

## Objective Assessment of Quality of Services for (QoS) for Cellular Mobile (Wireless) Service Providers – Kolkata Circle

Report: April–May - June - 2011



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## Preface

TRAI, the regulatory watch dog for the Quality of Service for the telecom services – Basic (Wireline), Cellular Mobile (Wireless) and Broadband has commissioned this study with the objective of measuring Quality of Services under the parameters as per the published notifications.

The Audit module would assess the Quality of Service of telecom operators Basic (Wireline), Cellular Mobile (Wireless) and Broadband services) by auditing the service level records maintained by the operators, conducting drive tests as well as live measurements and comparing them with quality of service benchmarks stipulated by TRAI.

The Audit module for various circles within the Zones, due the sheer scale of data collection, have been distributed across various quarterly periods. IMRB International Auditors carried out Audits across Orissa, Bihar & Jharkhand, West Bengal, North-East, Assam and Kolkata circles in the second quarter of 2010. **This report details the performance of various service providers in Kolkata circle against Quality of Services benchmarks for various parameters laid down by TRAI in respective regulations for Cellular (Mobile) services.**

## Table of contents

	<u>Page no.</u>
<b>1.0 Background.....</b>	<b>4</b>
<b>2.0 Objectives and Methodology .....</b>	<b>5</b>
<b>3.0 Sampling methodology .....</b>	<b>6</b>
<b>3.0 Sampling methodology .....</b>	<b>6</b>
<b>4.0 Audit methodology .....</b>	<b>7</b>
<b>4.1 Cellular Mobile Services .....</b>	<b>7</b>
<b>5.0 Executive Summary.....</b>	<b>8</b>
<b>5.1 Service provider performance report based on one month data verification: Cellular Mobile Services .....</b>	<b>9</b>
<b>6.0 Detailed findings – Includes comparison between Live calling/Live measurements and One month data collection .....</b>	<b>14</b>
<b>6.1 Graphical/Tabular Representations for Cellular Mobile Services .....</b>	<b>14</b>
<b>7.0 Compliance reports: Results of Verification of PMR.....</b>	<b>24</b>
<b>7.1 Cellular Mobile services.....</b>	<b>24</b>
<b>8.0 Conclusions .....</b>	<b>27</b>
<b>9.0 Annexure - I.....</b>	<b>28</b>
<b>9.1 Service provider performance report based on one month data .....</b>	<b>28</b>
<b>9.2 Monthly Point of Interconnection (POI) Congestion Report .....</b>	<b>28</b>
<b>9.3 Parameter wise performance reports for Cellular Mobile services .....</b>	<b>29</b>

## **1.0 Background**

The Telecom Regulatory Authority of India (TRAI) has a critical mandate to protect the interest of telecom consumers in addition to various other functions bestowed upon it. As part of the license conditions to telecom operators, it has the power and authority to measure the Quality of Service provided by various govt. (BSNL & MTNL) and private telecom operators. The parameters that need to be measured for Basic (Wireline) and Cellular Mobile (Wireless) services have been specified in the TRAI notification on Quality of Services of Basic (Wireline) and Cellular Mobile (Wireless) services dated 20<sup>th</sup> March, 2009. The parameters for Broadband Service have been specified in the TRAI notification for Quality of Services of Broadband Service Regulation, 2006

IMRB has been carrying out this exercise for TRAI since December 2007 to assess the quality of services being provided by Basic (Wireline), Cellular Mobile (Wireless) and Broadband service providers.

**Audit module:** To assess the quality of service of telecom operators Basic (Wireline), Cellular Mobile (Wireless) and Broadband services by auditing the service level records maintained by the operators, conducting drive tests as well as live measurements and comparing them with quality of service benchmarks stipulated by TRAI

This report highlights the findings for the Audit module for Kolkata circle that was covered in period of April-June 2011. The verification of records maintained by various operators of Cellular Mobile (Wireless) service was undertaken by the auditors of IMRB International during the period Oct-Dec 2010.



***This report highlights the Audit Module findings for Kolkata circle for Cellular Mobile services***

## **2.0 Objectives and Methodology**

The primary objective of the Audit module is to Audit and Assess the Quality of Services being rendered by Basic (Wireline), Cellular Mobile (Wireless), and Broadband service against the parameters notified by TRAI. (The parameters of Quality of Services (QoS) have been specified by in the respective regulations published by TRAI). Following are the key activities undertaken by Auditors during the Audit process conducted at the operator's premises



***All Network related and Non network related parameters notified by TRAI in various regulations were Audited***

- 1. Verification of the data submitted by service providers:** This involved verification of the quarterly Performance Monitoring Reports (PMR's) and monthly Point of Interconnect (POI) Congestion reports being submitted by various service providers. The raw data in the records maintained by service providers was audited to assess the book keeping methodology.
- 2. Live measurement for three days:** Network performance of service providers was assessed for three days in the month in which the Audit was carried out. Live figures from the server/ NMS software were recorded for various network related parameters.
- 3. Data verification for the month in which Audits were carried out:** Subsequent to the visits for Audit during the live measurement at various Exchanges/ISP Nodes/Exchanges, data for all the network and Non network related parameters was collected from various service providers for the complete month in which the Audit was carried out. Raw data/records pertaining to these were also verified on sample basis to check the veracity of data provided by the operators.
- 4. Drive tests:** Operator assisted were conducted in three cities as per the norms stated in the tender.
- 5. Live calling:** Live testing was done on a sample basis to check efficiency of various parameters

- Any changes or discrepancies found in the methodology were reported to the service providers and changes were suggested by IMRB Auditors.
- PMR verification was done as per the new parameters being reported to TRAI by all operators.
- Live measurement and 1 month data collection was done as per the new regulations published by TRAI on 20th March, 2009.
- Separate formats were designed each for Basic (Wireline), Cellular mobile (Wireless) and Broadband services to collect the information on various parameters

### **3.0 Sampling methodology**

#### **3.1 Sampling for Cellular Mobile (Wireless) service providers**

Data pertaining to 100% of the Gateway MSC's (GMSC's) and Mobile Switching Centers (MSC's) of all the Cellular Mobile Service Providers or Unified Access Service Providers (UASP) was collected and verified in specified circles/service areas. Following are the various operators covered in Kolkata circle

	<b>Name of Operator</b>	<b>Month of Audit</b>
Operator 1	BSNL	April, 2011
Operator 2	Tata Indicom	April, 2011
Operator 3	Reliance GSM	April, 2011
Operator 4	Uninor	April, 2011
Operator 5	Vodafone	April, 2011
Operator 6	Aircel	April, 2011
Operator 7	Idea	April, 2011
Operator 8	Tata Docomo	April, 2011
Operator 9	Airtel	April, 2011
Operator 10	MTS	April, 2011
Operator 11	Reliance CDMA	April, 2011

## 4.0 Audit methodology

### 4.1 Cellular Mobile Services

In a nutshell the following activities were done while auditing for various parameters for Cellular Mobile Services:

S.no	Parameter	AS REPORTED IN PMR	AS FOUND IN ACTUAL RECORDS AFTER VERIFICATION	AS FOUND IN VERIFICATION FOR THE MONTH OF AUDIT	AS FOUND IN 3 DAY LIVE MEASUREMENT DATA	LIVE CALLING	OPERATOR ASSISTED DRIVE TESTS	INDEPENDENT DRIVE TESTS
<b>A</b>	<b>Network Performance</b>							
<b>A (i)</b>	BTS accumulated down time	Yes	Yes	Yes				
<b>A (ii)</b>	Call setup success rate (within licensee own network)	Yes	Yes	Yes	Yes		Yes	Yes
<b>A (iii)</b>	Blocked Call Rate	Yes	Yes	Yes	Yes		Yes	Yes
<b>A (iv)</b>	Call Drop rate	Yes	Yes	Yes	Yes		Yes	Yes
<b>A (v)</b>	% Connections with good voice quality	Yes	Yes	Yes			Yes	Yes
<b>A (vi)</b>	Service Coverage	Yes	Yes	Yes			Yes	Yes
<b>A (vii)</b>	PoI Congestion	Yes	Yes	Yes				
<b>B</b>	<b>Customer Helpline</b>							
<b>B (i)</b>	Response time to the customer for assistance	Yes	Yes	Yes		Yes		
<b>C</b>	<b>Billing Complaints</b>							
<b>C (i)</b>	Billing complaints per 100 bills issued	Yes	Yes	Yes				
<b>C (ii)</b>	%age of billing complaints resolved within 4 weeks	Yes	Yes	Yes		Yes		
<b>C (iii)</b>	Period of all refunds/payments due to customers from date of resolution as in (ii) above	Yes	Yes	Yes		Yes		

## **5.0 Executive Summary**

The objective assessment of Quality of Services (QoS) was carried out by IMRB International for all the Cellular mobile service providers during the period starting from April 2011 to June 2011 in Kolkata circle. The executive summary encapsulates the key findings of the Audit by providing: -

- “Service provider performance report” for Cellular mobile service , which gives a glimpse of the performance of various operators against the benchmark specified by TRAI, during the month in which the Audit was carried out by IMRB Auditors
- “Parameter wise critical findings” for Cellular mobile services: This indicates key observations and findings from different activities carried out during the Audit process



### 5.1 Service provider performance report based on one month data verification: Cellular Mobile Services

Name of Service Provider	Time Consistent Busy Hour (TCBH)	Network Availability					Connection Establishment (Accessibility)			Connection Maintenance (Retainability)				POI		Network Traffic Capacity and Utilization			
		Total no. of BTSs in the licensed service area	Sum of downtime of BTSs in a month in hours i.e. total outage time of all BTSs in hours during a month	BTSs Accumulated downtime (not available for service) (%age)	No. of BTSs having accumulated downtime of >24 hours in a month	Worst affected BTSs due to downtime (%age)	Call Set-up Success Rate (within licensee's own network)	SDCCH/Paging Chl. Congestion (%age)	TCH Congestion (%age)	Call Drop Rate (%age)	Total No. of cells exceeding 3% TCH drop (call drop)	Total no. of cells in the network	Worst affected cells having more than 3% TCH drop (call drop) rate (%age)	%age of connection with good voice quality	POI Congestion (No. of POIs not meeting the benchmark) Note :2)	Total number of working POI Service Area wise	Equipped Capacity of Network in respect of Traffic in erlang	Total traffic handled in TCBH in erlang	Total no. of customers served (as per VLR) on last day of the month
Benchmark				≤ 2%		≤ 2%	≥ 95%	≤ 1%	≤ 2%	≤ 2%			≤ 5%	≥ 95%	≤ 0.5%				
BSNL	19:00 - 20:00	1243	8356	0.90%	64	5.15%	99.32%	0.03%	0.01%	0.70%	144	3285	4.38%	99.76%	1	120	6834	5401	785168
Tata Indicom	19:00 - 20:00	560	140	0.03%	0	0.00%	98.91%	0.00%	0.00%	0.83%	1205	55877	2.16%	97.25%	0	74	76365	36287	728316
Reliance GSM	19:00 - 20:00	1491	0	0.00%	0	0.00%	99.52%	0.50%	0.01%	0.33%	1	4473	0.02%	98.16%	0	8	44000	40653	1833005
Uninor	19:00 - 20:00	1028	399	0.05%	0	0.00%	99.10%	0.11%	0.90%	0.81%	54	3077	1.75%	96.34%	0	67	30480	21605	559686
Vodafone	19:00 - 20:00	2356	638	0.04%	2	0.08%	99.70%	0.09%	0.30%	0.65%	37	5857	0.63%	98.63%	0	41	129795	2556561	3421179
Aircel	19:00 - 20:00	2070	427	0.03%	0	0.00%	97.63%	0.31%	0.08%	0.55%	98	5869	1.67%	97.85%	0	39	83819	29692	816545
Idea	20:00 - 21:00	1584	358	0.03%	2	0.13%	97.22%	0.16%	0.42%	0.49%	2490	135508	1.84%	98.96%	0	53	31230	13633	527572
Tata Docomo	20:00 - 21:00	1432	178	0.02%	0	0.00%	99.32%	0.09%	0.09%	0.51%	1615	124752	1.29%	98.72%	0	39	55153	22437	987984
Airtel	19:00 - 20:00	1998	472	0.03%	0	0.00%	99.43%	0.06%	0.06%	0.69%	7	5464	0.13%	98.40%	0	69	116636	70878	2953772
MTS	19:00 - 20:00	449	289	0.09%	0	0.00%	98.78%	0.00%	0.46%	0.86%	26	1383	1.88%	97.11%	0	40	50400	11977	35748
Reliance CDMA	20:00 - 21:00	469	207	0.06%	0	0.00%	99.78%	0.00%	0.05%	0.21%	1	469	0.21%	99.88%	0	9	84000	45988	1287087

