

Objective Assessment of Quality of Services for (QoS) for Basic Wireline, Cellular Mobile (Wireless) and Broadband Service Providers – Bihar & Jharkhand Circle

Final Report: October - 2008



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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 study, from the execution perspective, has been divided into two modules – Survey module and Audit module.

The Survey module has been commissioned with the objective of gauging the subscriber feedback on Quality of Services by way of primary survey and comparing them with quality of service benchmarks stipulated by TRAI. In addition, Survey module would also measure the compliance of 'Telecom Consumer Protection and Redressal of Grievances Regulations, 2007'.

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.

For the ease of execution both the modules have been commissioned as two separate exercises. However, the findings of each module would feed into the justification of the other module.

The Survey and Audit modules 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 Tamil Nadu, Karnataka, West Bengal, Bihar & Jharkhand, Haryana, Punjab and Uttar Pradesh (East) circles in the period of May – August 2008. **This report details the performance of various service providers in Bihar and Jharkhand circle against Quality of Services benchmarks for various parameters laid down by TRAI in respective regulations for Basic (Wireline), Cellular (Mobile) and Broadband services**

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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 1st July, 2005. The parameters for Broadband Service have been specified in the TRAI notification for Quality of Services of Broadband Service Regulation, 2006

IMRB has been engaged by TRAI for a period of 12 months starting January 2008 to assess the quality of services being provided by Basic (Wireline), Cellular Mobile (Wireless) and Broadband service providers.

The study is being conducted broadly in two modules. They are:

Survey module: To obtain subscriber feedback on quality of services by way of primary survey and to check the 'Implementation and effectiveness of Telecom Consumer Protection and Redressal of Grievances Regulations, 2007'

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

The present report highlights the findings for the Audit module for Bihar and Jharkhand circle that was covered in the Quarter 2 (April – June 2008). The primary data collection and verification of records maintained by various operators of Basic (Wireline), Cellular Mobile (Wireless) and broadband services was undertaken by IMRB International during the period of May 2008 – August 2008.



***The study is being conducted broadly in two modules:
(i) Survey module and
(ii) Audit module***



This report highlights the Audit Module findings for Chennai circle for Basic (Wireline), Cellular Mobile services, and Broadband 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

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 and Independent drive test were conducted in three cities as per the norms stated in the tender document
5. **Live calling:** Live testing was done on a sample basis to check efficiency of the customer care, inter operator call assessment, Back check calls for service provisioning and fault repair

- Any changes or discrepancies found in the methodology were reported to the service providers and changes were suggested by IMRB Auditors.
 - Separate formats were designed each for Basic (Wireline), Cellular mobile (Wireless) and Broadband services to collect the information on various parameters (Please refer to Annexure)



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

3.0 Sampling methodology

3.1 Sampling for Basic (Wireline) services

- For BSNL the sample of exchanges was selected was spread across 10% of SDCA's in the entire service. Overall 40 exchanges (8 Urban and 32 Rural) exchanges were audited in Bihar and 24 exchanges were audited in Jharkhand (8 Urban and 16 Rural)
- For rest of the service providers (Reliance and Bharti) data was collected pertaining to all the exchanges present in the circle/service area

3.2 Sampling for Cellular Mobile (Wireless) service providers

Data pertaining to 100% of the Gateway MSC's (GMSC's) and Mobile Switching Centres (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 Bihar & Jharkhand circle

- Bharti Airtel Ltd. – 6 MSCs
- Reliance Telecom Limited (RTL) – 2 MSCs
- Tata Teleservices Ltd – 2 MSCs
- Reliance communications – 3 MSCs
- BSNL – 14 MSCs
- Dishnet Wireless Ltd. (Aircel) – 2 MSCs

3.3 Sampling for Broadband service providers

- Sify and BSNL are the only two operators offering Broadband services in Bihar. For Sify the audit was conducted at the central node in Chennai whereas live calling was conducted at the local office.
- For BSNL, Audit was conducted at the central node in Bihar & Jharkhand and data submitted by various exchanges/POPs providing Broadband service was verified and collected. This was done in such a way that atleast 5% of POPs spread across 10% of SDCA's were covered. Also, the data pertaining to network related parameters was obtained by IMRB Auditors at the central node in Bangalore.

4 Audit methodology

4.1 Basic (Wireline) Services

Following table explains the audit methodology for Basic (Wireline) services:-

Sl. No.	Parameters	One month data verification	Live measurement	Live calling
1	Provision of telephone after registration of demand	YES	----	YES
2	Fault incidence/clearance related statistic	YES		
2.1	- Total number of faults registered per month	YES		YES
2.2	- Fault repair by next working day	YES		YES
3	Mean Time to Repair (MTTR)	YES		
4	Call Completion Rate (CCR)	YES	YES	
5	Metering and billing credibility – billing complaints	YES		YES
6	Customer care promptness	YES		
6.1	- Shifting of telephone line	YES		YES
6.2	- Processing closure request	YES		YES
6.3	- Processing of additional supplementary services	YES		YES
7	Response time to customer	YES		
7.1	- While call is electronically answered	YES		YES
7.2	- While call is answered by operator (voice to voice)	YES		YES
8	Time taken to refund of deposits after closure	YES		YES

* In addition to above verification of records for PMR submitted during October to December 2007 was carried out for all the network and non network related parameters.

{Note: - A more detailed explanation of parameter wise audit methodology for Basic (wireline) services is explained in Annexure II}

4.2 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
A	Network Performance							
A (i)	Accumulated down time of community isolation	Yes	Yes	Yes				
A (ii)	Call setup success rate (within licensee own network)	Yes	Yes	Yes	Yes		Yes	Yes
A (iii)	Service Access Delay	Yes	Yes	Yes				
A (iv)	Blocked Call Rate	Yes	Yes	Yes	Yes		Yes	Yes
A (v)	Call Drop rate	Yes	Yes	Yes	Yes		Yes	Yes
A (vi)	% Connections with good voice quality	Yes	Yes	Yes			Yes	Yes
A (vii)	Service Coverage	Yes	Yes	Yes			Yes	Yes
A (viii)	PoI Congestion	Yes	Yes	Yes				
B	Customer Helpline							
B (i)	Response time to the customer for assistance	Yes	Yes	Yes		Yes		
C	Billing Complaints							
C (i)	Billing complaints per 100 bills issued	Yes	Yes	Yes				
C (ii)	%age of billing complaints resolved within 4 weeks	Yes	Yes	Yes		Yes		
C (iii)	Period of all refunds/payments due to customers from date of resolution as in (ii) above	Yes	Yes	Yes		Yes		

{Note: A more detailed explanation of parameter wise audit methodology for Broadband services is explained in Annexure II}

4.3 Broadband Services

In a nutshell, the audit methodology was as follows:

	Parameters	Verification of PMR	Three day live measurement	Data Verification for one month	Live calling
(i)	Service Provisioning/ Activation time	YES	YES	YES	YES
(ii)	Fault Repair/ Restoration Time	YES	YES	YES	YES
(iii)	Billing Performance				
-	Billing Complaints per 100 Bills issued	YES	YES	YES	
-	%age of billing complaints resolved in four weeks	YES	YES	YES	YES
-	Time taken for refund of deposits after closure	YES	YES	YES	YES
(iv)	Response time to the customer for assistance(Voice to Voice)				
-	<i>Within 60 seconds > 60%</i>	YES	YES	YES	YES
-	<i>Within 90 seconds > 90%</i>	YES	YES	YES	YES
(V)	Bandwidth Utilization/ Throughput:				
▪	<i>A)Bandwidth Utilization</i>				
-	POP to ISP gateway Node [Intra – network] Links	YES	YES	YES	
-	ISP Gateway Node to IGSP / NIXI Node upstream Link(s) for international connectivity	YES	YES	YES	
▪	<i>B) Broadband Connection Speed (Download)</i>	YES	YES	YES	YES
(vi)	Service availability / Uptime	YES	YES	YES	
(vii)	Packet Loss	YES	YES	YES	
(viii)	Network Latency for wired broadband access)				
-	<i>User reference point at POP / ISP Gateway Note to International Gateway (IGSP/NIXI)</i>	YES	YES	YES	
-	<i>User reference point at ISP Gateway Node to International nearest NAP port abroad (Satellite)</i>	YES	YES	YES	
-	<i>User reference point at ISP Gateway Node to International nearest NAP port abroad (Satellite)</i>	YES	YES	YES	

{Note: A more detailed explanation of parameter wise audit methodology for Broadband services is explained in Annexure II}

4.4 Audit Limitations

Despite having a wide scope of work, we have found following problems that may impair the comparison across operators. As mentioned earlier we have suggested changes to operators, which will allow comparison in future. TRAI has already suggested a book keeping methodology and practical ways to the operators (within the spirit of QoS definition), also there has been previous rounds of Audit being conducted by different independent audit agencies (including IMRB) which had enabled comparison of the findings but still some variations were observed in methodologies and understanding of parameters among service providers (especially for Broadband services where Audit was carried out for the first time). Hence, the data reported in here has to be used carefully in the light of variation in testing.

1. **Complete data not being maintained:** In certain cases lack of availability of the data with the service providers rendered verification of raw data unfeasible and verification was done to the extent possible. For e.g. for network related parameters for Broadband services service providers could not produce old raw data files for ping tests, download speed etc
2. **Difference in measurement methodology:** For some cases, calculation methodology for some of the parameters was found to be different across various service providers.
3. **Technical unfeasibility:** There were cases observed where service providers expressed technical unfeasibility to provide the data required as according them their current system does not support the data being maintained/ recorded in the desired form. For e.g. Service providers were unable to provide data on service access delay and signal coverage from OMC for cellular mobile services. Hence, data was collected from the results of recent drive tests being conducted by various service providers
4. **Decentralized system for book keeping:** In certain cases, book keeping of records was found to be decentralized. This was largely observed for call centre performance for BSNL, where required data was not available with the exchanges and hence data could not be collected for the same. Also for some service providers who have call centralized call centres located at places away from ISP Nodes/Exchanges detailed raw data i.e. call by call detail was not available for verification. Hence verification of records was done to the extent possible in such cases.
5. **Difference in level of reporting to TRAI:** Some of the large Broadband service providers were observed to be reporting their performance on various parameters to TRAI at an all India level. They claimed that since they are providing gateway service to other small service providers, they are "Category A" service providers and consider entire India as one circle. Data for some of the parameters was provided by these operators on All India basis.

5 Executive Summary

The objective assessment of Quality of Services(QoS) was carried out by IMRB International for all the Basic(Wireline), Cellular mobile and Broadband service providers during the period starting from May 2008 to August 2008 in Bihar & Jharkhand circle. The executive summary encapsulates the key findings of the Audit by providing -

- "Service provider performance report" for Basic (Wireline), Cellular mobile and Broadband 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 Basic (Wireline), Cellular mobile and Broadband 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 – Basic (Wireline) Services

S.no	Parameters	B'mark	BSNL – Bihar	BSNL – Jharkhand	TATA*
1	Provision of telephone after registration of demand				
1.1	Connections completed within 7 days	100%	24%	75%	NA
2	Fault incidence/clearance statistics				
3	Fault incidences(No. of faults/100 subscribers/month)	<3	10.6	8.7	2.1
3.1	Faults repaired within 24 hours	>90%	64%	85%	100%
3.2	Faults repaired within three working days	100%	83%	97%	100%
4	Mean time to Repair (MTTR)	<8 hours	29.00	23	<8
5	Call Completion Rate (CCR)	>55%	36%	37%	60%
6	Metering and billing credibility				
6.1	Billing complaints per 100 bills issued	<0.1%	0.11%	0.02%	Details pertaining to billing are not available at exchanges
6.2	%age of billing complaints resolved within 4 weeks	100%	97%	Only 2 complaints, none resolved in time	
7	Customer care/helpline promptness				
7.1	Shift requests attended				
	Shift requests attended within 3 days	95%	26%	64%	No cases
7.2	Closure request attended				
	Closure within 24 hours	95%	52%	53%	No cases
7.3	Supplementary (additional) service requests attended				
	Additional facility provided within 24 hours	95%	26%	64%	No cases
8	Response time to customer for assistance				
8.1	% age call answered through IVR in 20 seconds	80%	100%	100%	Centralized call centre in Hyderabad.
	% age call answered through IVR in 40 seconds	100%	100%	100%	
8.2	% age calls answered by operator in 60 seconds	80%	No call centre for Voice to Voice present in the circle		
	% age calls answered by operator in 90 seconds	95%			
9	Time taken for refund of deposits after closure				
9.1	%age cases where refund received within 60 days	100%	96%	52%	NA

(*Note: For BSNL data pertains to the sample 5% of exchanges audited during the period of April to July 2008, whereas for rest of the operators figures pertain to all the exchanges present in the circle. TATA teleservices has limited presence in Bihar and Jharkhand and cater only to corporate customers)

** 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 and Key take outs: Basic (Wireline) services

The Basic (Wireline) services audit for Bihar and Jharkhand circle broadly indicates that none of the operators is meeting all the benchmarks, as mandated by TRAI (Telecom Regulatory Authority of India). During the Audit process at TATA teleservices it was learned that the service provider has limited presence in the circle and cater primarily to corporate customers

The live calling results were found to be low for some parameters when compared with one month audit data collection in certain places. To some extent the difference can be attributed to the smaller sample size undertaken for the live calling.

For live measurements conducted to assess Call Completion Rate (CCR) BSNL (In Both Bihar and Jharkhand) was found to be falling short of TRAI specified benchmark of <55% for sample exchanges covered during the period of Audit.

Also, results of verification of the records for the period of October to December 2008 show that there was variation in the figures reported in the PMR and those found in actual records for BSNL, the reason can largely be attributed to the fact that BSNL has a decentralized system for Book keeping, and data was verified only for sample 5% of exchanges spread over 10% of Short Distance Charging Area (SDCA's) in Bihar and Jharkhand circle

The parameter wise key takeouts for the wireline service providers for the Bihar & Jharkhand circle are as under:-

Provision of telephone after registration of demand

- BSNL with 24% and 75% of connections provided within 7 days in Bihar and Jharkhand respectively falls short of the TRAI specified benchmark. One of the reasons for the same was observed to be the fact that the service provider provides connection at all the locations and SDCA's in the circle whereas private service providers normally provide connections in areas which are technically feasible for the operator, especially for retail customers.
- As far as live calling scores are concerned 39% of BSNL subscribers in Bihar and 73% BSNL subscribers in Jharkhand claimed that the connection was provided within the time period of 7 days.
- For TATA the service provider claimed that there were no new connections provided in the month in which audit was carried out.

