

TELECOM REGULATORY AUTHORITY OF INDIA

Independent Drive Test Report

Karnataka LSA

November 2024

File No. RP-4/18/4(1)/2024-RO_BGLR (Computer No. 14209)

Generated from eOffice by VIRENDRA SINGH RAJPUT , SRO (VSR) - QoS-I, SENIOR RESEARCH OFFICER, TRAL on 06/02/2025 11:33 am

Contents

1. Introduction	3
2. Executive Summary (LSA)	
2.1 Drive test details	
2.2 Drive test routes	4
2.3 Summary of areas covered	4
2.4 Telecom service providers detected frequency bands	5
3. QoS performance analysis- LSA level	7
3.1 Overview	7
3.2 Voice performance	7
3.3 Data performance	10
4. Detailed QoS performance analysis	13
4.1 Overview	13
4.2 City	13
4.2.1 Drive test route	13
4.2.2 Areas covered	13
4.2.3 Voice performance	14
4.2.4 Data performance	25
4.3 Hotspots	27
4.3.1 Locations	27
4.3.2 Hotspot covered	27
4.3.3 Voice performance	28
4.3.4 Data performance	30
4.4 Walk Test	34
4.4.1 Walk test location map	34
4.4.2 Walk Test covered	34
4.4.3 Voice performance	35
4.4.4 Data performance	36
4.5 Highway	37
4.5.1 Drive test routes	37
4.5.2 Routes Covered	37
4.5.3 Voice performance	37
4.5.4 Data performance	46
5. Voice & Data Key findings	47
5.1 Overall Voice	47
5.2 Overall Data	47

5.3 Operator wise Key Findings	
6. Annexure	51
6.1 Route wise coverage map	51
6.1.1 City	51
6.1.2 Highway Route	58
i) Mysuru to Kanakapura via maddur and Kanakapura to	Mysuru via
Malavalli	58
7. Appendix	62
7.1 Appendix-I	62
7.1.1 Drive test setup	62
7.1.2 Drive test Methodology	64
7.2 Appendix-II	66
7.2.1 Network Performance Parameters for Voice call	66
7.2.2 Network Performance Parameters Data tests	67

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 Karnataka License Service Area (LSA) during the month of November, 2024 under the supervision of TRAI Regional Office (RO), Bengaluru. Details of route/ area covered during the IDT are given below:

SI. No	Drive test route	Type of route	Distance covered (KMs)/ Locations	From date	To date
1	Mysuru	City	239.0	20-Nov-2024	21-Nov-2024
2	Mysuru	City (Inter- operator calling)	24.5	19-Nov-2024	19-Nov-2024
3	Mysuru	Hotspot	10 Locations	21-Nov-2024	22-Nov-2024
4	Mysuru	Walk Test	10.0	21-Nov-2024	22-Nov-2024
5	Mysuru to Kanakapura via Maddur Kanakapura to Mysuru via Malavalli	Highway	215.0	19-Nov-2024	19-Nov-2024

 Table-1: Drive test summary

2.2 Drive test routes

The map provides overview of drive test routes indicating city drive, interoperator 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- Brindavan Extension, Jaylakshmipuram, JP Nagar, Mandi Mohalla, Metagalli, Rajendra Nagar, Ramkrishna Nagar etc.

b) Hotspot-

- 1. Brindavana Garden
- 2. Chamundi Hills
- 3. DC Office
- 4. JSS University
- 5. Karnataka Police Academy
- 6. Mysuru Airport
- 7. Mysuru City Bus Stand
- 8. Mysuru University Sports Complex
- 9. Suyog Hospital
- 10. Zoological Garden

c) Walk Test-

- 1. Devaraja Market
- 2. Mysuru City Corporation
- 3. Mysore Palace
- 4. Mysuru Railway Station

d) Highway-

1. Mysuru to Kanakapura via Maddur & Kanakapura to Mysuru via Malavalli

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	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
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

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

168129/2025/RO_BGLR

QoS Performance Analysis-Karnataka 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 November-2024 covering city, hotspot, walk test & 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 the experience for respective users as they have only 3G/2G compatible handsets.

	Service Provider 3G/2G network mode only AIRTEL BSNL VIL			
Parameters				
Call Attempts	467	475	473	
Call Setup Success Rate %	99.36	99.79	96.62	
Drop Call Rate%	1.08	4.22	0.44	
Call Setup Time-Average (Second)	3.93	3.96	4.36	
Handover Success Rate %	98.89	99.14	98.30	



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



Number of unique cell id's covered in Voice test- Technology wise					
Service provider					
Technology	3G/2G network mode onlyAIRTELBSNLV				
3G	NA 176 NA				
2G 770 268 617					

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)

	Service Provider Auto-selection mode (5G/4G/3G/2G)					
Parameters						
	AIRTEL BSNL RJIL VIL					
Call Attempts	667	671	670	673		
Call Setup Success Rate %	100.00	98.96	100.00	98.81		
Drop Call Rate%	0.00	3.46	0.15	0.30		
Call Setup Time-Average (Second)	1.12	3.80	0.70	1.12		
Handover Success Rate %	99.80	99.52	99.84	99.87		

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

	Service Provider				
Parameter	Mobile-to-Mobile (5G/4G - Open Mode)				
	AIRTEL	BSNL	RJIL	VIL	
Call Established (within service provider Network)	458	533	456	463	
Number of silence call for >4 Sec	11	8	1	6	
Silence Call Rate %	2.40	1.50	0.22	1.30	
Number of silence instances for >4 Sec	14	10	2	8	
Number of silence instances for >3 Sec	30	14	7	21	
Number of silence instances for >2 sec	60	21	22	37	
RTP Jitter (4G & 5G) in ms	3.67	10.68	7.55	15.47	
Packet loss Rate Downlink %	1.03	23.96	0.41	0.98	
Packet loss Rate Uplink %	1.00	3.93	0.50	1.14	

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

NoteBSNL has latched 21.25% on LTE technology. Silence call, Jitter and packet loss rate have been taken that duration only (Volte call).





