Operator Assisted Drive Test Report

KHAMMAM SSA
OCT - 2023

(RO, Hyderabad)

Key Performance Indicators: **All TSPs have met the Drop Call Rate (DCR) benchmark of 2% except BSNL 3G. All TSPs have met the Call Setup Success Rate (CSSR) of 95%. Rx Quality of 95% is not achieved by BSNL 2G, BSNL 3G & VIL VoLTE.**

The Operator Assisted Drive Test (OADT) has been carried out by TRAI RO Hyderabad with the help of Service Providers in Khammam City and surrounding areas Sathupally, Kothagudem, Bhadrachalam, Manuguru & Madhira from 9:00 AM to 8:00 PM during 17th to 20th October 2023. The drive test covered drive route of 498+ KMs & 6 hotspot over a period of 4 days. Approximately 728+ calls were made for each of the 7 networks: Three 2G networks, One 3G network and Three LTE network covering four TSPs.

Overview

Voice Summary

Data Summary

Overview

TRAI Hyderabad conducted Operator Assisted Drive Test from 17th to 20th October 2023 covering various locations Sathupally, Aswaraopet, Wyra, Kalluru, Palwancha, Badrachalam, Ashwapur, Manugur, Yellandhu, Kusumanchi, Bonakal, Madhira. The performance of Airtel, BSNL, Jio and Vodafone Idea Limited were monitored across various technologies (2G, 3G, and 4G). The test results obtained from these drive tests were utilized to assess the network quality for Voice and Data services in terms of

Voice: Coverage, Quality, Handover Success Rate, Call Setup Success Rate, Drop Call Rate and Block Call Rate.

Data : Download and Upload Throughputs, Web Browsing Delay and Latency

Drive Test Details :

Voice Tests: Calls were made for 90 sec duration with wait time of 10 sec between calls in all technologies. The drive test covered a drive route of approximately 498+ KMs over a period of 4 days from 17th to 20th OCT' 2023. Approximately 728+ calls were made for each of the 7 networks: three 2G (Lock Mode) networks, one 3G (Dual mode) networks and three VoLTE (Free Mode) network covering 4 unique TSPs.

Data Tests:

1.Dynamic data test was conducted for 498+ kms over a period of 3 days for download throughput for 3G & 4G technologies.

Data Tests were performed at 6 static locations for 2G, 3G & 4G technologies of five iterations at each location.

2. For Voice and Data KPI's, 2G measurement is done with UE locked mode, 3G measurement is done with UE in Dual mode (2G & 3G) and 4G measurement is done with UE in Free Mode.

* 3G KPI's which are calculated from UE in Dual Mode (2G & 3G) includes samples and events of 2G.

* 4G KPI's which are calculated from the UE in Free Mode included samples and events of 2G & 3G.

| Service	Specifications
Download	2G (Locked) - 500KB, 3G (Dual) - 20 MB, 4G (Free) - 40 MB
Upload	2G (Locked) - 100KB, 3G (Dual) - 5 MB, 4G (Free) - 10 MB
Web Browsing	3 links of e/m commerce website www.amazon.in, www.flipkart.com and www.myntra.com
Video Streaming	130 Sec Clip
Latency	Bytes on www.google.com

Overview

Voice & Dynamic Data Test Drive Route

Areas Covered -KHAMMAM	
Khammam railway station road	New busstand area
BSNL Office exchange	Railway Station
Sundharayya nagar	Bypass Road
Mustafa nagar	Mamillagudem
Khanapuram haveli	Papakabanda
Mamatha hospital Road	Areas Covered-Sathupalli
Yellandhu cross roads	Wyra
Edulapuram road	Thallada
Areas Covered-Madhira	V.M Banjara
Kusumanchi	Sathupalli
Madhira	Dwarakapuri
Yerrupalem	Aswaraopeta
Areas Covered - Badrachalam	
Yellandhu	Palwancha
Kothagudem	KTPS
Bajanmadhir road	Manuguru
Nehru basti	Badrachalam

Overview
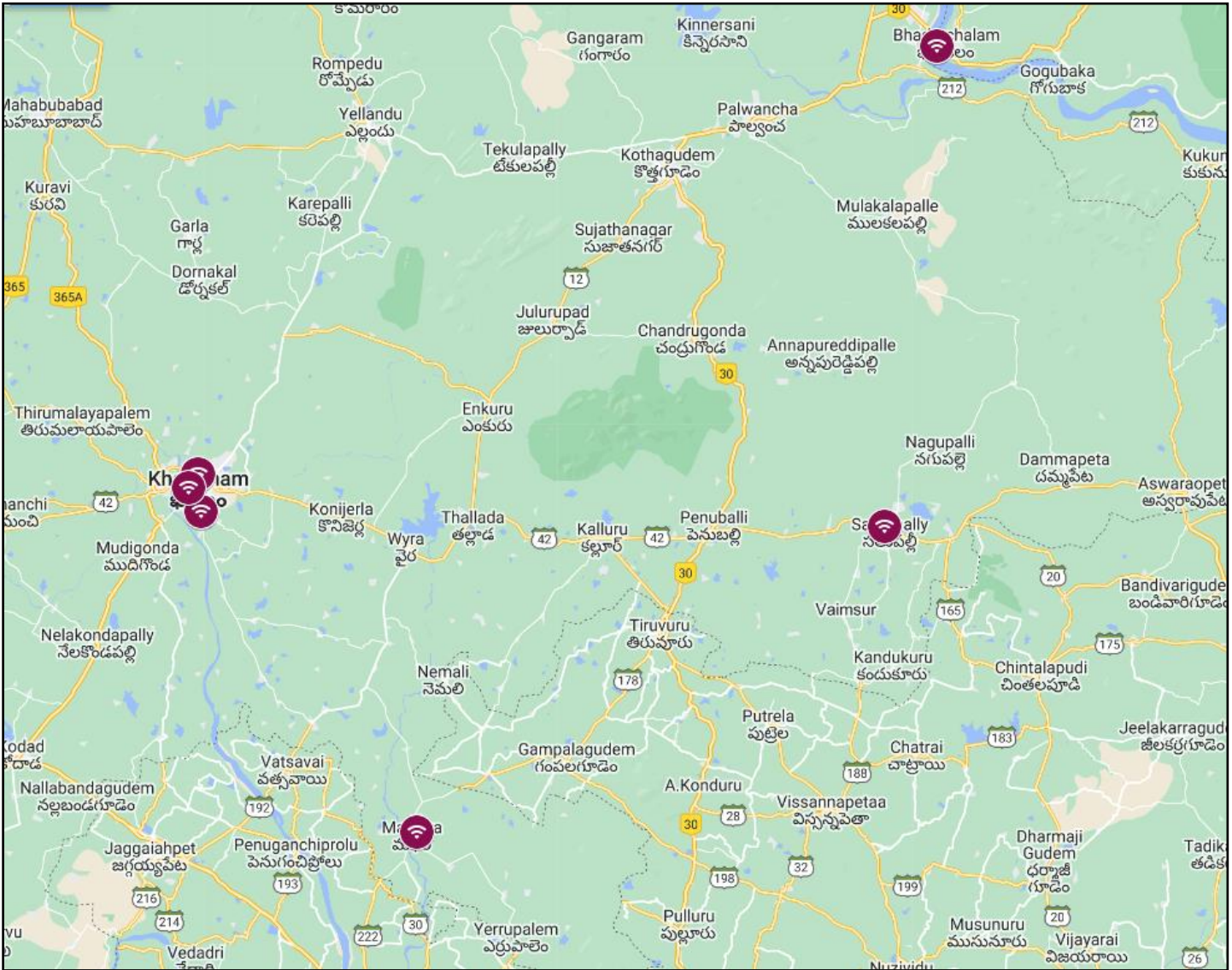
Static locations on Map

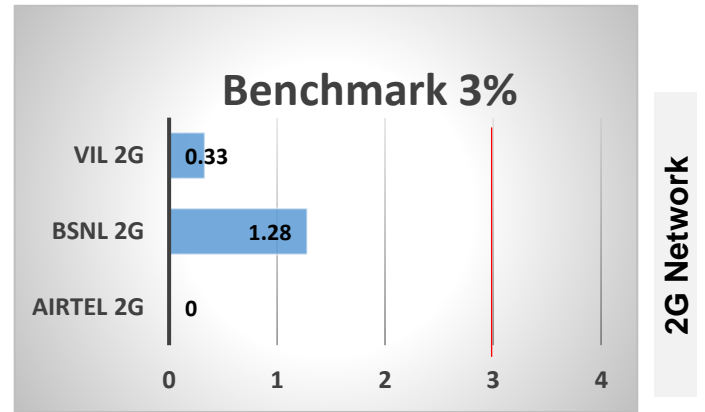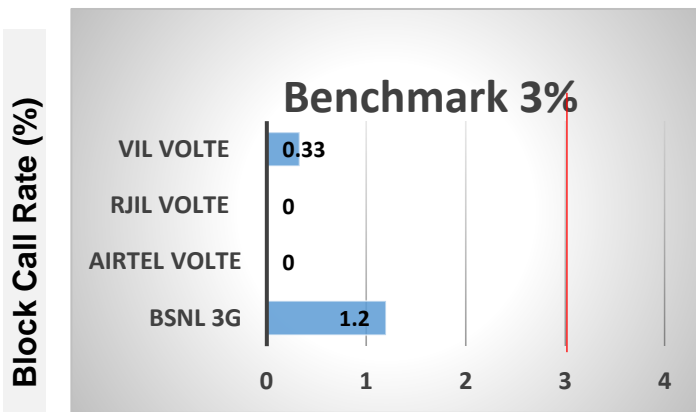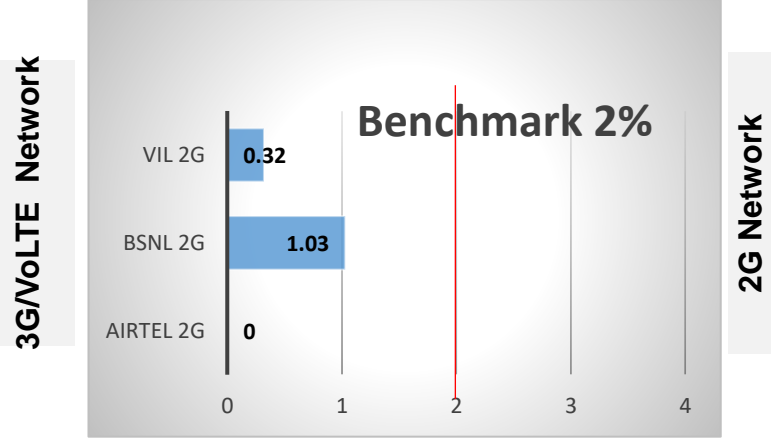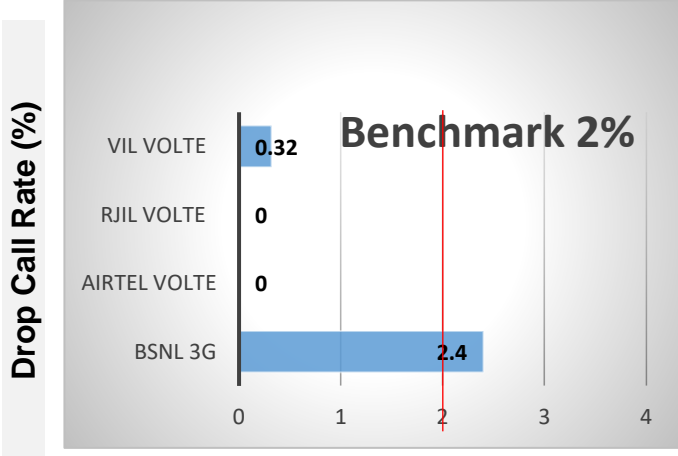| 6 Static Locations |
| :---: |
| Sathupally Bus Stop |
| Bhadrachalam Temple |
| Madhira RLY Station |
| Khammam RLY station |
| Khammam New Bus Stop |
| Khammam Mamatha Hospital |

Voice Calls

QoS compliance of the TSPs in Khammam for Voice across technologies 2G/3G/4G-VoLTE:

Drop Call Rate (%) — 3G/VoLTE Network

Benchmark 2%

VIL VOLTE	0.32
RJIL VOLTE	0
AIRTEL VOLTE	0
BSNL 3G	2.4

2G Network

Benchmark 2%

VIL 2G	0.32
BSNL 2G	1.03
AIRTEL 2G	0

Block Call Rate (%) — 3G / VoLTE Network

Benchmark 3%

VIL VOLTE	0.33
RJIL VOLTE	0
AIRTEL VOLTE	0
BSNL 3G	1.2

2G Network

Benchmark 3%

VIL 2G	0.33
BSNL 2G	1.28
AIRTEL 2G	0

KPIs	2G			3G	VoLTE`		
	Airtel	BSNL	VIL	BSNL	Airtel	RJIL	VIL
Drop Call Rate %	0	1.03	0.32	2.4	0	0	0.32
Block Call Rate %	0	1.28	0.33	1.2	0	0	0.33

a) All TSPs have met the 2% QoS benchmark of Drop Call Rate (DCR%) Except BSNL 3G.
b) Call Block Rate (CBR%) benchmark of 3% was achieved by all TSP's.