\*Details pertaining to these are obtained through operator done drive tests. Results of the operator assisted drive tests are explained in detail in critical findings

\*\* Methodology not in line with QoS

Figures provided on All India basis
  Not meeting the benchmark

B'mark = TRAI Benchmark, DNA = Details not available, NA: Not Applicable

### Critical findings: Cellular Mobile Services

The audit for cellular mobile service providers were conducted at their respective MSCs in the Kolkata circle apart from Reliance Communication whose audit was conducted at their central NOC at Mumbai.

The audit involved a three stage verification process which consisted of auditing the records of the service providers and verifying the data submitted to TRAI. The second step involved a three day live measurement of all the network parameters. Finally basis the three day live measurement the auditors needed to find out the busy hour for the service provider and collect the hourly data for this busy hour for the month in which the audit was conducted.

#### Busy Hour of Various Service Providers

Service Provider	Reported Time Consistent Busy Hour	Network Busy Hour found in 3 day live measurement
BSNL	19:00 - 20:00	21:00-22:00
Tata Indicom	19:00 - 20:00	20:00-21:00
Reliance GSM	19:00 - 20:00	19:00-20:00
Uninor	19:00 - 20:00	20:00-21:00
Vodafone	19:00 - 20:00	21:00-22:00
Aircel	19:00 - 20:00	21:00-22:00
Idea	20:00 - 21:00	20:00-21:00
Tata Docomo	20:00 - 21:00	21:00-22:00
Airtel	19:00 - 20:00	21:00-22:00
MTS	19:00 - 20:00	20:00-21:00
Reliance CDMA	20:00 - 21:00	19:00-20:00

The TCBH reported by only Reliance GSM and Idea matched the network busy hour calculated by IMRB auditors for the Kolkata circle.

#### BTSs Accumulated Downtime:

In the Kolkata circle, BSNL experienced the highest outage (64 BTS had more than 24 hours of accumulated downtime) hours in the month of audit.

#### Call Set-up Success Rate (CSSR):

All the operators were comfortably meeting the benchmark on this parameter. During the audits the maximum CSSR was observed for Reliance CDMA with 99.78% of their calls getting completed. All the operators were found to be calculating the parameter as per the norm specified by TRAI. CSSR was established as the ratio of total number of successful call attempts (establishment) to the total number of call attempts made.

#### Network Congestion parameters:

SDCCH / Paging Channel Congestion, TCH and POI are part of the network congestion parameters. All the operators are meeting the TRAI specified benchmarks on the congestion parameters. TATA Indicom and MTS lead the way in network congestion parameters with almost negligible paging as well as traffic channel congestion. The calculation methodology of these parameters was found to be in complete accordance with what has been specified by TRAI. Both RCOM CDMA and Tata Teleservices measure paging channel utilization. When the value of this parameter is less than 100%, it is counted as 0% congestion. There were almost no POIs with congestion more than the benchmark ( $\leq 0.5\%$ ) except for 1 POI for BSNL and 2 for Uninor.

#### Call Drop Rate:

During the audit it was found that all the service providers were measuring this parameter as per the TRAI guidelines. The call drop rate was measured as the ratio of total calls dropped to the total number of call attempts for all operators. Also, all of

service providers were found to be meeting the TRAI specified benchmark. The lowest call drop rate was of RCOM at 0.21% while the highest was for MTS at 0.86%.

#### Connections with good voice quality:

All the operators are measuring this parameter via their periodic drive tests. However, for some operators these parameters can be obtained at their switch as well. During the audit it was found that all the service providers were measuring this parameter as per the TRAI guidelines.

#### Customer Care / Helpline Assessment

For the percentage of calls answered by operators aspect all the service providers meet the TRAI benchmark except for Airtel, Aircel and Tata Docomo with Tata Docomo being the lowest at 83.50%. Airtel was also not meeting TRAI benchmark for the accessibility parameter.

#### Billing performance

With the exception of BSNL and Idea, all the operators were found to be meeting the benchmark of  $\leq 0.1\%$  complaints registered per 100 bills issued. The benchmark of 100% billing complaints being resolved within 4 weeks was not met by BSNL as they had only resolved 20.59% of all the complaints. In all cases where customers were due for refund, all the service providers meet the TRAI benchmark of 100% with 1 week.

#### Inter operator calls assessment

Inter operator call Assessment ↓ To.                      From →	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
BSNL	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Tata Indicom	100%	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%
Reliance GSM	100%	100%	NA	100%	100%	100%	100%	100%	100%	100%	100%
Uninor	100%	100%	100%	NA	100%	100%	100%	100%	100%	100%	100%
Vodafone	100%	100%	100%	100%	NA	100%	100%	100%	100%	100%	100%
Aircel	100%	100%	100%	100%	100%	NA	100%	100%	100%	100%	100%
Idea	100%	100%	100%	100%	100%	100%	NA	100%	100%	100%	100%
Tata Docomo	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%	100%
Airtel	100%	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%
MTS	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	100%
Reliance CDMA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA



The problems faced by the calling operator to other operators

In the inter-operator call assessment, calls were made from the test SIMs of service provider whose audit was being conducted to all the other service providers. There were no issues observed during the inter-operator calling process.

**Results of Operator assisted Drive test**

The drive test was conducted simultaneously for all the operators present in the Kolkata circle. There was in total of three drive tests conducted in the circle. These tests were conducted in the city of Kolkata. IMRB auditors were present in vehicles of every operator. A sample of 15 – 30 test calls were made along each of the routes. The holding period for all test calls was between 120 seconds to 180 seconds. The drive test vehicle across all routes plied at a speed of less than 20 km per hour. Taking into consideration the route that was taken for the drive test; most of the major areas Kolkata telecom circles were covered.

For measuring voice quality RxQual samples for GSM operators and Frame Error Rate (FERs) for CDMA service providers were measured. RxQual greater than 5 meant that the sample was not of appropriate voice quality and for CDMA operators FERs of more than 4 were considered bad. Call drops were measured by the number of calls that were dropped to the total number of calls established during the drive test. Similarly CSSR was measured as the ratio of total calls established to the total call attempts made. Signal strength was measured in Dbm with strength > -75dbm for indoor, -85 dms for in-vehicle and > -95 dbm outdoor routes. The drive tests in the Kolkata circle was conducted along the following route:

	Type of location	Kolkata
Outdoor	Periphery of the city	2nd Hooghly Bridge Toll Tax NH2 NH6 Bally-Dakshinswar Belghoria Eway Dunlop
	Congested area	Park St- Mullick Bazar-Sealdah MG Road-Brabourn Road-Dalhousie Red Road-Park St.
	Across the city	Meherali Road-AJC Flyover-2nd Hooghly Bridge Toll Tax Dunlop-Shyambazar-Cr Avenue Park St.
Indoor	Office complex	Stephen House, Dalhousie
	Shopping complex	Pantaloons, 22 Camac St.

The tables given below gives a glimpse of the results of the operator assisted drive test:

**Drive Test – Kolkata**

	B'mark	BSNL		Tata Indicom		Reliance GSM		Uninor		Vodafone		Aircel		Idea		Tata Docomo		Airtel		MTS		Reliance CDMA	
		In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	≥ 95%	100.00%	99.93%	94.77%	95.52%	99.50%	96.71%	99.01%	95.44%	99.52%	96.43%	99.18%	91.21%	97.44%	96.55%	99.42%	95.60%	99.56%	96.19%	78.13%	67.23%	98.71%	87.52%
CSSR	≥ 95%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	98.67%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	99.23%	100.00%	100.00%
%age Blocked calls		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Call drop rate	≤ 2%	0.00%	0.00%	0.00%	1.86%	0.00%	0.00%	0.00%	0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.67%
Hands off success rate		100.00%	100.00%	100.00%	100.00%	0.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	97.86%	100.00%	100.00%	100.00%	100.00%

 Not meeting the benchmark

Following were the areas where the signal strength was found to be inadequate for the operators:

### ALL SERVICE PROVIDERS

**Kolkata:** There was interference and low signal strength recorded for all operators in the outdoor areas near Second Hooghly bridge, Bally bridge, ISI while in the indoor areas inadequate coverage was found in the Pantaloons shopping complex.


### Conclusions:

Drive test was conducted by IMRB with the help of service providers to measure this parameter. In the drive test it was found that all the operators meet the TRAI benchmark on voice quality.

1. Tata Indicom, Aircel, Reliance CDMA do not meet the TRAI benchmark for Indoor areas for the city of Kolkata whereas MTS does not meet the TRAI benchmark for voice quality in all the indoor and outdoor areas for the city of Kolkata
2. All the operators meet the TRAI benchmark for CSSR and call drop rate

### Summary of Live Measurement Results – Cellular Mobile Services

Name of Service Provider	Connection Establishment (Accessibility)			Connection Maintenance (Retainability)			Metering and Billing	Response time to customer for assistance	
	Call Set-up Success Rate (within licensee's own network)	SDCCH/Paging Chl. Congestion (%)	TCH Congestion (%)	Call Drop Rate (%)	Worst affected cells having more than 3% TCH drop	%age of connection with good voice quality	%age complaints resolved within 4 weeks	Accessibility of call centre/customer care	Percentage of calls answered by the operators (voice to voice) within 60 seconds
<b>Benchmark</b>	≥ 95%	≤ 1%	≤ 2%	≤ 2%	≤ 5%	≥ 95%	100%	≥ 95%	≥ 90%
BSNL	98.29%	0.00%	0.00%	4.38%	2.13%	99.95%	86.00%	100.00%	81.00%
Tata Indicom	99.95%	0.00%	0.00%	2.16%	3.58%	95.31%	100.00%	97.86%	98.83%
Reliance GSM	98.80%	0.00%	0.06%	0.02%	0.02%	97.02%	100.00%	100.00%	100.00%
Uninor	98.20%	0.14%	0.11%	1.75%	3.32%	96.35%	92.31%	100.00%	100.00%
Vodafone	99.79%	0.16%	0.21%	0.63%	1.30%	97.40%	94.00%	100.00%	93.00%
Aircel	98.27%	0.08%	0.01%	1.67%	0.60%	93.87%	100.00%	100.00%	100.00%
Idea	96.80%	0.16%	0.12%	1.84%	1.67%	96.64%	94.12%	100.00%	100.00%
Tata Docomo	99.36%	0.09%	0.09%	1.29%	1.41%	96.63%	98.00%	73.00%	27.00%
Airtel	99.41%	0.03%	0.01%	0.13%	0.15%	97.18%	100.00%	100.00%	87.00%
MTS	98.28%	0.00%	0.09%	1.88%	1.23%	70.03%	100.00%	100.00%	100.00%
Reliance CDMA	99.64%	0.00%	0.32%	0.21%	1.49%	88.62%	100.00%	100.00%	100.00%

