



Operator Assisted Drive Test Report

Vadodara City & Nearby area

18th to 20th March. 2024

by

TRAI Regional office Jaipur

Key Performance Indicators: All TSPs have met the Drop Call Rate (DCR) benchmark of 2% . All TSPs have met the Call Setup Success Rate (CSSR) of 95%.

The Operator Assisted Drive Test has been carried out by Regional Office, Jaipur with the help of Service Providers in Vadodara City & Nearby Area from 9:00 AM to 8:00 PM during 18th Mar'2024 to 20th Mar'2024. The drive test covered drive route of 265 KMs & 5 hotspots over a period of 3 days. Approximately 370 calls were made for each of the 2G/3G/4G networks: three 2G networks , one 3G networks and three LTE networks covering four TSPs.

Overview

Voice Summary

Data Summary

Overview

Regional Office, TRAI Jaipur conducted Operator Assisted Drive Test from **18th Mar'2024 to 20th Mar'2024** covering Vadodara City and surrounding areas. The performance of Airtel, BSNL, Vodafone Idea and Jio was 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.

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

Data: Download Throughputs,
Drive Test Details :

Voice Tests: Calls were made for 90 sec duration with a wait time of 10 sec between calls in all technologies. The drive test covered a drive route of approximately 265 KMs. Approximately 370 calls were made for each of the 2G/4G networks: three 2G (Lock Mode) networks, one 3G (Dual mode) networks and three VoLTE networks covering 4 unique TSPs.

Data Tests:

Dynamic data test was conducted for 265 kms for download throughput in all technologies.
2G – measurement – UE Locked in 2G file size- 500KB

3G – measurement – UE in 3G File Size- 20MB

4G – measurement – UE in LTE File Size- 40MB

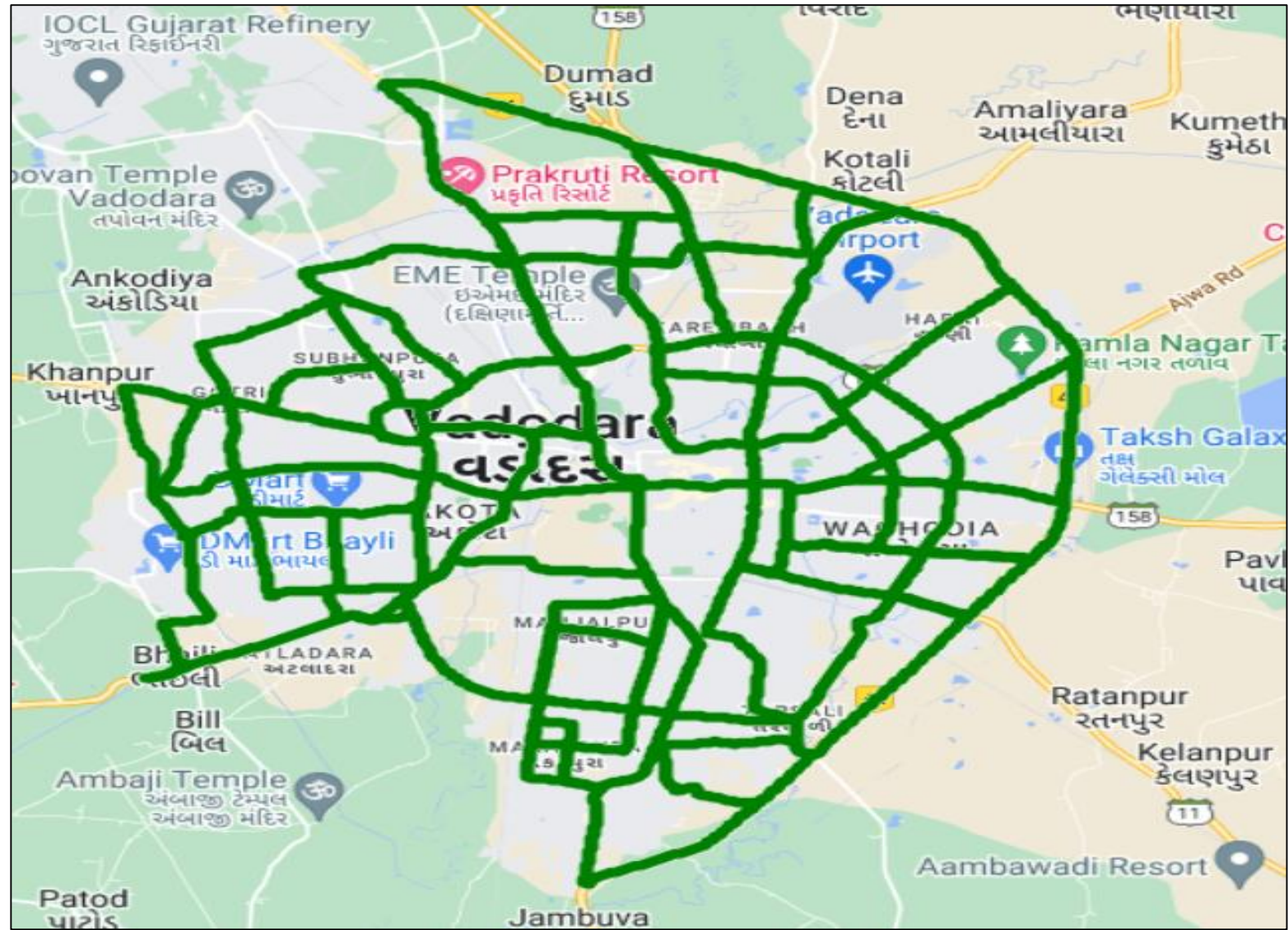
Static data tests on 5 hotspots

| | |
|----|---------------------|
| 1. | Airport |
| 2. | Railway Station |
| 3. | SSG Hospital |
| 4. | EVA Mall |
| 5. | Makarpura Bus Stand |

| 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 PayTm |
| Latency | 32 Bytes on www.google.com |

Overview

Voice & Dynamic Data Test Drive Route



| Date | Test Scenario | Area to be Covered |
|---------------------------|---------------------------------------|---|
| 18 th Mar'2024 | 2G/3G/4G Voice and 3G/4G Dynamic Data | Starting Point: Fatehguni: Nijampura, Raghuvirnagar, Ramnagar, Gurunanak Nagar, Roshan Nagar, Bhaktinagar, Sardarnagar, Phulwadi, New Sama, Chanakyapuri, Chhani, Ektanagar, Akota, Gadapura, Vashantvihar, Taifnagar, Tandalja, Sukrutinagar, Ramancolony, Prathamupvan, Padra, Ushanagar, Vasna, Mujmahuda, Gotri, Saiyad Vasna, Shaisav colony, Yogeshwarnagar, Dattnagar, Sundramnagar |
| 19 th Mar'2024 | 2G/3G/4G Voice and 3G/4G Dynamic Data | Starting Point: Kala Ghoda: Salatwada, Bhutdi zampa, Hathikhana, Vithhalnagar, Gayatrinagar, Surajnagar, Airport, Paravatnagar, Kamlanagar, Madhavpura, Navapura, Lalbaug, ONGC colony, Kalali, Anandbaug, Bajwa, Bhaktinagar, Indiranagar, Makarpura, IOCL, Jawaharnagar, Undrea, Sonianagar, Laxmipura, Samta, Wadi |
| 20 th Mar'2024 | Hot Spots- 2G/3G/4G Static Data Tests | Hotspot Location : Airport, Railway Station, SSG Hospital, EVA Mall & Makarpura Bus Stand |