Voice Calls

Coverage

a) Percentage of coverage samples for 2G ≥ -85 dBm.

TSPS	2G		
	Airtel	**BSNL**	**VIL**
Coverage %	81.9	77.0	77.88

b) Percentage of coverage samples for 3G ≥ -90 dBm, LTE ≥ -110 dBm

TSP	3G	VoLTE		
	BSNL	**Airtel**	**JIO**	**VIL**
Coverage %	56.4	95.28	99.16	89.51

c) Percentage of time spent on 3G/VoLTE network

TSP	3G	VoLTE		
	BSNL	**Airtel**	**J IO**	**VIL**
Time spent %	43.9	100	100	99.54

Summary

Voice Calls	2G		
	Airtel	**BSNL**	**VIL**
Call attempts	710	639	616
Block call rate %	0	1.28	0.33
CSSR %	100	98.72	99.67
Drop call rate %	0	1.03	0.32
Mobility HOSR %	99.079	96.30	99.23
RX Quality %	95.11	92.6	95.10

Voice Calls	3G	VoLTE		
	BSNL	**Airtel**	**JIO**	**VIL**
Call attempts	9	716	621	610
Block call rate %	1.2	0	0	0.33
CSSR %	98.8	100	100	99.68
Drop call rate %	2.4	0	0.00	0.32
Mobility HOSR %	100	99.87	99.12	99.91
RX Quality %	94.8	97.6	96.59	87.94

Dynamic Data was tested for 498+ Kms. Download Throughput was tested.

Data Download Performance (Mbps) - Dynamic

3G/4G/ Network:

Download Throughput (Mbps)
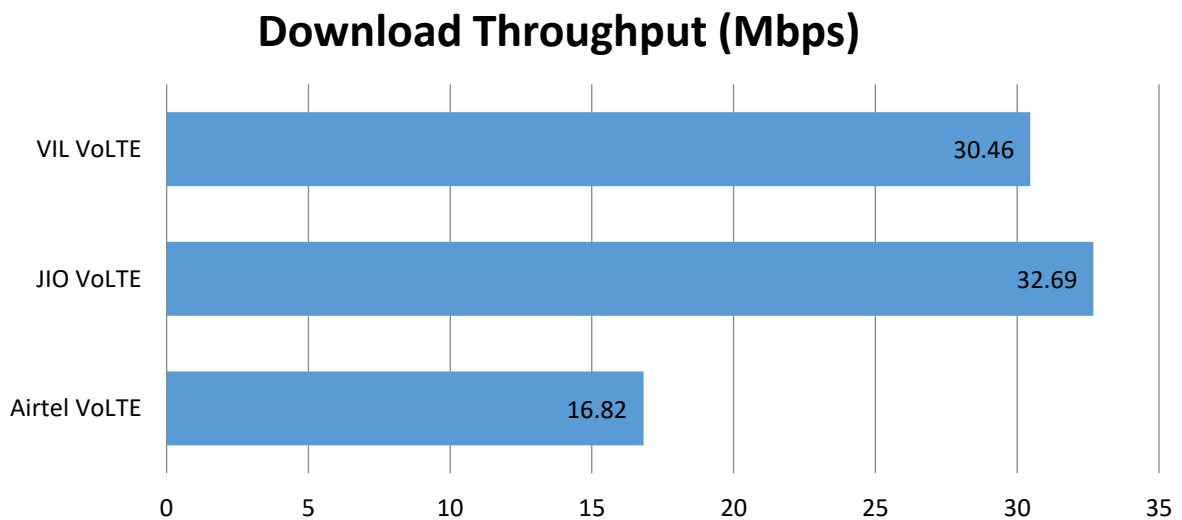
Data Services Dynamic	VoLTE		
	Airtel VoLTE	JIO VoLTE	VIL VoLTE
Download throughput in Mbps	16.82	32.69	30.46

Dynamic data test was Not conducted by BSNL due to Not supporting mobiles and Drive Tool Kits
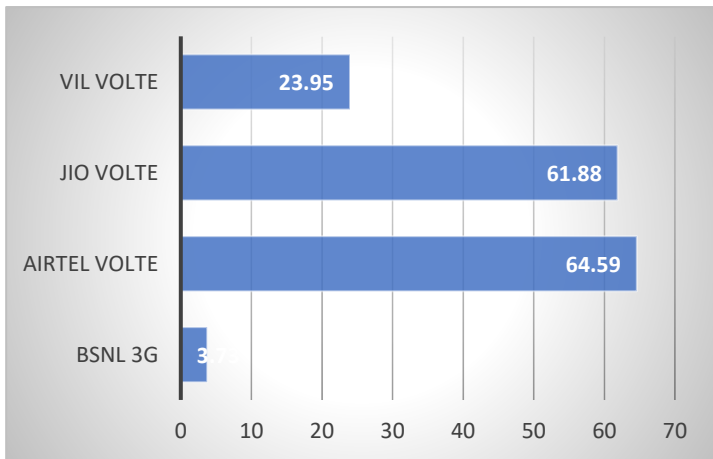
Data Services Static

Data was tested at 6 locations for 5 iterations. Following services were tested: Data Download/Upload, Latency (www.google.com), and Web browsing (Flipkart, Amazon, Myntra)
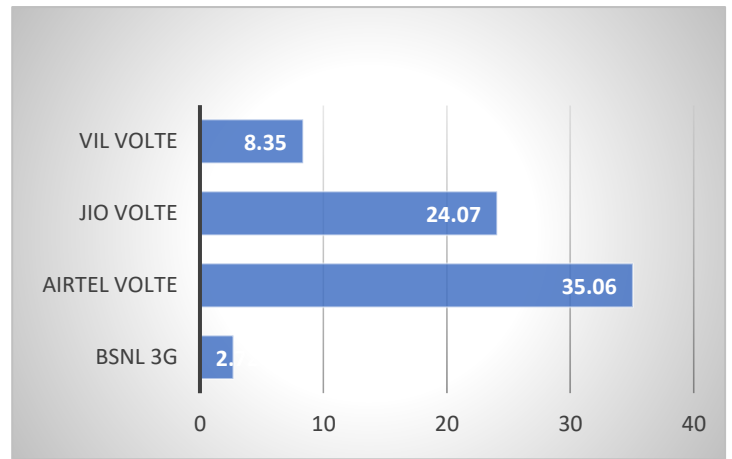
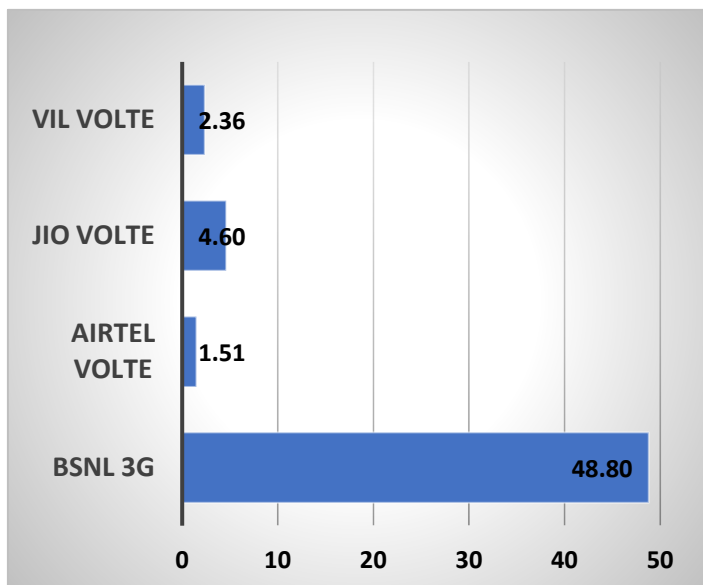**Data Download and Upload Performance (kbps)**

3G/4G Network:

Download Throughput (Mbps)

Carrier	Mbps
VIL VOLTE	23.95
JIO VOLTE	61.88
AIRTEL VOLTE	64.59
BSNL 3G	3

Upload Throughput (Mbps)

Carrier	Mbps
VIL VOLTE	8.35
JIO VOLTE	24.07
AIRTEL VOLTE	35.06
BSNL 3G	2.

Web Browsing (Sec)

Carrier	Sec
VIL VOLTE	2.36
JIO VOLTE	4.60
AIRTEL VOLTE	1.51
BSNL 3G	48.80

Latency (ms)

Carrier	ms
VIL VOLTE	71.5
JIO VOLTE	63.75
AIRTEL VOLTE	23.75
BSNL 3G	167.34
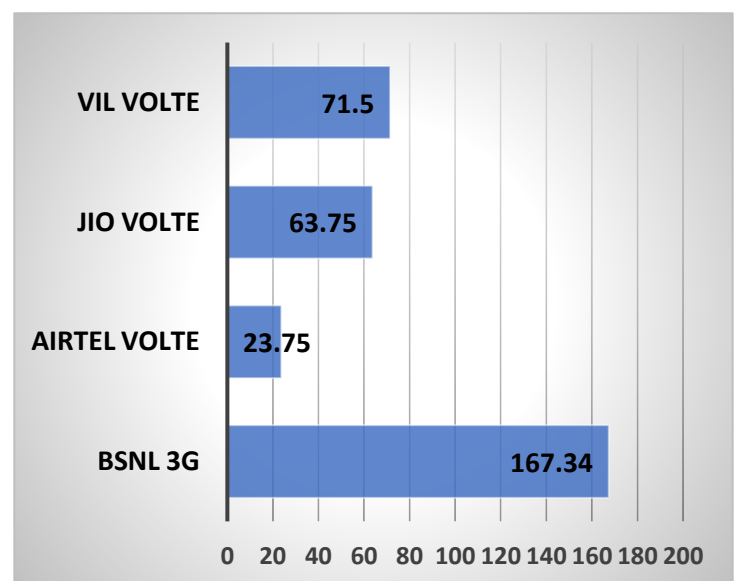
Summary

Data Services Static	2G		
	Airtel	**BSNL**	**VIL**
Download throughput in Kbps	264.70	149.44	60.64
Upload Throughput in Kbps	60.27	111.25	37.57
Web browsing delay in second	4.49	64.19	13.5
Latency in (msec)	100.18	190.82	198.23

Data Services Static	3G / 4G			
	BSNL 3G	**Airtel 4G**	**JIO 4G**	**VIL 4G**
Download throughput in Mbps	3.73	64.59	61.88	23.95
Upload Throughput in Mbps	2.72	35.06	24.07	8.35
Web browsing delay in second	48.80	1.51	4.6	2.36
Latency in (msec)	167.34	23.75	63.75	71.5

Sathupally Bus Station	2G		
	Airtel	BSNL	VIL
Download throughput in Kbps	283.1	206.12	44.01
Upload Throughput in Kbps	78.6	125.41	9.80
Web browsing delay in second	2.71	84.40	12.8
Latency in (msec)	66.6	177.78	212.8

Bhadrachalam Temple	2G		
	Airtel	BSNL	VIL
Download throughput in Kbps	296.7	30.17	48.50
Upload Throughput in Kbps	63.8	106.53	35.90
Web browsing delay in second	4.77	91.76	13.6
Latency in (msec)	138	249	196.5

Madhira Railway Station	2G		
	Airtel	BSNL	VIL
Download throughput in Kbps	262.1	121.36	120.6
Upload Throughput in Kbps	44.5	120.26	13.14
Web browsing delay in second	5.02	24.53	13.5
Latency in (msec)	75	214	202.7

