**INDEPENDENT DRIVE TEST REPORT**

*For*

**Bikaner**

**February 2019**

**NORTH ZONE**

**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 Independent Drive Test has been carried out by M/s PhiMetrics Technologies Pvt. Ltd. on behalf of TRAI in Bikaner City & adjoining areas from 9:00 AM to 9:00 PM; 11th February to 14th February 2019. The drive test covered an drive route of 440 KMs & 7 hotspot over a period of four days. Approximately 620 calls were made for each of the 11 networks: five 2G networks, five 3G networks and one LTE network covering 5 unique TSPs.
Overview:

Telecom Regulatory Authority of India has been entrusted with the task of laying down the standards of quality of service to be provided by the service providers and ensuring its enforcement; and also TRAI is 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.

TRAI is regularly monitoring the performance of Telecom Service Providers (TSP) against the benchmarks for the various Quality of Service (QoS) parameters laid down by the Authority. TSPs submit Performance Monitoring Reports to TRAI every quarter. TRAI also undertakes audit and assessment of Quality of Service through independent agencies to verify the Quality of Service claimed. The Audit agencies conduct sample ‘Drive tests’ across various cities in the country as part of audit and assessment of the TSPs’ performance.

In view of complaints on call drops and other network quality issues, on behalf of TRAI, an Independent Drive Test (IDT) was conducted by PhiMetrics Technologies Pvt. Ltd. From 11th February to 14th February 2019 covering various locations in Bikaner City & surrounding region. The performance of Airtel, BSNL, Tata, Vodafone Idea Ltd (VIL( Idea, Vodafone) and Jio were monitored across various technologies (2G, 3G, and 4G). The drive test route was defined on the basis of several factors that include - areas from where call drop complaints are commonly received; areas of heavy usage; residential areas away from arterial roads; office areas; areas where previous Drive tests showed network issues; etc.

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, Video Streaming Delay and Latency.

Drive Test Details For Bikaner:

Independent Drive Test was conducted for a period of four days from 11th February to 14th February 2019 in Bikaner city & surrounding areas from 9:00 AM to 9:00 PM. Calls were made for 90 sec duration with wait time of 10 sec between calls in all technologies.

Voice Tests: The drive test covered a drive route of approximately 440 KMs over a period of three days from 11th February to 13th February 2019. Approximately 620 calls were made for each of the 11 networks: five 2G (Lock Mode) networks, five 3G (Dual mode) networks and one VoLTE network covering 5 unique TSPs.

* In case of multiple call failure in similar geo location in given period of 60secs has been counted as one call failure.

Data Tests: Data Tests were performed at 7 static locations for four days from 11th February to 14th February 2019; five 2G (Lock mode) networks, five 3G (Dual mode) networks and four 4G (Free mode) networks covering 5 unique TSPs were tested.

* For Voice and Data KPI’s, 2G measurement is done with UE locked on 2G, 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.

<table>
<thead>
<tr>
<th>Service</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Download</td>
<td>2G (Locked) - 500KB, 3G (Dual) - 20 MB, 4G (Free) - 40 MB</td>
</tr>
<tr>
<td>Upload</td>
<td>2G (Locked) - 100KB, 3G (Dual) - 5 MB, 4G (Free) - 10 MB</td>
</tr>
<tr>
<td>Web Browsing</td>
<td>3 links of e/m commerce website <a href="http://www.amazon.in">www.amazon.in</a>, <a href="http://www.flipkart.com">www.flipkart.com</a> and PayTm</td>
</tr>
<tr>
<td>Video Streaming</td>
<td>130 sec clip</td>
</tr>
<tr>
<td>Latency</td>
<td>32 Bytes on <a href="http://www.google.com">www.google.com</a></td>
</tr>
</tbody>
</table>