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

Number of unique cell id's covered in Voice test- Technology wise						
Service Provider						
Technology	Auto Mode (5G/4G/3G/2G)					
	AIRTEL	BSNL	RJIL	VIL		
5G	0	NA	531	NA		
4G	1346	0	1851	913		
3G	NA	189	NA	NA		

Generated from eOffice by VIRENDRA SINGH RAJPUT , SRO (VSR) - QoS-I, SENIOR RESEARCH OFFICER, TRAI on 06/02/2025 11:33 am

2G	0	250	NA	44
----	---	-----	----	----

Table-7: Technology wise number of network cell id's latched during drive test

Note-

NA- Service provider doesn't provide services on 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				
Speech Quality (MOS) distribution	AIRTEL	BSNL	RJIL	VIL		
Total Number of MOS Samples for calls in table-6		2661	3253	3282		
Speech Quality (Average MOS Score)		2.66	3.89	3.90		
Number of samples with MOS >=4 to <5 (Excellent)	2704	184	2292	2094		
Number of samples with MOS >=3 to <4(Good)	451	686	757	960		
Number of samples with MOS >=2 to <3 (Fair)	64	1263	153	162		
Number of samples with MOS >=1 to <2 (Poor)	79	528	51	66		
%age of samples with MOS >=4 to <5 (Excellent)	81.99%	6.91%	70.46%	63.80%		
%age of samples with MOS >=3 to <4(Good)	13.67%	25.78%	23.27%	29.25%		
%age of samples with MOS >=2 to <3 (Fair)	1.94%	47.46%	4.70%	4.94%		
%age of samples with MOS >=1 to <2 (Poor)	2.40%	19.84%	1.57%	2.01%		

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 38 to 52 inter operator calls were attempted. The Call setup success rate and call setup time observation are as below.

Call setup success rate %						
To Service Provider						
From Service Provider	AIRTEL BSNL RJIL VIL					
AIRTEL	NA	100.00	98.08	100.00		
BSNL	95.35	NA	94.87	95.00		
RJIL	100.00	97.37	NA	98.00		
VIL	100.00	95.24	96.15	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)				
To Service Provider				
From Service Provider	AIRTEL	BSNL	RJIL	VIL
AIRTEL	NA	6.18	2.39	3.58
BSNL	5.79	NA	4.65	5.12
RJIL	2.86	14.93	NA	2.55
VIL	2.85	5.42	3.20	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 VI			VIL	
	Average	164.66	3.96	243.10	19.63	
Download Throughput	80th Percentile	252.44	5.93	410.02	33.73	
(MDIts/s)	20th Percentile	44.12	0.60	55.04	7.97	
	Average	37.76	2.57	25.14	11.90	
(Mbite/s)	80th Percentile	69.88	3.67	44.84	16.04	
(11013/3)	20th Percentile	5.73	1.13	4.88	5.76	
Ping (ms)	Average	32.85	188.37	68.71	53.10	

Table-11: Summar	y of data	performance	in netw	work auto	-selection	mode
------------------	-----------	-------------	---------	-----------	------------	------

Note-

• TSPs experiencing exceptionally high latency at specific hotspot locations, which have skewed the overall latency performance of the LSA, have been excluded from the LSA-wise performance evaluation.



Figure- 5: Download and upload throughput

Number of unique cell id's covered in Data test- Technology wise									
Service Provider									
Technology	Auto-selection mode 5G/4G/3G/2G								
	AIRTEL	AIRTEL BSNL RJIL VII							
5G	0	NA	806	NA					
4G	1676	378	384	956					
3G	NA	136	NA	NA					
2G	1	71	NA	70					

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.

168129/2025/RO_BGLR

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

4.2 City

Drive test has been conducted from 20^{th} to 21^{st} November 2024 in Mysuru. (Refer Table-1)

Melapu lu Hulikere Chandagalu Belagola Pa Naguvanahalli Hosunu Naganahalli Hosa Badavane Bastipura hyadanahalli Hebbadi Belavadi Metagai Industria Ar Kamanakere Kalisiddana Kurgalli Hebbalu Hundi Hundi Metagalli Brindavan Hutagalli Raj endr Nagar tension tagalli shmip Jayala garahundi Bo Alan ratikyatanahalli nakrishna Nagara Chik Lalitadrig Saluhundi hamundip halli Chora Muganahundi Bandipaly Uttanahalli Nagartahalli V ARA BUURNEL

4.2.1 Drive test route

Figure- 6: Drive test routes

4.2.2 Areas covered

Brindavan Extension, Jaylakshmipuram, JP Nagar, Mandi Mohalla, Metagalli, Rajendra Nagar, Ramkrishna 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 the experience for respective users as they have only 3G/2G compatible handsets.

	Service Provider 3G/2G network mode only AIRTEL BSNL VIL				
Parameters					
Call Attempts	373	373	377		
Call Setup Success Rate %	99.20	100.00	96.02		
Drop Call Rate %	0.54	1.88	0.28		
Call Setup Time-Average (Second)	3.76	3.64	4.18		
Handover Success Rate %	98.55	99.10	98.36		





Figure-7: Performance for call setup success rate



Figure-8: Performance for drop call rate

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

Technology	Service Provider			
rechnology	AIRTEL	BSNL	VIL	
3G	NA	41.47%	NA	
2G	99.94%	58.53%	100.00%	
Limited Service	0.06%	0.00%	0.00%	

Table-14:	Time spent of	on technology	during drive	test 3G/2G n	network mode o	nly



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 and 44 for map view)



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

Observations:

- Airtel has 38% of samples falling in the excellent signal strength category.
- BSNL has 24% of samples falling in the excellent signal strength category.
- VIL has 62% of samples falling in the excellent signal strength category.

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

	Service Provider					
Parameters	Auto-selection mode (5G/4G/3G/2G)					
	AIRTEL BSNL RJIL VI					
Call Attempts	387	385	386	392		
Call Setup Success Rate %	100.00	99.22	100.00	98.47		
Drop Call Rate%	0.00 2.36 0.00		0.00	0.26		
Call Setup Time Average (Second)	ond) 1.11 3.78 0.		0.71	0.98		
Handover Success Rate %	99.79	99.59	99.85	99.93		

	Service Provider Mobile-to-Mobile				
Parameter					
	(5	G /4G - U	pen mou	e)	
	AIRTEL	BSNL	RJIL	VIL	
Call Established	376	426	372	378	
(within service provider Network)	570	420	572	570	
Number of silence call for >4 Sec	9	5	1	3	
Silence Call Rate %	2.39 1.17 0.27		0.79		
Number of silence instances for >4 Sec	12	6	2	4	
Number of silence instances for >3 Sec	23	9	6	10	
Number of silence instances for >2 sec	46	13	15	17	
RTP Jitter (4G & 5G) in ms	3.83	11.68	7.6	15.52	
Packet loss Rate Downlink %	1.73	24.28	1.82	1.00	
Packet loss Rate Uplink %	1.60	4.56	0.97	1.07	

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

Note-

• BSNL has latched 16.88% on LTE technology. Silence call, Jitter and packet loss rate have been taken that duration only (Volte call).