Khammam Railway station	2G		
	Airtel	BSNL	VIL
Download throughput in Kbps	252.3	139.43	60.64
Upload Throughput in Kbps	28.4	112.76	50.09
Web browsing delay in second	6.08	51.61	14.2
Latency in (msec)	82	180.16	176

Khammam New Bus Station	2G		
	Airtel	BSNL	VIL
Download throughput in Kbps	242.4	203.83	53.61
Upload Throughput in Kbps	68.3	103.40	59.17
Web browsing delay in second	4.38	62.05	13.1
Latency in (msec)	102.24	171.33	205.4

Khammam Mamatha Hospital	2G		
	Airtel	BSNL	VIL
Download throughput in Kbps	251.7	195.74	49.31
Upload Throughput in Kbps	78.0	99.14	57.37
Web browsing delay in second	4.00	70.81	13.8
Latency in (msec)	137.21	152.66	196

Sathupally Bus Station	3G	4G		
	BSNL	Airtel	JIO	VIL
Download throughput in Mbps	3.29	94.75	46.41	21.5
Upload Throughput in Mbps	2.45	23.43	17.35	6.3
Web browsing delay in second	33.38	1.05	4.73	2.63
Latency in (msec)	145.68	22.24	65.67	84

Bhadrachalam Temple	3G	4G		
	BSNL	Airtel	JIO	VIL
Download throughput in Mbps	*BSNL is not offering 3G services	45.18	93.19	14.06
Upload Throughput in Mbps		25.68	23.90	4.87
Web browsing delay in second		1.9	4.46	2.73
Latency in (msec)		25.63	65.1	80.2

Madhira Railway Station	3G	4G		
	BSNL	Airtel	JIO	VIL
Download throughput in Mbps	4.16	62.75	74.82	23.76
Upload Throughput in Mbps	2.98	38.54	23.16	21.84
Web browsing delay in second	64.23	3.04	4.98	2.37
Latency in (msec)	189	24.55	57.67	80.8

Khammam Railway station	3G	4G		
	BSNL	Airtel	JIO	VIL
Download throughput in Mbps	*BSNL is not offering 3G services	57.65	45.17	42.71
Upload Throughput in Mbps		43.65	26.43	7.72
Web browsing delay in second		1.09	5.0	1.97
Latency in (msec)		21.3	65	58.4

Khammam New Bus Station	3G	4G		
	BSNL	Airtel	JIO	VIL
Download throughput in Mbps	*BSNL is not offering 3G services	77.59	46.11	17.65
Upload Throughput in Mbps		48.33	26.98	4.76
Web browsing delay in second		0.99	4.03	2.85
Latency in (msec)		21.24	61.67	75.4

Khammam Mamatha Hospital	3G	4G		
	BSNL	Airtel	JIO	VIL
Download throughput in Mbps	*BSNL is not offering 3G services	49.61	61.53	24.05
Upload Throughput in Mbps		30.75	25.21	4.65
Web browsing delay in second		0.97	61.53	1.76
Latency in (msec)		27.55	25.21	50.2

RF Coverage relates to the geographical footprint within the system that has sufficient RF signal strength to provide for a call session. The Coverage rate is calculated on the basis of % of samples in which the Rx level ≥ -85 dBm, RSCP is ≥ -90 dBm & RSRP ≥ -110dBm. The details are as follows.

TSP	Coverage Rate %
Airtel 2G	**81.90**
BSNL 2G	**77.00**
VIL 2G	**77.88**
BSNL 3G	**56.40**
Airtel VoLTE	**95.28**
Jio VoLTE	**99.16**
VIL VoLTE	**89.51**

Coverage Distribution

	Airtel 2G	BSNl 2G	VIL 2G	BSNL 3G	Airtel VoLTE	Jio VoLTE	VIL VoLTE
2G:[-95,>=Min] 3G:[-90,>=Min] VoLTE:[-110,>=Min]	3.3	6	3.92	43.6	4.72	0.84	10.49
2G:[-85,>=-95] 3G:[-80,>=-90] VoLTE:[-90,>=-110]	14.8	17.1	18.2	28.9	22.94	36.14	50.68
2G:[-75,>=-85] 3G:[-70,>=-80] VoLTE:[-80,>=-90]	28	45.7	29.03	18.8	43.52	24.66	23.46
2G:[Max,>=-75] 3G:Max,>=-70 VoLTE:>=80	53.9	31.2	48.85	8.7	28.82	38.36	15.37

- ■ 2G:[Max,>=-75] 3G:Max,>=-70 VoLTE:>=80
- ■ 2G:[-75,>=-85] 3G:[-70,>=-80] VoLTE:[-80,>=-90]
- ■ 2G:[-85,>=-95] 3G:[-80,>=-90] VoLTE:[-90,>=-110]
- ■ 2G:[-95,>=Min] 3G:[-90,>=Min] VoLTE:[-110,>=Min]
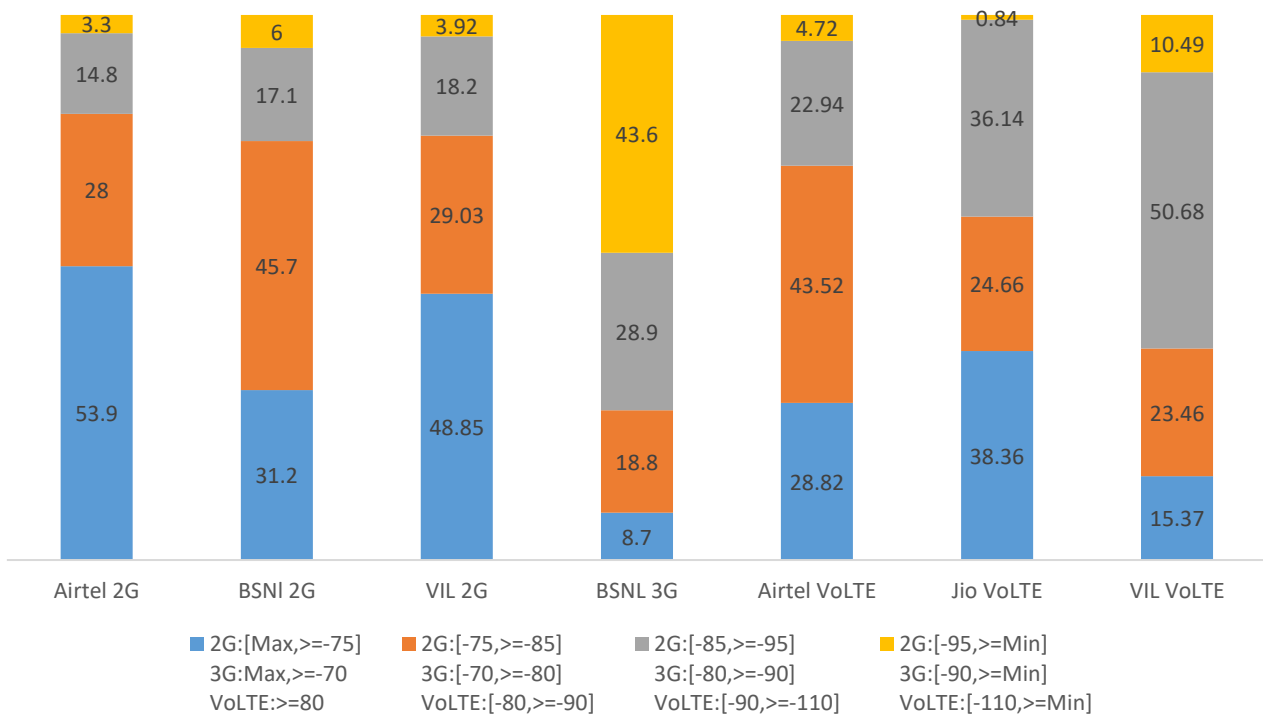
AIRTEL

Technology	Coverage Rate %
2G	**81.90**
VoLTE	**95.28**

2G	**VoLTE**

2G			VoLTE		
Overall RxLevel	**# Samples**	**%**	**Overall RSRP**	**# Samples**	**%**
[Max, >=-75]	4611969	53.9	[Max, >=-80]	5164854	28.82
[-75, >=-85]	2389715	28.0	[-80, >=-90]	7750836	43.52
[-85, >=-95]	1268560	14.8	[-90, >=-110]	4111843	22.94
[-95, >=Min]	278509	3.3	[-110, >=-120]	845980	4.72
Total	8548753	100	**Total**	17922480	100

BSNL

Technology	Coverage Rate %
2G	77.0
3G	56.40
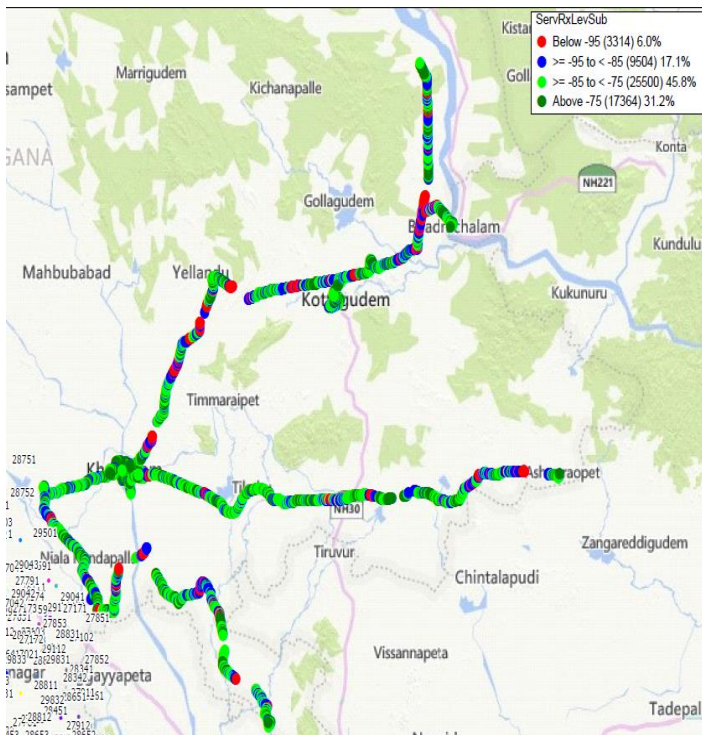
2G	3G
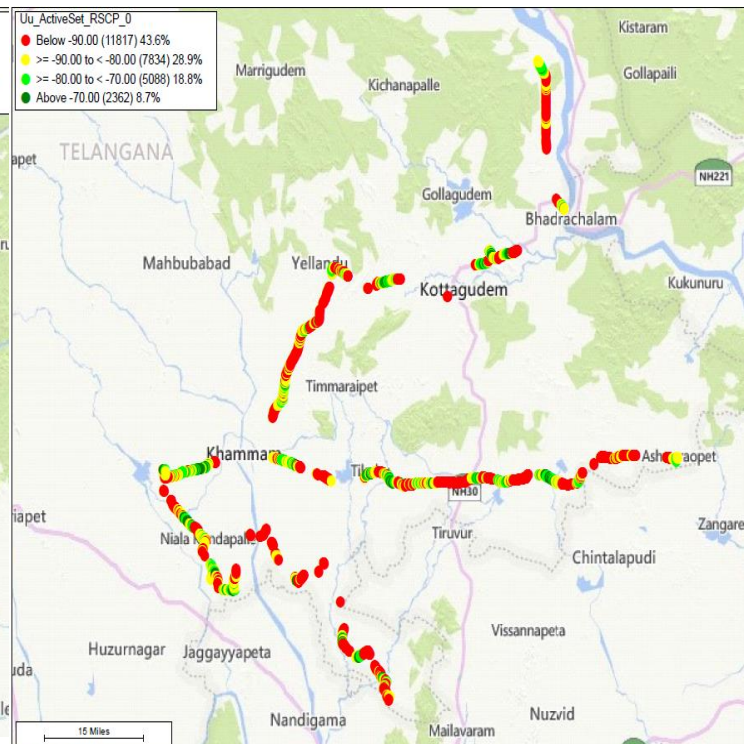
2G		
Overall RxLevel	# Samples	% PDF
[Max, >=-75]	17364	31.2
[-75, >=-85)	25500	45.7
[-85, >=-95)	9504	17.1
[-95, >=Min)	3314	6.0
Total	55682	100

3G		
Overall RSCP	# Samples	% PDF
[Max, >=-70]	2362	8.7
[-70, >=-80)	5088	18.8
[-80, >=-90)	7834	28.9
[-90, >=Min)	11817	43.6
Total	27101	100