Voice Test Drive Route - Bikaner

Data Service testing across 7 Static Locations
Voice Calls

Key Observations

QoS compliance of the TSPs in Bikaner for Voice across technologies 2G/3G/4G-VoLTE is given below:

<table>
<thead>
<tr>
<th>KPI</th>
<th>Airtel</th>
<th>BSNL</th>
<th>Tata</th>
<th>Vodafone Idea Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDCCH Congestion (&lt;1%)</td>
<td>0.44%</td>
<td>0.31%</td>
<td>0.18%</td>
<td>0.40% 0.00%</td>
</tr>
<tr>
<td>TCH Congestion (&lt;2%)</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.37%</td>
<td>0.21% 0.00%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KPI</th>
<th>Airtel</th>
<th>BSNL</th>
<th>Tata</th>
<th>Vodafone Idea Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSFB Failure %</td>
<td>0.16%</td>
<td>NA</td>
<td>NA</td>
<td>0.54% 0.00%</td>
</tr>
<tr>
<td>SDCCH Congestion%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00% 0.00%</td>
</tr>
<tr>
<td>RRC Congestion%</td>
<td>0.32%</td>
<td>0.96%</td>
<td>0.34%</td>
<td>0.54% 0.15%</td>
</tr>
<tr>
<td>SDCCH &amp; RRC Congestion (&lt;1%)</td>
<td>0.32%</td>
<td>0.96%</td>
<td>0.34%</td>
<td>0.54% 0.15%</td>
</tr>
<tr>
<td>TCH Congestion%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00% 0.00%</td>
</tr>
<tr>
<td>RAB Congestion%</td>
<td>0.16%</td>
<td>0.00%</td>
<td>2.22%</td>
<td>0.00% 0.16%</td>
</tr>
<tr>
<td>TCH &amp; RAB Congestion (&lt;2%)</td>
<td>0.16%</td>
<td>0.00%</td>
<td>2.22%</td>
<td>0.00% 0.16%</td>
</tr>
</tbody>
</table>

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 ≥ -85 dBm.**

<table>
<thead>
<tr>
<th>TSPs</th>
<th>2G</th>
<th>Vodafone Idea Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
</tr>
<tr>
<td>Coverage%</td>
<td>86.62%</td>
<td>90.34%</td>
</tr>
</tbody>
</table>

b) **Percentage of coverage samples for 2G ≥ -85 dBm, 3G ≥ -90 dBm & LTE ≥ -110 dBm.**

<table>
<thead>
<tr>
<th>TSPs</th>
<th>3G</th>
<th>VolTE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
</tr>
<tr>
<td>Coverage %</td>
<td>79.39%</td>
<td>82.98%</td>
</tr>
</tbody>
</table>

c) **Percentage of time spent on 3G network:**

<table>
<thead>
<tr>
<th>TSPs</th>
<th>3G</th>
<th>Vodafone Idea Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
</tr>
<tr>
<td>Time Spent on 3G%</td>
<td>71.94%</td>
<td>21.78%</td>
</tr>
</tbody>
</table>

d) **Percentage of RLT >=48:**

<table>
<thead>
<tr>
<th>TSPs</th>
<th>2G</th>
<th>Vodafone Idea Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
</tr>
<tr>
<td>%RLT &gt;=48</td>
<td>0.00%</td>
<td>82.11%</td>
</tr>
</tbody>
</table>

e) **Average CST Second**

<table>
<thead>
<tr>
<th>TSPs</th>
<th>2G</th>
<th>Vodafone Idea Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
</tr>
<tr>
<td>Second</td>
<td>2.91</td>
<td>2.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TSPs</th>
<th>3G</th>
<th>VolTE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
</tr>
<tr>
<td>Second</td>
<td>5.34</td>
<td>2.12</td>
</tr>
</tbody>
</table>
Data was tested at 7 locations. Following services were tested: Data Download/Upload, Latency (www.google.com), Video Streaming (YouTube) and Web browsing (Flipkart, Amazon, PayTm)