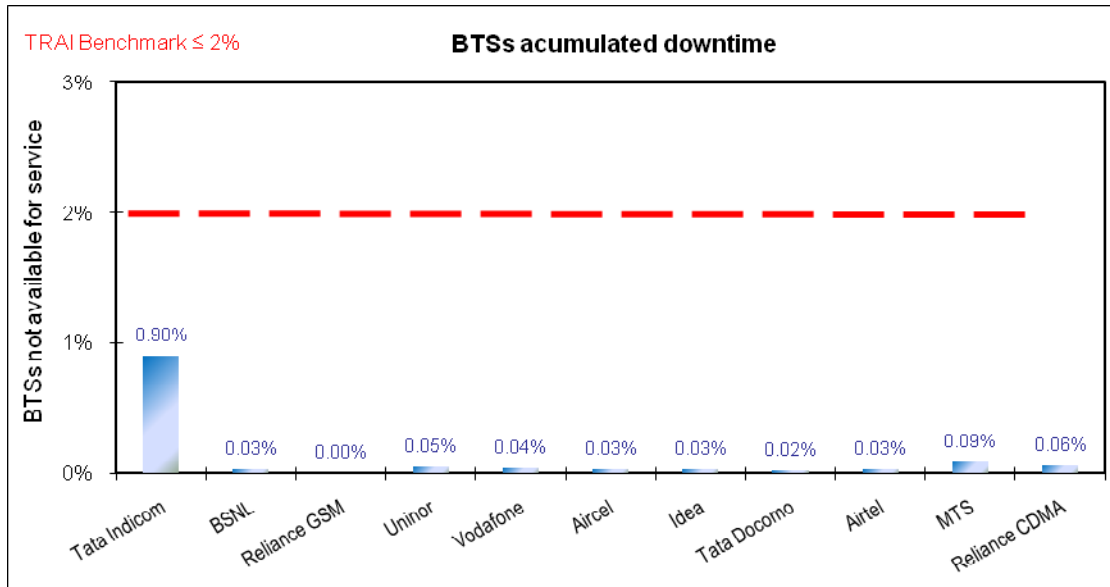
 Not meeting the benchmark

During the three day live measurement, all operators except BSNL and Tata Indicom were found to be meeting the TRAI benchmark on call drop rate. Also Tata Docomo was found to be measuring poorly on all parameters related to the customer care parameters with an especially poor performance for call centre answered by voice operators. Reliance CDMA, Aircel and MTS were found to be not meeting the TRAI benchmark for voice quality with MTS having lowest voice quality at 70%.

## 6.0 Detailed findings – Includes comparison between Live calling/Live measurements and One month data collection

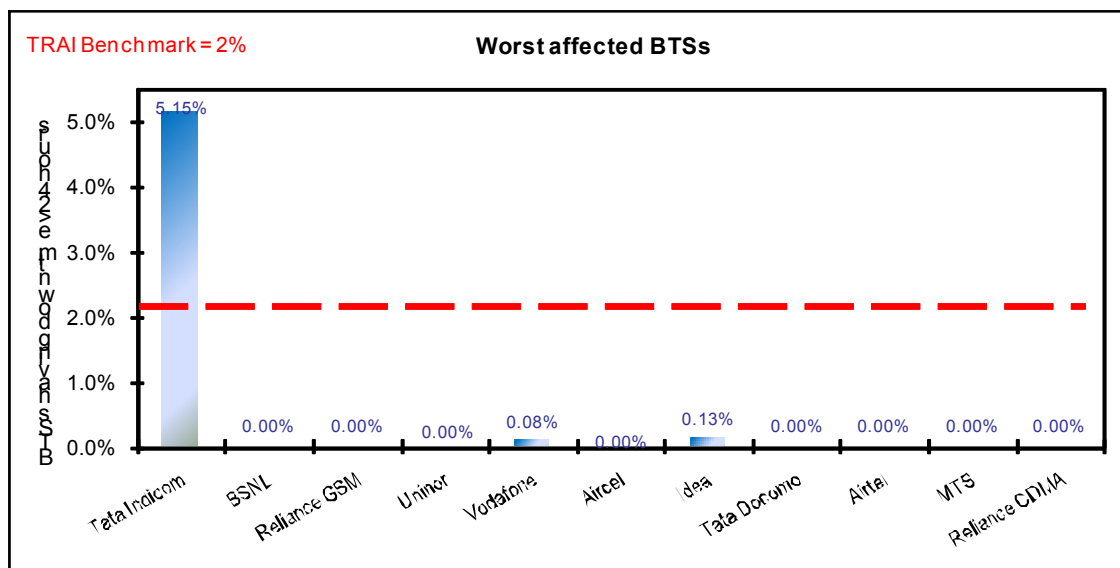
### 6.1 Graphical/Tabular Representations for Cellular Mobile Services

#### BTSs Accumulated Downtime



All the operators meet the benchmark

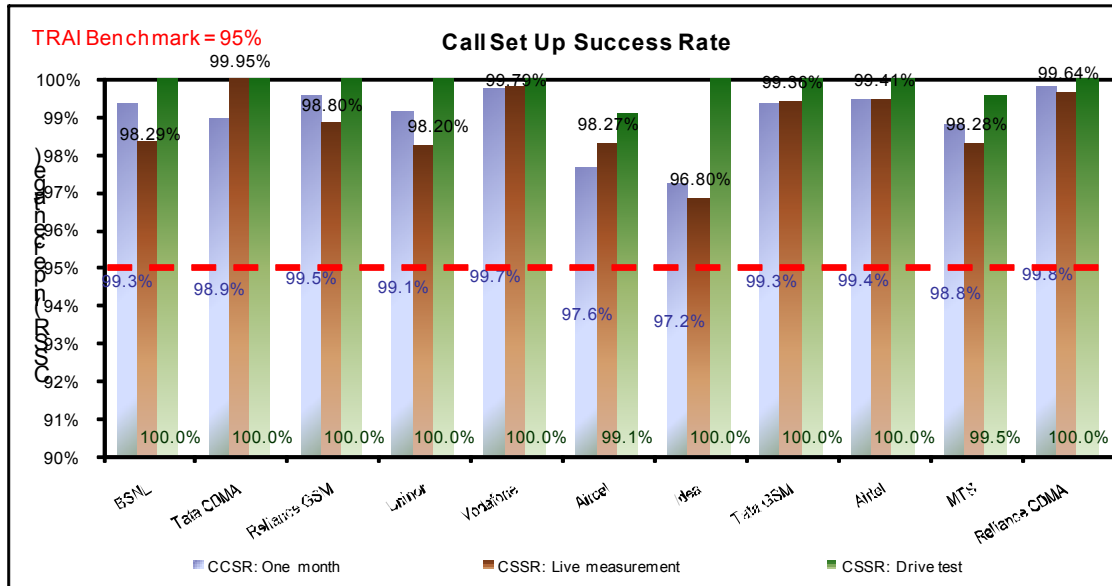
#### Worst Affected BTSs



Operator(s) meeting benchmark: BSNL, Reliance GSM, Uninor, Vodafone, Aircel, Idea, Tata Docomo, Airtel, MTS, Reliance CDMA