Fault incidence / clearance statistics

- For BSNL fault incidences and Mean Time to Repair (MTTR) was found to be high at some individual exchanges which has resulted in a poor score for the service provider on these parameters.
- As per the 1-month audit data findings, BSNL at 64% and 85% falls short of TRAI specified benchmark of >90% of faults to be repaired within 24 hours in Bihar and Jharkhand respectively. The reason for low score by BSNL could be the fact that service providers also has presence in rural areas where fault repair may sometimes take time due to operational difficulties.
- For fault repair within 3 working days BSNL at 83% and 97% falls short of the benchmark all short of the TRAI specified benchmark of 100%. However, considering the operational problems which can be in category "C" circles its score is good in Jharkhand

- The live calling scores (for fault repair within 24 hrs) were observed to be highest for TATA at 100 % (10 calls made) followed by BSN in Bihar and Jharkhand at 61% and 86% respectively.
- The live calling scores for fault repair within 3 working days were observed to be 78% and 94% for BSNL in Bihar and Jharkhand respectively

Traffic statistics (CCR)

- BSNL was found to be not meeting the benchmark cumulatively for sample exchanges covered during the period of Audit.

Metering and billing credibility

- All the service providers meet/almost meet the TRAI specified benchmark of <0.1% billing complaints.
- For resolution of billing complaints BSNL score in Bihar was 97%. However in Bihar out of 2 cases of billing disputes in Jharkhand none was resolved in time stipulated by TRAI
- For TATA billing details were not available at the concerned exchange in Jamshedpur.

Customer care/helpline promptness

- For “shift requests attended within 3 days” and “Supplementary services requests attended within 24 hours”, BSNL - Bihar (26%) and BSNL Jharkhand (64%) fall short of TRAI specified benchmark of 95% for the month in which audit was carried out.
- For closure requests attended within 24 hours BSNL scores in Bihar and Jharkhand were observed to be 52% and 53% respectively.

Response time to customer for assistance

- For calls answered by IVR BSNL meets the parameter in both Bihar and Jharkhand during the month in which audit was carried out.
- However, it should be noted that exchanges in Jharkhand do not have an electronic system to maintain data. Records of calls received and dialed were obtained from manual records available at main exchanges.
- For Bihar details of call centre were obtained from main exchange in Patna where records of all the calls received is maintained centrally.
- Interestingly it was observed that there is no “Voice to Voice” call centre service available for BSNL subscribers in Bihar and Jharkhand. Service provider claimed that all complaints are booked electronically (through IVR) on 198 and docket number is generated for every complained and provided to the subscriber.
- BSNL with live calling scores of 79% and 70% in Bihar and Jharkhand respectively falls short of TRAI specified benchmark of 80% calls answered by IVR in 20 seconds.
- For TATA 100% of the calls were answered by the operator in 60 seconds.

Time taken for refund of deposits after closure

- BSNL in both Bihar (96%) and Jharkhand (52%) falls short of TRAI specified benchmark of 100 percent refunds to be made within 60 days.

Level 1 Services

To test the efficiency of level 1 services (Trunk booking, Child helpline, Women helpline, Airline booking etc) offered by BSNL at least 200 calls were made to different numbers and time taken to answer the call was noticed. 74% and 57% of the total calls made were answered in 60 seconds in Jharkhand and Bihar respectively. The connectivity was found to be relatively poor for General enquiry i.e. 197 Aids control (Number1097), Medical Counselor (Number 1911)

For TATA 200 calls were made at their call centre number (121) and Railway enquiry (131) out of which 92% were answered in 60 seconds. All the calls which were not answered in 60 seconds were made to railway enquiry. The service provider does not offer any other Level 1 service in Bihar and Jharkhand circle apart from those mentioned above and emergency services i.e. Fire, Police etc

Summary of Live Measurement Results – Basic Wireline Services

Traffic statistics - Call Completion Rate	Benchmark	BSNL – Bihar	BSNL - Jharkhand	Tata
Call Completion Rate (CCR) in the local network	>55%	41%	39%	77%

- For basic wireline services there was only one parameter (Call Completion Rate – Benchmark > 55%) for which live measurement was applicable.
- BSNL falls short of the benchmark with a score of 41% (Bihar) and 39% (Jharkhand) cumulatively for sample 5% of exchanges. TATA score during live measurements was observed to be 77%.

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

Parameters	Benchmark	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Accumulated downtime for community isolation	< 24 hrs.	3.48	0.00	0.75	0.00	0.00	17.60
Call Set Up Success Rate (CSSR)	> 95%	94.80%	91.58%	98.03%	97.77%	98.23%	96.00%
Service Access Delay*	9 to 20 seconds (< = 15 seconds for 100 calls)	20.60	12.00	4.00	11.62	13.20	Complied
Blocked Call Rate							
<i>SDCCH/Paging Channel Congestion</i>	<1%	7.53%	0.69%	0.00%	0.00%	3.74%	0.97%
<i>TCH Congestion</i>	< 2%	7.34%	0.39%	0.56%	0.00%	3.90%	1.79%
Call drop rate	< 3%	2.30%	2.51%	2.21%	0.98%	5.51%	2.00%
Percentage connections with good voice quality*	> 95%	79.26%	84.71%	98.92%	98.55%	92.91%	95.07%
Service coverage*							
<i>In door</i>	>-75dbm	Complied	Complied	Complied	Complied	Complied	Complied
<i>In vehicle</i>	>-85dbm						
<i>Out door - in city</i>	>-95dbm						
POI congestion	< 0.5%	Complied	Complied	Complied	Complied	Complied	Complied
Calls answered electronically							
Percentage calls answered within 20 seconds	80%	100%	97.64%	97.90%	DNP – Operator claimed no data is present at circle level	100.00%	Details not available as call centre is outsourced
Percentage calls answered within 40 seconds	95%	100%	99.21%	97.90%		100.00%	
Calls Answered by the operator							
Percentage calls answered within 60 seconds	80%	84.07%	81.50%	52.10%	DNP – Operator claimed no data is present at circle level	29.00%	100.00%
Percentage calls answered within 90 seconds	95%	88.37%	89.00%	59.73%		Not Measured	DNP – Operator claims that the parameter is not measured
Billing Complaints							
Billing complaints per 100 bills issued	<0.1%	0.00%	0.02%	0.09%	0.06%	Only prepaid subscribers	0.00%
Percentage billing complaints resolved within 4 weeks	100%	No billing complaints received	100%	100%	100%		No billing complaints received
Period of refunds/payments due to customers from the date of resolution of complaints	<4 weeks		100%	100%	100%		

*Details pertaining to these are obtained through operator assisted drive tests. Results of the drive tests are explained in greater 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 Bihar circle apart from Reliance Communication whose audit was conducted at their central NOC at Mumbai.

It should be noted that most of the service providers claimed that they were submitting the PMR basis their inference of the QoS parameters. However, we need to take a larger view of the picture and ignore some differences in measurement methodologies. We believe that book keeping is bound to get better as more such Audits will be carried out in subsequent quarters as mandated by TRAI.