RJIL

Technology	Coverage Rate %
VoLTE	99.16

LTE KPI PCell Serving RSRP[dBm]
- -80 <= x (38.36%, 23160)
- -90 <= x < -80 (24.66%, 14887)
- -110 <= x < -90 (36.14%, 21822)
- -120 <= x < -110 (0.49%, 297)
- x < -120 (0.35%, 213)
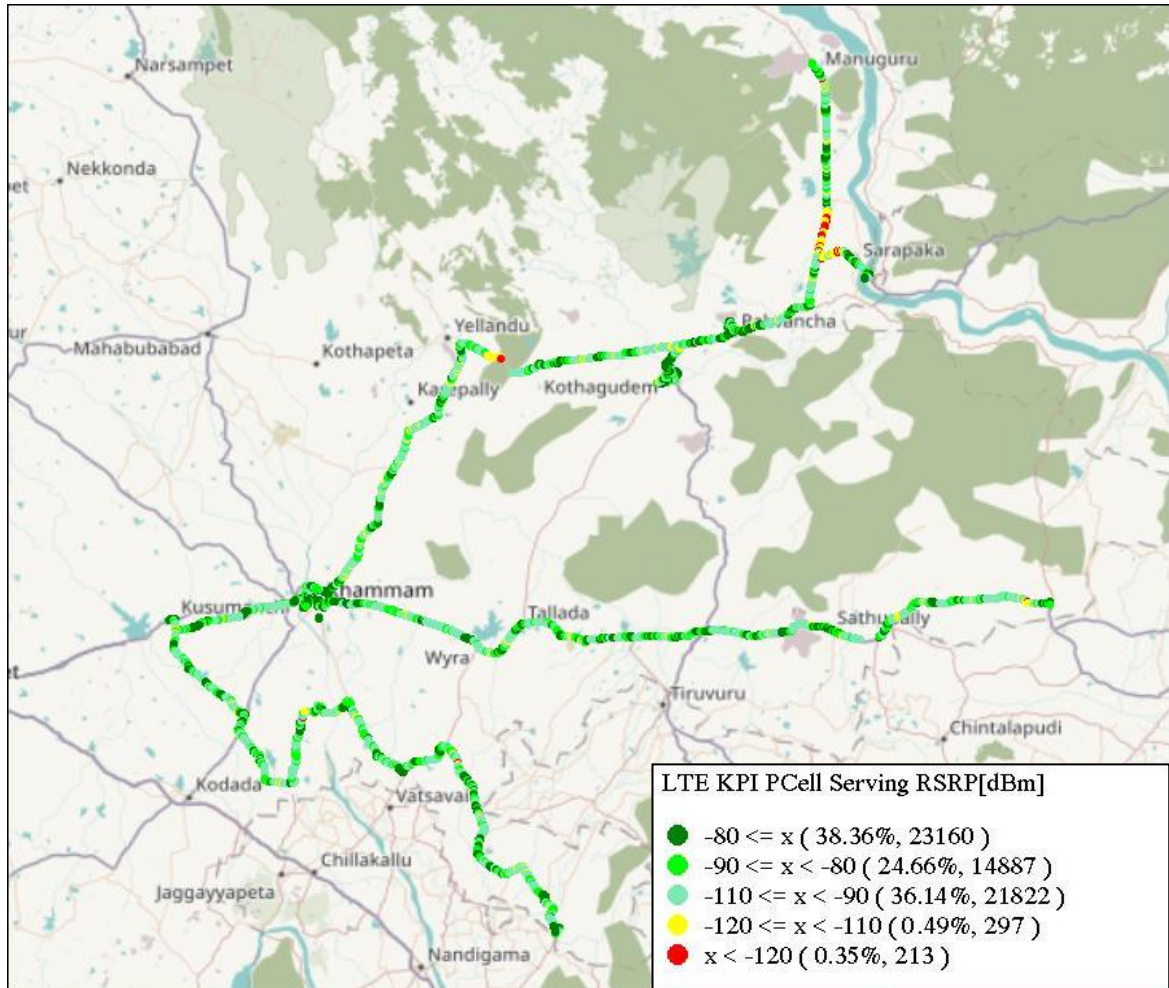
VoLTE

Overall RSRP	# Samples	%
[Max, >=-80]	23160	38.36
[-80, >=-90]	14887	24.66
[-90, >=-110]	21822	36.14
[-110, >=-120]	297	0.84
Total	**60379**	**100**

VIL

Technology	Coverage Rate %
2G	**77.88**
VoLTE	**89.51**
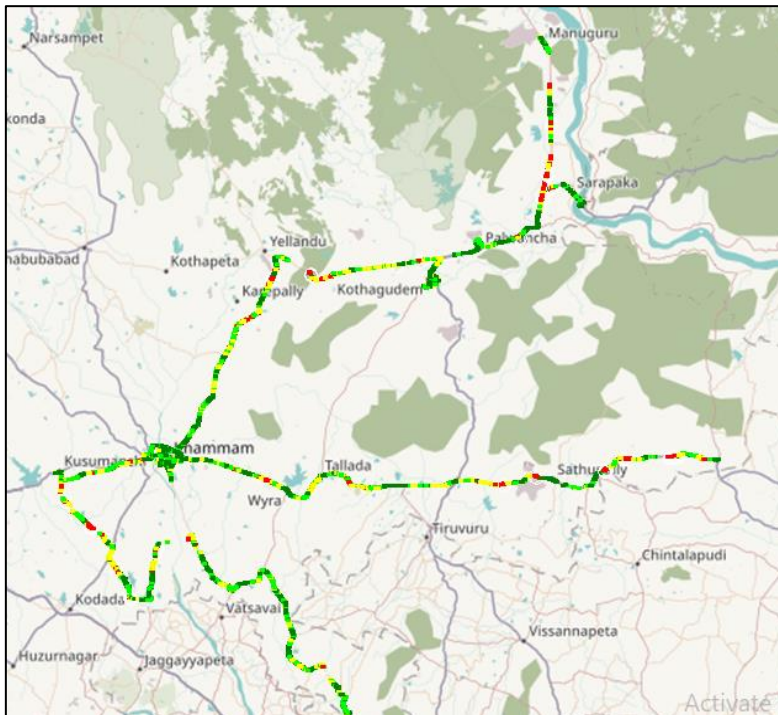
2G	VoLTE

2G
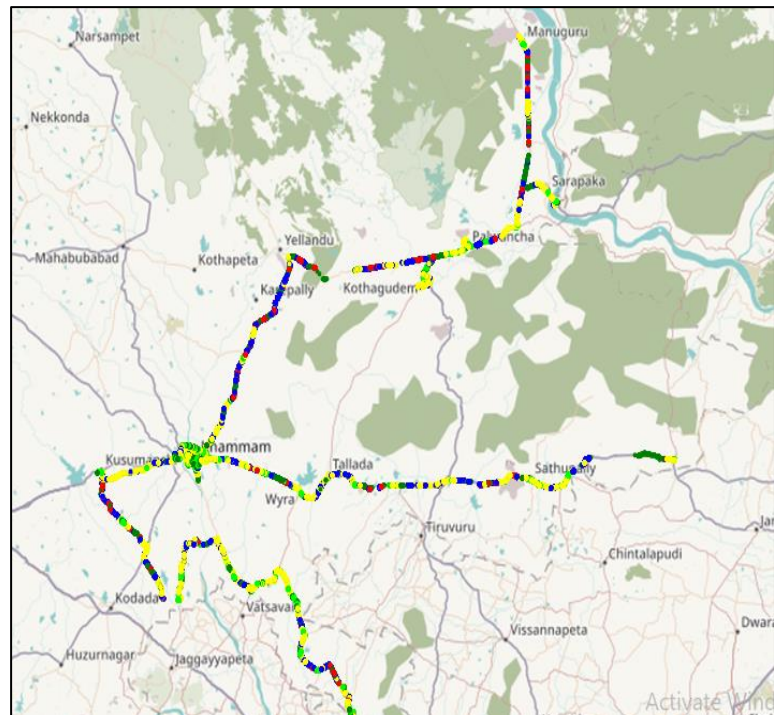
Overall RxLevel	# Samples	%
[Max, >=-75]	2922693	48.85
[-75, >=-85]	1735589	29.03
[-85, >=-95]	1088728	18.20
[-95, >=Min]	234960	3.92
Total		**100**

VoLTE

Overall RSRP	# Samples	%
[Max, >=-80]	1816536	15.37
[-80, >=-90]	2772942	23.46
[-90, >=-110]	5988839	50.68
[-110, >=-120]	1082425	10.49
Total		**100**

For measuring voice quality, as per the QoS norms, RxQual <=5 for GSM TSPs, EcNo >= -14 dBm for 3G TSPs and SINR >0 in case of VoLTE is considered to be good, where as quality beyond this benchmark is considered to be bad. The benchmark should usually be ≥ 95%.

TSP	Rx Quality %
Airtel 2G	95.11
BSNL 2G	92.6
VIL 2G	95.10
BSNL 3G	94.8
Airtel VoLTE	97.60
Jio VoLTE	96.59
VIL VoLTE	87.94
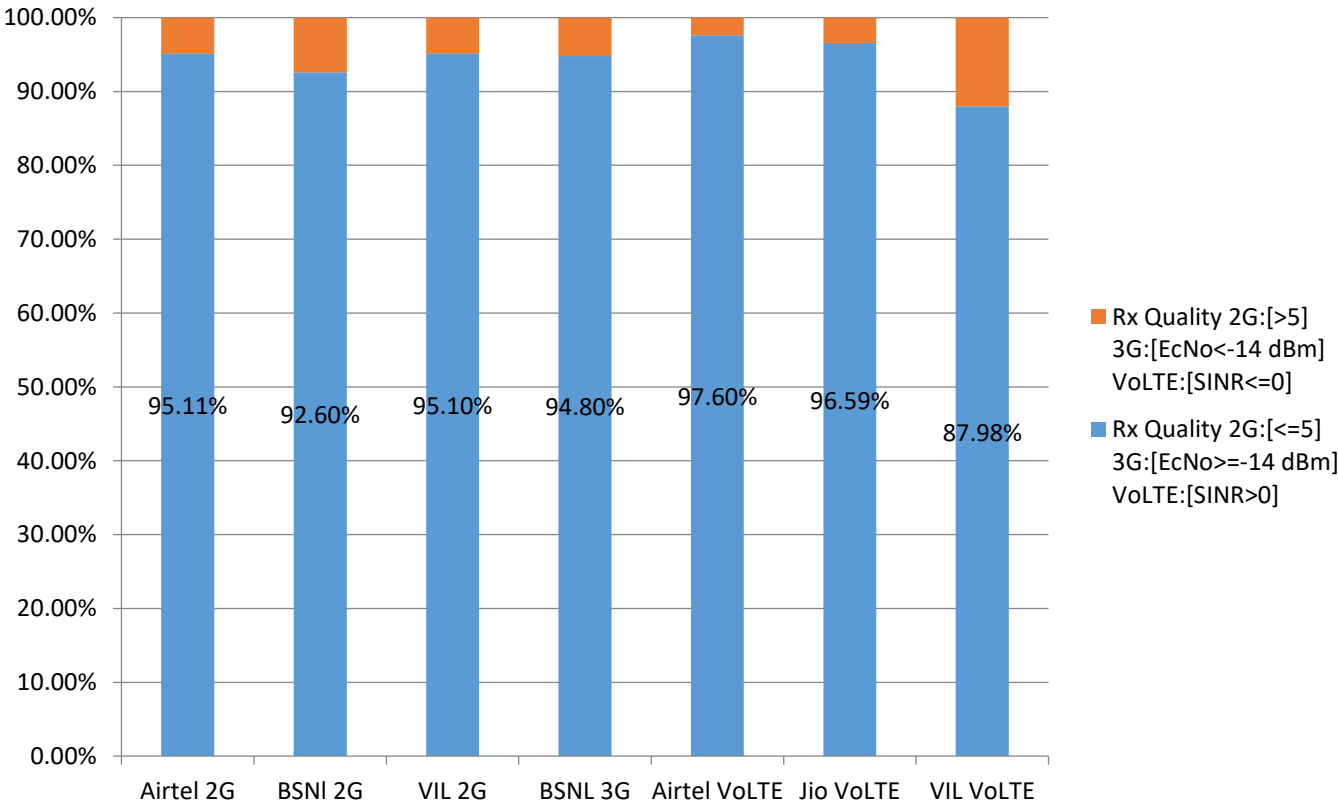
Airtel