Operator(s) not meeting the benchmark: Tata Indicom

**Call Set-up Success Rate (CSSR)**



**One month**

All the operators meet the benchmark

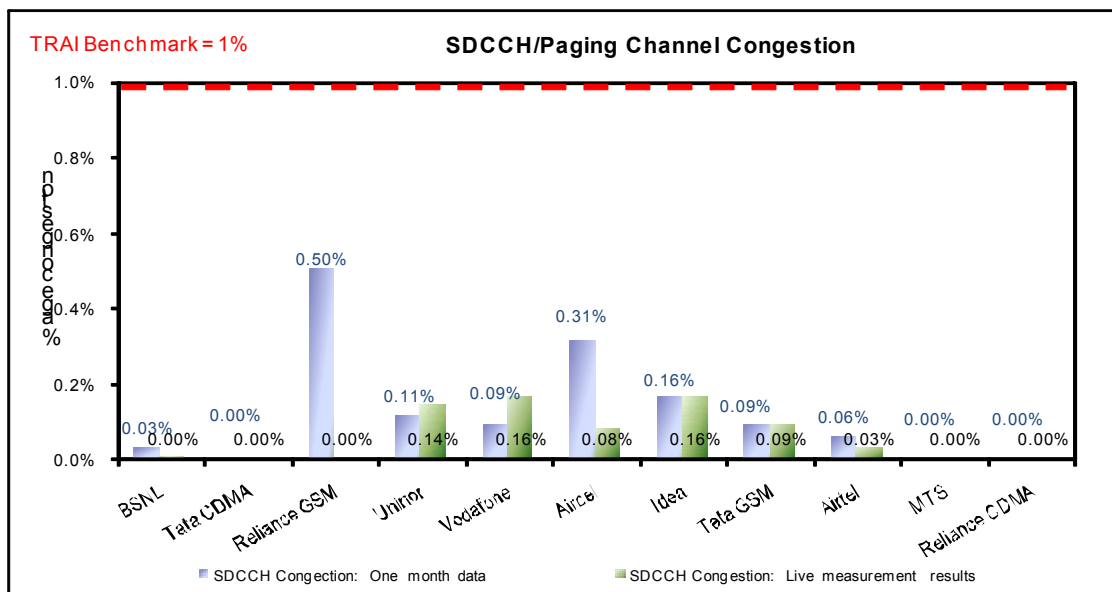
**Live measurement**

All the operators meet the benchmark

**Drive test**

All the operators meet the benchmark

**SDCCH / Paging Channel Congestion**



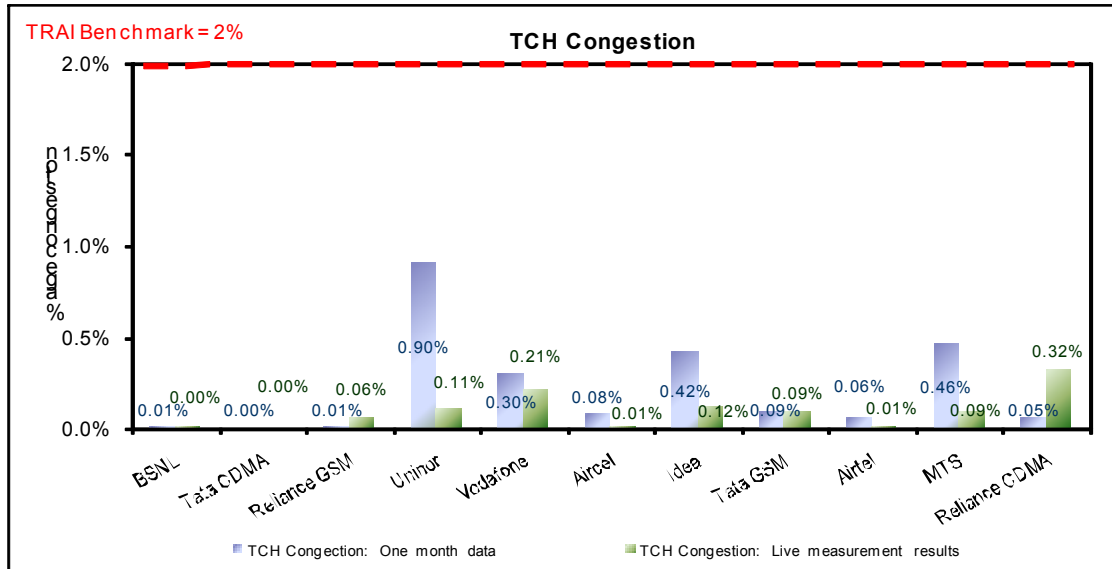
**One month**

All the operators meet the benchmark

**Live measurement**

All the operators meet the benchmark

**TCH Congestion**



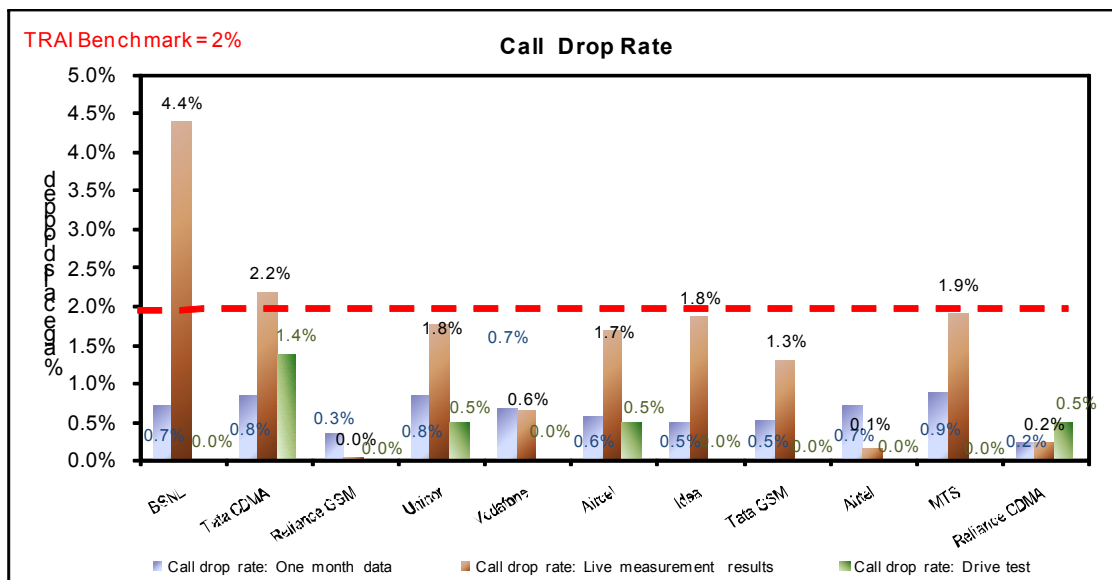
**One month**

All the operators meet the benchmark

**Live measurement**

All the operators meet the benchmark

**Call Drop Rate**





**One month**

All the operators meet the benchmark

**Live measurement**

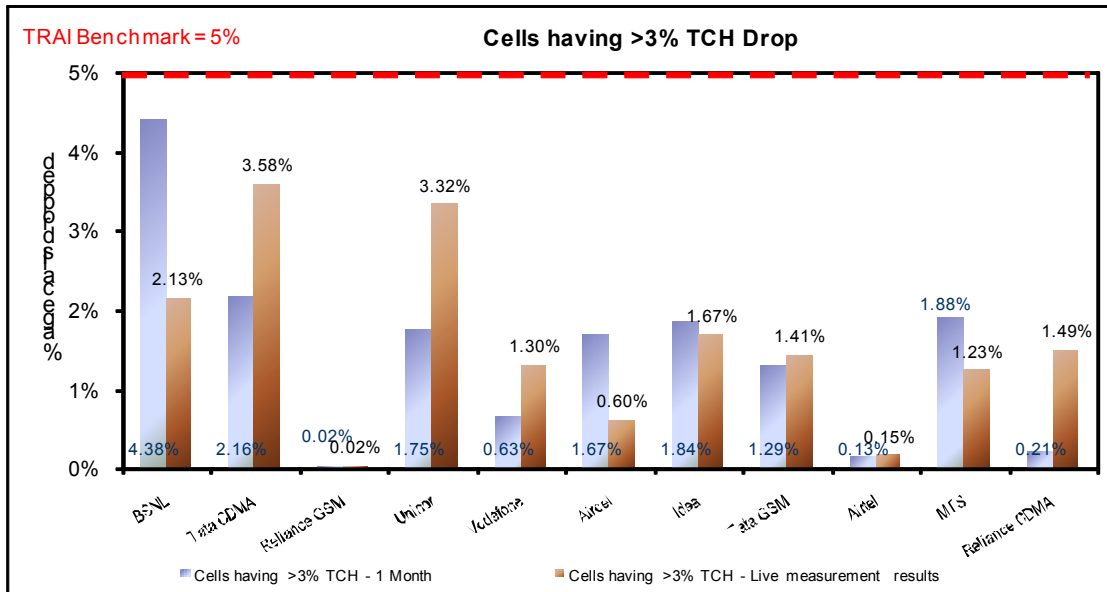
Operator(s) meeting benchmark: Reliance GSM, Uninor, Vodafone, Aircel, Idea, Tata GSM, Airtel, MTS, Reliance CDMA

Operator(s) not meeting the benchmark: BSNL, Tata CDMA

**Drive test**

All the operators meet the benchmark

**Cells with more than 3% TCH Drop Rate**



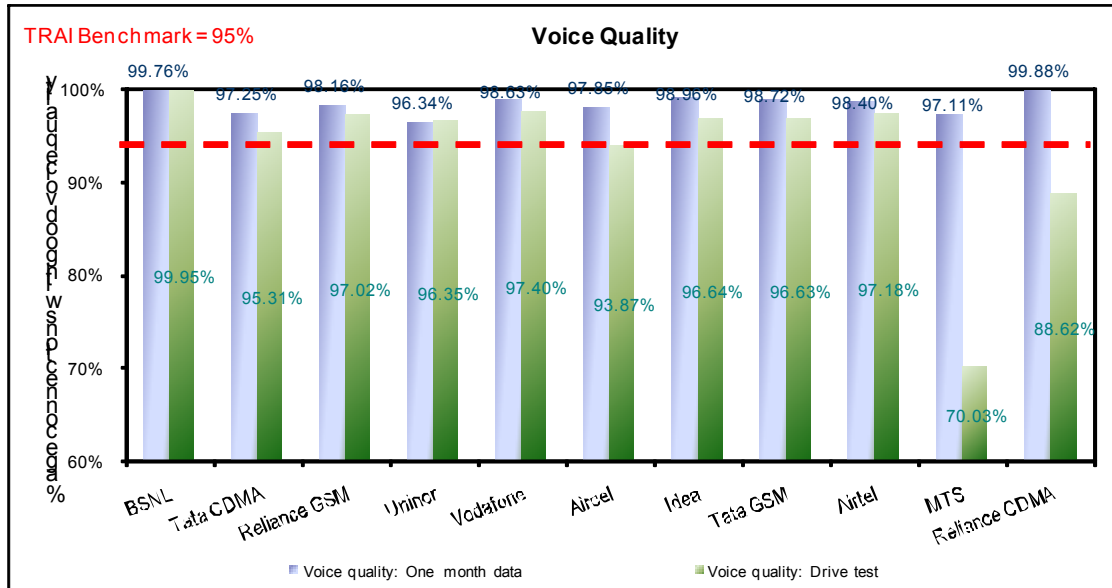
**One month**

All the operators meet the benchmark

**Live measurement**

All the operators meet the benchmark

**Voice quality**



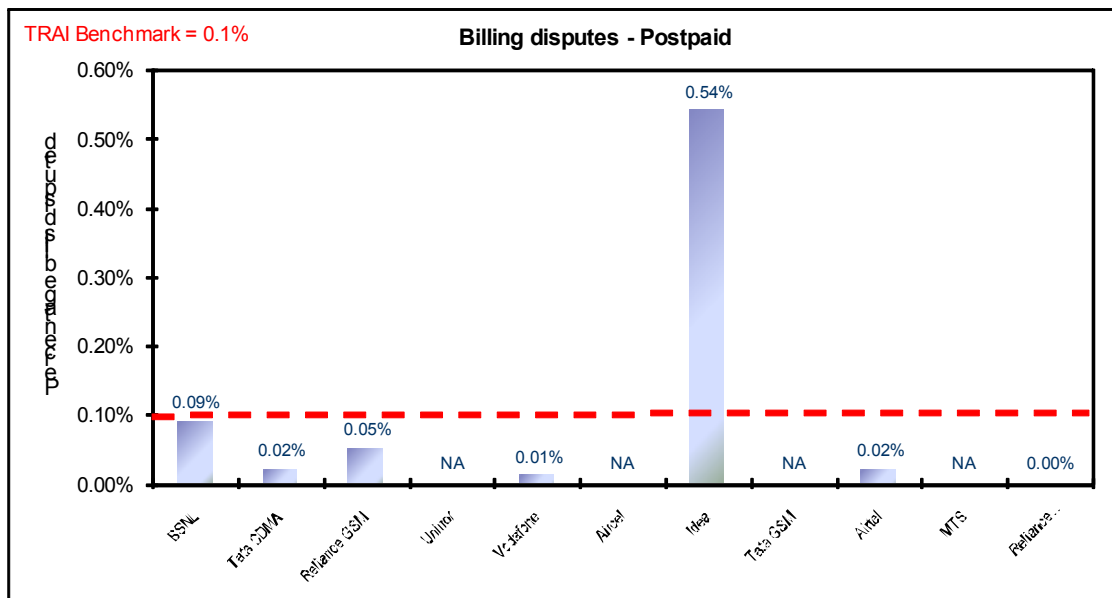
**One month**

All the operators meet the benchmark

**Live measurement (Drive test)**

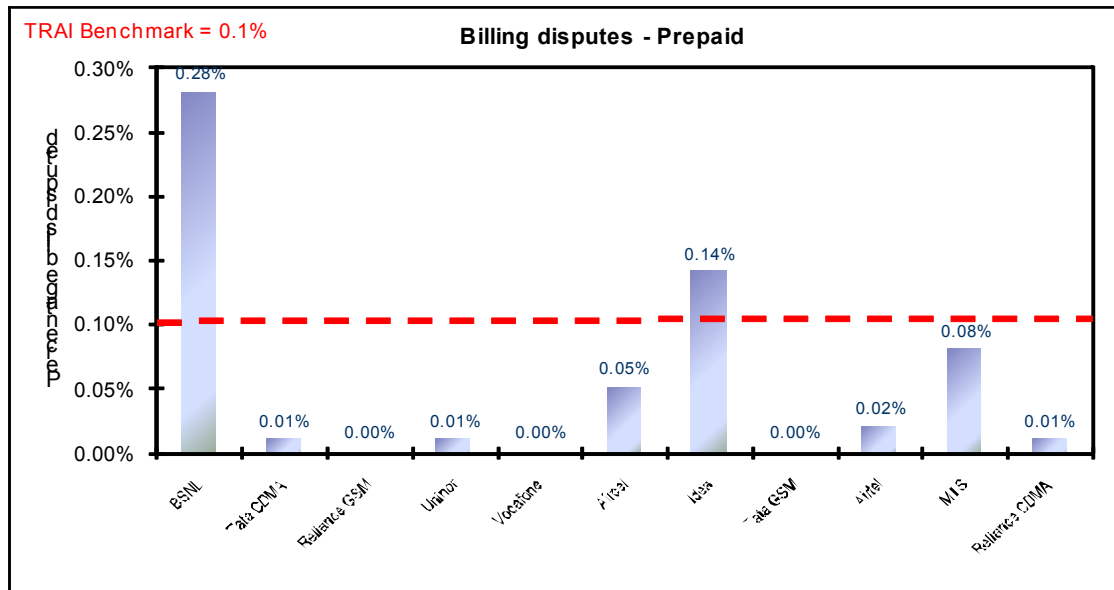
Operator(s) meeting benchmark: BSNL, Tata CDMA, Reliance GSM, Uninor, Vodafone, Idea, Tata GSM, Airtel  
 Operator(s) not meeting the benchmark: Aircel, MTS, Reliance CDMA