Figure-13: Performance for call setup success rate



Figure-14: Performance for drop call rate

(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				
Speech Quality (MOS) distribution	AIRTEL	BSNL	RJIL	VIL	
Total Number of MOS Samples for calls in table-16	2237	1724	2191	2243	
Speech Quality (Average MOS Score)	3.96	2.69	3.88	3.92	
Number of samples with MOS >=4 to <5 (Excellent)	1824	79	1504	1424	

Number of samples with MOS >=3 to <4(Good)	321	538	546	691
Number of samples with MOS >=2 to <3 (Fair)	32	822	108	100
Number of samples with MOS >=1 to <2 (Poor)	60	285	33	28
%age of samples with MOS >=4 to <5 (Excellent)	81.54%	4.58%	68.64%	63.49%
%age of samples with MOS >=3 to <4(Good)	14.35%	31.21%	24.92%	30.81%
%age of samples with MOS >=2 to <3 (Fair)	1.43%	47.68%	4.93%	4.46%
%age of samples with MOS >=1 to <2 (Poor)	2.68%	16.53%	1.51%	1.25%

Table-17: Summary of speech quality (MOS) samples



Figure-15: Distribution of samples in MOS score range

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

Technology	Service Provider				
Гесппогоду	AIRTEL	BSNL	RJIL	VIL	
5G	3.08%	NA	18.07%	NA	
4G	96.92%	0.00%	81.93%	99.83%	
3G	NA	51.65%	NA	NA	
2G	0.00%	48.35%	NA	0.17%	
Limited Service	0.00%	0.00%	0.00%	0.00%	

Table-18: Time spent on technology during drive test

Note-

• NA- Service provider doesn't provide services on 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 provides signal strength distribution for auto-selection mode (5G/4G/3G/2G). (Refer figure-45, 46, 47 and 48 for map view)



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

Observations:

- Airtel has 45% of samples falling in the excellent signal strength category.
- BSNL has 18% of samples falling in the excellent signal strength category.
- RJIL has 43% of samples falling in the excellent signal strength category.
- VIL has 29% 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
Devenload Three shout	Average	174.36	3.62	262.22	18.71
	80th Percentile	255.57	5.57	435.09	31.83
(11013/3)	20th Percentile	65.07	0.61	103.08	7.77
	Average	42.14	2.17	28.54	10.84
Upioad Inrougnput	80th Percentile	74.73	2.85	50.62	11.03
(11013/3)	20th Percentile	9.86	1.21	6.25	5.85
Ping (ms)	Average	31.91	249.05	76.23	34.55









Figure- 22: Upload throughput

4.3 Hotspots

Hotspot testing has been done on 21^{st} & 22^{nd} of November 2024. Ten locations have been tested in the city.

4.3.1 Locations



Figure- 23: Hotspot locations

4.3.2 Hotspot covered

- 1. Brindavana Garden
- 2. Chamundi Hills
- 3. DC Office
- 4. JSS University
- 5. Karnataka Police Academy
- 6. Mysuru Airport
- 7. Mysuru City Bus Stand
- 8. Mysuru University Sports Complex
- 9. Suyog Hospital
- 10. Zoological Garden

4.3.3 Voice performance

Overall Voice Performance				
		Service	Provider	
Parameters	Auto-selection mode (5G/4G/3G/			
	AIRTEL	BSNL	RJIL	VIL
Call Attempt	100	100	100	100
Call Setup Success Rate %	100.00	98.00	100.00	98.00
Drop Call Rate%	0.00	0.00	0.00	0.00
Call Setup Time-Average (Sec)	1.13	3.09	0.86	0.89

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

Brindavana Garden					
Service Provider					
Parameters	Auto-selection mode (5G/4G/3G/2				
	AIRTEL	BSNL	RJIL	VIL	
Call Attempt	10	10	10	10	
Call Setup Success Rate %	100.00 100.00 100.00 80.00				
Drop Call Rate%	0.00	0.00	0.00	0.00	
Call Setup Time-Average (Sec)	0.97	2.91	0.47	0.83	

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

Chamundi Hills					
	Service Provider				
Parameters	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 (Sec)	1.08 3.53 4.29 1.22				

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

DC Office				
		Service	Provider	
Parameters	Auto-selection mode (5G/4G/3G/2			
	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 (Sec)	1.18	2.75	0.49	0.80

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

JSS University							
Service Provider							
Parameters	Auto Mode (5G/4G/3G/2G)			Auto 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 (Sec)	1.50	3.14	0.44	0.77			

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

Karnataka Police Academy				
	Provider			
Parameters	Auto 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 (Sec)	0.92	2.99	0.45	0.76

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

Mysuru Airport				
		Service F	Provider	
Parameters	Auto 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 (Sec)	1.10	3.48	0.40	0.84

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

Mysuru City Bus Stand					
	Service Provider Auto Mode (5G/4G/3G/2G)				
Parameters					
	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 (Sec)	1.16	2.56	0.48	0.90	

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

Mysuru University Sports Complex					
Service Provider					
Parameters	Auto Mode (5G/4G/3G/2G)				
	AIRTEL	BSNL	RJIL	VIL	
Call Attempt	10	10	10	10	
Call Setup Success Rate %	100.00	80.00	100.00	100.00	
Drop Call Rate%	0.00	0.00	0.00	0.00	
Call Setup Time-Average (Sec)	1.13	3.49	0.52	0.91	

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

Suyog Hospital				
	Service Provider			
Parameters	Auto 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 (Sec)	1.09	2.85	0.58	0.86

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

Zoological Garden							
	Service Provider Auto Mode (5G/4G/3G/2G)						
Parameters							Auto Mode (5G/4G/3G/2G)
	AIRTEL	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 (Sec)	1.15	3.31	0.49	1.02			