Technology	Rx Quality %
2G	95.11
VoLTE	97.60

2G	VoLTE
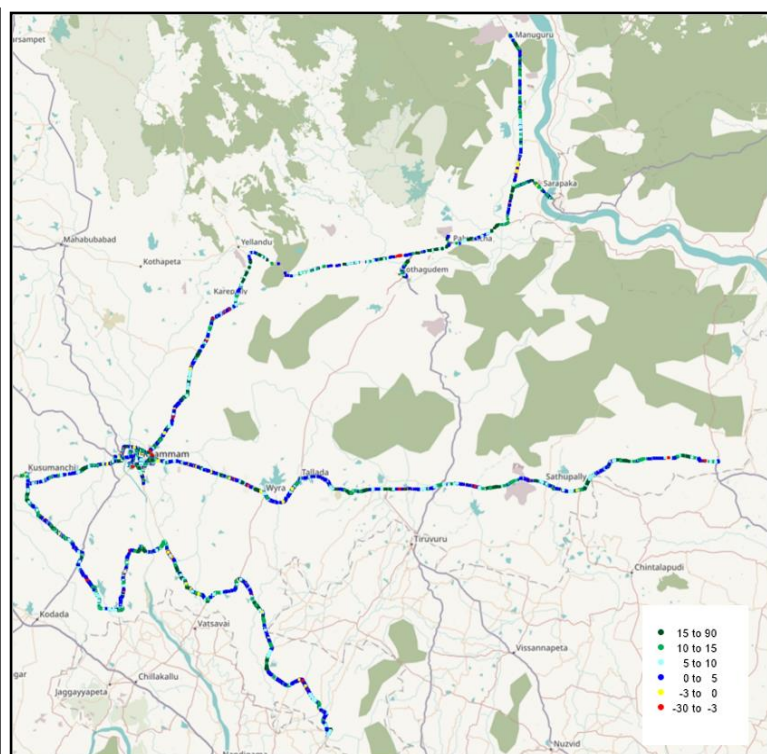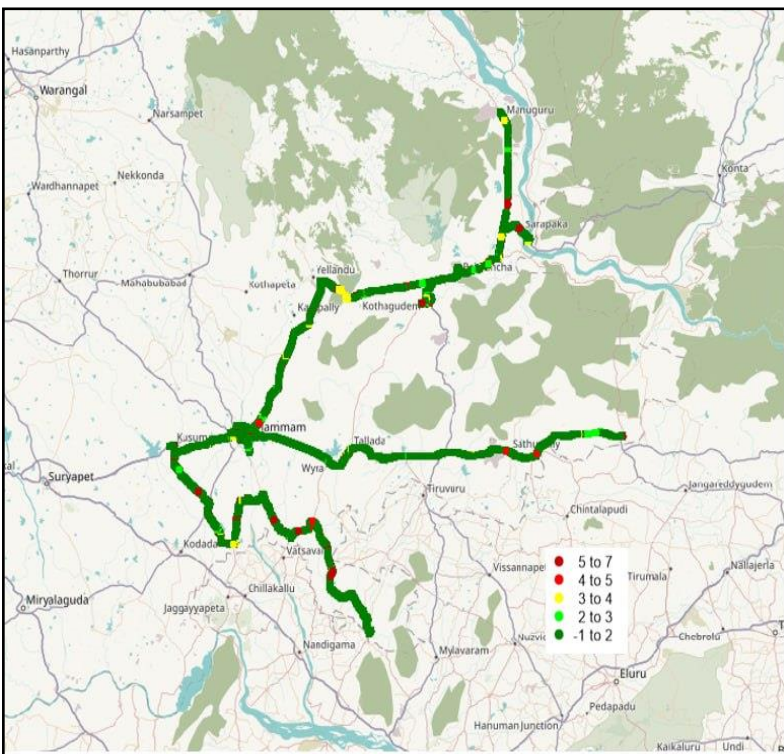
Rx Qual	Samples	%
1 to 2	7012516	89.31
2 to 3	184618	2.35
3 to 4	156367	1.99
4 to 5	114737	1.46
5 to 7	383794	4.89

SINR	Total Samples	%
90 to 15	3058371	16.91
15 to 10	4269042	23.61
10 to 5	4860763	26.88
5 to 0	5159224	28.53
0 to -3	433424	2.40

BSNL

Technology	Rx Quality %
2G	**92.6**
3G	**94.8**

2G

3G
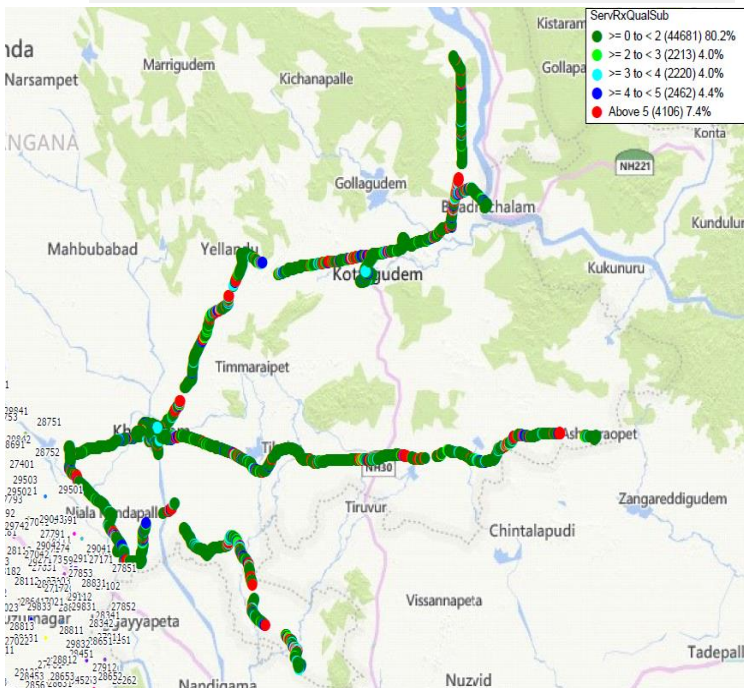
Overall Rx Quality	# Samples	% PDF
(Min, <=2)	44681	80.2%
(2, <=3)	2213	4.0%
(3 , <=4)	2220	4.0%
(4 , <=5)	2462	4.4%
(5 , <=Max)	4106	7.4
Total	**55682**	**100%**
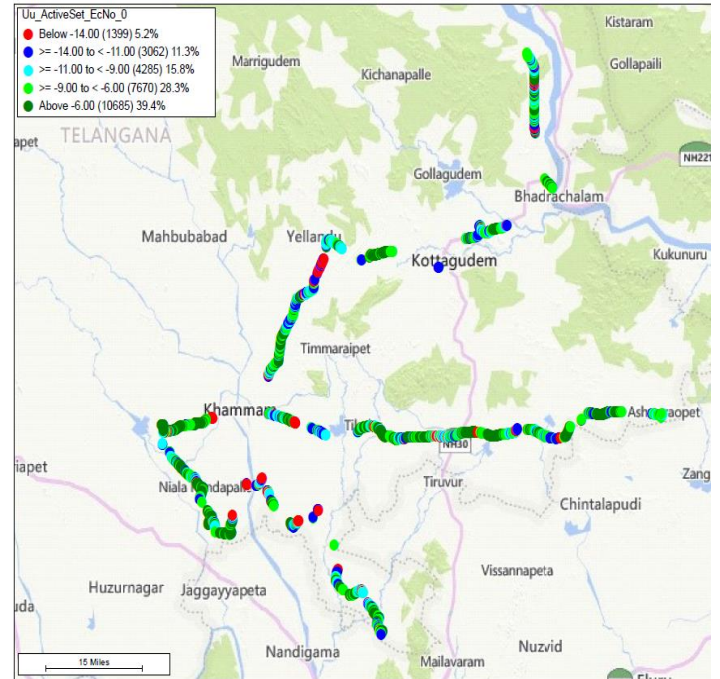
Overall EcNo	# Samples	% PDF
(Max, <=-6)	10685	39.4%
(-6, <=-9)	7670	28.3%
(-9, <=-11)	4285	15.8%
(-11, <=-14)	3062	11.3%
(-14, <= Min)	1399	5.2%
Total	**27101**	**100%**

RJIL

Technology	Rx Quality %
VoLTE	96.59

LTE KPI PCell SINR[dB]

- 15 <= x (36.26%, 21895)
- 10 <= x < 15 (20.65%, 12470)
- 5 <= x < 10 (20.91%, 12628)
- 0 <= x < 5 (18.76%, 11328)
- -3 <= x < 0 (2.03%, 1224)
- x < -3 (1.38%, 834)
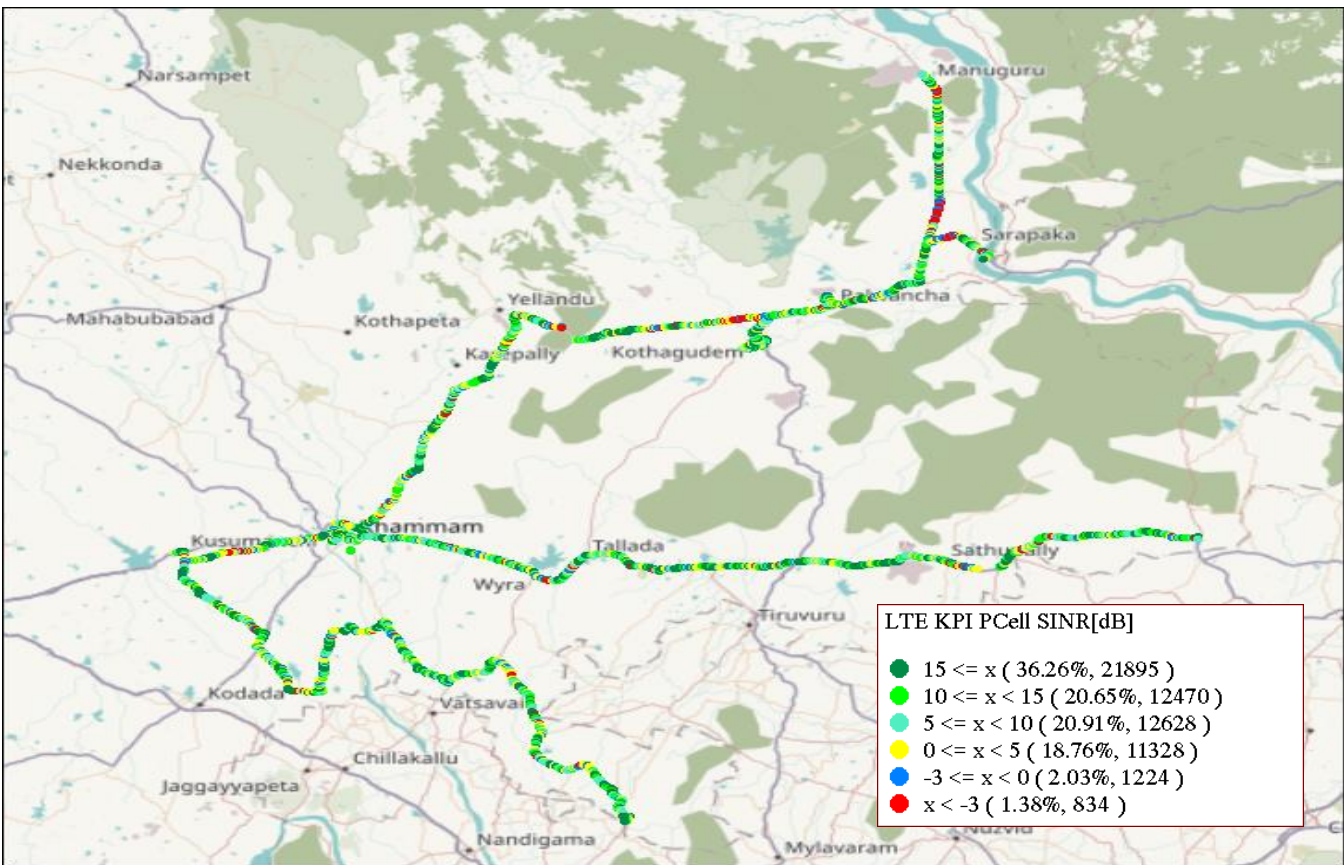
Overall SINR	# Samples	%
(Min, <=-3)	834	1.38
(-3, <=0)	1224	2.03
(0, <=5)	118	18.76
(5, <=10)	12628	20.91
(10, <=15)	12470	20.65
(15, <=Max)	21895	36.26
Total	**60379**	**100**