**Billing Disputes - Postpaid**



Operator(s) meeting benchmark: BSNL, Tata CDMA, Reliance GSM, Vodafone, Aircel, Tata GSM, Airtel, Reliance CDMA  
 Operator(s) not meeting the benchmark: Idea

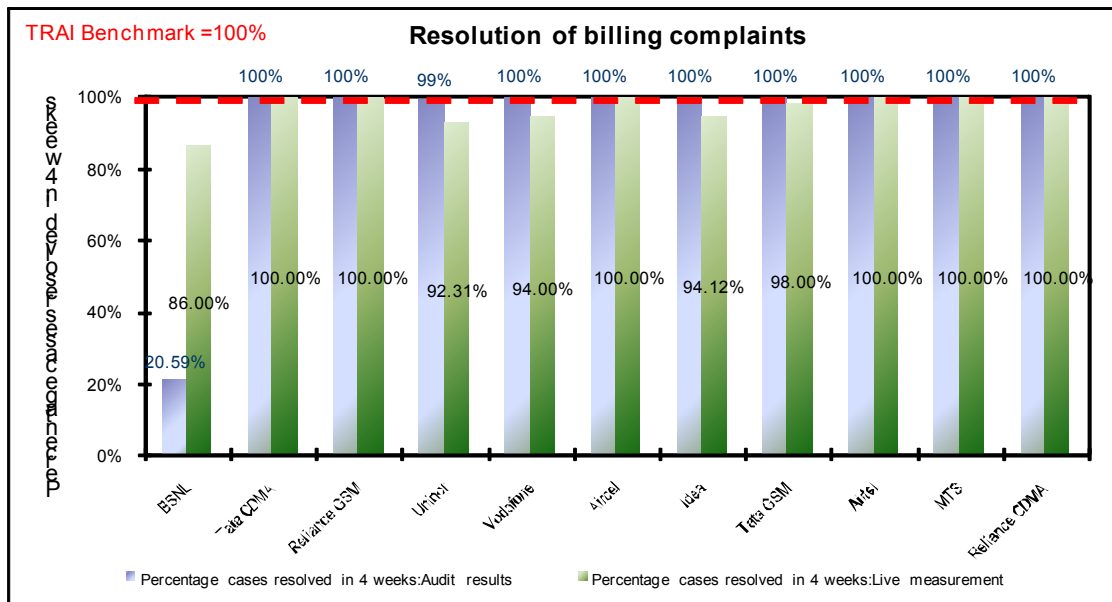
**Complaints - Prepaid**



Operator(s) meeting benchmark: Tata CDMA, Reliance GSM, Uninor, Vodafone, Aircel, Tata GSM, Airtel, MTS, Reliance CDMA

Operator(s) not meeting the benchmark: BSNL, Idea

**Resolution of billing complaints**



**One month**

Operator(s) meeting benchmark: Tata CDMA, Reliance GSM, Aircel, Idea, Tata GSM, Airtel, MTS, Reliance CDMA

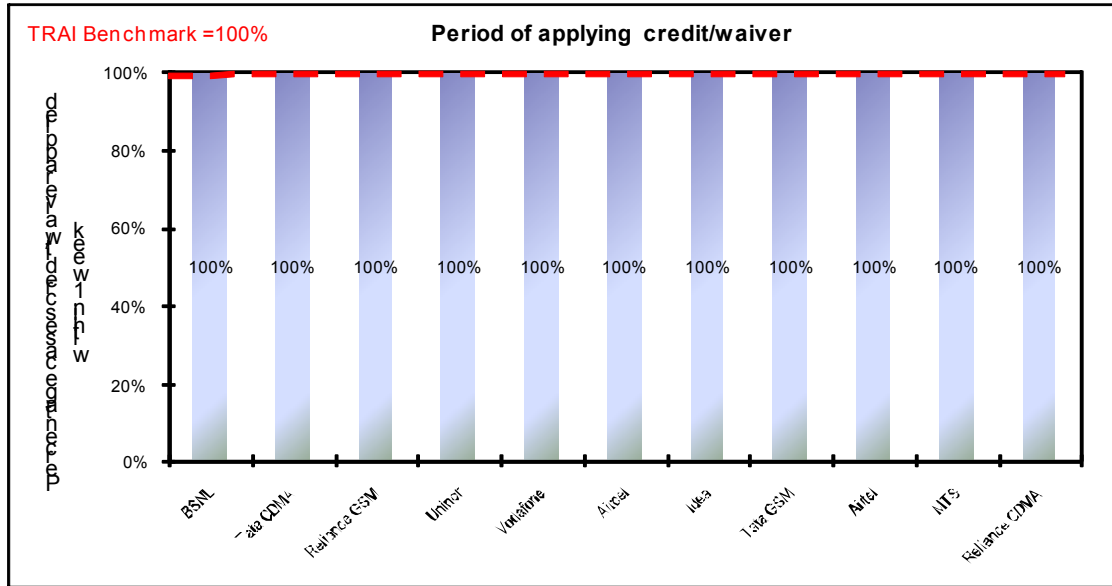
Operator(s) not meeting the benchmark: BSNL, Uninor,

**Live measurement**

Operator(s) meeting benchmark: Tata CDMA, Reliance GSM, Aircel, Airtel, MTS, Reliance CDMA

Operator(s) not meeting the benchmark: BSNL, Uninor, Vodafone, Idea, Tata GSM

**Period of applying credit / waiver**

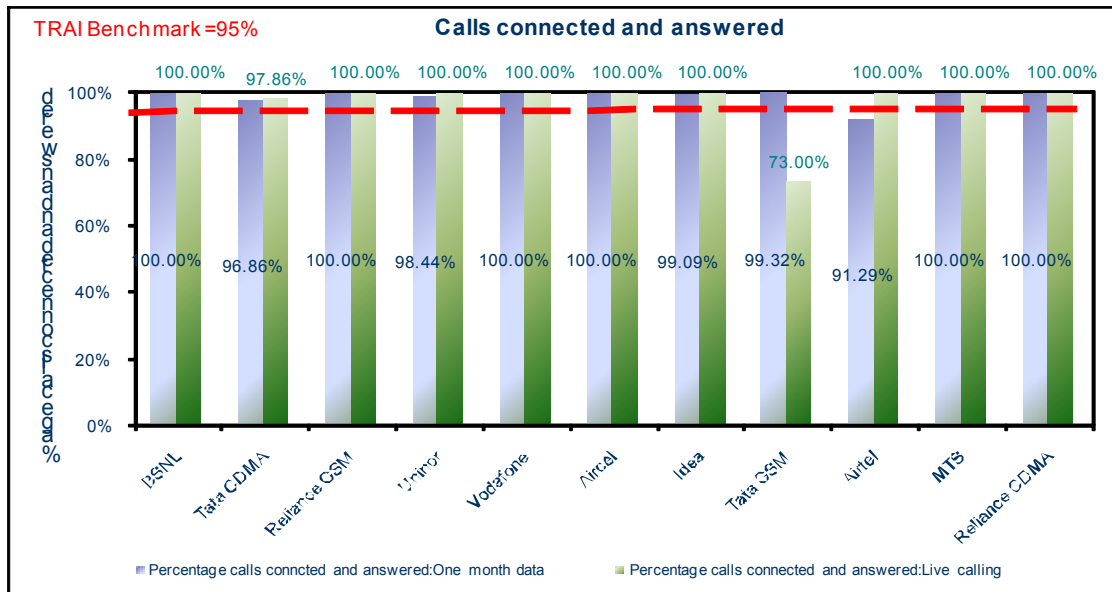


All the operators meet the benchmark

**Live calling for billing Complaints**

Resolution of billing complaints	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total Number of calls made		50	50	50	26	50	50	17	50	50	50	50
Number of cases resolved in 4 weeks		43	50	50	24	47	50	16	49	50	50	50
Percentage cases resolved in four weeks	100%	86.00%	100.00%	100.00%	92.31%	94.00%	100.00%	94.12%	98.00%	100.00%	100.00%	100.00%

**Customer Care / Helpline: Calls answered**



**One month**

Operator(s) meeting benchmark: BSNL, Tata CDMA, Reliance GSM, Uninor, Vodafone, Aircel, Idea, Tata GSM, MTS, Reliance CDMA

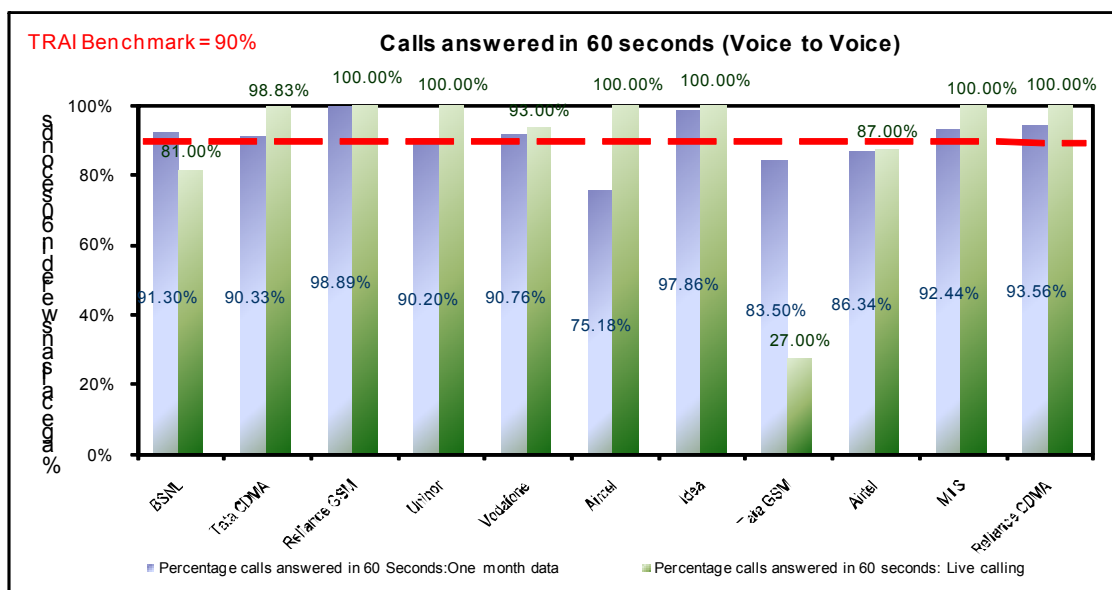
Operator(s) not meeting the benchmark: Airtel