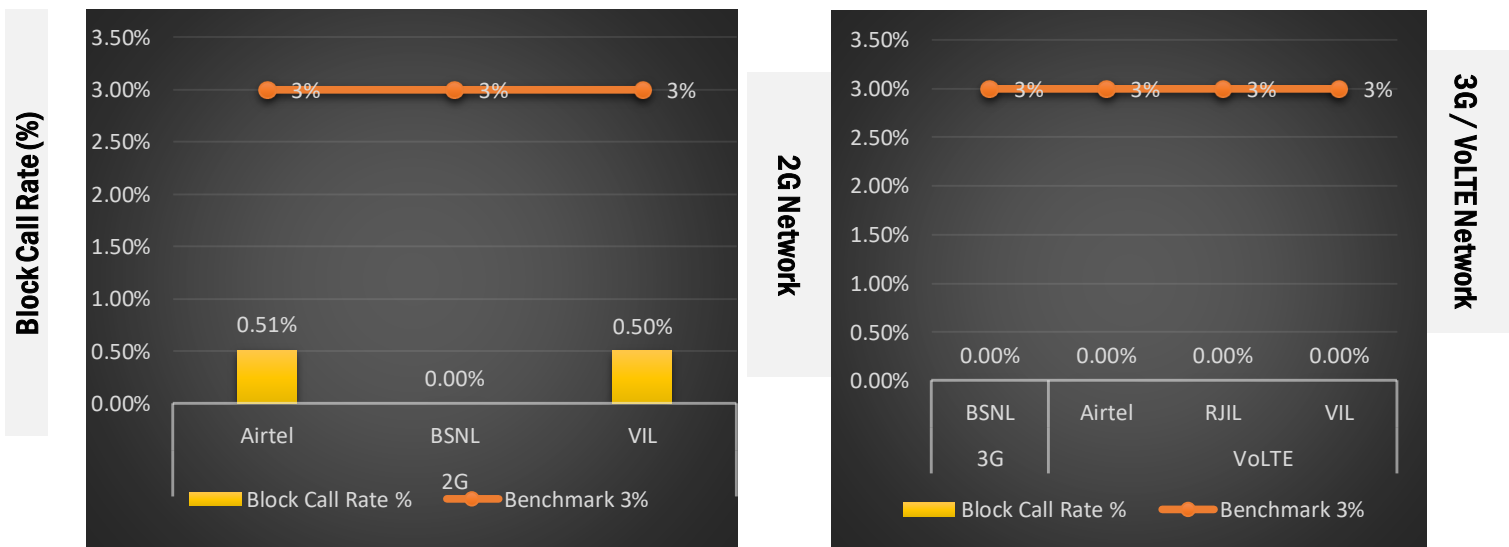
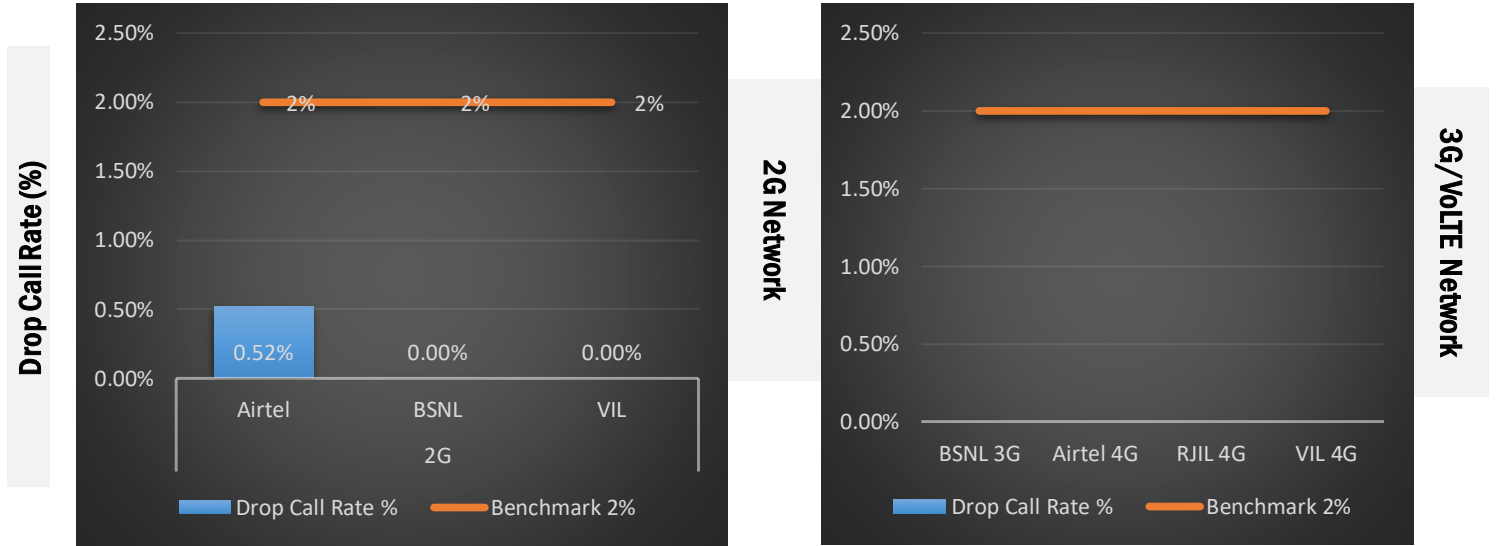
Data Service Test- Static Locations



Hotspot Locations

1. Airport
2. Railway Station
3. SSG Hospital
4. EVA Mall
5. Makarpura Bus Stand

QoS compliance of the TSPs in Vadodara City & Nearby area for Voice across technologies 2G/3G/4G-VoLTE:



| KPIs | 2G | | | 3G | 4G | | |
|-------------------|--------|-------|-------|-------|--------|-------|-------|
| | Airtel | BSNL | VIL | BSNL | Airtel | RJIL | VIL |
| Drop Call Rate % | 0.52% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Block Call Rate % | 0.51% | 0.00% | 0.50% | 0.00% | 0.00% | 0.00% | 0.00% |

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

Voice Calls

Key Observations

Coverage

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

| TSPs | 2G | | |
|------------|--------|--------|--------|
| | Airtel | BSNL | VIL |
| Coverage % | 97.11% | 93.59% | 99.90% |

b) Percentage of coverage samples for 3G \geq -90 dBm

| TSPs | 3G |
|------------|--------|
| | BSNL |
| Coverage % | 91.30% |

c) Percentage of coverage samples for LTE \geq -110 dBm.

| TSPs | VoLTE | | |
|------------|--------|--------|--------|
| | Airtel | JIO | VIL |
| Coverage % | 99.86% | 99.91% | 98.85% |

d) Percentage of time spent on 3G/4G network

| TSPs | 3G | VoLTE | | |
|-------------------------------|--------|--------|------|------|
| | BSNL | Airtel | JIO | VIL |
| Time spent on 3G/4G Network % | 98.58% | 99.33% | 100% | 100% |

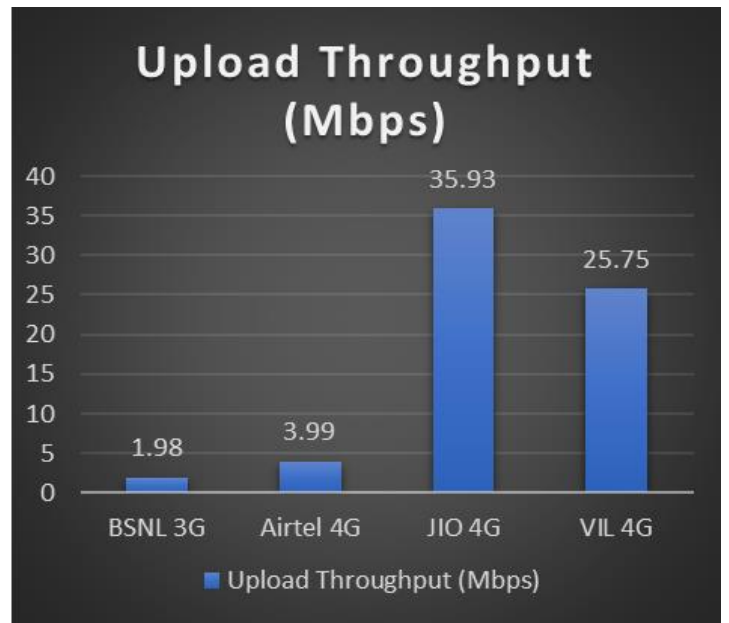
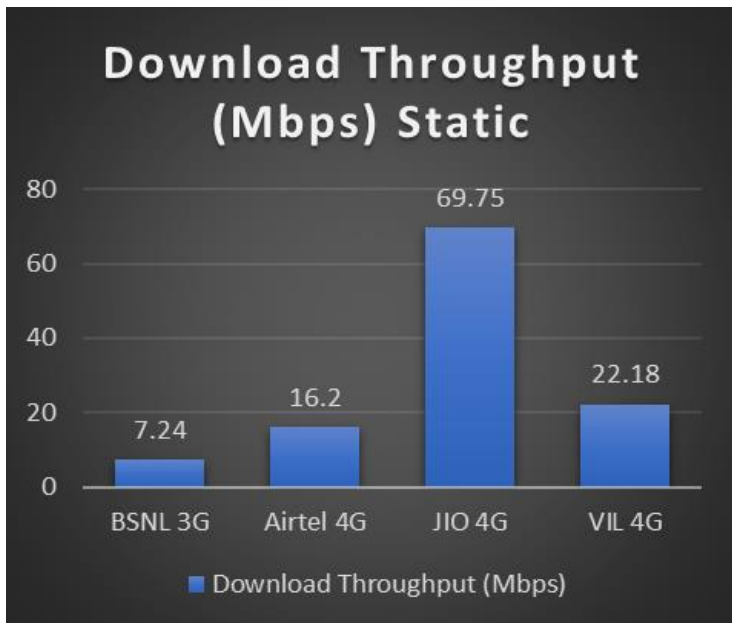
Data Services Static

Key Observations

Data was tested at 5 locations .Following services were tested: Data Download/Upload, Latency (www.google.com), and Web browsing (Flipkart, Amazon, Paytm)