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
Bharti	1900 -2000	1900 -2000
BSNL	1900 -2000	1900 -2000
RCOM	1100 – 1200	1900 – 2000
TATA	1900 -2000	1900 -2000
Aircel	1900 -2000	1900 -2000
RTL	2100 -2200	2100 -2200

The TCBH reported by all the service providers except Reliance matched the network busy hour calculated by IMRB auditors for the Bihar & Jharkhand circle. During the three day live measurement the busy hour of Reliance was found to be between 1900 – 2000 hours. The auditors came to this conclusion by studying the traffic reports that were generated from the switch during the audit.

Accumulated Downtime:

In the Bihar & Jharkhand circle, there were outages observed in various BTS across all the service providers, actually leading to a community being isolated at a particular point in time except for Bharti, RCOM & RTL. RTL had the maximum outage in the month of audit with an outage of more than 17 hours observed. Bharti's outage was found to be more than 3 hours for the month of audit. The community isolation of RCOM was less than one hour in the month of audit.

Call Set-up Success Rate (CSSR):

All the operators except Bharti and BSNL were comfortably meeting the benchmark on this parameter. During the audits the maximum CSSR was observed for Dishnet with 98.23% of their calls getting completed. BSNL had 91.58% CSSR which was relatively the lowest among all services providers. All the operators were found to be calculating the parameter as per the norm

specified by TRAI. CCSR was established as the ratio of total number of successful call attempts (establishment) to the total number of call attempts made.

Service Access Delay:

This parameter is reported to TRAI basis the periodic drive tests that are conducted by the service providers during that quarter. It is measured using a drive test tool kit and a protocol analyzer. All the operators except Bharti with a service access delay of 20.4 seconds in the Bihar & Jharkhand comfortably meet the TRAI specified benchmark. Also, all the operators follow the TRAI specified mechanism for measuring the parameter. During the drive test, none of the operators were found to be using engineering hand sets.

Network Congestion parameters:

SDCCH / Paging Channel Congestion, TCH and POI are part of the network congestion parameters. Bharti and Dishnet are not meeting the TRAI specified on the congestion parameters. Bharti relatively has the highest SDCCH congestion at 7.53% and TCH congestion at 7.34%. Dishnet has SDCCH congestion of 3.74% and TCH congestion of 3.90%. TATA leads the way in network congestion parameters with almost negligible paging traffic channel congestion. The calculation methodology of these parameters was found to be in complete accordance with what has been specified by TRAI. There was almost 0 POI congestion on almost all individual POI links between a service provider vis-à-vis other service providers.

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 (unexpected seizure) to the total number of successful call attempts for all operators. Also, all of service providers except Dishnet with call drop rate of 5.51% were found to be meeting the TRAI specified benchmark. The lowest call drop rate was of TATA with only 0.98% call drop. All the other operators have a call drop rate of either 2% or more than 2%.

% connections with good voice quality:

All of the operators are measuring these parameters via their periodic drive tests. During the audit it was found that all the service providers were measuring this parameter as per the TRAI guidelines. Drive test was conducted by IMRB with the help of service providers to measure this parameter. In the drive test it was found that Bharti with 79.26%, BSNL with 84.71% and Dishnet with 92.91% did not meet the TRAI benchmark.

Service coverage:

This parameter is reported by the service provider basis the periodic drive tests in a particular circle. The service coverage for all the operators was found to be within the TRAI specified limits for 100% of the drive test route (for which the audit was conducted). However, there were places where interference and inadequate coverage was recorded (explained in greater detail along with drive test findings).

Customer Care / Helpline Assessment

For the IVR aspect all the service providers meet the TRAI benchmark. In case of RCOM no breakup of IVR calls by circle is present. The figure reported is for all India level. Also, RCOM claimed that whatever calls cannot be routed to the IVR is directly routed to the voice to voice operator.

In case of calls answered by operators, RTL claimed that all of its calls were answered within 60 seconds. TATA was not able to provide the customer care details claiming that they are not measured on a circle level. Also, Dishnet with only 29% calls answered within 60% is way below the TRAI benchmark. Bharti, BSNL and RCOM also do not meet the TRAI benchmark for calls answered within 90 seconds for the month of audit.

Billing performance

All the operators were found to be meeting the benchmark of < 0.1% complaints registered per 100 bills issued. Also Bharti and RTL (which has a low postpaid subscriber base) claim to have not received any billing complaint. In all cases where customers were due for refund, all the service providers meet the TRAI benchmark of 100% with 4 weeks.

Inter operator calls assessment

Inter operator call Assessment (To/From)	Bharti	BSNL	RCOM	TATA	Aircel	RTL
Bharti	NA	93.5%	61%	94%	97%	97%
BSNL	94%	NA	86%	96%	98%	97%
TATA	97%	96.5%	86%	NA	97%	97%
Aircel	99%	95.5%	97%	98%	NA	98%
RCOM	96%	85.0%	NA	93%	98%	88%
RTL	97%	75.5%	59%	28%	98%	NA

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. The calls from Bharti to all other service providers were established in the range of 94% to 99%. Similarly BSNL's connectivity with all the operators was found to be not that good where only 75.5% to 96.5% of its calls to numbers of other operators got connected. BSNL had major problems in connecting to a RCOM and RTL number. However, RCOM has maximum difficulty in connecting to a RTL number with 59% of its calls getting connected. TATA had major problems in connecting to RTL with only 28 out of 100 of its calls getting established. RTL had the most problem in connecting to RCOM number with only 88 out of 100 calls getting established.

Results of Operator assisted Drive test

The drive test was conducted simultaneously for all the operators present in the Bihar circle. There was in total of three drive tests conducted in the circle. These tests were conducted in the cities of Patna, Ranchi and Hazipur. 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 of UP(E) 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 dbm for in-vehile and > -95 dbm outdoor routes.

The drive tests in the Bihar circle were conducted in the cities of Patna, Ranchi and Hazipur was conducted along the following route:

Area	Type of Location	Patna	Ranchi	Hazipur
Outdoor	Periphery of the city	Anisabad, Beur More, Sipara, IOC Colony, Bus Stand, Agam Kuan, Ram Krishna Nagar, Transport Nagar, Zero Mile	Airport to Patna road, Via Harmu by Pass, Argoda chowk	Gandhi Chowk to Ramashish Chowk to Paswan Chowk
	Congested Area	Mauya Lok, Dakbanglow Chowk, Frazer Road, Gandhi Maidan, Exhibition Road, NP Centre, SP Varma Road, Maharaja Complex	Kachahari Chowk to over bridge via Main road Firayalal chowk	Station Road, National Cinema
	Across the City	From Dakbanglow Road, Planterium, Income Tax, Punaichowk, Shekhpura, Jagdev Path	Kantatoli to Argoda chowk via Sujata Cinema Kadme, Ashok Nagar	Paswan Chowk to Subhash Chowk to Rajindra Chowk
Indoor	Office Complex	Raj Tower Baring Road Crossing	Hari Om Tower	BSNL Telephone Exchange
	Shopping Complex	Mauya Complex	Church complex	Ganesh Cinema