### Data Download and Upload Performance (Mbps)

#### 4G Network:

<table>
<thead>
<tr>
<th>Service</th>
<th>Download Throughput</th>
<th>Upload Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>6.56</td>
<td>2.27</td>
</tr>
<tr>
<td>Jio</td>
<td>6.96</td>
<td>6.09</td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>4.06</td>
<td>3.77</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>3.32</td>
<td>4.82</td>
</tr>
</tbody>
</table>

#### 3G Network:

<table>
<thead>
<tr>
<th>Service</th>
<th>Download Throughput</th>
<th>Upload Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>2.59</td>
<td>0.61</td>
</tr>
<tr>
<td>BSNL</td>
<td>4.10</td>
<td>1.36</td>
</tr>
<tr>
<td>Tata</td>
<td>2.29</td>
<td>0.54</td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>3.81</td>
<td>1.86</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>2.5</td>
<td>1.4</td>
</tr>
</tbody>
</table>

### Latency (msec)

#### 3G Network

<table>
<thead>
<tr>
<th>Service</th>
<th>Latency (msec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>257</td>
</tr>
<tr>
<td>BSNL</td>
<td>136</td>
</tr>
<tr>
<td>Tata</td>
<td>296</td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>162</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>147</td>
</tr>
</tbody>
</table>

#### 4G Network

<table>
<thead>
<tr>
<th>Service</th>
<th>Latency (msec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>106</td>
</tr>
<tr>
<td>Jio</td>
<td>81</td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>109</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>99</td>
</tr>
</tbody>
</table>
Data Services Static

Video Streaming Performance (130 sec YouTube video sample sizes)

Streaming (sec)

<table>
<thead>
<tr>
<th></th>
<th>3G Network</th>
<th></th>
<th>4G Network</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>3.21</td>
<td></td>
<td>2.89</td>
<td></td>
</tr>
<tr>
<td>BSNL</td>
<td>2.67</td>
<td></td>
<td>3.85</td>
<td></td>
</tr>
<tr>
<td>Tata</td>
<td>3.44</td>
<td></td>
<td>1.29</td>
<td></td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>1.47</td>
<td></td>
<td>VIL(Vodafone)</td>
<td>1.71</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>1.44</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Streaming Delay further broken into 2 parameters which form the end-user perception to assess consistency on Video streaming.
- Initial Start time
- Interruption time while playing the video.

<table>
<thead>
<tr>
<th>Video Streaming</th>
<th>3G</th>
<th></th>
<th>4G</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
<td>Tata</td>
<td>Vodafone Idea Ltd</td>
</tr>
<tr>
<td>Avg. Initial Start Time (sec)</td>
<td>2.77</td>
<td>2.67</td>
<td>2.94</td>
<td>1.47</td>
</tr>
<tr>
<td>Avg. Interruption Time (sec)</td>
<td>0.44</td>
<td>0</td>
<td>0.5</td>
<td>0</td>
</tr>
</tbody>
</table>

Web Page Download Time (sec)

<table>
<thead>
<tr>
<th></th>
<th>3G Network</th>
<th></th>
<th>4G Network</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>13.69</td>
<td></td>
<td>9.16</td>
<td></td>
</tr>
<tr>
<td>BSNL</td>
<td>11.78</td>
<td></td>
<td>8.86</td>
<td></td>
</tr>
<tr>
<td>Tata</td>
<td>17.55</td>
<td></td>
<td>9.93</td>
<td></td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>12.25</td>
<td></td>
<td>VIL(Vodafone)</td>
<td>12.71</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>15.72</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Web browsing experience is the average time taken to fully load the websites tested.
Data Services Dynamic

Data was tested between one location to another location. Following services were tested: Data Download/Upload, Latency (www.google.com), Video Streaming (YouTube) and Web browsing (Flipkart, Amazon, PayTm)