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

4.3.4 Data performance

Overall Data Performance					
	Service Provider				
Parameters	Auto-selection mode (5G/4G/3G/2G)				
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	180.95	8.55	250.74	13.11	
Download Throughput 80th Percentile (Mbit/s)	311.02	14.45	344.15	13.85	
Download Throughput 20th Percentile (Mbit/s)	25.53	4.83	108.12	8.30	
Download Session Setup Success Rate %	100.00	88.00	88.00	100.00	
Upload Throughput Average (Mbits/s)	15.57	5.77	20.99	8.81	
Upload Throughput 80th Percentile (Mbit/s)	29.83	10.45	36.55	10.27	
Upload Throughput 20th Percentile (Mbit/s)	1.52	1.68	3.99	4.19	
Upload Session Setup Success Rate %	100.00	92.00	92.00	98.00	
Web Browsing Delay (Second)	5.59	2.84	2.48	6.34	
Youtube Initial Buffer Delay (Second)	1.15	1.44	0.70	1.23	
Ping (ms)	22.44	47.99	30.99	73.91	
Jitter (ms)	18.42	28.58	16.29	41.49	
Packet Loss Rate-Ping %	1.03	4.79	1.73	11.58	

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

Note-

• TSPs experiencing exceptionally high latency at specific hotspot locations, due to which jitter and packet loss rate are also high, which have skewed the latency, Jitter & Packet loss performance of overall hotspots, and same have been excluded from the overall hotspot performance evaluation.

Brindavana Garden					
	Service Provider				
Parameters	Auto-selection mode (5G/4G/3G/			i/3G/2G)	
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	15.56	5.04	176.10	8.52	
Download Session Setup Success Rate %	100.00	60.00	100.00	100.00	
Upload Throughput Average (Mbits/s)	1.31	1.42	3.72	5.93	
Upload Session Setup Success Rate %	100.00	80.00	100.00	80.00	
Web Browsing Delay (Second)	7.74	3.58	2.06	5.09	
Youtube Initial Buffer Delay (Second)	4.83	1.46	0.70	0.68	
Ping (ms)	27.52	43.71	15.35	303.79	
Jitter (ms)	16.93	6.69	4.61	286.81	
Packet Loss Rate-Ping %	2.30	0.10	0.00	71.79	

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

Chamundi Hills					
	Service Provider				
Parameters	Auto-selection mode (5G/4G/3G/			i/3G/2G)	
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	42.22	16.88	0.00	7.02	
Download Session Setup Success Rate %	100.00	100.00	20.00	100.00	
Upload Throughput Average (Mbits/s)	3.16	8.81	1.55	2.53	
Upload Session Setup Success Rate %	100.00	100.00	20.00	100.00	
Web Browsing Delay (Second)	2.26	2.24	7.45	2.58	
Youtube Initial Buffer Delay (Second)	0.66	0.75	-	0.83	
Ping (ms)	17.52	88.23	7410.61	495.41	
Jitter (ms)	9.90	170.24	2528.79	390.79	
Packet Loss Rate-Ping %	0.20	8.90	59.60	32.20	

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

Note-

• All Youtube tests were failed in RJIL.

DC Office					
	Service Provider				
Parameters	Auto	o Mode (50	G/4G/3G/	/2G)	
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	316.20	6.69	294.86	8.72	
Download Session Setup Success Rate %	100.00	80.00	100.00	100.00	
Upload Throughput Average (Mbits/s)	30.32	5.98	34.53	4.64	
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00	
Web Browsing Delay (Second)	5.86	2.03	1.93	5.21	
Youtube Initial Buffer Delay (Second)	0.56	1.44	0.59	0.71	
Ping (ms)	21.88	37.68	22.36	26.08	
Jitter (ms)	20.36	17.85	6.16	2.49	
Packet Loss Rate-Ping %	1.20	1.30	0.00	0.50	

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

JSS University					
		Service	Provider		
Parameters	Auto Mode (5G/4G/3G/2G)			2G)	
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	78.58	2.64	235.56	7.84	
Download Session Setup Success Rate %	100.00	80.00	80.00	100.00	
Upload Throughput Average (Mbits/s)	4.20	1.21	15.15	3.47	
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00	
Web Browsing Delay (Second)	7.39	5.41	1.93	5.67	
Youtube Initial Buffer Delay (Second)	0.76	2.00	0.68	1.07	
Ping (ms)	39.05	53.82	17.52	27.85	
Jitter (ms)	71.25	17.01	3.13	4.57	
Packet Loss Rate-Ping %	5.40	18.40	0.00	2.00	

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

Karnataka Police Academy				
	Service Provider			
Parameters	Auto Mode (5G/4G/3G/2G)			
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	399.74	7.16	227.82	8.72
Download Session Setup Success Rate %	100.00	100.00	80.00	100.00
Upload Throughput Average (Mbits/s)	20.77	4.77	13.88	10.26
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	10.20	2.12	2.08	8.04
Youtube Initial Buffer Delay (Second)	0.59	1.18	0.65	0.62
Ping (ms)	18.59	38.35	20.92	32.07
Jitter (ms)	13.75	9.73	6.43	2.76
Packet Loss Rate-Ping %	0.20	0.70	0.00	2.80

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

Mysuru Airport					
	Service Provider				
Parameters	Auto	o Mode (5G	/4G/3G/	2G)	
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	12.81	3.69	29.01	8.53	
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00	
Upload Throughput Average (Mbits/s)	1.62	3.52	3.42	10.10	
Upload Session Setup Success Rate %	100.00	80.00	100.00	100.00	
Web Browsing Delay (Second)	11.70	3.81	5.81	8.20	
Youtube Initial Buffer Delay (Second)	5.80	1.74	1.56	0.63	
Ping (ms)	22.74	59.71	127.50	27.24	
Jitter (ms)	32.16	29.51	103.98	2.68	
Packet Loss Rate-Ping %	0.80	14.00	15.50	1.50	