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

Drive Test - Patna

	Bharti		BSNL		RCOM		TATA		Aircel		RTL	
	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	89.45%	89.49%	97.21%	95.99%	99.79%	98.87%	99.99%	96.50%	94.82%	94.01%	93.79%	93.69%
CSSR	96.67%	96.15%	100.00%	98.84%	100.00%	97.22%	100.00%	100.00%	100.00%	97.02%	96.72%	92.00%
Call drop rate	0.00%	0.67%	0.00%	0.58%	0.00%	2.78%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hands off success rate	100.00%	98.6%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Drive Test - Ranchi

	Bharti		BSNL		RCOM		TATA		Aircel	
	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	97.75%	94.95%	47.81%	69.20%	99.68%	98.45%	97.09%	94.71%	93.54%	92.87%
CSSR	100.00%	100.00%	85.71%	92.68%	100.00%	96.77%	100.00%	99.44%	100.00%	98.05%
Call drop rate	0.00%	0.00%	6.67%	3.95%	0.00%	0.00%	0.00%	0.56%	0.00%	1.32%
Hands off success rate	100.00%	100.0%	96.72%	96.15%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Drive Test - Hazipur

	Bharti		BSNL		RCOM		TATA		Aircel		RTL	
	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	94.67%	92.45%	96.15%	96.31%	98.90%	99.02%	100.00%	99.90%	95.55%	90.15%	99.14%	96.11%
CSSR	91.18%	97.44%	100.00%	98.68%	100.00%	100.00%	100.00%	100.00%	100.00%	99.37%	90.32%	90.67%
Call drop rate	0.00%	0.00%	0.00%	0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hands off success rate	100.00%	33.33%	100.00%	32.43%	100.00%	100.00%	100.00%	100.00%	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

Patna: There was interference and low signal strength recorded for all operators in the outdoor areas of SP Verma Road, Rajwanshi road, Zero Mile, Dak Banglow chowk, Transport Nagar, CR Complex and near ICICI Bank, Fraser whereas in the indoor areas across all operators there was adequate coverage found.

Ranchi: There was interference and low signal strength recorded for all operators in the outdoor areas of new by pass of Harmu Chowk, Bahu Bazaar and Birsa Chowk whereas in the indoor areas across all operators there was adequate coverage found.

Hazipur: There was interference and low signal strength recorded for all the operators in the outdoor areas of flyover of Ramashish Chowk, Near Funfood restaurant, Subhash Chowk, Near Lalganj more, Near Footwear shop, Rajender chowk while there was no interference or inadequate coverage recorded in the indoor areas

Conclusions:

1. In Patna, Bharti, Dishnet and RTL do not meet the TRAI benchmark on percentage connections with good voice quality during the drive test.
2. RTL does not meet the TRAI benchmark in Patna for CSSR for outdoor areas
3. BSNL in Ranchi performs poorly on all the parameters
4. Dishnet does not meet the TRAI benchmark on percentage connections with good voice quality during the drive test in Ranchi
5. RTL does not meet the TRAI benchmark in Hazipur for CSSR

Summary of Live Measurement Results – Cellular Mobile Services

Parameters	Benchmark	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
CSSR	> 95%	95.33%	86.11%	95.89%	97.00%	97.74%	96.00%
SDCCH / Paging Channel Congestion	< 1%	8.08%	1.34%	0.00%	0.00%	3.86%	0.98%
TCH Congestion	< 2%	6.63%	6.72%	0.51%	0.00%	4.57%	1.69%
POI congestion	< 0.5%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Call drop rate	< 3%	2.27%	2.50%	1.54%	1.16%	8.19%	1.92%

 Not meeting the benchmark

During the three day live measurement, all the operators except BSNL were found to be meeting the TRAI benchmark on CSSR. Dishnet leads the way with a CSSR of 97.74% while BSNL relatively has the lowest CSSR in the Bihar & Jharkhand circle for the three day live measurement with a call success rate of 86.11%.

All the operators except Bharti and Dishnet meet the TRAI benchmark on the SDCCH / paging channel congestion parameter. During the live measurements the maximum SDCCH congestion was observed for Bharti at 8.08% followed by Dishnet at 3.86%. RCOM and TATA experienced no Paging Channel Congestion. Bharti, BSNL and Dishnet did not meet the benchmark on traffic channel congestion with a congestion of 6.63%, 6.72% and 4.57% respectively.

Also, during the three days live measurement, all the operators except Dishnet met the benchmark on call drop rates. The maximum call drop rate was observed for it with 8.19% calls getting dropped after establishment followed by BSNL at 2.50%. The lowest call drop rate was observed for TATA with only 1.16% of total calls getting dropped after establishment.

5.3 Service provider performance report based on one month data Verification – Broadband Services

S.No	Parameters	B'mark	BSNL - Bihar	BSNL – Jharkhand	Sify
1	Service provisioning uptime				
1.1	Total connections registered		396	478	No new connections registered in the month of audit
1.2	Percentage connections provided within 15 days	100%	90%	100%	
2	Fault repair restoration time				
2.1	Total number of faults registered/calls made		777	676	No faults reported in the month of Audit. Only fault complaint booked at the call centre are reported in PMR
2.2	Percentage faults repaired by next working days	> 90%	96%	91%	
2.3	Percentage faults repaired within three working days	99%	100%	100%	
3	Billing performance				
3.1	Total bills generated		6804	7541	AI prepaid customers
3.2	Billing complaints per 100 bills issued	<2%	0.03%	0.13%	
3.3	%age of billing complaints resolved within 4 weeks	100%	50%	100%	
3.4	Time taken for refund of deposits after closure	100% cases within 60 days	80%	No cases	No cases
4	Customer care/helpline assessment				
4.1	Percentage calls answered within 60 seconds	> 60%	Break up not available	80%	No calls received from Bihar and Jharkhand circle
4.2	Percentage calls answered within 90 seconds	>80%		100%	
5	Bandwidth utilization/Throughput				
5.1	Total number of intra network links tested		BRAS-23,T1-24,T2-610, DSLAM-5456		400
5.2	Total number if intra network links crossing 90%		Uplink Traffic in Chennai BRAS is > 90%		4
	<i>Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)</i>				
5.3	Total number of upstream links		97	28	
5.4	Number of upstream links > 90%		1	0	
5.5	Percentage bandwidth utilised on upstream links	<80%	75%	74%	
6	Broadband download speed	>80%	Complied	Complied	
7	Service availability/uptime	>98%	100.00%	100.00%	
8	Packet loss	<1%	<1%	<1%	
9	Network Latency				
9.1	POP/ISP Node to NIXI to IGSP	<120msec	Complied	<45 ms	
9.2	ISP node to NAP port	<350msec	Complied	<250 ms	

** 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 and Key take outs: Broadband services

Before concluding the Audit findings for Broadband services we would like to accentuate the fact that the Broadband audit process was being carried out for the first time by an independent audit agency. Most of the service providers claimed that they were submitting the PMR basis their inference of the QoS parameters.