**Live measurement**

Operator(s) meeting benchmark: BSNL, Tata CDMA, Uninor, Vodafone, Aircel, Idea, Airtel, MTS, Reliance CDMA. Reliance GSM

Operator(s) not meeting the benchmark: Tata GSM

**Customer Care / Helpline: Calls answered voice to voice**



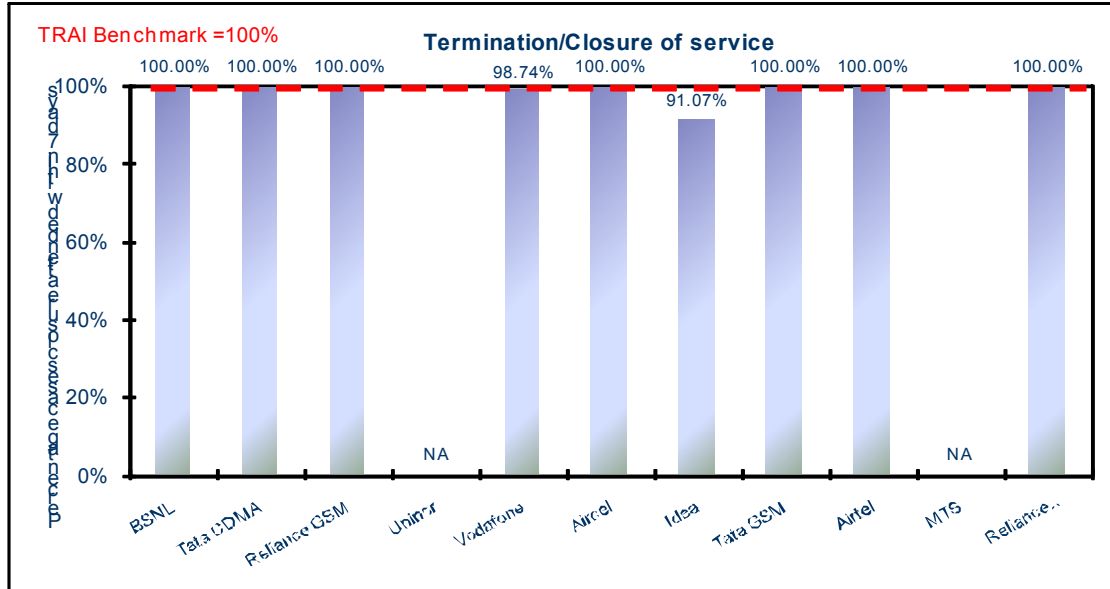
**One month**

Operator(s) meeting benchmark: BSNL, Tata CDMA, Reliance GSM, Uninor, Vodafone, Idea, MTS, Reliance CDMA  
 Operator(s) not meeting the benchmark: Aircel, Tata GSM, Airtel

**Live measurement**

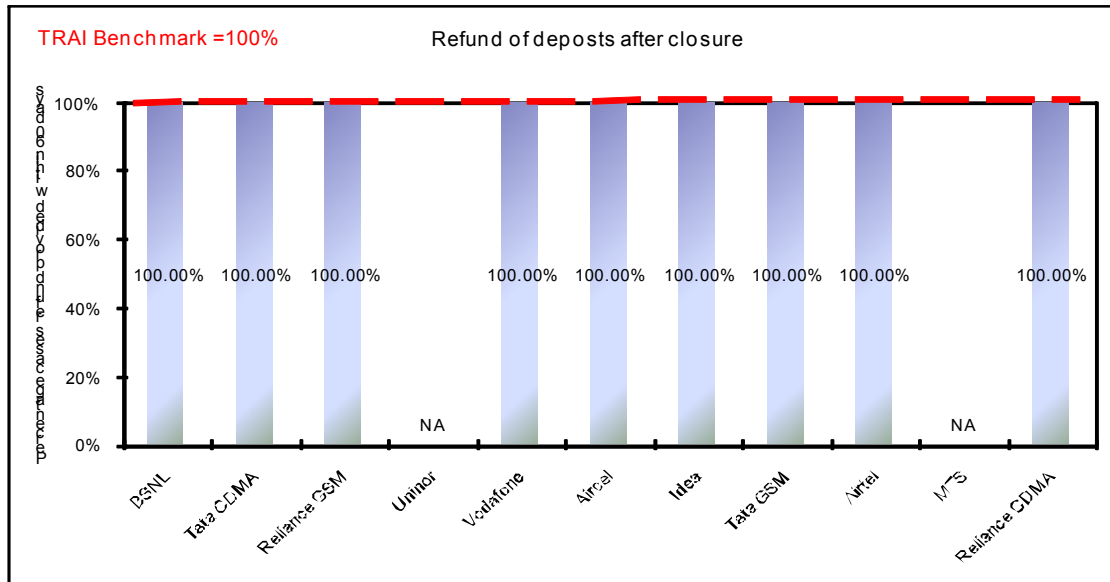
Operator(s) meeting benchmark: Tata CDMA, Uninor, Vodafone, Aircel, Idea, MTS, Reliance CDMA, Reliance GSM  
 Operator(s) not meeting the benchmark: BSNL, Tata GSM, Airtel

**Termination / Closure of service**



Operator(s) meeting benchmark: BSNL, Tata CDMA, Reliance GSM, Aircel, Tata GSM, Airtel, Reliance CDMA  
 Operator(s) not meeting the benchmark: Vodafone, Idea


**Refund of deposits**



All the operators meet the benchmark

Inter operator calls assessment

Inter operator call Assessment To. From	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
BSNL	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Tata Indicom	100%	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%
Reliance GSM	100%	100%	NA	100%	100%	100%	100%	100%	100%	100%	100%
Uninor	100%	100%	100%	NA	100%	100%	100%	100%	100%	100%	100%
Vodafone	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Aircel	100%	100%	100%	100%	NA	NA	100%	100%	100%	100%	100%
Idea	100%	100%	100%	100%	100%	100%	NA	100%	100%	100%	100%
Tata Docomo	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%	100%
Airtel	100%	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%
MTS	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	100%
Reliance CDMA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA

 The problems faced by the calling operator to other operators

In the inter-operator call assessment, calls were made from the test SIMs of service provider whose audit was being conducted to all the other service providers. There were no issues observed during the inter-operator calling process.

## 7.0 Compliance reports: Results of Verification of PMR

### 7.1 Cellular Mobile services

Name of Service Provider	Network Availability					Connection Establishment			Connection Maintenance (Retainability)				POI			
	Total no. of BTSs in the licensed service area	Sum of downtime of BTSs in a month in hours i.e. total outage time of all BTSs in hours during a month	BTSs Accumulated downtime (not available for service) (%age)	No. of BTSs having accumulated downtime of >24 hours in a month	Worst affected BTSs due to downtime (%age)	Call Set-up Success Rate (within licensee's own network)	SDCCH/Paging chl. Congestion (%age)	TCH Congestion (%age)	Call Drop Rate (%age)	Total No. of cells exceeding 3% TCH drop (call drop)	Total no. of cells in the network	Worst affected cells having more than 3% TCH drop (call drop) rate (%age)	%age connection with good voice quality	Point of interconnection (POI) Congestion	Total number of working POI Service Area wise	
<b>Benchmark</b>			≤ 2%		≤ 2%	≥ 95%	≤ 1%	≤ 2%	≤ 2%			≤ 5%	≥ 95%			
BSNL	PMR	3626	39506	0.68%	246	6.78%	98.41%	0.06%	0.01%	2.62%	458	9612	4.76%	99.78%	12	312
	IMRB	3626	39506	0.68%	246	6.78%	98.41%	0.06%	0.01%	2.62%	458	9612	4.76%	99.78%	12	312
Tata Indicom	PMR	531	233	0.01%	0	0.00%	99.68%	0.00%	0.00%	0.27%	183	156704	0.12%	99.79%	0	63
	IMRB	531	233	0.01%	0	0.00%	99.68%	0.00%	0.00%	0.27%	183	156704	0.12%	99.79%	0	63
Reliance GSM	PMR	19	1185	0.01%	46	0.00%	99.55%	0.71%	1.00%	0.73%	45	3555	1.26%	97.50%	0	8
	IMRB	1185	46	0.01%	0	0.00%	99.54%	0.63%	0.10%	0.71%	45	3555	1.26%	97.50%	0	8
Uninor	PMR	935	286	0.02%	0	0.00%	99.97%	0.03%	0.03%	0.69%	198	7613	2.60%	98.26%	0	54
	IMRB	935	286	0.02%	0	0.00%	99.97%	0.03%	0.03%	0.69%	198	7613	2.60%	98.26%	0	54
Vodafone	PMR	7014	1733	0.03%	7	0.10%	99.05%	0.09%	0.36%	0.71%	185	17458	1.06%	98.64%	0	40
	IMRB	7014	1733	0.03%	7	0.10%	99.05%	0.09%	0.36%	0.71%	185	17458	1.06%	98.64%	0	40
Aircel	PMR	6069	515	0.00%	0	0.00%	97.69%	0.06%	0.08%	0.90%	214	5735	3.68%	97.59%	0	111
	IMRB	6069	515	0.00%	0	0.00%	97.69%	0.06%	0.08%	0.90%	214	5832	3.68%	97.59%	0	111
Idea	PMR	3466	499	0.01%	5	0.14%	96.85%	0.11%	0.34%	0.57%	166	3359	4.93%	98.49%	0	131
	IMRB	3466	499	0.01%	5	0.14%	96.85%	0.11%	0.34%	0.57%	161	3245	4.93%	98.49%	0	131
Tata Docomo	PMR	4243	126	0.00%	0	0.00%	99.12%	0.06%	0.08%	0.58%	229	12366	1.85%	99.89%	0	24
	IMRB	4243	126	0.00%	0	0.00%	99.12%	0.06%	0.08%	0.58%	229	12366	1.85%	99.89%	0	24
Airtel	PMR	5889	1517	0.01%	6	0.10%	99.56%	0.04%	0.05%	0.72%	16	16097	0.10%	98.77%	0	67
	IMRB	5889	1517	0.01%	6	0.10%	99.56%	0.04%	0.05%	0.72%	16	16097	0.10%	98.77%	0	67
MTS	PMR	467	373	0.11%	0	0.00%	99.72%	0.00%	0.12%	0.60%	5.33	467	1.14%	98.72%	0	9
	IMRB	467	373	0.11%	0	0.00%	99.72%	0.00%	0.12%	0.60%	5.33	467	1.14%	98.72%	0	9
Reliance CDMA	PMR	1121	862	0.00%	0	0.00%	98.26%	0.00%	0.20%	1.14%	51	3423	1.49%	99.70%	0	116
	IMRB	1121	862	0.00%	0	0.00%	98.26%	0.00%	0.20%	1.14%	51	3423	1.49%	99.70%	0	116




