations only.

7.1.2 Drive test Methodology

(a) Dynamic voice testing (on the move)

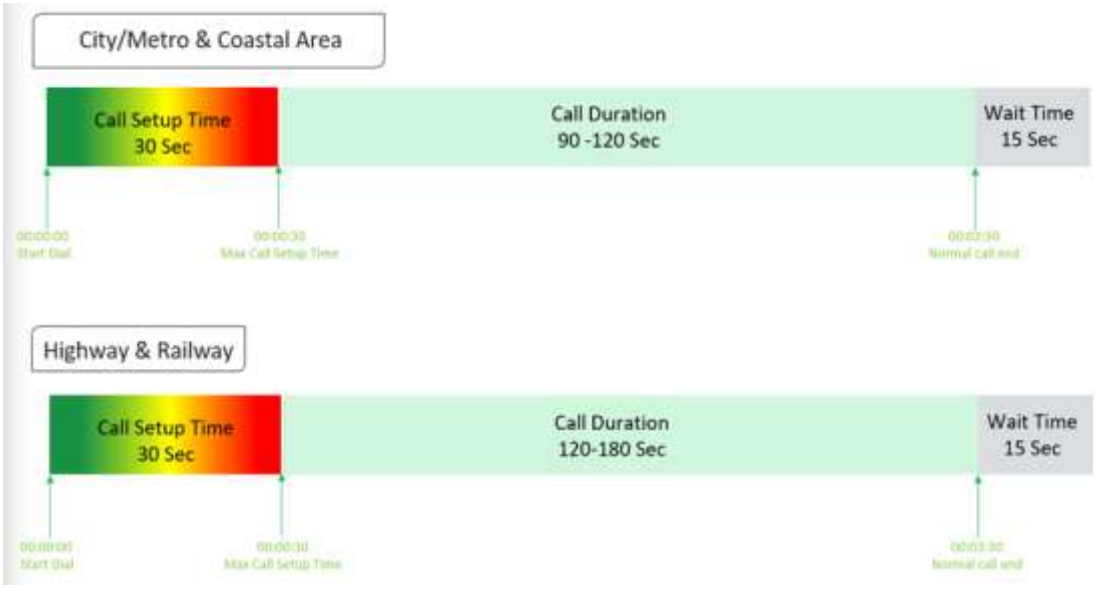


Figure-20: Voice test script for city/railway/metro/highway & coastal area

- 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-21: 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-22: Data test script used in city/metro/railway/highway/walk test & coastal area

(d) Static Data(internet) testing

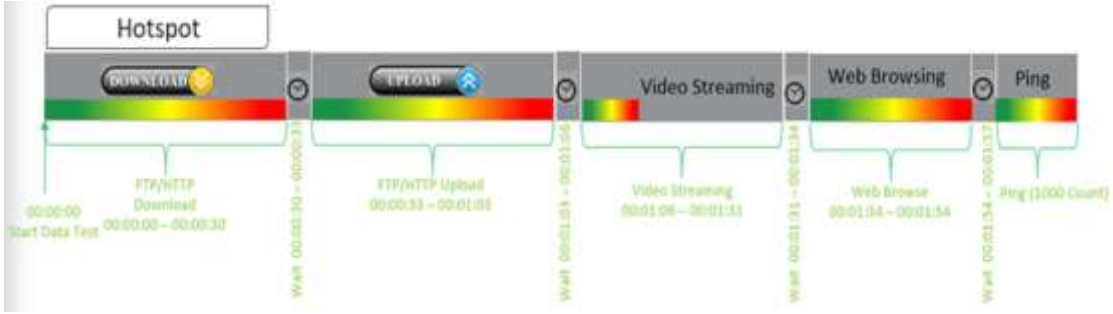


Figure-23: Data test script used at hotspot

- 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.

7.2 Appendix-II

7.2.1 Network Performance Parameters for Voice calls

Parameter Name	Definition
Call Setup Success Rate	(i) Call Setup Success Rate is defined as the ratio of Established Calls to Call Attempts. 'Established Calls' mean the following events have happened in call setup: (a) Call attempt is made (b) The signaling channel is allocated (c) The call is routed to the outwards path of the terminating network (d) An alert signal is received by caller in the form of ring back tone, busy tone, or an announcement. CSSR = (Total Call Established/ Total Call Attempt) *100 As per QoS Regulation 2024 benchmark value is **>=98%**
Drop Call Rate	Call drop represents the service provider network's ability to maintain a call once it has been successfully established. This parameter shall include both incoming calls and outgoing calls which, once they have been established and have an assigned traffic channel/ bearer, are dropped, or interrupted before their normal completion by the user, the cause of the early termination being within the service provider's network Drop Call Rate = (Total Call Drop/Total Call Established) *100 As per QoS Regulation 2024 benchmark value is **<=2%**
Call Setup Time	Time taken from call initiate to call alerting/ringing. Call Setup Time = T2- T1 T2- Ringing (VoLTE/VoNR) & Alerting (for WCDMA & GSM), T1- Invite (VoLTE/VoNR) & CM Service Request (for WCDMA & GSM)
Voice Quality (MOS)	Voice quality in mobile networks is measured with algorithms based on ITU-T P.863 (POLQA). The grading for Voice quality has been given as: Excellent: MOS $\geq$ 4 and < 5 Good : MOS $\geq$ 3 and < 4 Fair : MOS $\geq$ 2 and < 3 Poor : MOS $\geq$ 1 and < 2
Handover Success Rate	Handover Success Rate = Count of successful handovers (All Technology Handover combined) / Total count of Handover Attempt (All Technology Handover combined) *100 Handover type which are considered- 2G Inter & Intra cell, 3G Soft & IRAT, 4G Inter & Intra frequency & SRVCC, 5G Inter & Intra frequency & 5G to 4G handovers.
Silence Call	A call which has ≥ 4 sec continuous RTP gap is considered as a Silence Call. Silence call rate = (count of silence call / Total calls established) *100 If a call observes multiple silence count >=4 sec in a particular established call it has been taken as one silent event.

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

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

<table>
<tr><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>
</td></tr>
</table>

Table-12: 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-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.