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

Mysuru City Bus Stand					
	Service Provider				
Parameters	Auto Mode (5G/4G/3G/2G)			2G)	
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	250.50	5.54	129.11	17.93	
Download Session Setup Success Rate %	100.00	60.00	100.00	100.00	
Upload Throughput Average (Mbits/s)	0.00	4.36	37.95	6.31	
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00	
Web Browsing Delay (Second)	1.60	2.34	1.98	6.42	
Youtube Initial Buffer Delay (Second)	0.59	1.02	0.72	2.23	
Ping (ms)	19.42	38.07	19.14	30.05	
Jitter (ms)	3.81	4.46	8.71	4.28	
Packet Loss Rate-Ping %	0.00	0.20	0.10	1.90	

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

Mysuru University Sports Complex					
	Service Provider				
Parameters	Auto Mode (5G/4G/3G/2G)				
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	320.40	14.62	344.94	12.17	
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00	
Upload Throughput Average (Mbits/s)	40.49	11.12	18.97	7.12	
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00	
Web Browsing Delay (Second)	1.72	2.17	1.99	8.20	
Youtube Initial Buffer Delay (Second)	0.68	1.08	0.67	2.03	
Ping (ms)	18.70	39.29	22.70	31.58	
Jitter (ms)	2.02	4.18	3.44	4.12	
Packet Loss Rate-Ping	0.00	0.00	0.00	0.40	

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

Suyog Hospital					
	Service Provider				
Parameters	Auto Mode (5G/4G/3G/2G)			2G)	
	AIRTEL	BSNL	RJIL	VIL	
Download Throughput Average (Mbits/s)	159.90	5.36	210.50	8.39	
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00	
Upload Throughput Average (Mbits/s)	21.43	1.77	17.13	10.13	
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00	
Web Browsing Delay (Second)	10.62	3.16	1.83	6.99	
Youtube Initial Buffer Delay (Second)	1.60	2.87	0.58	0.64	
Ping (ms)	19.00	45.70	16.80	28.47	
Jitter (ms)	9.28	29.49	4.52	1.86	
Packet Loss Rate-Ping %	0.20	4.30	0.00	1.00	

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

Zoological Garden				
		Service Provider		
Parameters	Auto Mode (5G/4G/3G/2G)			i)
	AIRTEL	BSNL	RJIL	VIL
Download Throughput Average (Mbits/s)	213.60	13.75	651.29	42.34
Download Session Setup Success Rate %	100.00	100.00	100.00	100.00
Upload Throughput Average (Mbits/s)	32.41	12.52	48.01	27.04
Upload Session Setup Success Rate %	100.00	100.00	100.00	100.00
Web Browsing Delay (Second)	1.51	2.13	1.97	7.13
Youtube Initial Buffer Delay (Second)	0.56	1.06	0.67	2.73
Ping (ms)	20.11	40.16	17.97	24.27
Jitter (ms)	5.19	3.54	6.89	2.23
Packet Loss Rate-Ping %	0.00	0.00	0.00	1.70

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

4.4 Walk Test

Walk test activity done on 21st & 22nd November 2024. Four locations have been tested in the city.

WANDE ಯಾದವಗಿರಿ MOHALLA ಮಂದಿ MYSORE ಮೊಹಲ್ಲಾ ಮೈಸೂರು 4 RAJA ALLA JAYANAGAR ಜಯನಗರ ಕರಾಜ Overhead ಹಲ್ಲಾ Water Tank LASHKAR MOHALLA ಲಷ್ಯರ್ /erhead ಮೊಹೆಲ್ಲಾ SHIVARAMPET ಶಿವರಾಮಪೇಟೆ ter Tank -IUNDI boରି CHAMRAJPURA ಚಾಮರಾಜಪುರ HARA ಗ,ಹಾರ OPPAL JAPURAM ALLA **KR MOHALLA** Doddake

4.4.1 Walk test location map

Figure- 24: Walk Test locations

4.4.2 Walk Test covered

- 1. Devaraja Market
- 2. Mysuru City Corporation

- 3. Mysore Palace
- 4. Mysuru Railway Station

4.4.3 Voice performance

Devaraja Market							
Service Provider							
Parameters	de (5G/4G/	(5G/4G/3G/2G)					
	AIRTEL	BSNL	RJIL	VIL			
Call Attempt	20	20	21	20			
Call Setup Success Rate %	100.00	100.00	100.00	100.00			
Drop Call Rate%	0.00	0.00	0.00	0.00			
Call Setup Time-Average (Sec)	1.10 3.13 0.57 1.05						

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

Mysuru City Corporation							
		Service	Provider				
Parameters	Auto-selection mode (5G/4G/3G/20						
	BSNL	RJIL	VIL				
Call Attempt	11	11	11	11			
Call Setup Success Rate %	100.00 100.00 100.00						
Drop Call Rate%	0.00 0.00 0.00 0.0						
Call Setup Time-Average (Sec)	1.06 3.88 0.57 0.83						

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

Mysore Palace							
	Service Provider						
Parameters	Auto-selection mode (5G/4G/3G/20						
	AIRTEL	RJIL	VIL				
Call Attempt	23	24	23	23			
Call Setup Success Rate %	100.00	100.00	100.00	100.00			
Drop Call Rate%	0.00 0.00 0.00						
Call Setup Time-Average (Sec)	1.14 3.55 0.60 0.99						

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

Mysuru Railway Station							
		Service I	Provider				
Parameters	Auto Mode (5G/4G/3G/2G)						
	AIRTEL	BSNL	RJIL	VIL			
Call Attempt	28	28	29	29			
Call Setup Success Rate %	100.00	96.43	100.00	100.00			
Drop Call Rate%	0.00	7.41	0.00	0.00			
Call Setup Time-Average (Sec)	(Sec) 1.11 6.32 0.59 0.99						

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

4.4.4 Data performance

Devaraja Market						
	Service Provider					
Parameters	Auto-selection mode (5G/4G/3G/2G)					
	AIRTEL	BSNL	RJIL	VIL		
Download Throughput Average (Mbits/s)	241.93	2.70	66.01	32.73		
Download Session Setup Success Rate %	100.00	79.31	45.45	100.00		
Upload Throughput Average (Mbits/s)	67.24	2.12	28.60	21.02		
Upload Session Setup Success Rate %	100.00	82.76	95.24	100.00		
Ping (milli second) 26.37 364.66 21.31 43.6						