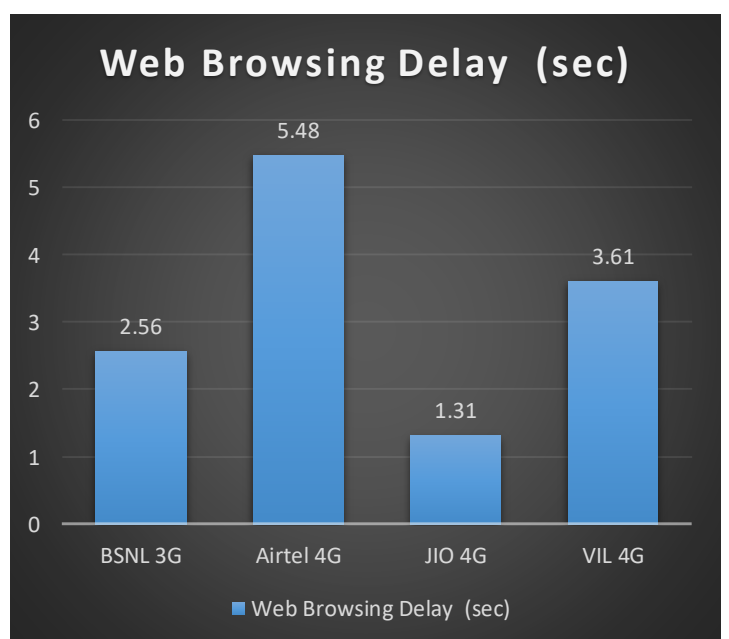
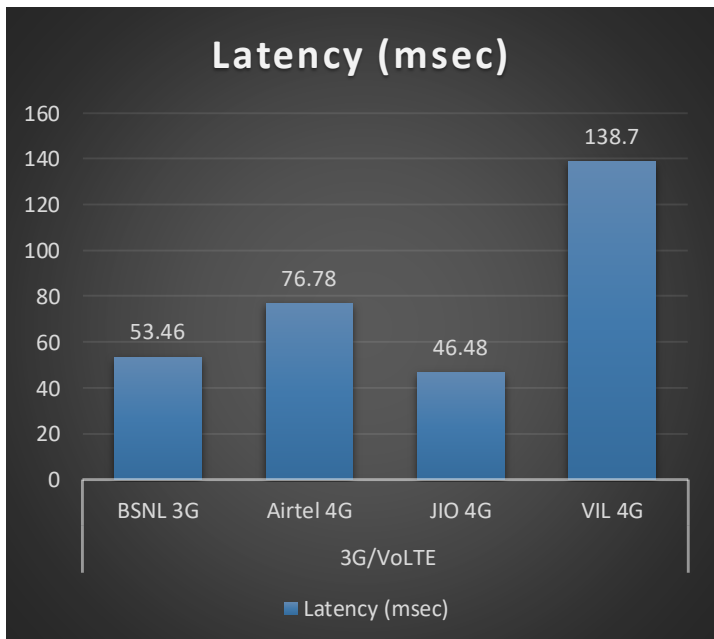
Data Download and Upload Performance Static (Mbps)

3G/4G/ Network:



Latency (ms)

Web Browsing (Sec)



Data Services Dynamic

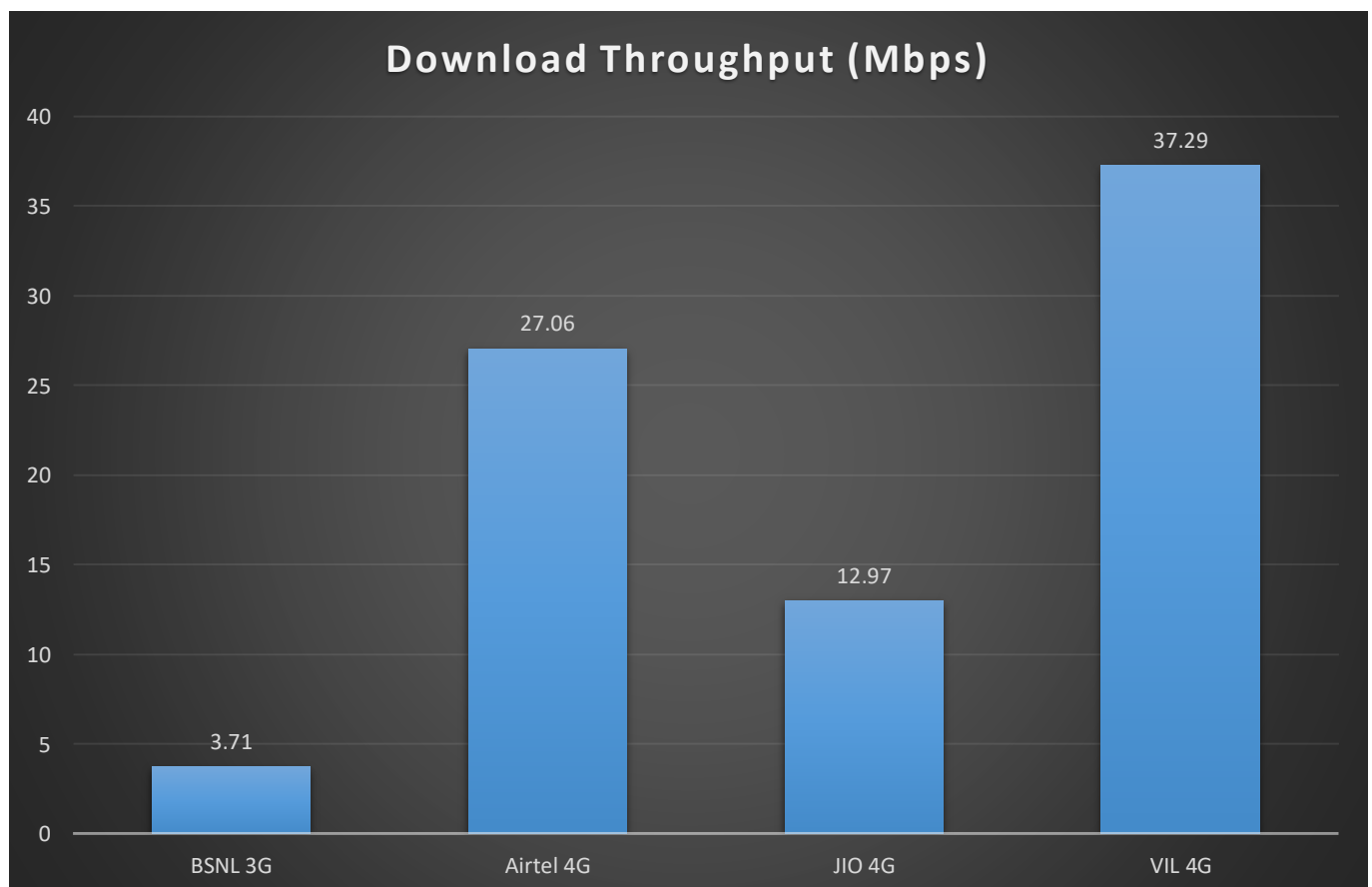
Key Observations

Dynamic Data was tested for whole voice route. Download Throughput was tested.

Data Download Performance (kbps) - Dynamic

3G/4G/ Network:

| Data Services Dynamic | 3G/VoLTE | | | |
|----------------------------|----------|-----------|--------|--------|
| | BSNL 3G | Airtel 4G | JIO 4G | VIL 4G |
| Download Throughput (Mbps) | 3.71 | 27.06 | 12.97 | 37.29 |



Summary

City Level Summary- Voice

| Voice Call | 2G | | |
|-----------------------|--------|--------|--------|
| | Airtel | BSNL | VIL |
| Call Attempt | 393 | 365 | 373 |
| Blocked Call Rate (%) | 0.51% | 0% | 0.5% |
| CSSR% (Accessibility) | 99.49% | 100% | 99.5% |
| Drop Call Rate (%) | 0.52% | 0% | 0% |
| Mobility HOSR (%) | 97.97% | 99.46% | 98.95% |
| Rx Quality (%) | 92.99% | 98.53% | 96.68% |
| Average CST Sec | 3.28 | 2.65 | 3.07 |

| Voice Call | 3G/VoLTE | | | |
|-----------------------|----------|--------------|-----------|-----------|
| | BSNL 3G | Airtel VoLTE | JIO VoLTE | VIL VoLTE |
| Call Attempt | 369 | 399 | 351 | 378 |
| Blocked Call Rate (%) | 0% | 0% | 0% | 0% |
| CSSR% (Accessibility) | 100% | 100% | 100% | 100% |
| Drop Call Rate (%) | 0% | 0% | 0% | 0% |
| Mobility HOSR (%) | 96.32% | 100% | 99.81% | 99.98% |
| Rx Quality (%) | 96.1% | 92.48% | 95.08% | 89.98% |
| Average CST Sec | 1.99 | 0.91 | 0.62 | 0.45 |

Summary

City Level Summary- Data Services

| Data Services Static | 2G | | |
|----------------------------|--------|--------|--------|
| | Airtel | BSNL | VIL |
| Download Throughput (kbps) | 188.85 | 154.47 | 122.46 |
| Upload Throughput (kbps) | 75.83 | 78.81 | 63.69 |
| Web Browsing Delay (sec) | 81.96 | 13.27 | 72.89 |
| Latency (msec) | 185.4 | 185.27 | 291.94 |

| Data Services Static | 3G / 4G | | | |
|-----------------------------|---------|-----------|--------|--------|
| | BSNL 3G | Airtel 4G | JIO 4G | VIL 4G |
| Download Throughput (Mbps) | 7.24 | 16.2 | 69.75 | 22.18 |
| Upload Throughput(Mbps) | 1.98 | 3.99 | 35.93 | 25.75 |
| Video Streaming Delay (sec) | 3.2 | 0 | 0.3 | 0.08 |
| Web Browsing Delay (sec) | 2.56 | 5.48 | 1.31 | 3.61 |
| Latency (msec) | 53.46 | 76.78 | 46.48 | 138.7 |

| <u>Airport</u> | 2G | | |
|----------------------------|--------|--------|--------|
| | Airtel | BSNL | VIL |
| Download Throughput (kbps) | 199.85 | 173.44 | 130.26 |
| Upload Throughput (kbps) | 112.1 | 83.74 | 74.42 |
| Web Browsing Delay (sec) | 80.44 | 13.75 | 60.85 |
| Latency (msec) | 224.93 | 168.67 | 227 |