VIL

Technology	Rx Quality %
2G	**95.10**
VoLTE	**87.94**
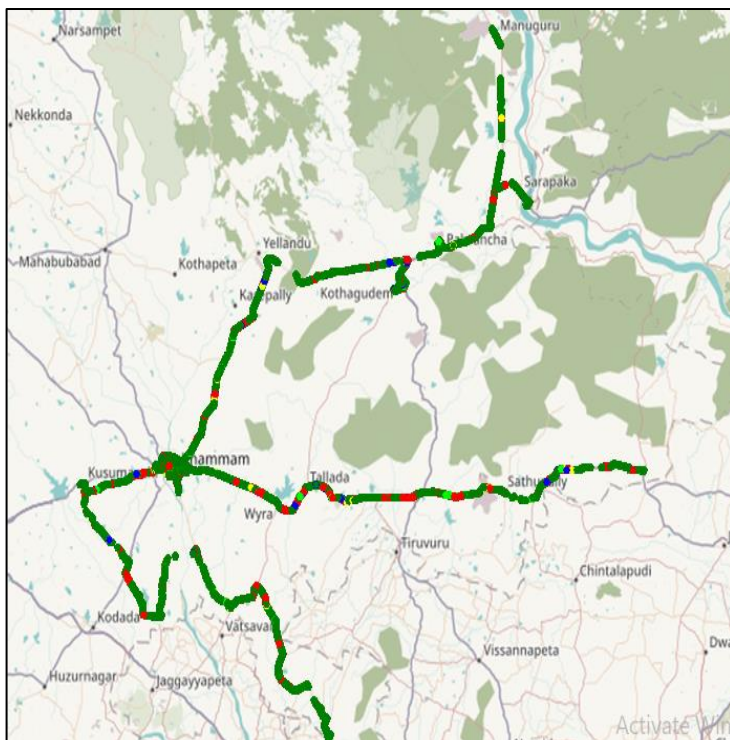
2G	VoLTE
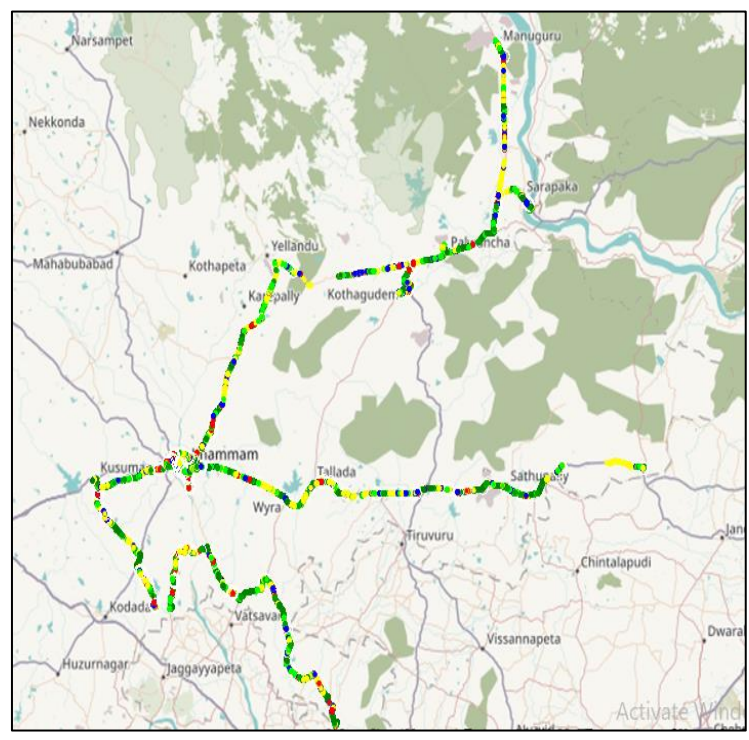
Overall Rx Quality	# Samples	%
(Min, <=2)	5167547	89.43
(2, <=3)	105684	1.82
(3 , <=4)	103314	1.78
(4 , <=5)	118157	2.04
(5 , <=Max)	2887	4.90
Total		

Overall SINR	# Samples	%
(Min, <=-3)	507354	4.48
(-3, <=0)	854029	7.54
(0, <=5)	2129793	18.82
(5, <=10)	26282	20.56
(10, <=15)	2076078	18.35
(15, <=Max)	3418126	30.21
Total		

TSP	% of Time Spent on
BSNL 3G	43.9
Airtel VoLTE	100
Jio VoLTE	100
VIL VoLTE	99.54
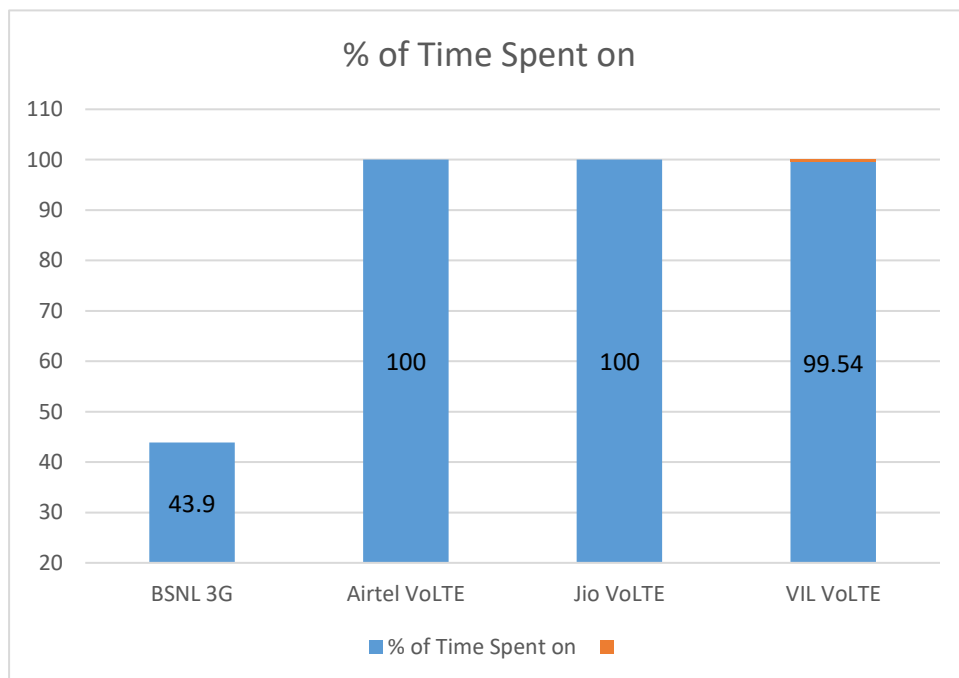
% of Time Spent on

Airtel

Technology	Time Spent %
3G / VoLTE	**100%**
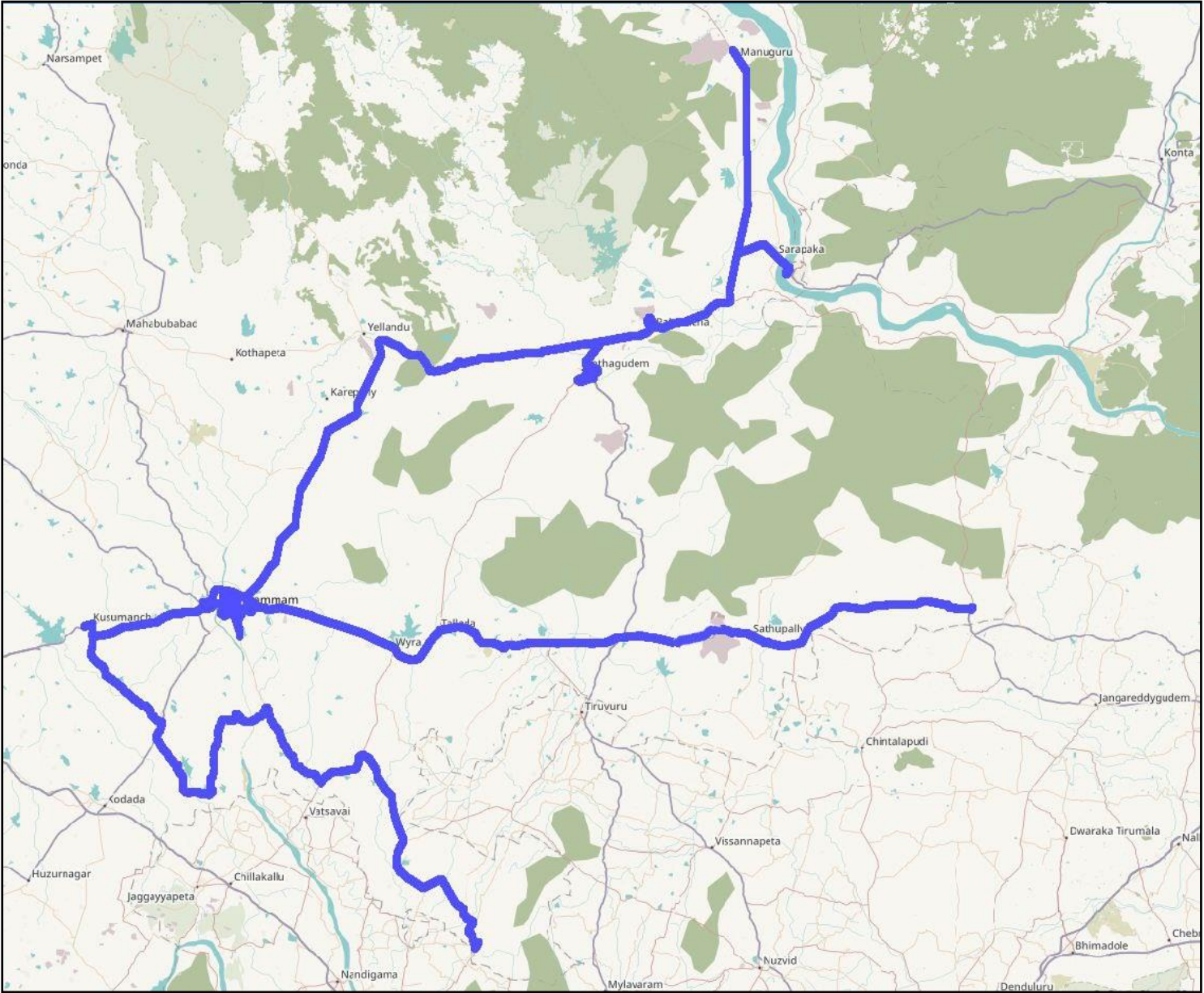
BSNL