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

Mysuru City Corporation						
	Service Provider					
Parameters	Auto-selection mode (5G/4G/3G/2G)					
	AIRTEL	BSNL	RJIL	VIL		
Download Throughput Average (Mbits/s)	146.92	3.16	166.12	7.95		
Download Session Setup Success Rate %	100.00	93.33	63.64	100.00		
Upload Throughput Average (Mbits/s)	12.69	4.76	9.94	5.63		
Upload Session Setup Success Rate %	100.00	80.00	81.82	91.67		
Ping (milli second) 22.08 40.00 25.25 122						

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

Mysore Palace						
	Service Provider					
Parameters	Auto-selection mode (5G/4G/3G/2G)					
	AIRTEL	BSNL	RJIL	VIL		
Download Throughput Average (Mbits/s)	234.47	3.45	169.42	7.00		
Download Session Setup Success Rate %	100.00	96.67	70.83	100.00		
Upload Throughput Average (Mbits/s)	49.04	3.85	17.38	8.29		
Upload Session Setup Success Rate %	100.00	90.00	100.00	100.00		
Ping (milli second) 22.01 81.30 645.00 37.1						

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

Mysuru Railway Station						
	Service Provider					
Parameters	Auto Mode (5G/4G/3G/2G)					
	AIRTEL	BSNL	RJIL	VIL		
Download Throughput Average (Mbits/s)	222.22	3.19	163.28	29.91		
Download Session Setup Success Rate %	100.00	56.82	43.33	97.22		
Upload Throughput Average (Mbits/s)	76.67	4.57	24.93	17.93		
Upload Session Setup Success Rate %	100.00	63.64	96.67	97.22		
Ping (milli second)	22.26	173.61	23.72	40.91		

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

4.5 Highway

Drive test has been conducted on 19th November 2024 covering Highway routes. (Refer Table-1)





Figure-25: Drive test route highway

4.5.2 Routes Covered

Mysuru to Kanakapura via Maddur and Kanakapura to Mysuru via Malavalli- Which covered NH948 and NH275. Drive test for this route has been conducted on 19th November 2024.

4.5.3 Voice performance

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

	Service Provider 3G/2G network mode only AIRTEL BSNL VIL				
Parameters					
Call Attempts	94	102	96		
Call Setup Success Rate %	100.00	99.02	98.96		
Drop Call Rate %	3.19	12.87	1.05		
Call Setup Time-Average (Second)	4.58	5.17	5.05		
Handover Success Rate %	99.71 99.29				

Table-50: 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.

Tashnalagy	Service Provider				
recinology	AIRTEL	BSNL	VIL		
3G	NA	30.78%	NA		
2G	100.00%	68.81%	100.00%		
Limited Service	0.00%	0.41%	0.00%		

Table-51: Time spent on technology during drive test 3G/2G network mode only

Note-

• NA- Service provider doesn't provide services in the 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 and 51 for map view)



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

Observations:

- Airtel has 22% of samples falling in the excellent signal strength category.
- BSNL has 13% of samples falling in the excellent signal strength category.
- VIL has 30% of samples falling in the excellent signal strength category.

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

	Service Provider					
Parameters	Auto-selection mode (5G/4G/3G/2G)					
	AIRTEL	BSNL	RJIL	VIL		
Call Attempts	98	103	100	98		
Call Setup Success Rate %	100.00	99.03	100.00	100.00		
Drop Call Rate%	0.00	11.76	1.00	1.02		
Call Setup Time Average (Second)	1.16	4.06	0.59	1.98		
Handover Success Rate %	99.72	98.53	99.79	99.64		

Table-52: Summary of voice call performance in network auto-selection mode

	Service Provider					
Paramotor	Mobile-to-Mobile					
Faidilletei	(!	5G/4G - O	pen Mod	le)		
	AIRTEL	BSNL	RJIL	VIL		
Call Established	07	107	01	07		
(within service provider Network)	02	107	04	65		
Number of silence call for >4 Sec	2	3	0	3		
Silence Call Rate %	2.44	2.80	0.00	3.61		
Number of silence instances for >4 Sec	2	4	0	4		
Number of silence instances for >3 Sec	7	5	1	11		
Number of silence instances for >2 sec	14	8	7	20		
RTP Jitter (4G & 5G) in ms	3.31	9.60	7.47	15.36		
Packet loss Rate Downlink %	0.57	23.50	0.24	1.20		
Packet loss Rate Uplink %	1.03	2.56	0.62	1.96		

Table-53: Summary of silence instances & packet loss rate for mobile to mobile call

Note-

• BSNL has latched 31.45% on LTE technology. Silence call, Jitter and packet loss rate have been taken that duration only (Volte call).



Figure-32: Performance for call setup success rate



Figure-33: Performance for drop call rate

(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.

Creash Quality (NOC) distribution		Service Provider				
Speech Quality (MOS) distribution	AIRTEL	BSNL	RJIL	VIL		
Total Number of MOS Samples for calls in table-53	1061	937	1062	1039		
Speech Quality (Average MOS Score)	3.98	2.59	3.91	3.86		
Number of samples with MOS >=4 to <5 (Excellent)	880	105	788	670		
Number of samples with MOS >=3 to <4(Good)	130	148	211	269		
Number of samples with MOS >=2 to <3 (Fair)	32	441	45	62		
Number of samples with MOS >=1 to <2 (Poor)	19	243	18	38		
%age of samples with MOS >=4 to <5 (Excellent)	82.94%	11.21%	74.20%	64.49%		
%age of samples with MOS >=3 to <4(Good)	12.25%	15.80%	19.87%	25.89%		
% age of samples with MOS >=2 to <3 (Fair)	3.02%	47.07%	4.24%	5.97%		
%age of samples with MOS >=1 to <2 (Poor)	1.79%	25.93%	1.69%	3.66%		

Table-54: 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.

Taskuslaus	Service Provider				
Гесплогоду	AIRTEL	BSNL	RJIL	VIL	
5G	0.97%	NA	8.39%	NA	
4G	99.03%	0.00%	91.61%	83.53%	
3G	NA	29.73%	NA	NA	
2G	0.00%	69.17%	NA	16.41%	
Limited Service	0.00%	1.10%	0.00%	0.07%	

Table-55: Time spent on technology during drive test

Note-

- RJIL does not offer 3G/2G network services.
- 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



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



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

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





Observations:

- Airtel has 33% samples falling in the excellent signal strength category.
- BSNL has 8% samples falling in the excellent signal strength category.
- RJIL has 30% samples falling in the excellent signal strength category.
- VIL has 19% samples falling in the excellent signal strength category.