| <u>Vadodara Railway station</u> | 2G | | |
|---------------------------------|--------|--------|-------|
| | Airtel | BSNL | VIL |
| Download Throughput (kbps) | 235.53 | 167.56 | 105.9 |
| Upload Throughput (kbps) | 55.5 | 88.11 | 47.44 |
| Web Browsing Delay (sec) | 68.89 | 13.24 | 77 |
| Latency (msec) | 196.03 | 170.67 | 327 |

| <u>SSG Hospital</u> | 2G | | |
|----------------------------|--------|--------|--------|
| | Airtel | BSNL | VIL |
| Download Throughput (kbps) | 163.4 | 142.01 | 164.23 |
| Upload Throughput (kbps) | 68.75 | 76.26 | 59.36 |
| Web Browsing Delay (sec) | 90.39 | 13.07 | 105.65 |
| Latency (msec) | 234.47 | 157.67 | 304.72 |

| <u>EVA Mall</u> | 2G | | |
|----------------------------|--------|--------|--------|
| | Airtel | BSNL | VIL |
| Download Throughput (kbps) | 138.23 | 155.82 | 124.67 |
| Upload Throughput (kbps) | 58.43 | 68.54 | 70.64 |
| Web Browsing Delay (sec) | 104.81 | 13.19 | 50.66 |
| Latency (msec) | 176.37 | 212.67 | 321 |

| <u>Makarpura bus stand</u> | 2G | | |
|----------------------------|--------|--------|-------|
| | Airtel | BSNL | VIL |
| - | | | |
| Download Throughput (kbps) | 207.23 | 133.52 | 87.24 |
| Upload Throughput (kbps) | 84.37 | 77.44 | 66.57 |
| Web Browsing Delay (sec) | 65.27 | 13.12 | 70.31 |
| Latency (msec) | 144.27 | 216.67 | 280 |

Data Services static

| <u>Airport</u> | 3G | 4G | | |
|--------------------------------|-------|--------|--------|------|
| | BSNL | Airtel | JIO | VIL |
| Download Throughput (mbps) | 12.88 | 16.28 | 108.42 | 32 |
| Upload Throughput (mbps) | 3.19 | 1.6 | 52.64 | 32 |
| Video Streaming Delay (Secs.) | 1.89 | 0 | 0.29 | 0.08 |
| Web Browsing Delay (sec) | 1.86 | 5.91 | 1.33 | 3.74 |
| Latency (msec) | 40.67 | 75.63 | 46.70 | 125 |

| Vadodara Railway station | 3G | 4G | | |
|---------------------------------|-------|--------|-------|------|
| | BSNL | Airtel | JIO | VIL |
| Download Throughput (mbps) | 5.65 | 18.42 | 64.70 | 22 |
| Upload Throughput (mbps) | 1.48 | 6.35 | 21.90 | 24 |
| Video Streaming Delay (Secs.) | 2.45 | 0 | 0.30 | 0.08 |
| Web Browsing Delay (sec) | 2.45 | 5.47 | 1.30 | 3.45 |
| Latency (msec) | 45.33 | 70.5 | 44 | 190 |

| <u>SSG Hospital</u> | 3G | 4G | | |
|--------------------------------|-------|--------|-------|--------|
| | BSNL | Airtel | JIO | VIL |
| Download Throughput (mbps) | 3.34 | 15.12 | 64.50 | 13.24 |
| Upload Throughput (mbps) | 1.64 | 3.16 | 25.70 | 28.79 |
| Video Streaming Delay (Secs.) | 5.24 | 0 | 0.33 | 0.09 |
| Web Browsing Delay (sec) | 3 | 5.95 | 1.33 | 3.31 |
| Latency (msec) | 61.67 | 96.31 | 40 | 119.03 |

Data Services static

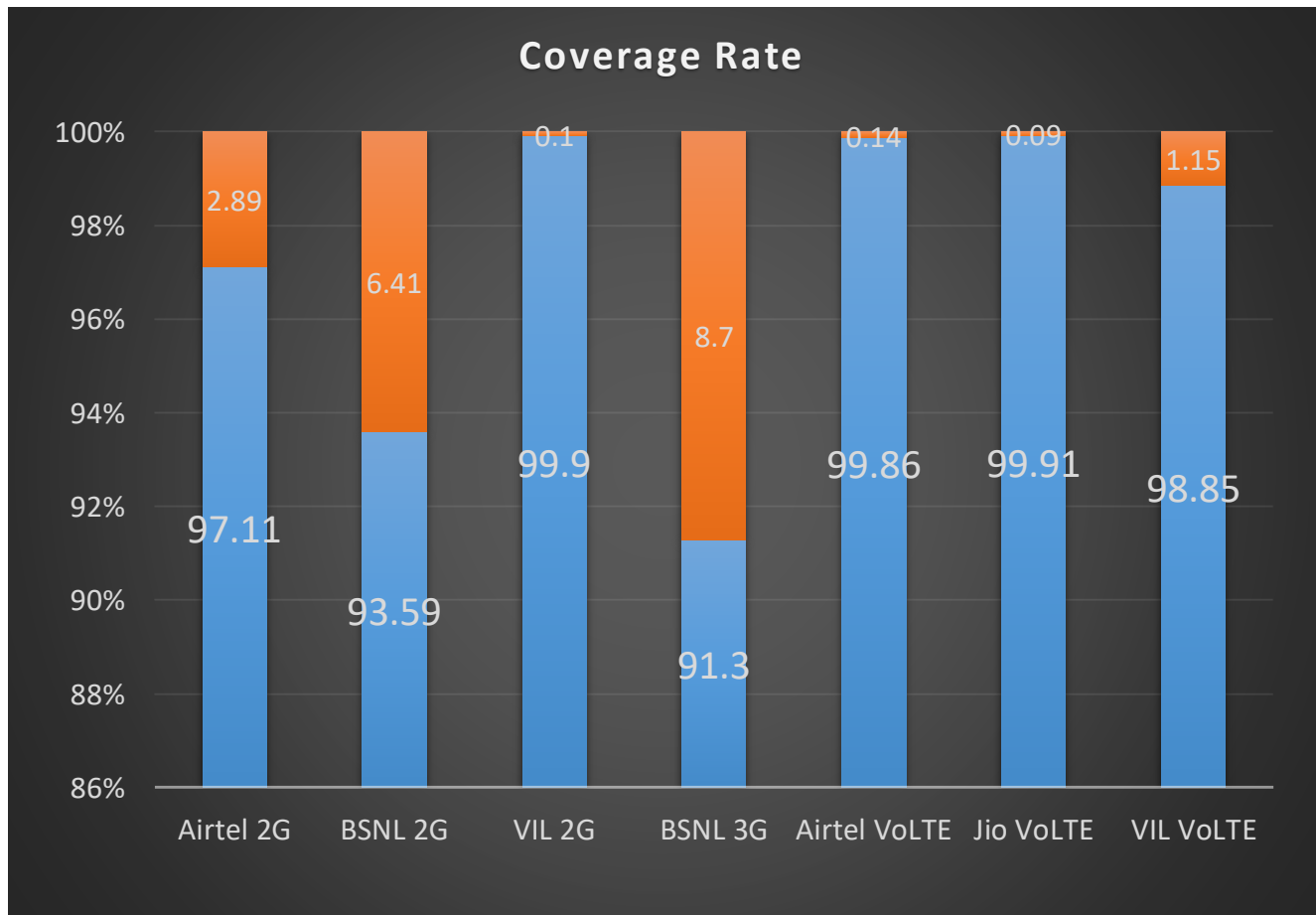
| <u>EVA Mall</u> | 3G | 4G | | |
|--------------------------------|--------------|--------------|--------------|---------------|
| | BSNL | Airtel | JIO | VIL |
| Download Throughput (mbps) | 6.39 | 14.38 | 53.30 | 19.68 |
| Upload Throughput (mbps) | 1.39 | 2 | 26.20 | 22 |
| Video Streaming Delay (Secs.) | 3.82 | 0 | 0.28 | 0.08 |
| Web Browsing Delay (sec) | 3.15 | 5.57 | 1.33 | 4.31 |
| Latency (msec) | 64.33 | 73.9 | 50.70 | 105.96 |

| <u>Makarpura Bus stand</u> | 3G | 4G | | |
|--------------------------------|--------------|--------------|--------------|--------------|
| | BSNL | Airtel | JIO | VIL |
| Download Throughput (mbps) | 7.94 | 16.82 | 57.84 | 24 |
| Upload Throughput (mbps) | 2.21 | 6.84 | 53.22 | 21.97 |
| Video Streaming Delay (Secs.) | 2.63 | 0 | 0.31 | 0.07 |
| Web Browsing Delay (sec) | 2.36 | 4.98 | 1.27 | 3.28 |
| Latency (msec) | 55.33 | 67.57 | 51 | 153.5 |

Coverage Details

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 \geq -85 dBm, RSCP is \geq -90 dBm & RSRP \geq -110dBm. The details are as follows.