Technology	Time Spent on 3G
3G	43.9
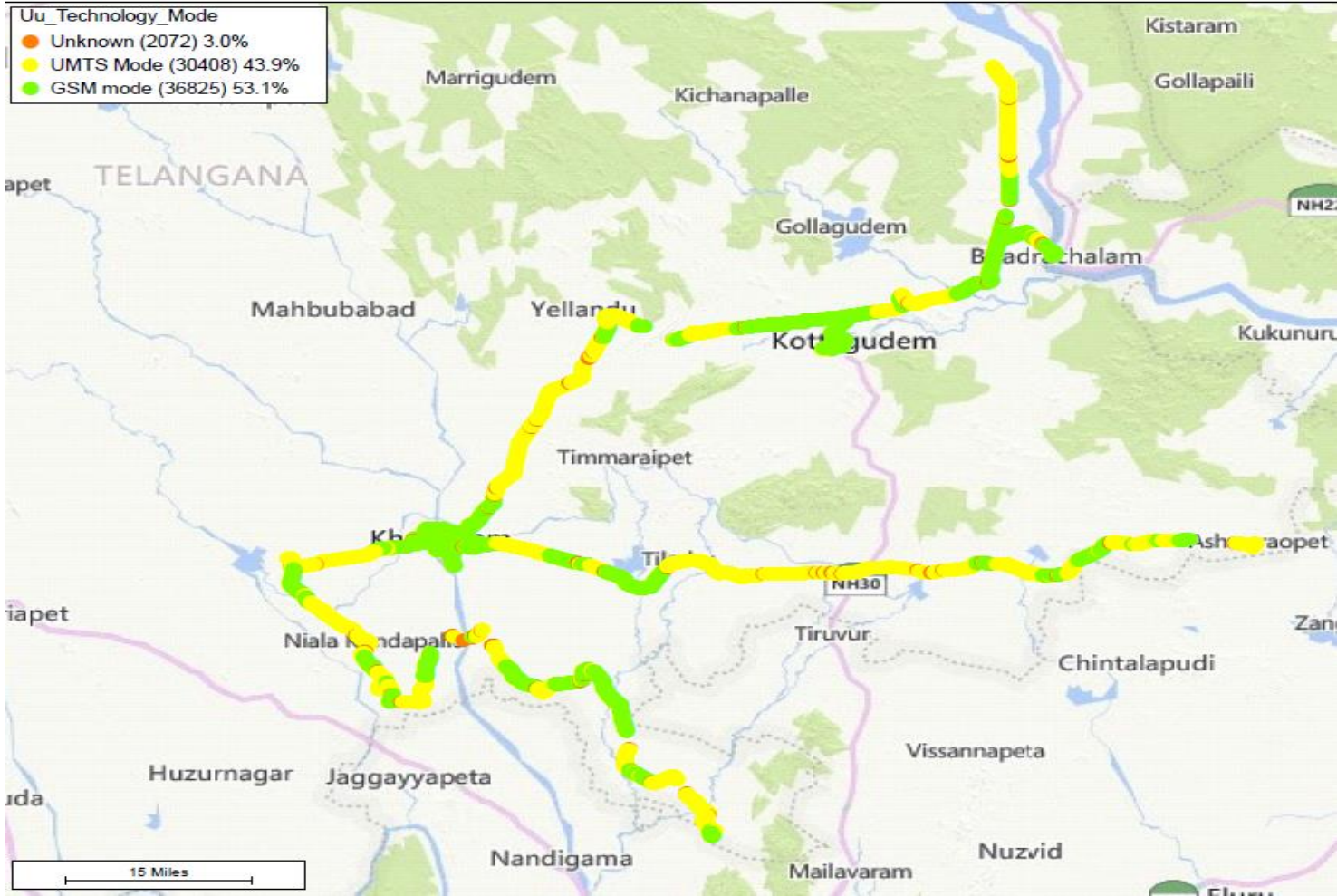
RJIL

Technology	Time Spent %
VoLTE	100
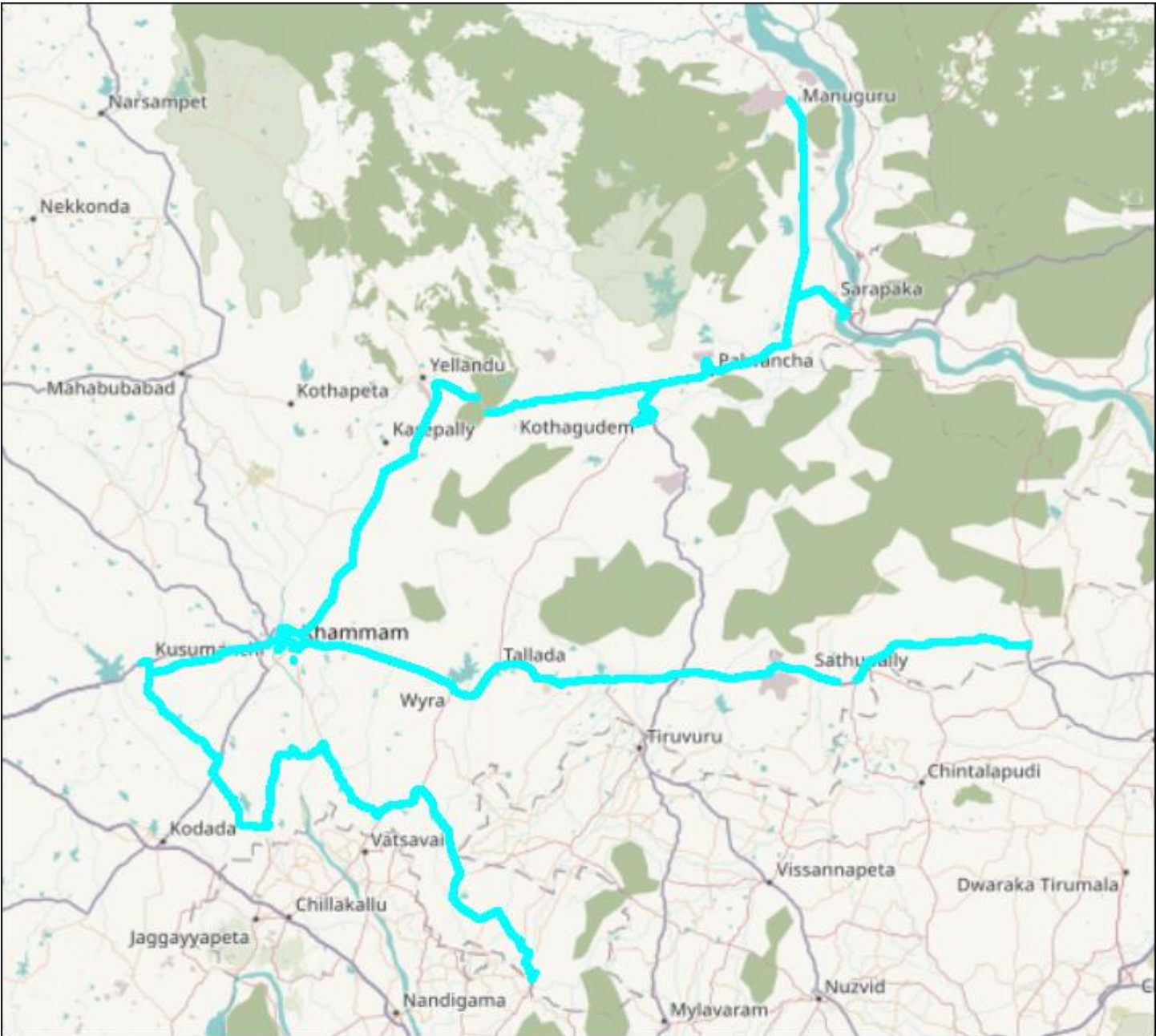
VIL

Technology	Time Spent %
3G / VoLTE	**99.54**
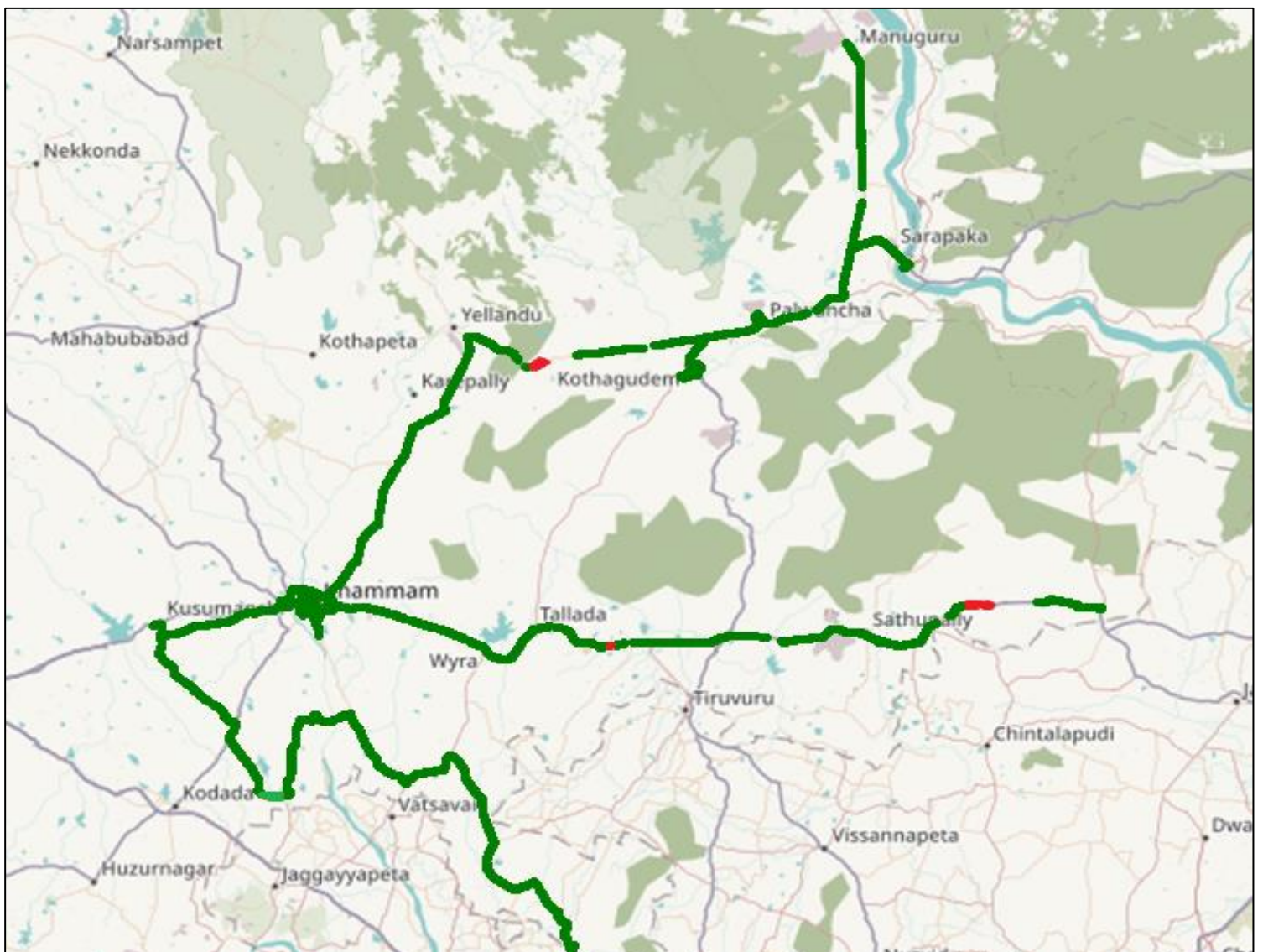
Airtel

Data Statistics - Dynamic Complete SSA 498 Kms

Data KPIs - Overall	4G
Download Throughput (Mbps)	16.82
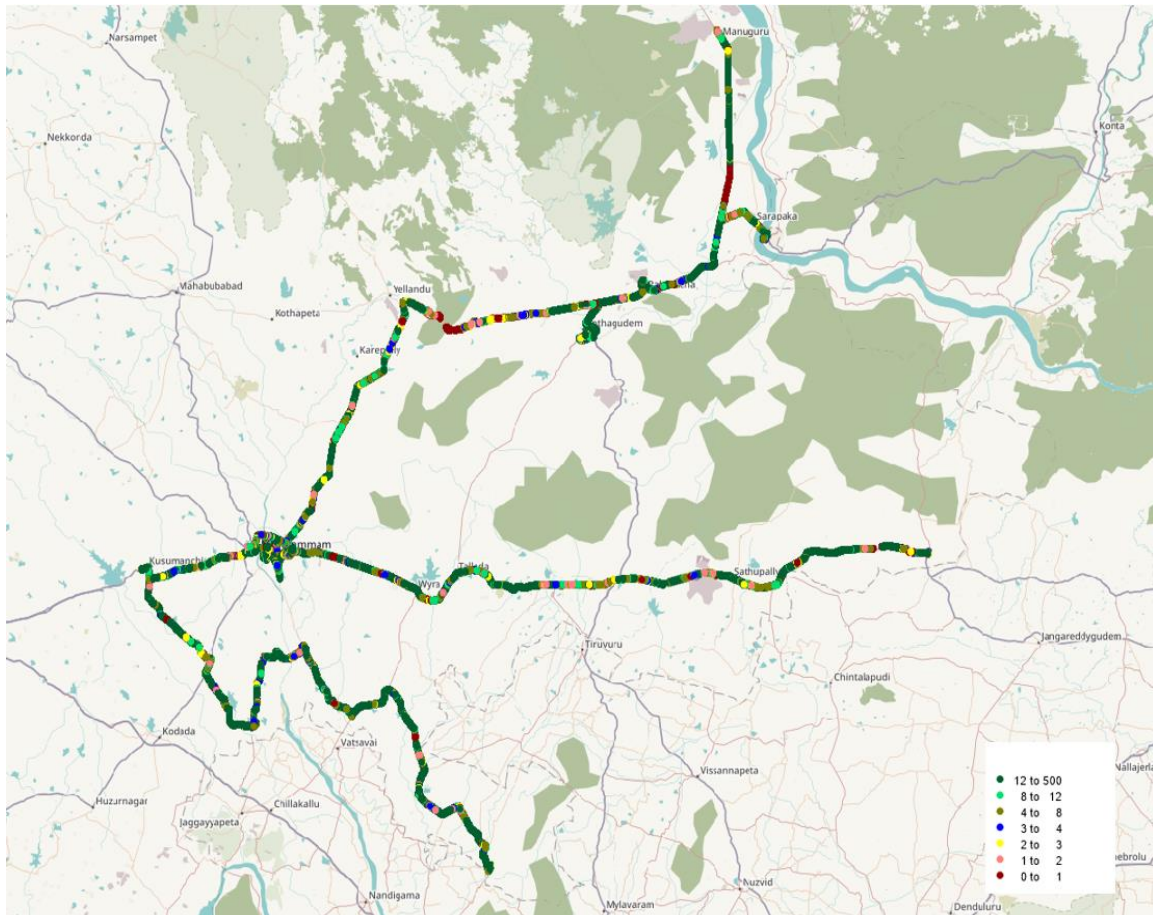
DL throughput	No of Sample	%
0 to 1 Mbps	160073	3.4
1 to 2 Mbps	150085	3.2
2 to 3 Mbps	205602	4.4
3 to 4 Mbps	198218	4.2
4 to 8 Mbps	678904	14.6
8 to 12 Mbps	509696	10.9
>12 Mbps	2761426	59.21
Total	4664004	