Both Sify and BSNL claimed to be category “A” service providers. The data for non network parameters for BSNL was audited at the POP’s distributed across Bihar and Jharkhand circle whereas data for network related parameters was verified at their central node in Bangalore

The data for network related parameters is provided at an all India level for both the operators

The key conclusions (Parameter wise) emerging out from the Audit exercise of seven Broadband service providers are highlighted below

Service provisioning/Activation time

- BSNL in Bihar falls short of TRAI benchmark of 100% as only 90% of total connections were provided in 15 days during the month of Audit. For Sify there were no connections registered during the month of Audit
- For Live calling carried out BSNL Jharkhand and Sify were found to be doing well as 100% of subscribers called claimed that connection was provided within 15 days. For BSNL - Bihar score was observed to be 69% for live calling.

Fault Repair/Restoration time

- BSNL meets the TRAI specified benchmark for fault complaints repaired by next working day and repaired within 3 working days for the month of Audit.
- Sify claimed that there were no fault complaints registered during the month in which audit was carried out. However it should be noted that only the fault complaints booked through the call centre are reported in the PMR. Complaints booked by customers with the cable operators and local office are not being taken into consideration by the operator.
- None of the service providers were found to be meeting the benchmark for Fault repair within 24 hours for live calling results. Scores are as low as only 47% subscribers (for Sify) claiming that their fault was repaired within next working day. The reason for low scores can partly be attributed to low sample size (10% of total faults reported in the month prior to visit of Audit)

Billing performance

- BSNL in both Bihar and Jharkhand was found to be meeting the benchmark for % age billing complaints for the month in which data was collected. Sify however claim that all its retail broadband customers are prepaid and hence there are no billing complaints for Sify.
- For resolution of billing complaints within 4 weeks BSNL falls short of TRAI specified benchmark in Bihar as only 1 out of 2 cases (in sample PoP’s) reported was found to be resolved in 4 weeks.

Customer Care/Helpline Assessment

- Interestingly, break up of calls answered by the operator within 60 and 90 seconds was not available for BSNL Bihar. Out of the total 24108 calls received at the call centre 45% were answered in 5 seconds, 6% percent were answered in 5 to 10 seconds and rest 49% were answered in greater than 10 seconds.
- For one month data BSNL (Jharkhand) comfortably meets the benchmark while Sify has a centralized call centre located in Chennai and claimed that there were no calls received from subscribers in Bihar.
- For Live calling results for calls answered within 60 seconds for BSNL in Jharkhand falls short of the benchmark for calls answered within 60 seconds with a score of 38%. However 100% of the calls made were answered in 90 seconds by the operator.

Bandwidth Utilisation:

- For Intra network link, data for Sify, BSNL was obtained on all India basis. Only 4 links for Sify were observed to be having more than 90% bandwidth utilization during the month of Audit. Similarly for BSNL uplink Traffic from Chennai Broadband Remote Access Server (BRAS) was found to be more than 90% during the month for which the data was obtained.
- It was observed that all the links (tested during three day live measurement) in the Access segment for Sify and BSNL were found be below 80%.
- Sify claim that it is not possible to measure the Bandwidth available from Cable operator to their base stations. Hence, it is believed that last mile experience may suffer as operators have relatively less control over the operations of cable operator.
- For Bandwidth utilisation on upstream links (From ISP Node to IGSP/NIXI), BSNL, and Sify meet the TRAI specified benchmark cumulatively for all the gateways present in India.

Download speed

- Also, during live measurements carried out at Pop's/ISP Node it was observed that all the operators are meeting the TRAI prescribed benchmark of greater than 80% speed available to the customer.
- However, no historic data was available for verification of records for month of Audit as well as quarter ending October to December 2007 the service providers. Most of them claimed that they are reporting to TRAI basis live tests conducted at customer premises during field visits and tests conducted at POPs/ISP Node.
- Hence, IMRB Auditors also carried out live calling to understand the download speed available to the customer. None of the service providers could meet the benchmark cumulatively for sample calls made to subscribers.

Service Availability/Uptime:

- Both Sify and BSNL are meeting the benchmark on service availability/uptime for the month in which audit was carried out. Sify claimed that since its base stations are connected with multiple links the possibility of having a situation where Broadband access network is down for all users is very rare. Also for BSNL none of its Broadband remote access server observed significant downtime which would affect the service availability

Packet Loss and Network Latency

- It was observed that both Sify and BSNL are measuring packet loss and latency by conducting random ping tests for their internal performance measurement, but there are no records being maintained or book keeping methodology was non-existent for Sify.
- Due to non-availability of the records of old ping tests, verification process could not be conducted for Sify.
- However, ping tests conducted during live measurements revealed that both Sify and BSNL are meeting the benchmark prescribed by TRAI.

Summary of Live Measurement Results – Broadband Services

Parameters	Benchmark	BSNL	Sify
Service Availability Uptime	>98%	100.00%	100.00%
No of Intra network links found to be above 90% (Out of sample links tested)		0	0
Total Bandwidth utilization at all upstream links	< 80%	71%	74%
Data Download Speed	> 80%	Complied	Complied
Packet Loss (Percentage)	< 1%	<1%	<1%
From user reference point at POP/ISP Node to IGSP NIXI (msec)	<120msec	Complied	<15 ms
From user reference point at ISP Gateway Node to nearest NAP Port (Terrestrial) (In msec)	<350msec	Complied	240 ms

** Methodology not in line with QoS

■ Figures provided on All India basis

■ Not meeting the benchmark

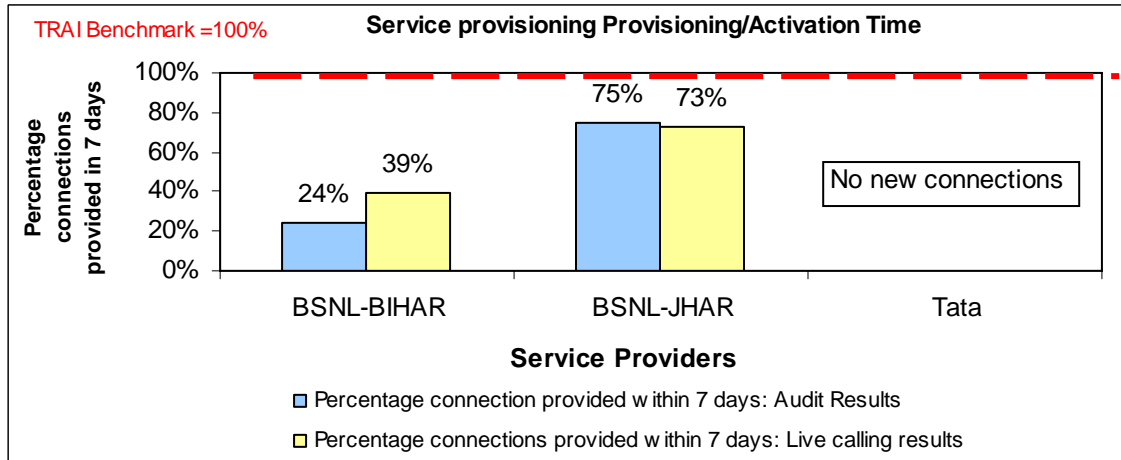
B'mark = TRAI Benchmark, DNA = Details not available, NA: Not Applicable

- Both Sify and BSNL meet the TRAI specified benchmark on service availability during the month of Audit.
- The testing for Bandwidth utilization during live measurement was carried out on sample basis by IMRB auditors for intra network links. There were no intra network links that were found to have a utilization of more than 90% for both the operators
- For Bandwidth utilization on upstream links, both the service providers were meeting the benchmark during the three day live measurement and have excess capacities available on their upstream links.
- However, it should be noted that for BSNL out of the total 97 gateway links present at different places in India 10 to 20 were found to be > 90 %.
- For network latency both the service providers comfortably meet the TRAI specified benchmark for ping tests carried out during live measurements. The same was measured by conducting ping tests as per the TRAI specifications.