Name of Service Provider		Metering and Billing												Response time to the customer for assistance			Termination/ closure of service				
		Metering and billing credibility - post paid	No. of bills issued during the period	No. of bills disputed including billing complaints during the period	Metering and billing credibility - pre paid	No. of charging / credit / validity complaints during the quarter	Total no. of pre-paid customers at the end of the quarter	Resolution of billing/charging complaints	No. of billing/ (post-paid) and charging, credit / validity (pre-paid) complaints resolved within 4 weeks during the quarter	Total no. of billing (post-paid) and charging, credit / validity (pre-paid) complaints received during the quarter	No. of billing complaints (post-paid) and charging, credit / validity complaints (pre-paid) resolved in favor of the customer during the quarter	No. of complaints disposed on account of not considered as valid complaints during the quarter	Period of applying credit / waiver / adjustment to customer's account from the date of resolution of complaints	Accessibility of call centre/ customer care	Total no. of call attempts to call centre / customer care nos. during TCBH (Note)	No. of calls connected and answered successfully to call centre / customer care nos. during TCBH (Note)	Percentage of calls answered by the operators (voice to voice) within 60 seconds	%age request for Termination / Closure of service complied within 7 days	Total No. of request for Termination / Closure of service received during the quarter	No. of requests for Termination / Closure of service complied within 7 days during the quarter	Time taken for refund of deposits after closure
Benchmark		≤ 0.1%			≤ 0.1%		100% within 4 weeks					100% Within 1 week	≥ 95%			≥ 90%	100% within 7 days			100% within 60 days	
BSNL	PMR	0.03%	409232	106	0.94%	21219	2245353	100%	7337	7337	6953	221	100%	100%	3154738	3154738	92.9%	100%	3099	3099	100%
	IMRB	0.03%	409232	106	0.94%	21219	2245353	100%	21325	21325	0	32	100%	100%	3154738	3154738	92.9%	100%	3099	3099	100%
Tata Indicom	PMR	0.05%	179793	93	0.07%	1101	1633747	100%	1391	1391	198	1193	100%	98%	531952	520019	93.0%	100%	8083	8083	96%
	IMRB	0.05%	179793	93	0.07%	1101	1633747	100%	1391	1391	198	1193	100%	98%	531952	520019	93.0%	100%	8083	8083	96%
Reliance GSM	PMR	0.09%	24125	194	0.04%	3242	2326659	100%	9919	9919	2955	6964	100%	76%	292085	209391	81.0%	100%	278	278	100%
	IMRB	0.09%	24125	21	0.04%	978	2326659	100%	9919	9919	2955	6964	100%	72%	3644131	2962977	81.0%	100%	601	601	100%
Uninor	PMR	NA	NA	NA	0.02%	164	1025775	100%	164	164	0	164	100%	95%	1647029	1556966	84.5%	NA	NA	NA	NA
	IMRB	NA	NA	NA	0.02%	164	1025775	100%	164	164	0	164	100%	95%	1647029	1556966	84.5%	NA	NA	NA	NA
Vodafone	PMR	0.01%	1066595	78	0.01%	197	3677382	100%	275	275	182	93	100%	NA	305280	206999	68.0%	98%	7478	7350	100%
	IMRB	0.01%	1066595	78	0.01%	197	3677382	100%	275	275	182	93	100%	DNA	305280	206999	68.0%	98%	7478	7350	100%
Aircel	PMR	0.01%	22541	3	0.31%	6007	1953977	100%	6010	6010	5506	504	100%	100%	7135463	7135463	76.0%	97%	353	343	100%
	IMRB	0.01%	22541	3	0.31%	6007	1953977	100%	6010	6010	5506	504	100%	100%	7135463	7135463	76%	97%	353	343	100%
Idea	PMR	0.33%	17985	59	0.06%	1476	2522603	100%	3054	3054	1519	1535	100%	99%	490343	487185	80.0%	100%	573	561	39%
	IMRB	0.33%	17985	59	0.06%	1476	2522603	100%	3054	3054	1519	1535	100%	99%	490343	487185	80%	100%	573	561	39%
Tata Docomo	PMR	0.00%	14924	0	0.00%	34	1577459	100%	10815	10815	10781	234	100%	99%	6688699	6590059	88.0%	100%	815	814	100%
	IMRB	0.00%	14924	0	0.00%	34	1577459	100%	10815	10815	10781	234	100%	99%	6688699	6590059	88.0%	100%	815	814	100%
Airtel	PMR	0.02%	581455	135	0.02%	1870	11617793	100%	10260	10260	8255	2005	100%	95%	99935951	94740021	52.0%	100%	3810	3810	100%
	IMRB	0.02%	581455	135	0.02%	1870	11617793	100%	10260	10260	8255	2005	100%	95%	99935951	94740021	52.0%	100%	3810	3810	100%


Quality of Service – Audit module report for Kolkata Circle

MTS	PMR	0.00%	0	0	0.09%	547	589049	100%	547	547	223	324	100%	100%	2345379	2345379	91.0%	NA	NA	NA	NA
	IMRB	0.00%	0	0	0.09%	547	589049	100%	547	547	223	324	100%	100%	2345379	2345379	91.0%	NA	NA	NA	NA
Reliance CDMA	PMR	0%	422719	310	0%	806	1836443	100%	10265	10265	2728	7537	100%	96%	526210	506233	94%	100%	8554	8554	100%
	IMRB	0%	422719	310	0%	806	1836443	100%	10265	10265	2728	7537	100%	96%	526210	506233	94%	100%	8554	8554	100%

 Figures do not match with those reported in PMR

 Figures verified on all India basis

B'mark = TRAI Benchmark, DNA = Details not available

 Not meeting benchmark

## **8.0 Conclusions**

### **8.1 Cellular Mobile services**

1. Most of the operators do not meet the TRAI parameter for percentage of calls answered by operators, with the lowest being Vodafone at 68%. Vodafone was unable to provide the data for the accessibility parameter for the Kolkata circle.
2. RCOM GSM also does not meet the benchmark for call centre accessibility parameter.
3. Idea does not meet the PMR benchmark for the post-paid metering and billing capability whereas BSNL and Aircel fall short of meeting TRAI benchmark in pre-paid charging credibility.
4. There is a mismatch between data given in PMR for the month of Oct-Dec 2010 and data audited by IMRB for these months for the parameters of CSSR, Call drop rate, and TCH congestion.
5. BSNL does not meet the benchmark on Call drop rate and for percentage worst affected BTS.

## 9.0 Annexure - I

### 9.1 Service provider performance report based on one month data

Name of Service Provider	Network Availability		Connection Establishment (Accessibility)			Connection Maintenance (Retainability)			Metering and Billing				Response time to customer for assistance		Termination / closure of service	
	BTSs Accumulated downtime (not available for service)	Worst affected BTSs due to downtime	Call Set-up Success Rate (within licensee's own network)	SDCCH/ Paging Chl. Congestion	TCH Congestion	Call Drop Rate (%age)	Worst affected cells having more than 3% TCH drop	%age of connection with good voice quality	Metering and billing credibility (Postpaid)	Metering and billing credibility (Prepaid)	%age complaints resolved within 4 weeks	Period of applying credit/waiver less than 1 week	Accessibility of call centre/ customer care	Percentage of calls answered by operators within 60 sec	%age requests for Termination complied within 7 days	Refund of deposits after closure within 60 days
Benchmark	≤ 2%	≤ 2%	≥ 95%	≤ 1%	≤ 2%	≤ 2%	≤ 5%	≥ 95%	≤ 0.1%	≤ 0.1%	100%	100%	≥ 95%	≥ 90%	100%	100%
BSNL	0.90%	5.15%	99.32%	0.03%	0.01%	0.70%	4.38%	99.76%	0.09%	0.28%	20.59%	100.00%	100.00%	91.30%	100.00%	100.00%
Tata Indicom	0.03%	0.00%	98.91%	0.00%	0.00%	0.83%	2.16%	97.25%	0.02%	0.01%	100.00%	100.00%	96.86%	90.33%	100.00%	100.00%
Reliance GSM	0.00%	0.00%	99.52%	0.50%	0.01%	0.33%	0.02%	98.16%	0.05%	0.00%	100.00%	100.00%	100.00%	98.89%	100.00%	100.00%
Uninor	0.05%	0.00%	99.10%	0.11%	0.90%	0.81%	1.75%	96.34%	NA	0.01%	99.00%	100.00%	98.44%	90.20%	NA	NA
Vodafone	0.04%	0.08%	99.70%	0.09%	0.30%	0.65%	0.63%	98.63%	0.01%	0.00%	100.00%	100.00%	100.00%	90.76%	98.74%	100.00%
Aircel	0.03%	0.00%	97.63%	0.31%	0.08%	0.55%	1.67%	97.85%	0.00%	0.05%	100.00%	100.00%	100.00%	75.18%	100.00%	100.00%
Idea	0.03%	0.13%	97.22%	0.16%	0.42%	0.49%	1.84%	98.96%	0.54%	0.14%	100.00%	100.00%	99.09%	97.86%	91.07%	100.00%
Tata Docomo	0.02%	0.00%	99.32%	0.09%	0.09%	0.51%	1.29%	98.72%	0.00%	0.00%	100.00%	100.00%	99.32%	83.50%	100.00%	100.00%
Airtel	0.03%	0.00%	99.43%	0.06%	0.06%	0.69%	0.13%	98.40%	0.02%	0.02%	100.00%	100.00%	91.29%	86.34%	100.00%	100.00%
MTS	0.09%	0.00%	98.78%	0.00%	0.46%	0.86%	1.88%	97.11%	NA	0.08%	100.00%	100.00%	100.00%	92.44%	NA	NA
Reliance CDMA	0.06%	0.00%	99.78%	0.00%	0.05%	0.21%	0.21%	99.88%	0.00%	0.01%	100.00%	100.00%	100.00%	93.56%	100.00%	100.00%

### 9.2 Monthly Point of Interconnection (POI) Congestion Report

Name of the Service Provider	Name of POI not meeting the benchmark	Total No. of circuits on POI	Total No. of call attempts on POI	Total traffic served on POI (Erlang)	% of Congestion POI	Action already taken/ action plan for meeting the benchmark
BSNL	HOTTAX	151	1449.53	44.34	2	
Tata Indicom						All POI's meeting TRAI specified benchmark
Reliance GSM						All POI's meeting TRAI specified benchmark
Uninor						All POI's meeting TRAI specified benchmark
Vodafone						All POI's meeting TRAI specified benchmark
Aircel						All POI's meeting TRAI specified benchmark
Idea						All POI's meeting TRAI specified benchmark
Tata Docomo						All POI's meeting TRAI specified benchmark
Airtel						All POI's meeting TRAI specified benchmark
MTS						All POI's meeting TRAI specified benchmark
Reliance CDMA						All POI's meeting TRAI specified benchmark

### 9.3 Parameter wise performance reports for Cellular Mobile services

#### 1. Network Availability

##### Audit Results for Network Availability

	Benchmark	Tata Indicom	BSNL	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata Docomo	Airtel	MTS	Reliance CDMA
Number of BTSs in the licensed service area		1243	560	1491	1028	2356	2070	1584	1432	1998	449	469
Sum of downtime of BTSs in a month (in hours)		8356	140.4	0	399	638	426.97	358	178	472	289	207
BTSs accumulated downtime (not available for service)	≤ 2%	0.90%	0.03%	0.00%	0.05%	0.04%	0.03%	0.03%	0.02%	0.03%	0.09%	0.06%
Number of BTSs having accumulated downtime >24 hours		64	0	0	0	2	0	2	0	0	0	0
Worst affected BTSs due to downtime	≤ 2%	5.15%	0.00%	0.00%	0.00%	0.08%	0.00%	0.13%	0.00%	0.00%	0.00%	0.00%