RJIL

Data Statistics - Dynamic Complete SSA 500 Kms

Data KPIs - Overall	4G
Download Throughput (Mbps)	32.69

LTE KPI MAC DL Throughput[Mbps]

- 12 <= x (29.59%, 20002)
- 8 <= x < 12 (12.27%, 8292)
- 4 <= x < 8 (15.79%, 10672)
- 3 <= x < 4 (6.69%, 4523)
- 2 <= x < 3 (7.60%, 5136)
- 1 <= x < 2 (6.35%, 4292)
- 0 <= x < 1 (21.71%, 14676)
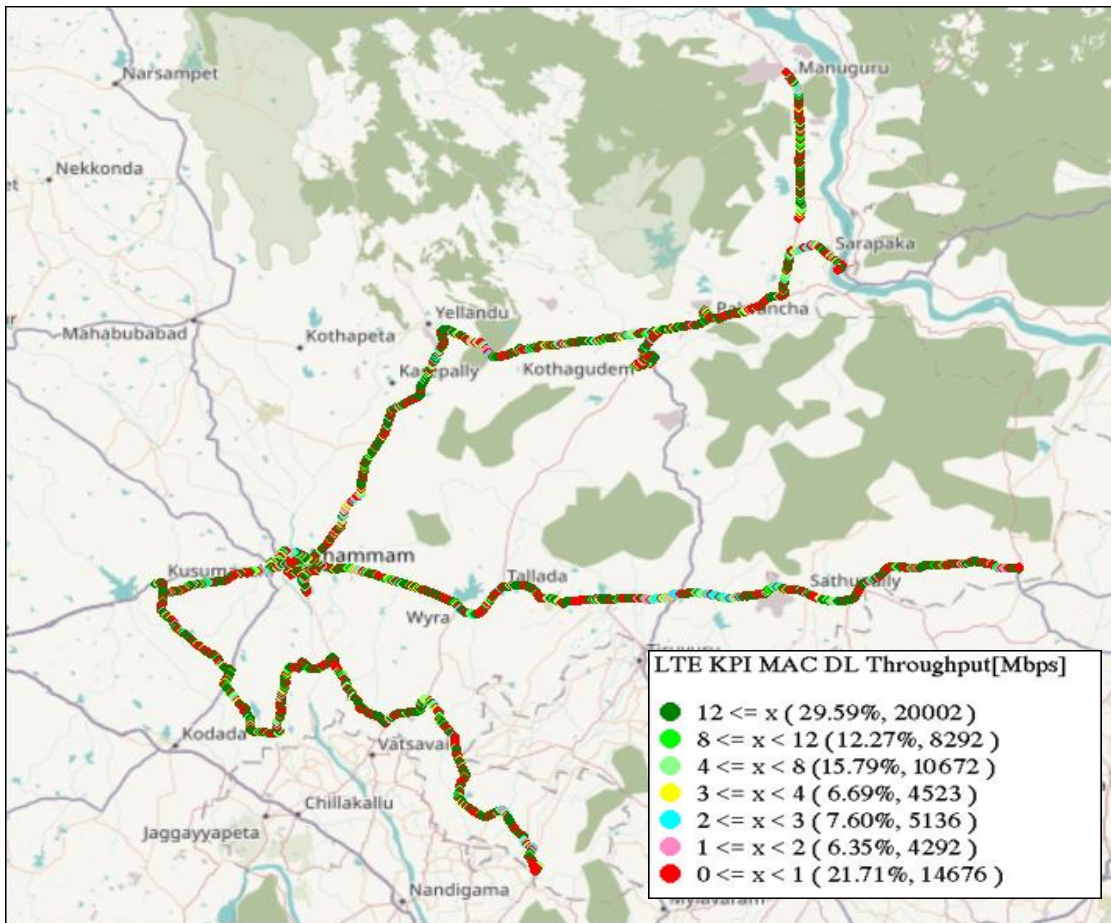
DL throughput	No. of Samples	%
0 to 1 Mbps	14676	21.71
1 to 2 Mbps	4292	6.35
2 to 3 Mbps	5136	7.6
3 to 4 Mbps	4523	6.69
4 to 8 Mbps	10672	15.79
8 to 12 Mbps	8292	12.27
>12 Mbps	20002	29.59
Total	**67593**	**100**

VIL

Data Statistics - Dynamic Complete SSA 498 Kms

Data KPIs - Overall	4G
Download Throughput (Mbps)	30.46
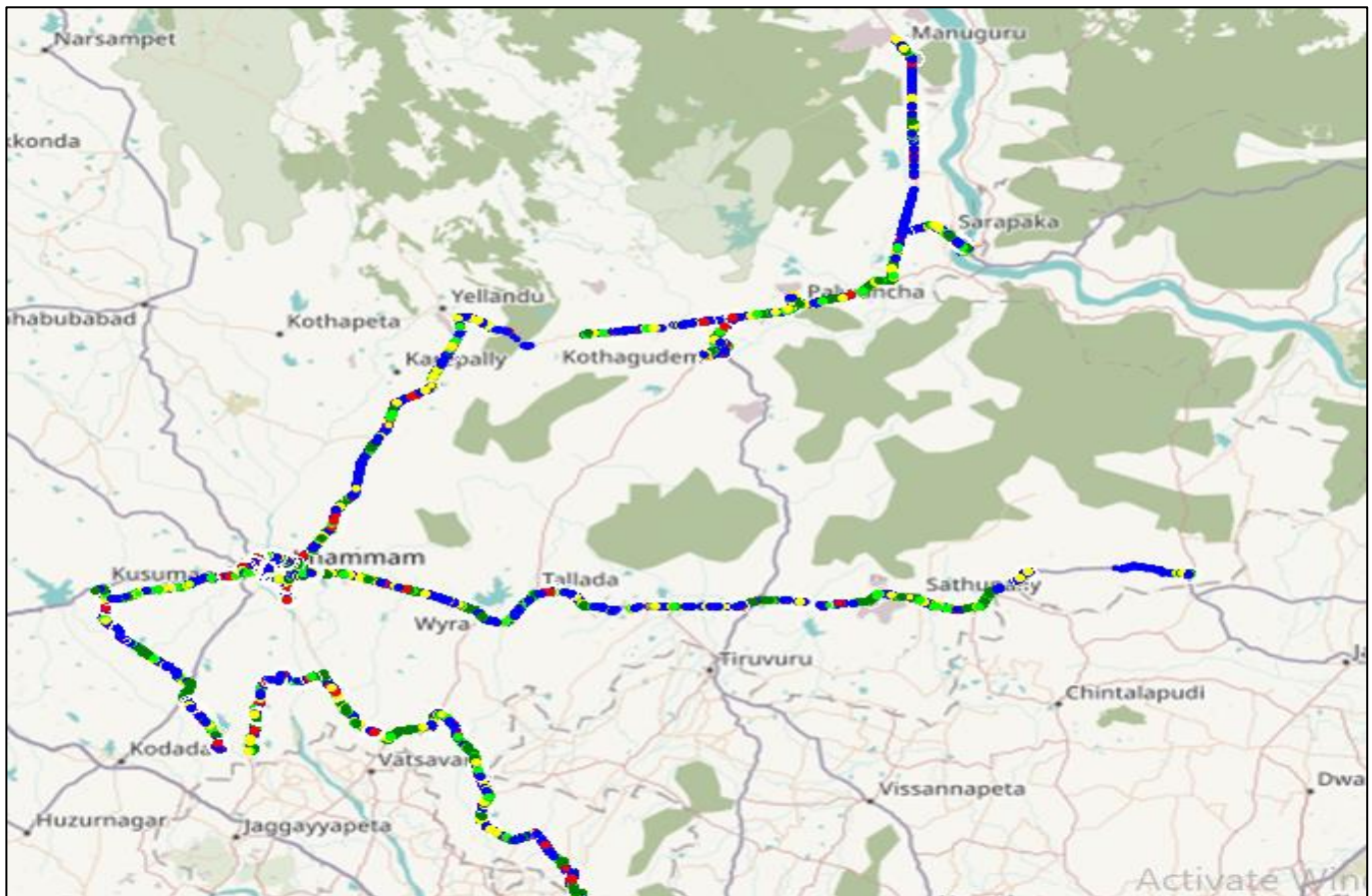
DL throughput	No of Sample	%
0 to 1 Mbps	126149	4.42
1 to 2 Mbps	783077	2.74
2 to 3 Mbps	649519	2.27
3 to 4 Mbps	2356785	8.25
4 to 8 Mbps	7521125	26.35
8 to 12 Mbps	2008613	7.03
>12 Mbps	13956925	48.90
Total	24268292	100

Airtel

Technology- 4G	Sathupally Bus Station	Bhadrachalam Temple	Madhira Railway Station	Khammam Railway station	Khammam New Bus Station	Khammam Mamatha Hospital
Download Speed Mbps	83.81	72.70	113.10	1.92	78.47	1.90
Upload Speed Mbps	20.35	38.29	35.37	75.37	20.98	38.0

BSNL

Technology- 3G/4G	Sathupally Bus Station - 3G	Bhadrachalam Temple – 4G	Madhira Railway Station - 3G	Khammam Railway station – 4G	Khammam New Bus Station – 4G	Khammam Mamatha Hospital – 4G
Download Speed Mbps	4.74	6.59	4.18	16.11	10.17	10.02
Upload Speed Mbps	3.04	1.83	0.18	9.44	7.60	4.40

JIO

Technology- 4G	Sathupally Bus Station	Bhadrachalam Temple	Madhira Railway Station	Khammam Railway station	Khammam New Bus Station	Khammam Mamatha Hospital
Download Speed Mbps	90.83	123.74	143.34	133.49	152.91	128
Upload Speed Mbps	27.06	27.09	39.93	30.2	35.	30.18

VIL

Technology- 4G	Sathupally Bus Station	Bhadrachalam Temple	Madhira Railway Station	Khammam Railway station	Khammam New Bus Station	Khammam Mamatha Hospital
Download Speed Mbps	24.93	21.	21.9	41.12	30.17	19.25
Upload Speed Mbps	23.59	3.80	24.53	8.48	17.96	3.35

VI. NH/SH Routes covered

S.No	No of NH/SH routes	NH routes	SH routes	Distance(Km)
NH/SH Routes covered in OADT by Airtel / BSNL / RJIL / VIL
1	Khammam to Aswaraopet		SH42	80.5
2	Thallada to Kothagudem		SH12	47
3	Kusumanchi		SH42	2
4	Nelakondapally to Tirumalapuram	NH 365A		3
5	Tallampadu - Gangabanda Thanda	NH 365B		12
6	Kothagudem to Badrachalam	NH30		40
	Total KMs			**184.5**