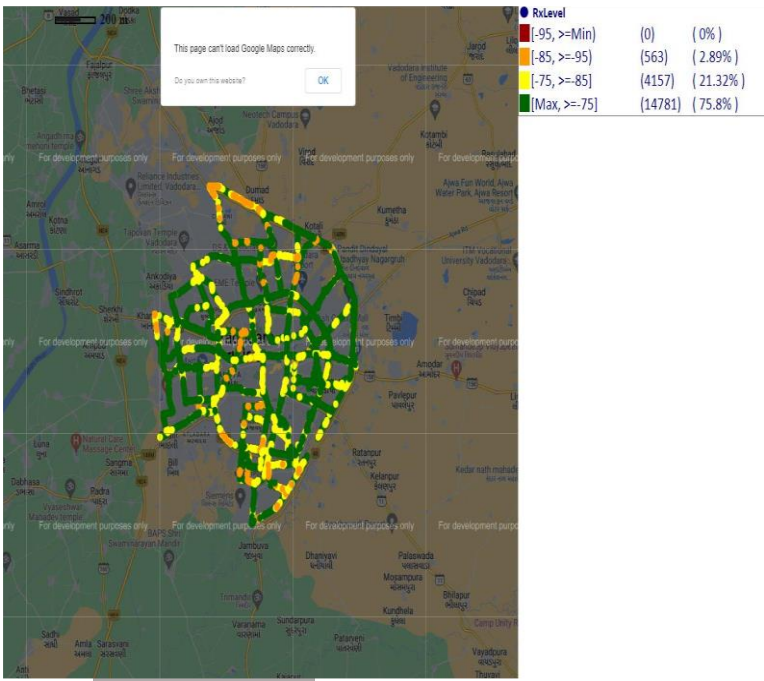
| TSP | Coverage Rate % |
|--------------|-----------------|
| Airtel 2G | 97.11% |
| BSNL 2G | 93.59% |
| VIL 2G | 99.9% |
| BSNL 3G | 91.3% |
| Airtel VoLTE | 99.86% |
| Jio VoLTE | 99.91% |
| VIL VoLTE | 98.85% |



TSP-AIRTEL

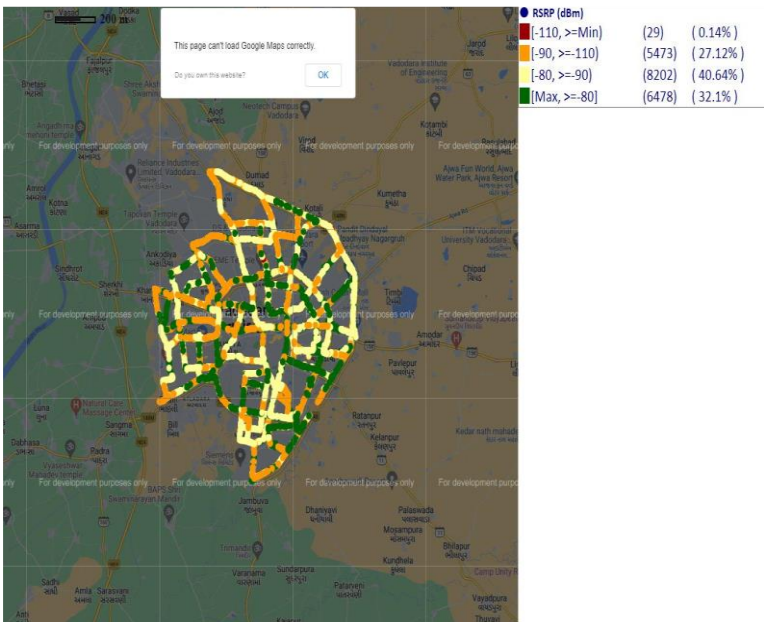
| Technology | Coverage % |
|------------|------------|
| 2G | 97.11% |
| VoLTE | 99.86% |

2G



| 2G | | | |
|-----------------|--------------|-------------|---------|
| Overall RxLevel | # Samples | % PDF | Legends |
| [Max, >=-75] | 14781 | 75.80% | Green |
| [-75, >=-85) | 4157 | 21.32% | Yellow |
| [-85, >=-95) | 563 | 2.89% | Orange |
| [-95, >=Min) | 0 | 0.00% | Red |
| Total | 19501 | 100% | |

VoLTE



| VoLTE | | | |
|---------------|--------------|-------------|---------|
| Overall RSRP | Sample s | % PDF | Legends |
| [Max, >=-80] | 6478 | 32.10% | Green |
| [-80, >=-90) | 8202 | 40.64% | Yellow |
| [-90, >=-110) | 5473 | 27.12% | Orange |
| [-110, >=Min) | 29 | 0.14% | Red |
| Total | 20182 | 100% | |

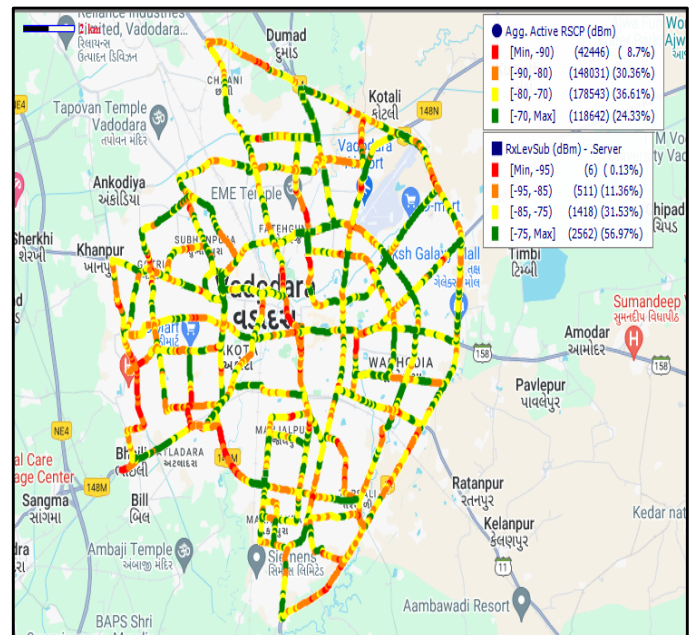
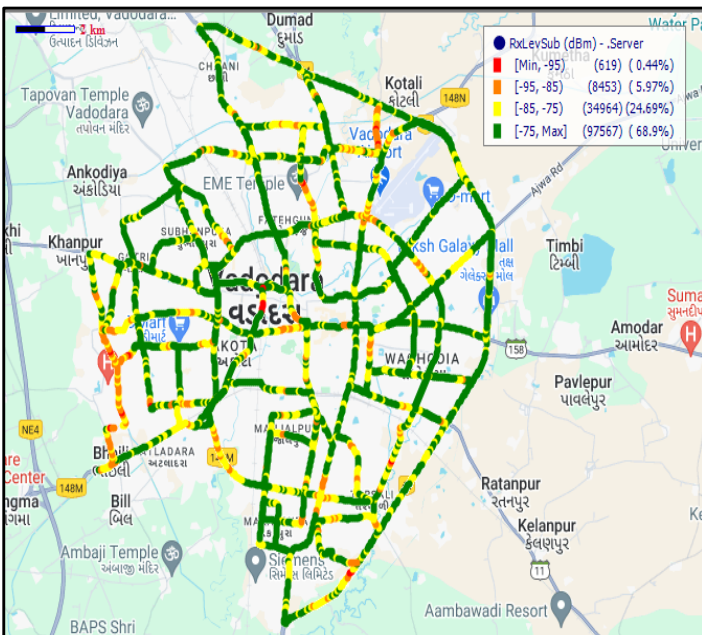
Coverage Details

TSP- BSNL

| Technology | Coverage % |
|------------|------------|
| 2G | 93.59% |
| 3G | 91.3% |