<table>
<thead>
<tr>
<th>Data Download and Upload Performance (Mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4G Network:</strong></td>
</tr>
<tr>
<td>Download Throughput</td>
</tr>
<tr>
<td>Airtel: 10.67</td>
</tr>
<tr>
<td>Jio: 7.09</td>
</tr>
<tr>
<td>VIL(Idea): 6.20</td>
</tr>
<tr>
<td>VIL(Vodafone): 2.21</td>
</tr>
<tr>
<td>Upload Throughput</td>
</tr>
<tr>
<td>Airtel: 5.22</td>
</tr>
<tr>
<td>Jio: 6.11</td>
</tr>
<tr>
<td>VIL(Idea): 5.15</td>
</tr>
<tr>
<td>VIL(Vodafone): 3.77</td>
</tr>
</tbody>
</table>

| **3G Network:**                            |
| Download Throughput                        |
| Airtel: 1.29                               |
| BSNL: 2.89                                 |
| Tata: 1.64                                 |
| VIL(Idea): 3.57                            |
| VIL(Vodafone): 0.65                        |
| Upload Throughput                          |
| Airtel: 0.41                               |
| BSNL: 1.19                                 |
| Tata: 0.55                                 |
| VIL(Idea): 1.90                            |
| VIL(Vodafone): 1.7                         |

<table>
<thead>
<tr>
<th>Latency (msec)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3G Network</strong></td>
</tr>
<tr>
<td>Airtel: 400</td>
</tr>
<tr>
<td>BSNL: 121</td>
</tr>
<tr>
<td>Tata: 293</td>
</tr>
<tr>
<td>VIL(Idea): 141</td>
</tr>
<tr>
<td>VIL(Vodafone): 265</td>
</tr>
<tr>
<td><strong>4G Network</strong></td>
</tr>
<tr>
<td>Airtel: 99</td>
</tr>
<tr>
<td>Jio: 81</td>
</tr>
<tr>
<td>VIL(Idea): 82</td>
</tr>
<tr>
<td>VIL(Vodafone): 76</td>
</tr>
</tbody>
</table>
Video Streaming Performance (130 sec YouTube video sample sizes)

Streaming (sec)

<table>
<thead>
<tr>
<th></th>
<th>3G Network</th>
<th>4G Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>5.88</td>
<td>1.63</td>
</tr>
<tr>
<td>BSNL</td>
<td>4.85</td>
<td>2.06</td>
</tr>
<tr>
<td>Tata</td>
<td>1.78</td>
<td>1.63</td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>1.39</td>
<td>1.91</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>1.6</td>
<td></td>
</tr>
</tbody>
</table>

Streaming Delay further broken into 2 parameters which form the end-user perception to assess consistency on Video streaming.
- Initial Start time
- Interruption time while playing the video.

<table>
<thead>
<tr>
<th>Video Streaming</th>
<th>3G</th>
<th>4G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
</tr>
<tr>
<td>Avg. Initial Start Time (sec)</td>
<td>3.51</td>
<td>2.52</td>
</tr>
<tr>
<td>Avg. Interruption Time (sec)</td>
<td>2.37</td>
<td>2.33</td>
</tr>
</tbody>
</table>

Web Page Download Time (sec)

<table>
<thead>
<tr>
<th></th>
<th>3G Network</th>
<th>4G Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>1.44</td>
<td>0.81</td>
</tr>
<tr>
<td>BSNL</td>
<td>1.24</td>
<td>0.98</td>
</tr>
<tr>
<td>Tata</td>
<td>1.53</td>
<td>1.03</td>
</tr>
<tr>
<td>VIL(Idea)</td>
<td>1.18</td>
<td>1.43</td>
</tr>
<tr>
<td>VIL(Vodafone)</td>
<td>1.83</td>
<td></td>
</tr>
</tbody>
</table>
## Summary