4.5.4 Data performance

			Service P	Provider	
Parameters		Auto-selection mode (5G/4G/3G/2G)			
		AIRTEL	BSNL	RJIL	VIL
	Average	110.90	3.87	241.67	22.63
	80th Percentile	197.79	5.76	460.48	39.34
(MDILS/S)	20th Percentile	17.82	0.20	21.32	8.12
	Average	24.08	1.60	20.20	13.94
	80th Percentile	47.48	2.35	37.55	22.45
(MDIts/s)	20th Percentile	2.78	0.41	2.39	6.51
Ping (ms)	Average	63.62	466.88	71.38	58.63

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









Figure-41: 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%, 98.96%, 100.00% and 98.81% call setup success rate respectively.
- b) All service providers except BSNL and VIL have 100.00% call setup success rate at hotspot locations.
- c) All service providers except BSNL have 100.00% call setup success rate during Walk Test.
- d) All service providers except BSNL have 100.00% call setup success rate across the highway.
- **2. Call Setup Time**: BSNL has taken comparatively longer time (3.80 seconds) to establish the voice call, whereas Airtel, RJIL and VIL call setup time is 1.12, 0.70 & 1.12 second respectively in open mode (5G/4G/3G/2G).
- 3. Call Silence/Mute Rate: In packet switched network (4G/5G), Airtel, BSNL, VIL and RJIL have 2.40%, 1.50%, 1.30% & 0.22% silence call rate respectively. Further BSNL has higher RTP packet loss rate in downlink (23.96%) compared to Airtel (1.03%), VIL (0.98%) and RJIL (0.41%). In uplink the RTP packet loss rate is higher for BSNL (3.93%) compared to VIL (1.14%), Airtel (1.00%) and RJIL (0.50%).

4. Call Drop Rate:

- a) Overall BSNL's call drop rate (3.46%) is higher (QoS benchmark of 2%), while Airtel, RJIL and VIL have 0.00%, 0.15% and 0.30% respectively.
- b) At hotspot locations, all service providers have 0.00% call drop rate.
- c) All operators are meeting QoS Benchmark for drop call rate in walk test except BSNL at Mysuru Railway Station.

5.2 Overall Data

- **1.** Data download and upload performance (Dynamic i.e. while moving) :
 - a) BSNL offers a download speed of 3.96 Mbps while VIL provides 19.63 Mbps, utilizing legacy technologies respectively. In contrast, Airtel and Jio achieve significantly higher average download speeds of 164.66 Mbps and 243.10 Mbps.
 - b) BSNL (2.57 Mbps) and VIL (11.90 Mbps), operating on 4G/3G legacy technologies respectively, have comparatively lower upload speeds. In contrast, Airtel and RJIL offer faster speeds of 37.76 Mbps and 25.14 Mbps, respectively.
- 2. Data download and upload performance (static i.e. while stationary):
 - a) RJIL demonstrates superior 5G Quality of Service performance at hotspots, with average download and upload speeds of 250.74 Mbps and 20.99 Mbps, respectively.

3. Data session setup success rate (static i.e. while stationary):

a) Airtel and VIL have 100% download session setup success rate, while BSNL and RJIL both have 88.00% download session setup success rate.

b) Airtel has 100% upload session setup success rate, while BSNL, RJIL and VIL have a success rate of 92.00%, 92.00% and 98.00% respectively.

5.3 Operator wise Key Findings

1. Airtel:

Voice

- In the 3G/2G network mode, a call setup success rate of 99.36% was observed, and the call drop rate of 1.08% is well within the benchmark of 98.00% & 2.00% (refer Table-3).
- 100% call setup success rate and 0% drop call rate have been observed for the auto-selection mode for LSA (refer Table-5).
- 100% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode during city drive (refer Table-15).

Data

- Airtel has an average download throughput of 164.66 Mbps and an average upload throughput of 37.76 Mbps across measured routes for LSA (refer Table-11).
- Airtel has an average download throughput of 174.36 Mbps and an average upload throughput of 42.14 Mbps across the measured routes during the city drive (refer Table 19).
- Brindavana Garden, Chamundi Hills, JSS University and Mysuru Airport hotspots experience lower download speeds, registering less than 100 Mbps among a total of 10 hotspots (refer Tables 32, 33, 35 and 37).
- Brindavana Garden, Chamundi Hills, JSS University, Mysuru Airport and Mysuru City Bus Stand hotspots have upload speeds less than 10 Mbps, which is below average out of a total of 10 hotspots. (refer Tables 32, 33, 35, 37 and 38)
- Airtel has an average download throughput of 110.90 Mbps and an average upload throughput of 24.08 Mbps across the measured routes during the highway drive. (refer Table-56)

2. BSNL:

Voice

- In the 3G/2G network mode, a call setup success rate of 99.79% was observed, while the call drop rate of 4.22% exceeded the benchmark of 2% (refer Table-3).
- BSNL's auto-selection mode has a drop call rate of 3.46%, which is considerably higher than the acceptable benchmark of 2% in LSA. (Refer to Table-5)

- 2.36% call drop rate was observed for auto-selection mode during city drive, which does not meet the benchmark. (refer Table 15)
- Drop call rates of 12.87% and 11.76% were observed in 3G/2G network mode and auto-selection mode across highway, which are higher than the benchmark of 2.00%. (Refer to Tables 50 and 52)

Data

- BSNL has an average download speed of 3.96 Mbps and an average upload speed of 2.57 Mbps across measured routes for LSA (refer Table-11).
- BSNL has an average download throughput of 3.62 Mbps and an average upload throughput of 2.17 Mbps across measured routes during a city drive (refer Table-19).
- The following hotspots have been identified as having low download speeds (less than 15 Mbps) out of a total of 10 hotspots which are Brindavana Garden, DC Office, JSS University, Karnataka Police Academy, Mysuru Airport, Mysuru City Bus Stand, Mysuru University Sport Complex, Suyog Hospital and Zoological Garden. (refer Table- 32, 34, 35, 36, 37, 38, 39, 40 and 41).
- Brindavana Garden, JSS University, Karnataka Police Academy, Mysuru Airport, Mysuru City Bus Stand and Suyog Hospital hotspots have an upload speed of less than 5 Mbps among a total of 10 hotspots. (refer Tables 32, 35, 36, 37, 38 and 40).
- All walk test locations have download speed less than 10 Mbps and upload speed 5 Mbps. (refer Table- 46, 47, 48 and 49)

3. RJIL:

Voice

- 100% call setup success rate and 0.15% drop call rate have been observed for the auto-selection mode for LSA (refer Table-5).
- 100% call setup success rate and 0.00% drop call rate have been observed for auto-selection mode during city drive (refer Table-15).