2G

3G

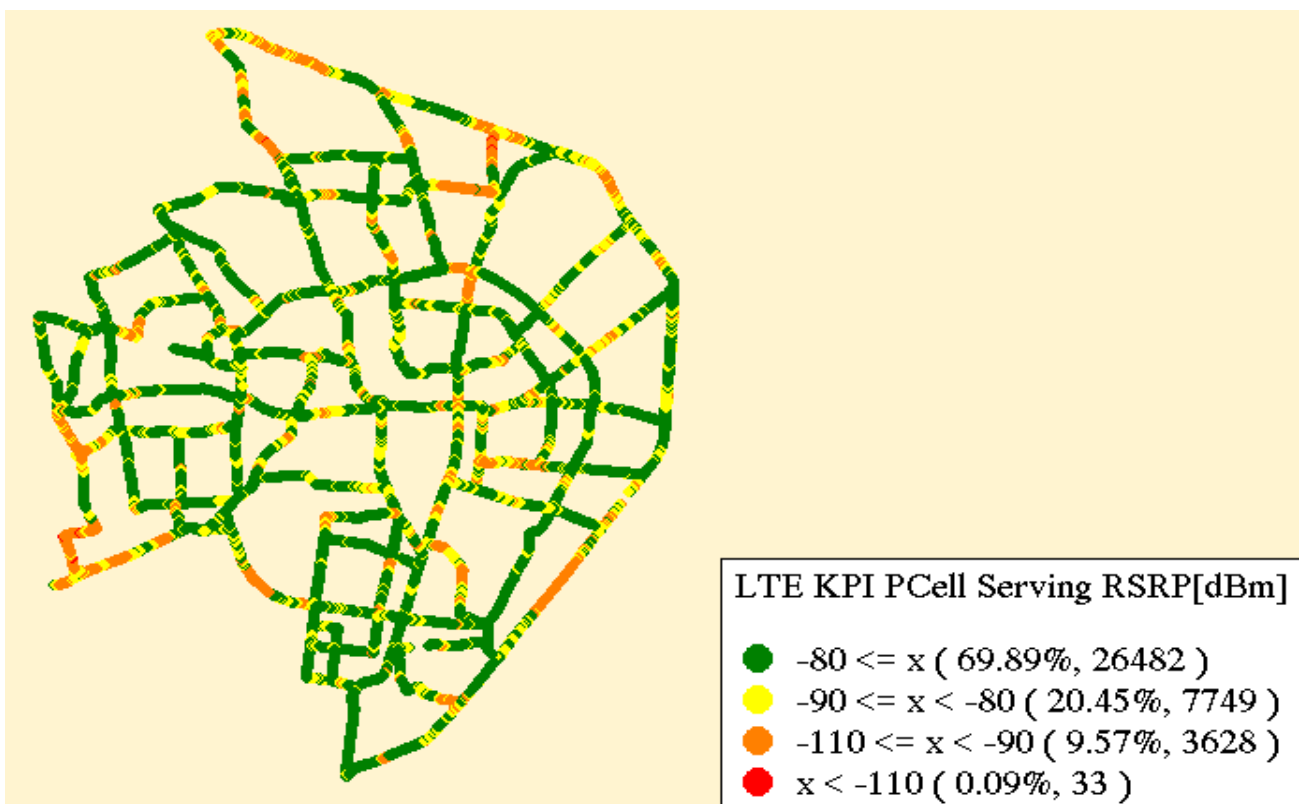


| 2G | | | |
|-----------------|---------------|-------------|---------|
| Overall RxLevel | # Samples | % PDF | Legends |
| [Max, >=-75] | 97567 | 68.90% | |
| [-75, >=-85) | 34964 | 24.69% | |
| [-85, >=-95) | 8453 | 5.97% | |
| [-95, >=Min) | 619 | 0.44% | |
| Total | 141603 | 100% | |

| 3G | | | |
|--------------|---------------|-------------|---------|
| Overall RSCP | # Samples | % PDF | Legends |
| [Max, >=-70] | 118642 | 24.33% | |
| [-70, >=-80) | 178543 | 36.61% | |
| [-80, >=-90) | 148031 | 30.36% | |
| [-90, >=Min) | 42446 | 8.70% | |
| Total | 487662 | 100% | |

JIO

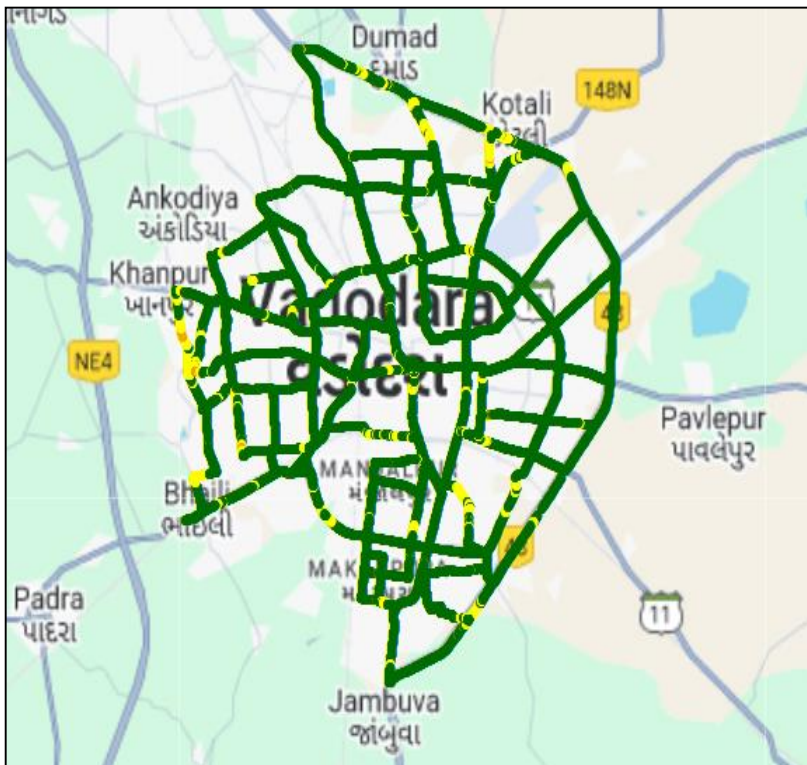
| Technology | Coverage % |
|------------|------------|
| VoLTE | 99.91% |



| VoLTE | | | |
|---------------------|--------------|-------------|---------------------------------------|
| Overall RSRP | # Samples | % PDF | Legends |
| [Max, ≥ -80] | 26482 | 69.89% | ■ |
| [-80, ≥ -90) | 7749 | 20.45% | ■ |
| [-90, ≥ -110) | 3628 | 9.57% | ■ |
| [-110, \geq Min) | 33 | 0.09% | ■ |
| Total | 37892 | 100% | |

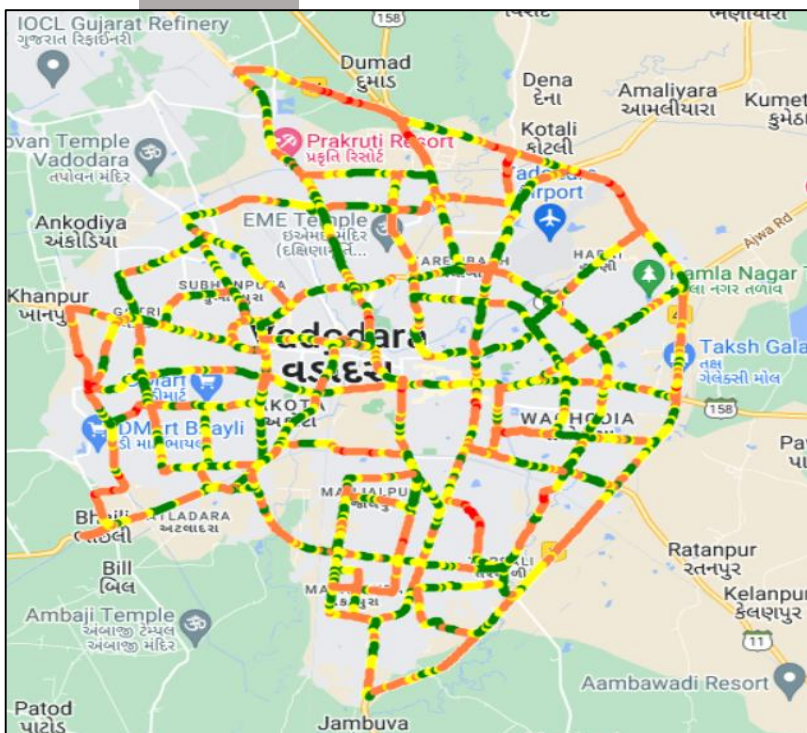
VIL

| | Technology | Coverage Rate % |
|----|------------|-----------------|
| | 2G | 99.9% |
| 2G | VoLTE | 98.85% |



| 2G | | | |
|-----------------|--------------|-------------|---------|
| Overall RxLevel | # Samples | % PDF | Legends |
| [Max, >=-75] | 34782 | 95.3% | Green |
| [-75, >=-85) | 1678 | 4.6% | Yellow |
| [-85, >=-95) | 38 | 0.1% | Orange |
| [-95, >=Min) | 0 | 0% | Red |
| Total | 36498 | 100% | |