6. Detailed findings – Includes comparison between Live calling/Live measurements and One month data collection

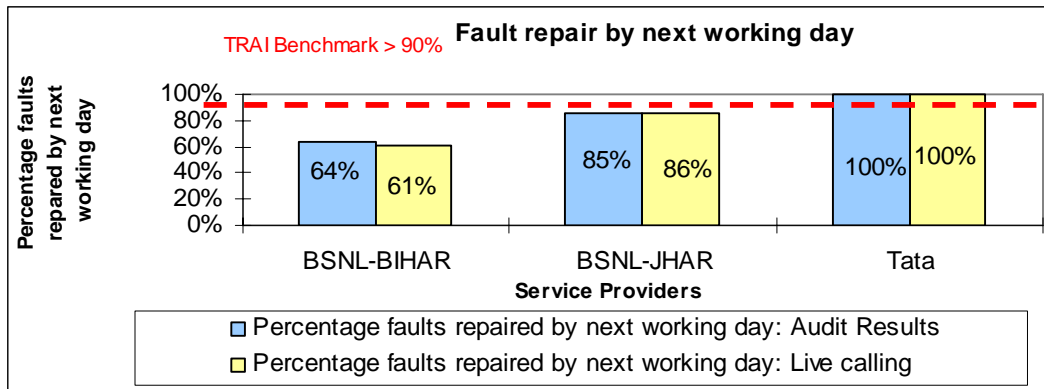
6.1 Graphical/Tabular Representations for Basic (Wireline) services

Service provisioning / Activation time (Comparison between one month audit results and live calling results)

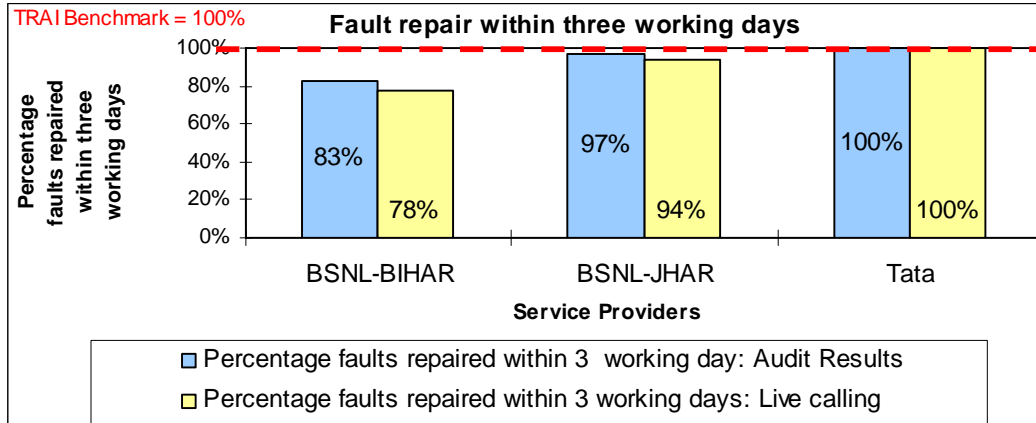


BSNL scores in Bihar and Jharkhand for one month audit are observed to be 24% and 75%. For live calling scores for BSNL in Bihar and Jharkhand are 39% and 73% respectively

Fault repair/Restoration time (Comparison between one month audit results and live calling results)

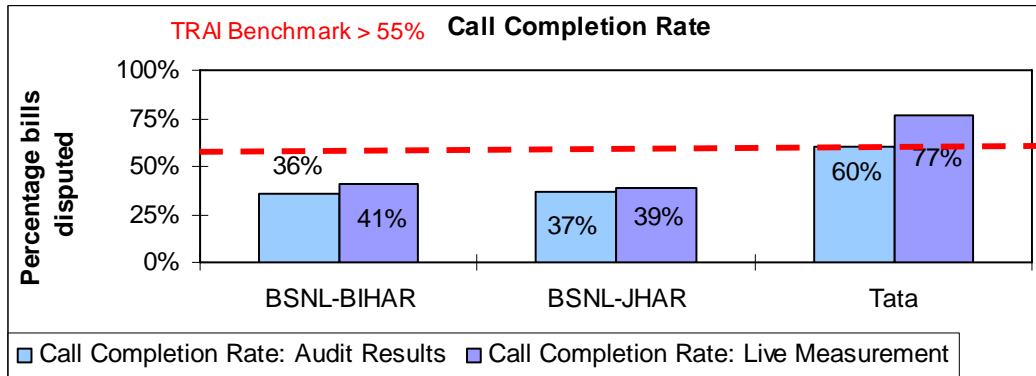


For fault repair by next working day BSNL falls short of the TRAI specified benchmark in Both Bihar and Jharkhand. For live calling, scores 61% (lowest) for BSNL - Bihar and 100% of TATA (Highest) subscribers called claimed that the faults reported by them where cleared by next working day. However sample live calls made were observed to be low for TATA owing to less number of faults reported.



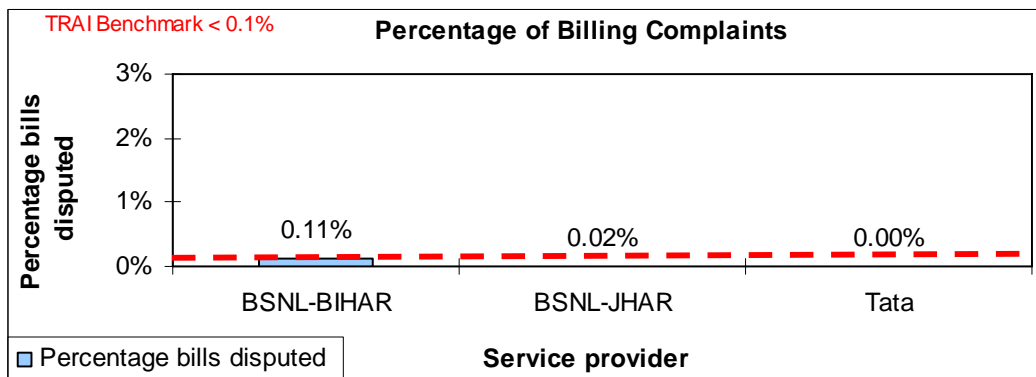
Considering the fact that BSNL provides services in both Rural and Urban areas it does well in both Bihar and Jharkhand with 83% and 97% of total faults repaired within 3 days during the month of Audit

Call completion rate (Comparison between one month audit results and three day live measurement)