Data

- RJIL has an average download throughput of 243.10 Mbps and an average upload throughput of 25.14 Mbps across measured routes in LSA. (refer Table-11)
- RJIL has an average download throughput of 262.22 Mbps and an average upload throughput of 28.54 Mbps across measured routes in the city drive (refer Table 19).

- Chamundi Hills and Mysuru Airport hotspot have a download speed of less than 100 Mbps, which is among the lowest out of a total of 10 hotspots (refer Table 33 and 37).
- Out of total 10 hotspots, Brindavana Garden, Chamundi Hills and Mysuru Airport have low upload speeds of less than 10 Mbps. (refer Table 32,33 and 37).
- RJIL has an average download throughput of 241.67 Mbps and an average upload throughput of 20.20 Mbps across highway. (refer Table-56)
- Ping latency, Jitter and packet loss rate are very high at Chamundi Hills hotspot location. (refer table-33)

4. VIL:

Voice

- VIL has a 96.62% success rate for call setup on 3G/2G networks, while the drop call rate is 0.44% in LSA. (Refer to Table-3)
- 98.81% call setup success rate and 0.30% drop call rate have been observed for the auto-selection mode for LSA (refer Table-5).
- 98.47% call setup success rate and 0.26% drop call rate have been observed for auto-selection mode during city drive (refer Table-15).

Data

- VIL has an average download throughput of 19.63 Mbps and an average upload throughput of 11.90 Mbps across the measured routes in LSA (refer Table 11).
- VIL has an average download throughput of 18.71 Mbps and an average upload throughput of 10.84 Mbps across measured routes in the city drive. (refer Table 19)
- All 10 hotspots have download speeds below 15 Mbps, except for Mysuru City Bus Stand and the Zoological Garden.(refer table- 32, 33, ,34, 35, 36, 37, 39 and 40)
- Chamundi Hills, DC Office and JSS University have upload speed of less than 5 Mbps, which is among the lowest out of total 10 hotspots. (refer Table 33, 34 and 35).
- VIL has an average download throughput of 22.63 Mbps and an average upload throughput of 13.94 Mbps across the highway (refer Table 56).

6. Annexure

6.1 Route wise coverage map

6.1.1 City



Figure-42: Signal strength 3G/2G network mode - AIRTEL



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



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 Route

i) Mysuru to Kanakapura via maddur and Kanakapura to Mysuru via Malavalli



Figure-49: Signal strength 3G/2G network mode – AIRTEL



Figure-50: Signal strength 3G/2G network mode - BSNL



Figure-51: Signal strength 3G/2G network mode - VIL



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**: Azenços 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	30 Sec		
Call Duration	5G/4G/3G/2G auto mode- switch Call	90 Sec /180 Sec		
Wait/ Guard Time	5G/4G MOS Call	15 Sec		

 Table-57:
 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		500 MB File- 30 Sec Timeout , (Multithread 3- TCP Connection at a time)		
HTTP/FTP Upload	5G/4G/3G/2G Auto Mode	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 (<u>www.amazon.in</u> , <u>www.flipkart.com</u> , <u>www.google.co.in</u>) 20 sec timeout (only at Hotspot)		

Ping	25 count- Dynamic 1000 count- Hotspot

Table-58: 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).



Figure-56: Number of handsets used in city & higway drive MO: Mobile originating MT: Mobile terminating



Figure-57: Number of handsets used in railway/metro/walktest/hotspot

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 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 walk test/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 & coastal area

(d) Static Data(internet) testing



Figure-61: Data test script used at hotspot/walk test

- 5 Data iteration to be done at each hotspot location.
- Min. 5 iteration to be made during the walk test.
- Web browsing duration mentioned above is for one web site only.
- Only 1 ping iteration (with 1000 Count) to be done at hotspot location.

7.2 Appendix-II

7.2.1 Network Performance Parameters for Voice call

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: $MOS \ge 4$ and < 5 Good : $MOS \ge 3$ and < 4 Fair : $MOS \ge 2$ and < 3 Poor : $MOS \ge 1$ 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. A call which has ≥ 4 sec continuous RTP gap is considered as a Silence Call.
Jitter	Silence call rate = (count of silence / 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. 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 will be 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 R ⁻ by total RTF sequence nur This KPI will I (VoNR/VoLTE	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 will be calculated from MOS call for packet call only (VoNR/VoLTE)				
Uplink Packet Drop Rate	Number of RT by total RTP p sequence nur calculated fro	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 will be calculated from MOS call for packet call only (VONB/Vol TE)				
Signal Strength	Signal streng user. Parameter Name Rx Level RSCP RSRP SS_RSRP	th is the signa Technology GSM WCDMA LTE NR	l power leve Sig Excellent 0 to ≥ -65 0 to ≥ -70 0 to ≥ -80 0 to ≥ -80	el received nal Stren Good <-65 to \geq -75 <-70 to \geq - 80 <-80 to \geq - 95 <-80 to \geq - 95 <-80	by the w th (dBm) Fair <-75 to ≥- 85 <-80 to ≥- 90 <-95 to ≥- 110 <-95 to ≥- 110	Poor <-85 to min <-90 to min <-110 to min <-110 to min

Table-60: Network performance parmeter 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.
Ping Test & Latency	Ping (latency is the technically more correct term) 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 ping time is measured in milliseconds (ms). To calculate the one way ping delay we just do half of the round trip time
Jitter- Ping	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 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 Stdys of IPDV considered as jitter
Packet Loss Rate	Number of packet lost out of total packet transferred during the ping testing. Packet loss rate= (Total packet lost/ Total packet sent)*100 *packet delay (ping delay) >90 ms considered as packet loss and included in packet loss rate. * Packet loss rate is calculated based on ICMP.

Table-61: Network performance parameter and definition Data.