### City Level Summary

<table>
<thead>
<tr>
<th>Voice Call</th>
<th>2G</th>
<th>3G</th>
<th>VoLTE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
<td>Tata</td>
</tr>
<tr>
<td>Call Attempt</td>
<td>617</td>
<td>648</td>
<td>544</td>
</tr>
<tr>
<td>Blocked Call Rate (%)</td>
<td>0.44%</td>
<td>0.31%</td>
<td>0.55%</td>
</tr>
<tr>
<td>CSSR% (Accessibility)</td>
<td>99.56%</td>
<td>99.69%</td>
<td>99.45%</td>
</tr>
<tr>
<td>Drop Call Rate (%)</td>
<td>0.11%</td>
<td>0.77%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Mobility HOSR (%)</td>
<td>97.00%</td>
<td>94.02%</td>
<td>98.29%</td>
</tr>
<tr>
<td>Rx Quality (%)</td>
<td>90.64%</td>
<td>97.75%</td>
<td>94.83%</td>
</tr>
<tr>
<td></td>
<td>Airtel</td>
<td>BSNL</td>
<td>Tata</td>
</tr>
<tr>
<td>Call Attempt</td>
<td>626</td>
<td>628</td>
<td>586</td>
</tr>
<tr>
<td>Blocked Call Rate (%)</td>
<td>0.64%</td>
<td>0.96%</td>
<td>2.56%</td>
</tr>
<tr>
<td>CSSR% (Accessibility)</td>
<td>99.36%</td>
<td>99.04%</td>
<td>97.44%</td>
</tr>
<tr>
<td>Drop Call Rate (%)</td>
<td>0.16%</td>
<td>1.29%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Mobility HOSR (%)</td>
<td>99.81%</td>
<td>98.74%</td>
<td>99.96%</td>
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## Summary

### City Level Summary (contd.)

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<td>Idea</td>
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*T0=Timeout
## Summary

### City Level Summary (contd.)

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*TO=Timeout*
## Summary

### City Level Summary (contd.)

#### District Collector Office

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#### Government Bikaner Engineering College

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### 3G

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### 4G

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* T0 = Timeout
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*TO=Timeout
## Summary

### City Level Summary (contd.)

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<td>Tata</td>
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*TO=Timeout*
I. Coverage Details

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

<table>
<thead>
<tr>
<th>TSP</th>
<th>Coverage Rate</th>
</tr>
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<tbody>
<tr>
<td>Airtel 2G</td>
<td>86.62%</td>
</tr>
<tr>
<td>BSNL 2G</td>
<td>90.34%</td>
</tr>
<tr>
<td>Tata 2G</td>
<td>87.68%</td>
</tr>
<tr>
<td>VIL(Idea) 2G</td>
<td>83.41%</td>
</tr>
<tr>
<td>VIL(Vodafone)2G</td>
<td>92.20%</td>
</tr>
<tr>
<td>Airtel Dual(2G/3G)</td>
<td>79.39%</td>
</tr>
<tr>
<td>BSNL Dual(2G/3G)</td>
<td>82.98%</td>
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<tr>
<td>Tata Dual(2G/3G)</td>
<td>87.70%</td>
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<td>VIL(Idea) Dual (2G/3G)</td>
<td>87.79%</td>
</tr>
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<td>VIL(Vodafone) Dual(2G/3G)</td>
<td>92.03%</td>
</tr>
<tr>
<td>Jio VoLTE</td>
<td>92.87%</td>
</tr>
</tbody>
</table>

![Coverage Map](image_url)

**Coverage Distribution**

- **Airtel 2G**: 86.62%
- **BSNL 2G**: 90.34%
- **Tata 2G**: 87.68%
- **VIL(Idea) 2G**: 83.41%
- **VIL(Vodafone)2G**: 92.20%
- **Airtel Dual(2G/3G)**: 79.39%
- **BSNL Dual(2G/3G)**: 82.98%
- **Tata Dual(2G/3G)**: 87.70%
- **VIL(Idea) Dual (2G/3G)**: 87.79%
- **VIL(Vodafone) Dual(2G/3G)**: 92.03%
- **Jio VoLTE**: 92.87%
I. Coverage Details (contd.)