VoLTE

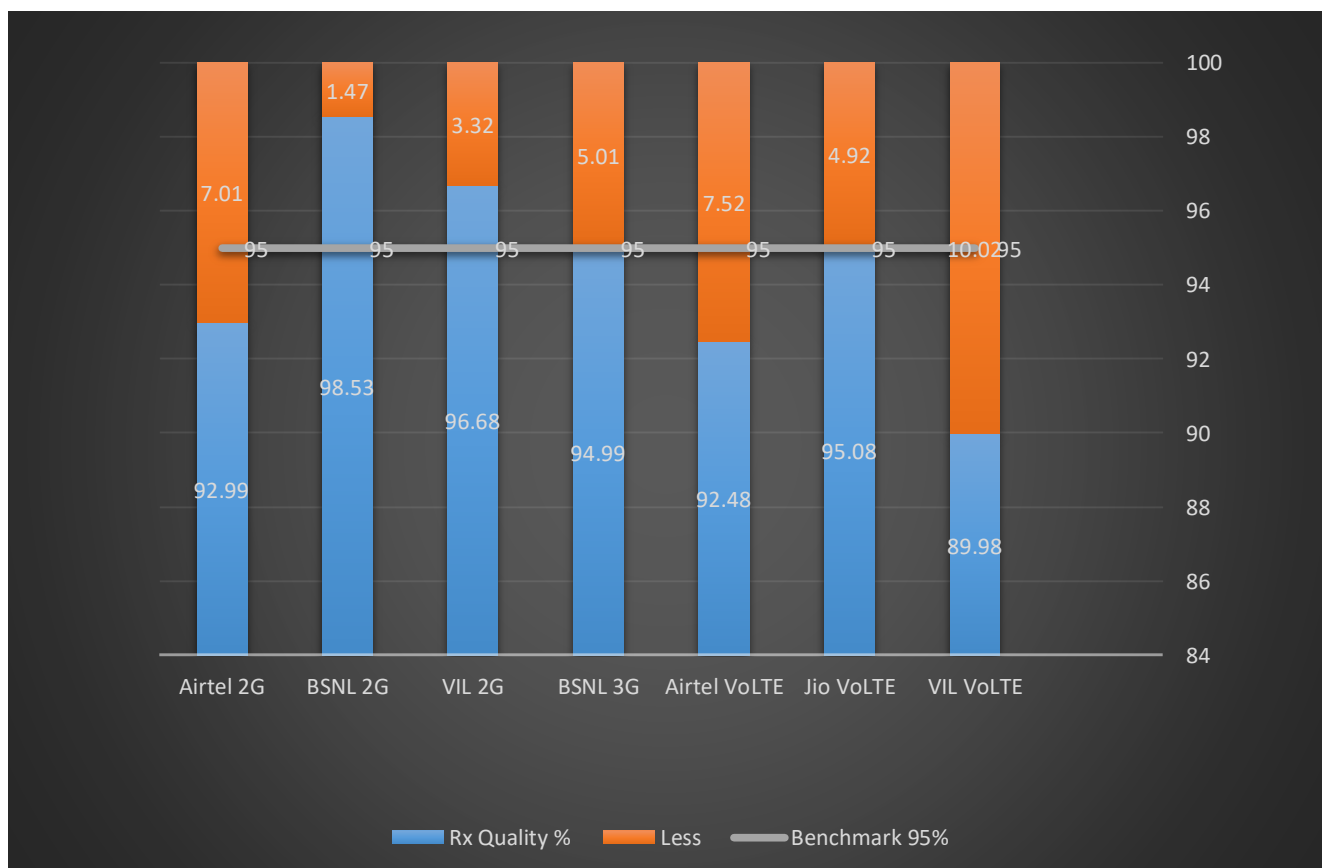


| VoLTE | | | |
|---------------|--------------|-------------|---------|
| Overall RSRP | # Samples | % PDF | Legends |
| [Max, >=-80] | 6540 | 33.43% | Green |
| [-80, >=-90) | 6255 | 31.97% | Yellow |
| [-90, >=-110) | 6543 | 33.45% | Orange |
| [-110, >=Min) | 225 | 1.15% | Red |
| Total | 19563 | 100% | |

II. Quality Details

For measuring voice quality, as per the QoS norms, RxQual ≤ 5 for GSM TSPs, EcNo ≥ -14 dBm for 3G TSP sand 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 $\geq 95\%$.

| <u>TSP</u> | <u>Rx Quality %</u> |
|--------------|---------------------|
| Airtel 2G | 92.99% |
| BSNL 2G | 98.53% |
| VIL 2G | 96.68% |
| BSNL 3G | 94.99 % |
| Airtel VoLTE | 92.48% |
| Jio VoLTE | 95.08% |
| VIL VoLTE | 89.98% |

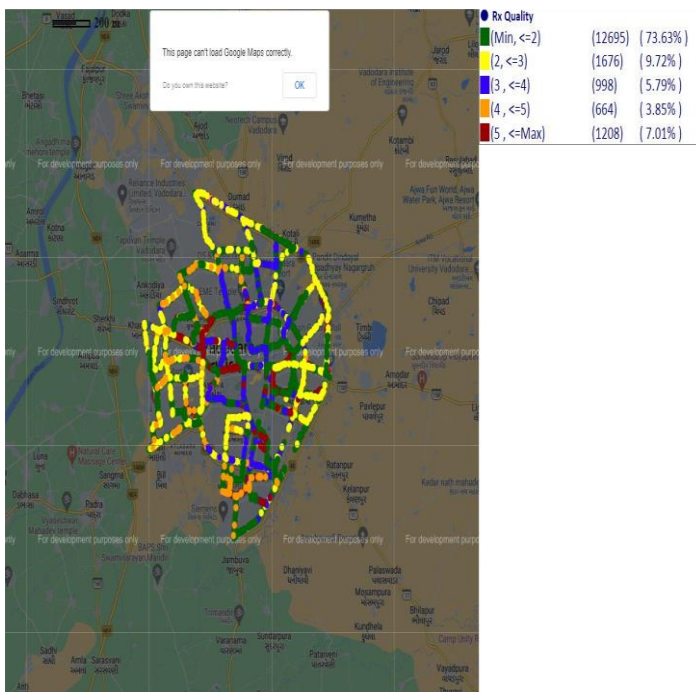


II. Quality Details

Airtel

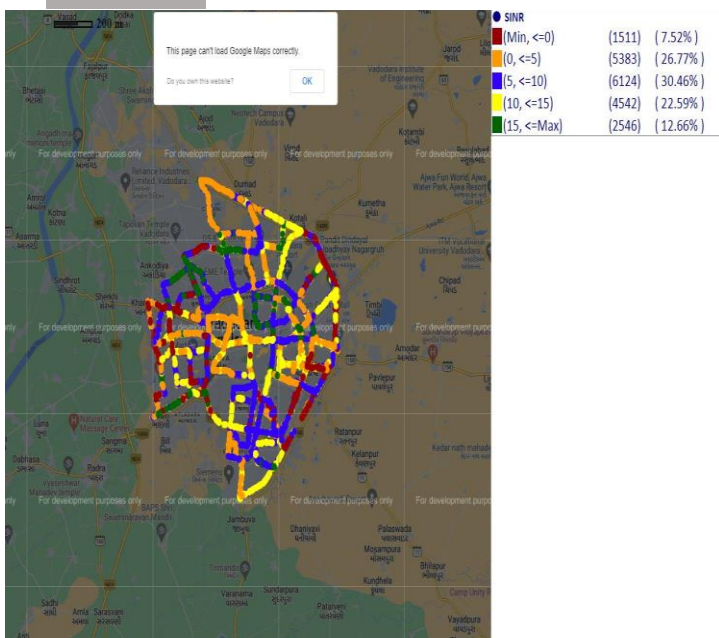
| Technology | Rx Quality % |
|------------|--------------|
| 2G | 92.99% |
| VoLTE | 92.48% |

2G



| Overall Rx Quality | # Samples | % PDF | Legends |
|--------------------|--------------|-------------|---------|
| (Min, <=2) | 12695 | 73.63% | Green |
| (2, <=3) | 1676 | 9.72% | Yellow |
| (3, <=4) | 998 | 5.79% | Blue |
| (4, <=5) | 664 | 3.85% | Orange |
| (5, <=Max) | 1208 | 7.01% | Red |
| Total | 17241 | 100% | |

VoLTE

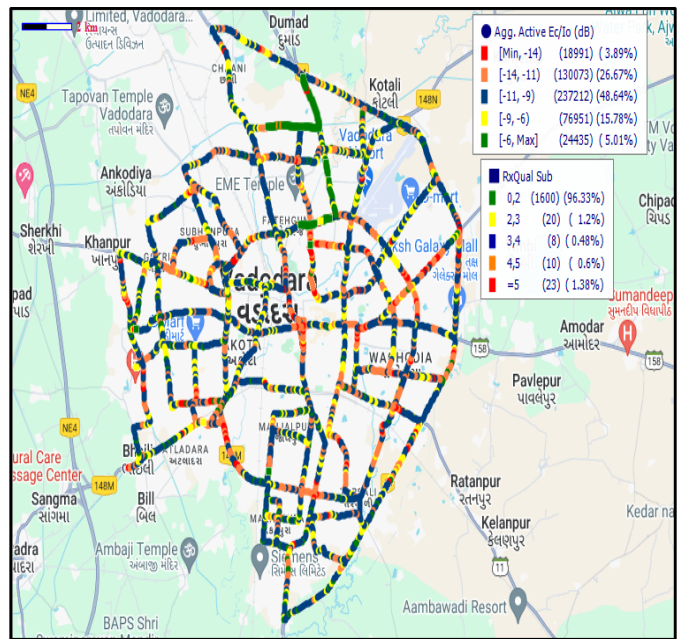
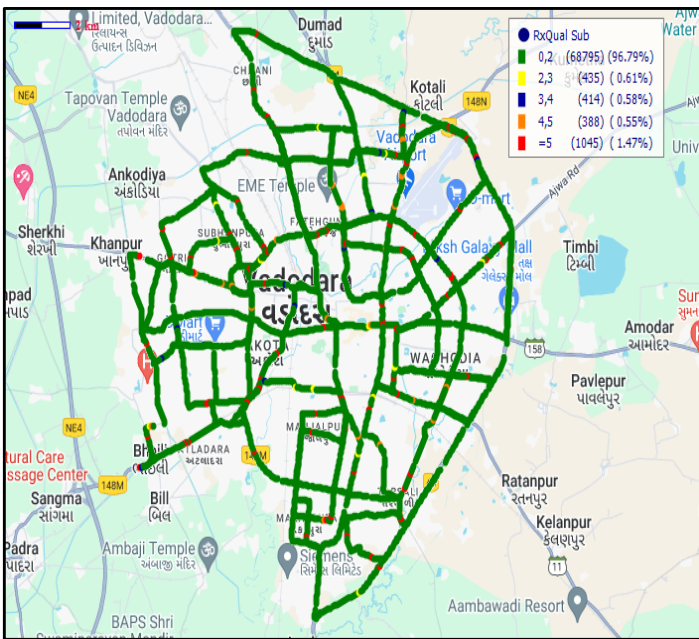


| Overall SINR | # Samples | % PDF | Legends |
|--------------|--------------|-------------|---------|
| (Min, <=0) | 1511 | 7.52% | Red |
| (0, <=5) | 5383 | 26.77% | Orange |
| (5, <=10) | 6124 | 30.46% | Blue |
| (10, <=15) | 4542 | 22.59% | Yellow |
| (15, <=Max) | 2546 | 12.66% | Green |
| Total | 20106 | 100% | |

II. Quality Details

BSNL

| | | | |
|-----------|-------------------|---------------------|-----------|
| | Technology | Rx Quality % | |
| 2G | 2G | 98.53% | 3G |
| | 3G | 94.99 % | |