#### 2. Connection Establishment (Accessibility)

##### Audit Results for CSSR, SDCCH and TCH congestion

CSSR	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
CSSR	≥ 95%	99.32%	98.91%	99.52%	99.10%	99.70%	97.63%	97.22%	99.32%	99.43%	98.78%	99.78%

SDCCH congestion	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
SDCCH/Paging channel congestion	≤ 1%	0.03%	0.00%	0.50%	0.11%	0.09%	0.31%	0.16%	0.09%	0.06%	0.00%	0.00%

TCH congestion	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
TCH congestion	≤ 2%	0.01%	0.00%	0.01%	0.90%	0.30%	0.08%	0.42%	0.09%	0.06%	0.46%	0.05%

##### Live measurement results for CSSR, SDCCH and TCH congestion

CSSR	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
CSSR	≥ 95%	98.29%	99.95%	98.80%	98.20%	99.79%	98.27%	96.80%	99.36%	99.41%	98.28%	99.64%

SDCCH congestion	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
SDCCH/Paging channel congestion	≤ 1%	0.00%	0.00%	0.00%	0.14%	0.16%	0.08%	0.16%	0.09%	0.03%	0.00%	0.00%

TCH congestion	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
TCH congestion	≤ 2%	0.00%	0.00%	0.06%	0.11%	0.21%	0.01%	0.12%	0.09%	0.01%	0.09%	0.32%

**Drive test results for CSSR (Average of three drive tests) and blocked calls**

CSSR	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
		Total number of call attempts		210	221	210	210	210	210	210	232	210
Total number of successful calls established		210	221	210	210	210	208	210	232	210	209	210
CSSR	≥ 95%	100.00%	100.00%	100.00%	100.00%	100.00%	99.05%	100.00%	100.00%	100.00%	99.52%	100.00%

Blocked calls	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
		%age blocked calls		0.00%	0.00%	0.00%	0.00%	0.00%	0.95%	0.00%	0.00%	0.00%

**3. Connection Maintenance (Retainability)****Audit Results for Call drop rate and for number of cells having more than 3% TCH**

Call drop rate	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
		Total number of calls established		928375	21876625	521044	39440191	107328465	27231739	18939975	44352248	106521380
Total number of calls dropped		6478	180720	1718	319522	696930	150020	92742	226314	737475	142264	80703
Call drop rate	≤ 2%	0.70%	0.83%	0.33%	0.81%	0.65%	0.55%	0.49%	0.51%	0.69%	0.86%	0.21%

Cells having more than 3% TCH	Benchmark	BSNL - GSM	Tata Indicom CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata Docomo GSM	Airtel	SSTL CDMA	Reliance CDMA
		Total number of cells in the network		3285	55877	4473	3077	5857	5869	135508	124752	5464
Total number of cells having more than 3% TCH		144	1205	1	54	37	98	2490	1615	7	26	1
Worst affected cells having more than 3% TCH	≤ 5%	4.38%	2.16%	0.02%	1.75%	0.63%	1.67%	1.84%	1.29%	0.13%	1.88%	0.21%

**Live measurement results for Call drop rate and for number of cells having more than 3% TCH**

Call drop rate	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
		Total number of calls established		3285	55877	4473	3077	5857	5869	135508	124752	5464
Total number of calls dropped		144	1205	1	54	37	98	2490	1615	7	26	1
Call drop rate	≤ 2%	4.38%	2.16%	0.02%	1.75%	0.63%	1.67%	1.84%	1.29%	0.13%	1.88%	0.21%

Cells having more than 3% TCH	Benchmark	BSNL - GSM	Tata Indicom CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata Docomo GSM	Airtel	SSTL CDMA	Reliance CDMA
		Total number of cells in the network		3285	133125	4551	3072	17571	5881	4623	12465	16400
Total number of cells having more than 3% TCH		70	4771	1	102	229	35	77	176	25	17	7
Worst affected cells having more than 3% TCH	≤ 5%	2.13%	3.58%	0.02%	3.32%	1.30%	0.60%	1.67%	1.41%	0.15%	1.23%	1.49%

**Drive test results for Call drop rate (Average of three drive tests)**

Call drop rate	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total number of calls established		210	221	250	210	210	208	210	232	210	209	210
Total number of calls dropped		0	3	0	1	0	1	0	0	0	0	1
Call drop rate	≤ 2%	0.00%	1.36%	0.00%	0.48%	0.00%	0.48%	0.00%	0.00%	0.00%	0.00%	0.48%

**4. Voice quality****Audit Results for Voice quality**

Voice quality	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total number of sample calls		7000	10508	521044	45305401.3	14554482303	4983638902	2290254384	3670479675	14299770810	16602221	42023772
Total number of calls with good voice quality		6983	10219	511456	43649038.1	14355401195	4876503666	2266354982	3623452641	14071201851	16122275	41971693
%age calls with good voice quality	≥ 95%	99.76%	97.25%	98.16%	96.34%	98.63%	97.85%	98.96%	98.72%	98.40%	97.11%	99.88%

**Drive test results for Voice quality (Average of three drive tests)**

Voice quality	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total number of sample calls		297870	12936	14010	59698	57472	420278	300489	56404	51975	14076	13473
Total number of calls with good voice quality		297723	12329	13593	57519	55979	394509	290387	54503	50510	9857	11940
%age calls with good voice quality	≥ 95%	99.95%	95.31%	97.02%	96.35%	97.40%	93.87%	96.64%	96.63%	97.18%	70.03%	88.62%


**5. POI Congestion****Audit Results for POI Congestion**

POI congestion	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total number of working POIs		120	74	8	67	41	39	53	39	69	40	9
No. of POIs not meeting benchmark		1	0	0	2	0	0	0	0	0	0	0
Total Capacity of all POIs (A) - in erlangs		779523	38912.62	44	21957.65	75061	29682	20533	6461.36	80323	533788.5	84000
Traffic served for all POIs (B) - in erlangs		18954	19011.58	31	12808.03	43185	13453	11399	3682.8	49366	303604.77	26000
POI congestion	≤ 0.5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

## Live measurement results for POI congestion

### 6. Inter Operator Call Assessment

Inter operator call Assessment To. From →												
	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA	
BSNL	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Tata Indicom	100%	NA	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Reliance GSM	100%	100%	NA	100%	100%	100%	100%	100%	100%	100%	100%	
Uninor	100%	100%	100%	NA	100%	100%	100%	100%	100%	100%	100%	
Vodafone	100%	100%	100%	100%	NA	100%	100%	100%	100%	100%	100%	
Aircel	100%	100%	100%	100%	100%	NA	100%	100%	100%	100%	100%	
Idea	100%	100%	100%	100%	100%	100%	NA	100%	100%	100%	100%	
Tata Docomo	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%	100%	
Airtel	100%	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%	
MTS	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	100%	
Reliance CDMA	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	

 The problems faced by the calling operator to other operators

### 7. Metering and Billing credibility

#### Audit Results for Billing performance

Billing Performance	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Billing disputes – Postpaid												
Total bills generated during the period		136754	197917	10819	NA	380370	8563	5210	8541	204364	NA	137549
Total number of bills disputed		119	46	5	NA	28	0	28	0	51	NA	3
Percentage bills disputed	≤ 0.1%	0.09%	0.02%	0.05%	NA	0.01%	0.00%	0.54%	0.00%	0.02%	NA	0.00%

#### Live calling results for resolution of billing complaints

Resolution of billing complaints	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total Number of calls made		50	50	50	26	50	50	17	50	50	50	50
Number of cases resolved in 4 weeks		43	50	50	24	47	50	16	49	50	50	50
Percentage cases resolved in four weeks	100%	86.00%	100.00%	100.00%	92.31%	94.00%	100.00%	94.12%	98.00%	100.00%	100.00%	100.00%



**8. Customer Care****Audit results for customer care**

Customer Care Assessment	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total number of call attempts to customer care for assistance		840719	463660	863614	1115335	5134507	2453662	101754	2687914	39341880	1100476	1475308
Number of calls getting connected and answered (electronically)		840719	449108	863614	1097936	5134507	2453662	100829	2669690	35915370	1100476	1475308
Percentage calls getting connected and answered	≥ 95%	100.00%	96.86%	100.00%	98.44%	100.00%	100.00%	99.09%	99.32%	91.29%	100.00%	100.00%
Number of calls getting transferred to the operator (voice to voice)		402611	463660	680870	531472	1624283	965143	340159	678064	3932174	495248	400027
Number of calls answered by operator (voice to voice) within 60 seconds		367584	418830	673310	479413	1474172	725551	332870	566182	3394941	457815	374268
Percentage calls answered within 60 seconds (V2V)	≥ 90%	91.30%	90.33%	98.89%	90.20%	90.76%	75.18%	97.86%	83.50%	86.34%	92.44%	93.56%

**Live calling results for customer care**

Customer Care Assessment	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total Number of calls received		100	40834	100	100	100	100	100	100	100	100	100
Total Number of calls getting connected and answered		100	39961	100	100	100	100	100	73	100	100	100
Percentage calls getting connected and answered	≥ 95%	100.00%	97.86%	100.00%	100.00%	100.00%	100.00%	100.00%	73.00%	100.00%	100.00%	100.00%

**Live calling results for customer care (Voice to Voice)**

Customer Care Assessment	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total Number of calls received		100	39961	100	100	100	100	100	100	100	100	100
Total Number of calls answered within 60 seconds		81	39493	100	100	93	100	100	27	87	100	100
Percentage calls answered within 60 seconds	≥ 90%	81.00%	98.83%	100.00%	100.00%	93.00%	100.00%	100.00%	27.00%	87.00%	100.00%	100.00%

**9. Termination / closure of service****Audit results for termination / closure of service**

Termination	Benchmark	BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total number of closure request		2223	2030	142	NA	2067	70	168	160	1206	NA	1172
Number of requests attended within 7 days		2223	2030	142	NA	2041	70	153	160	1206	NA	1172
Percentage cases in which termination done within 7 days	100%	100.00%	100.00%	100.00%	NA	98.74%	100.00%	91.07%	100.00%	100.00%	NA	100.00%

### Audit results for refund of deposits

Refund	Benchmark	11. Additional Network Related parameters										
		BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total number of cases requiring refund of deposits		39	37	39	NA	1761	NA	17	21	291	NA	222
Total number of cases where refund was made within 60 days		39	37	39	NA	1761	NA	17	21	291	NA	222
Percentage cases in which refund was received within 60 days	100%	100.00%	100.00%	100.00%	NA	100.00%	100.00%	100.00%	100.00%	100.00%	NA	100.00%

11. Additional Network Related parameters												
Audit Results for Total Traffic Handled in Erlang												
Traffic in Erlang		BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Equipped capacity of the network		6834	76365	44000	30479.83	129795.07	83819	31230	55153	116636	50400	84000
Total traffic handled in erlang during TCBH		5401	36287	40652.96	21604.92	2556560.59	29692	13633	22437	70878	11976.87	45988.48

Total number of customers as per VLR												
		BSNL	Tata CDMA	Reliance GSM	Uninor	Vodafone	Aircel	Idea	Tata GSM	Airtel	MTS	Reliance CDMA
Total no. of customers served (as per VLR)		785168	728316	1833005	559686	3421179	816545	527572	987984	2953772	35748	1287087

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