BSNL 2G

Tata 2G

Coverage Details
I. Coverage Details (contd.)
I. Coverage Details (contd.)

**Tata Dual Mode (2G/3G)**

- RxLev Sub In Service (dBm)
  - [Min, -85] (1165) (21.51%)
  - [-85, -75] (2084) (38.47%)
  - [-75, -65] (1366) (25.22%)
  - [-65, Max] (802) (14.81%)

- Agg. Active RSCP (dBm)
  - [Min, -90] (2863) (10.48%)
  - [-90, -80] (7260) (26.57%)
  - [-80, -70] (8460) (30.97%)
  - [-70, Max] (9738) (31.98%)

**VIL (Idea) Dual Mode (2G/3G)**

- RxLev Sub In Service (dBm)
  - [Min, -85] (1547) (50.44%)
  - [-85, -75] (1134) (36.97%)
  - [-75, -65] (315) (10.27%)
  - [-65, Max] (71) (2.31%)

- Agg. Active RSCP (dBm)
  - [Min, -90] (2156) (8.76%)
  - [-90, -80] (6025) (24.48%)
  - [-80, -70] (8604) (34.06%)
  - [-70, Max] (7828) (31.88%)

- Serving Cell RSRP (dBm)
  - [Min, -110] (309) (5.87%)
  - [-110, -95] (1474) (28.46%)
  - [-95, -80] (2407) (46.47%)
  - [-80, Max] (990) (19.11%)
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 ≥ 95%.

<table>
<thead>
<tr>
<th>TSP</th>
<th>Rx Quality</th>
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<tbody>
<tr>
<td>Airtel 2G</td>
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<td>BSNL 2G</td>
<td>97.75%</td>
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<tr>
<td>Tata 2G</td>
<td>94.83%</td>
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<tr>
<td>VIL(idea) 2G</td>
<td>98.26%</td>
</tr>
<tr>
<td>VIL(Vodafone) 2G</td>
<td>98.39%</td>
</tr>
<tr>
<td>Airtel Dual(2G/3G)</td>
<td>93.19%</td>
</tr>
<tr>
<td>BSNL Dual(2G/3G)</td>
<td>96.22%</td>
</tr>
<tr>
<td>Tata Dual(2G/3G)</td>
<td>96.35%</td>
</tr>
<tr>
<td>VIL(idea) Dual(2G/3G)</td>
<td>95.38%</td>
</tr>
<tr>
<td>VIL(Vodafone) Dual(2G/3G)</td>
<td>96.40%</td>
</tr>
<tr>
<td>JioVoLTE</td>
<td>85.59%</td>
</tr>
</tbody>
</table>

TSPs not meeting the Benchmark

Rx Quality Distribution

- RxQual >5, EcNo < -14 dBm, FER > 4%, SINR ≤ 0
- RxQual ≤ 5, EcNo ≥ -14 dBm, FER ≤ 4%, SINR > 0

Airtel 2G

RxQual Sub
- Mtn,2 (15241) (54.87%)
- 2,4 (7303) (26.29%)
- 1,5 (2632) (9.48%)
- 5,Max (2601) (9.36%)
II. Quality Details (contd.)

BSNL 2G

RxQual Sub
- Min,2 (25939) (80.45%)
- 2,4 (7267) (7.71%)
- 4,5 (460) (1.57%)
- 5,Max (661) (2.25%)

Tata 2G

RxQual Sub
- Min,2 (17392) (67.3%)
- 2,4 (5488) (21.24%)
- 4,5 (1627) (6.3%)
- 5,Max (1335) (5.17%)
II. Quality Details (contd.)