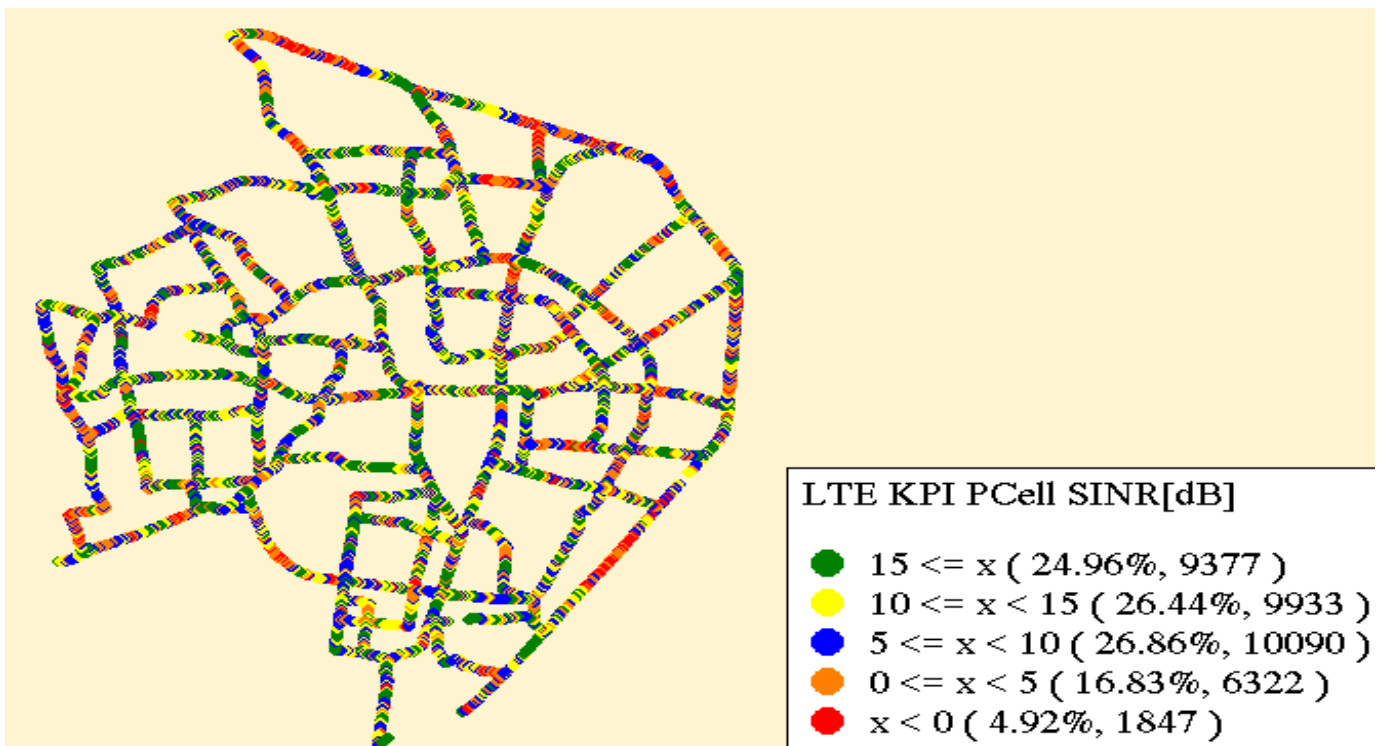
| Overall Rx Quality | # Samples | % PDF | Legends |
|--------------------|--------------|-------------|---------|
| (Min, <=2) | 68795 | 96.79% | |
| (2, <=3) | 435 | 0.61% | |
| (3, <=4) | 414 | 0.58% | |
| (4, <=5) | 388 | 0.55% | |
| (5, <=Max) | 1045 | 1.47% | |
| Total | 71077 | 100% | |

| Overall Ec/No | # Samples | % PDF | Legends |
|---------------|---------------|-------------|---------|
| (Max, <=-6) | 18991 | 3.89% | |
| (-6, <=-9) | 130073 | 26.67% | |
| (-9, <=-11) | 237212 | 48.64% | |
| (-11, <=-14) | 76951 | 15.78% | |
| (-14, <= Min) | 24435 | 5.01% | |
| Total | 487662 | 100% | |

For measuring voice quality, as per the QoS norms, RxQual ≤ 5 for GSM TSPs, EcNo ≥ -14 dBm for 3G TSP 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 $\geq 95\%$.

JIO

| Technology | Rx Quality % |
|------------|--------------|
| VoLTE | 95.08% |



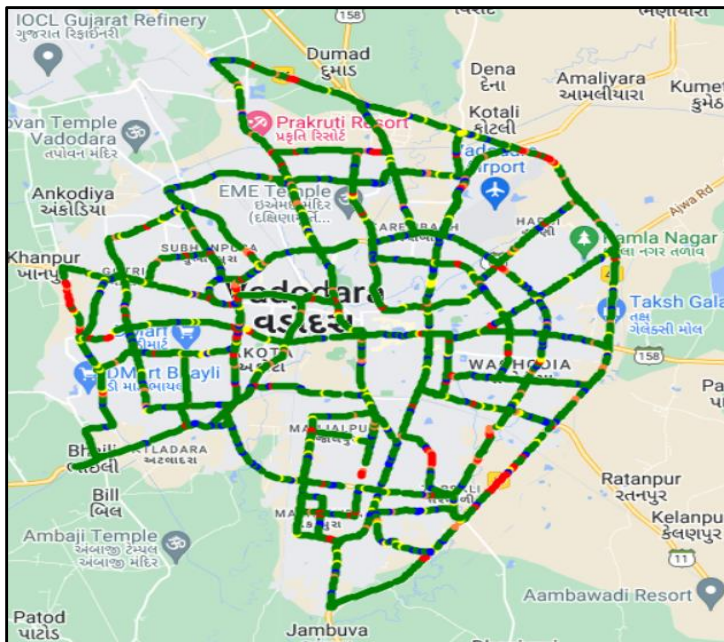
| Overall SINR | # Samples | % PDF | Legends |
|------------------|--------------|-------------|---------|
| (Min, ≤ 0) | 1847 | 4.92% | |
| (0, ≤ 5) | 6322 | 16.83% | |
| (5, ≤ 10) | 10090 | 26.86% | |
| (10, ≤ 15) | 9933 | 26.44% | |
| (15, \leq Max) | 9377 | 24.96% | |
| Total | 37569 | 100% | |

II. Quality Details

VIL

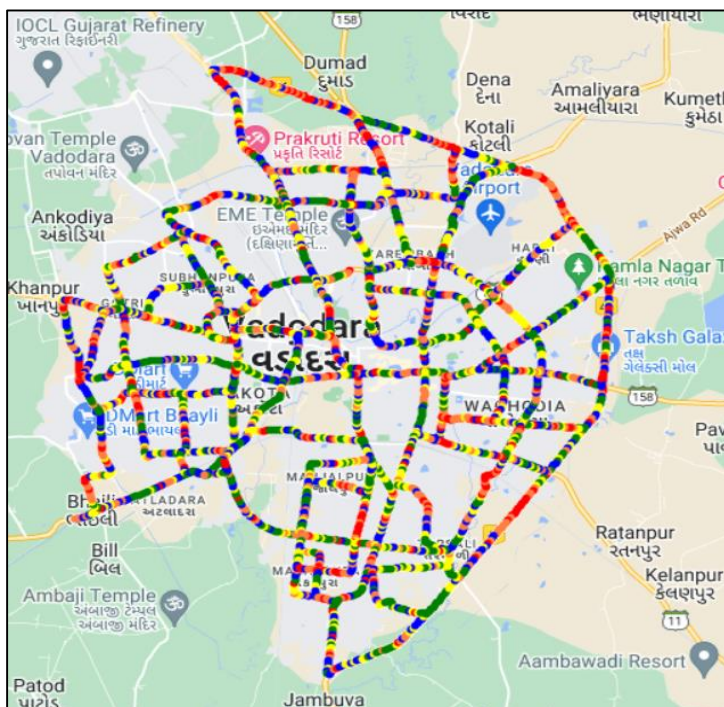
| Technology | Rx Quality % |
|------------|--------------|
| 2G | 96.68% |
| 4G | 89.98% |

2G



| Overall Rx Quality | # Samples | % PDF | Legends |
|--------------------|--------------|-------------|---------|
| (Min, <=2) | 14646 | 83.6% | |
| (2, <=3) | 784 | 4.47% | |
| (3, <=4) | 1118 | 6.38% | |
| (4, <=5) | 391 | 2.23% | |
| (5, <=Max) | 581 | 3.32% | |
| Total | 17520 | 100% | |

VoLTE



| Overall SINR | # Samples | % PDF | Legend s |
|--------------|--------------|-------------|----------|
| (Min, <=0) | 1961 | 10.02% | |
| (0, <=5) | 3674 | 18.79% | |
| (5, <=10) | 4450 | 22.76% | |
| (10, <=15) | 4287 | 21.93% | |
| (15, <=Max) | 5181 | 26.5% | |
| Total | 19553 | 100% | |

III. Technology Details

| TSP | % of Time Spent on 3G/VoLTE |
|---------------------|-----------------------------|
| BSNL 3G | 98.58% |
| Airtel VoLTE | 99.33% |
| Jio VoLTE | 100% |
| VIL VoLTE | 100% |