Tata Dual Mode (2G/3G)

- **RxQual Sub**
  - Min 2: (2972) (59.44%)
  - 2,4: (1154) (23.08%)
  - 4,5: (463) (9.26%)
  - 5,Max: (411) (8.22%)

- **Agg. Active Ec/Io (dB)**
  - [Min, -14]: (771) (2.81%)
  - [-14, -11]: (4186) (15.28%)
  - [-11, -9]: (6790) (24.78%)
  - [-9, Max]: (15654) (57.13%)

VIL (Idea) Dual Mode (2G/3G)

- **RxQual Sub**
  - Min 2: (2177) (80.15%)
  - 2,4: (310) (11.41%)
  - 4,5: (83) (3.06%)
  - 5,Max: (146) (5.38%)

- **Agg. Active Ec/Io (dB)**
  - [Min, -14]: (424) (1.71%)
  - [-14, -11]: (820) (3.31%)
  - [-11, -9]: (2562) (10.35%)
  - [-9, Max]: (20944) (84.62%)

- **RS SINR (dB)**
  - [Min, 0]: (938) (18.11%)
  - [0, 5]: (972) (18.77%)
  - [5, 15]: (1871) (36.13%)
  - [15, Max]: (1398) (26.99%)
II. Quality Details (contd.)

**VIL (Vodafone) Dual Mode (2G/3G)**

- **RxQual Sub**
  - Min, 2 (2545) (78.53%)
  - 2, 4 (1445) (13.73%)
  - 4, 5 (112) (3.46%)
  - 5, Max (139) (4.29%)

- **Agg. Active Ec/Io (dB)**
  - [Min, -14] (688) (2.56%)
  - [-14, -11] (4803) (17.05%)
  - [-11, -9] (6082) (22.6%)
  - [-9, Max] (15340) (57%)

- **RS SINR (dB)**
  - [Min, 0] (390) (10.66%)
  - [0, 5] (638) (17.45%)
  - [5, 15] (1713) (46.84%)
  - [15, Max] (916) (25.05%)

**Jio VoLTE**

- **RS SINR (dB)**
  - [Min, 0] (1871) (14.94%)
  - [0, 5] (2663) (20.51%)
  - [5, 15] (5604) (43.16%)
  - [15, Max] (2847) (21.93%)
### III. Technology Details

<table>
<thead>
<tr>
<th>TSP</th>
<th>% Time on 3G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel 3G</td>
<td>71.94%</td>
</tr>
<tr>
<td>BSNL 3G</td>
<td>21.78%</td>
</tr>
<tr>
<td>Tata 3G</td>
<td>83.20%</td>
</tr>
<tr>
<td>VIL (Idea) 3G</td>
<td>73.26%</td>
</tr>
<tr>
<td>VIL (Vodafone) 3G</td>
<td>78.71%</td>
</tr>
</tbody>
</table>

#### Technology Distribution

![Technology Distribution Chart]

- % Time on 3G
- % Time on 2G
- % Time on 4G

#### Airtel 3G

![Airtel 3G Map]

- **System**
  - GSM: 9776 (14.19%)
  - WCDMA: 49555 (71.94%)
  - LTE: 9551 (13.87%)
III. Technology Details (contd.)

BSNL 3G

- System
- GSM (53609) (78.22%)
- WCDMA (14928) (21.78%)

Tata 3G

- System
- GSM (11248) (16.8%)
- WCDMA (55687) (83.2%)
III. Technology Details (contd.)

VIL (Idea) 3G

- **System**: (7182) (10.47%)
- **GSM**: (7182) (10.47%)
- **WCDMA**: (50238) (73.26%)
- **LTE**: (11152) (16.26%)

VIL (Vodafone) 3G

- **System**: (7010) (10.69%)
- **GSM**: (7010) (10.69%)
- **WCDMA**: (54683) (78.71%)
- **LTE**: (7785) (11.2%)