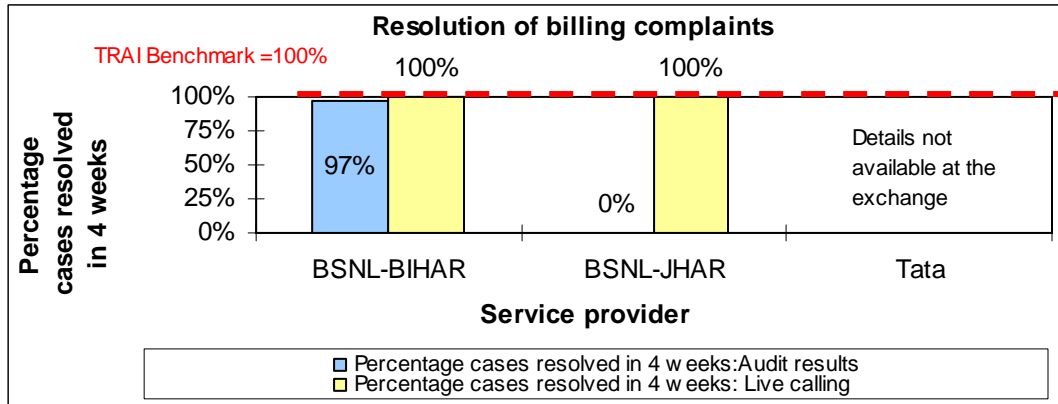
BSNL falls short of TRAI specified benchmark for CCR both for live measurements and one month data collection for sample 5% of exchanges covered for Audit.

Percentage bills disputed



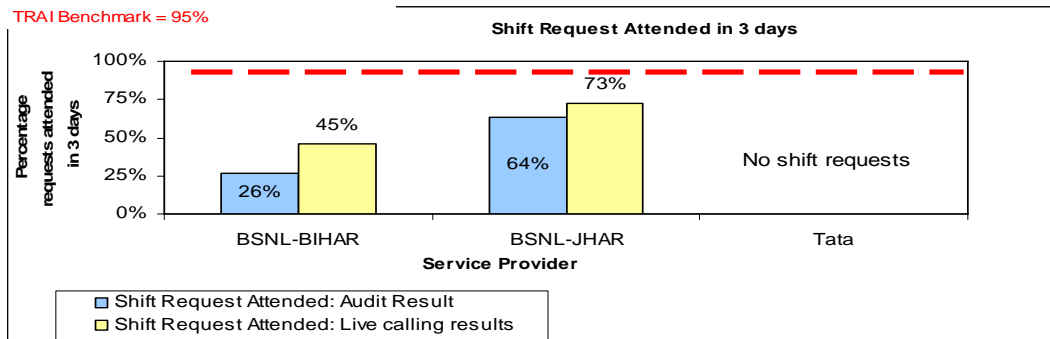
BSNL in Jharkhand (at 0.11%) score on %age billing disputes marginally falls short of the benchmark.

Resolution of billing complaints (Comparison between one month audit results and live calling results)



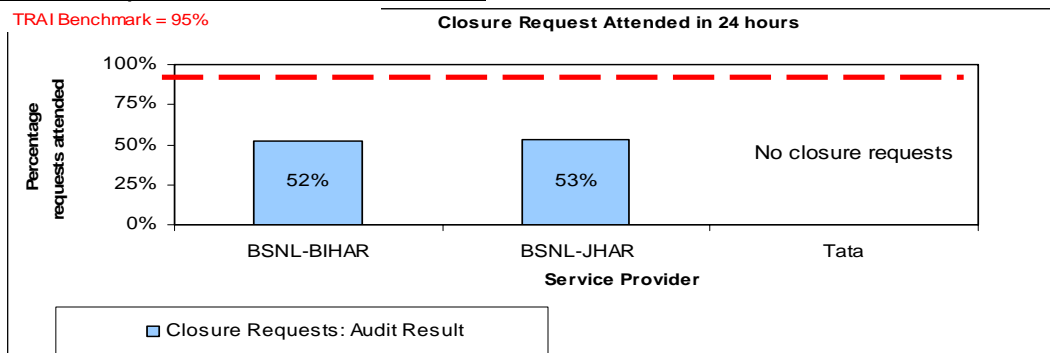
Out of 2 cases of billing complaints reported for BSNL in Jharkhand none was resolved within 4 weeks. For live calling results 100 % of BSNL subscribers in Bihar claimed that their complaint was resolved within 4 weeks. In Jharkhand live calling was only possible for one customer owing to low incidences of billing complaints in sample exchanges audited.

Shift requests attended (Comparison between one month audit results and live calling results)



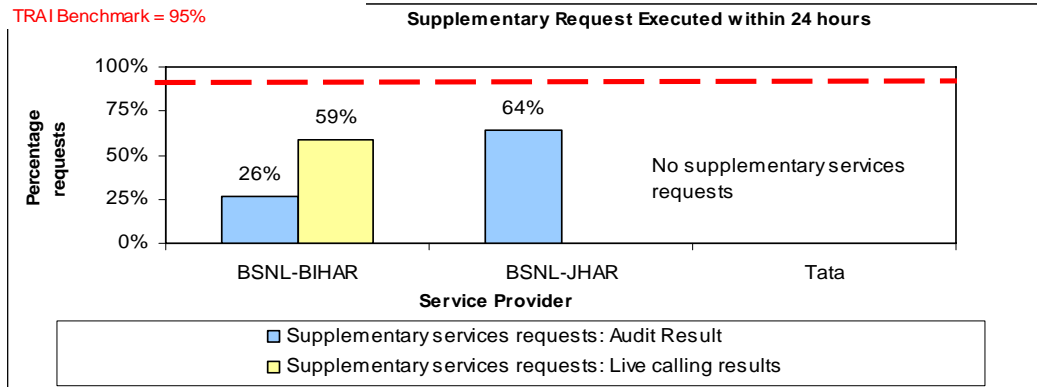
For shift requests attended within 3 days BSNL (Bihar and Jharkhand) fall short of TRAI specified benchmark for the month of audit. Live calling scores are observed to be 46% in Bihar and 73% in Jharkhand for BSNL.

Closure requests attended within 24 hours



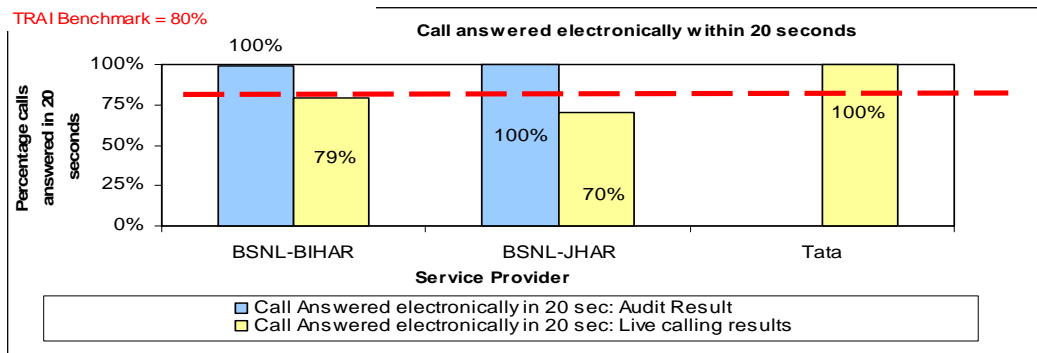
BSNL fall short of the benchmark of 95% closure requests attended within 24 hours for the month of Audit in both Bihar and Jharkhand.

Supplementary requests (Additional services) attended within 24 hours (Comparison between one month audit results and live calling results)

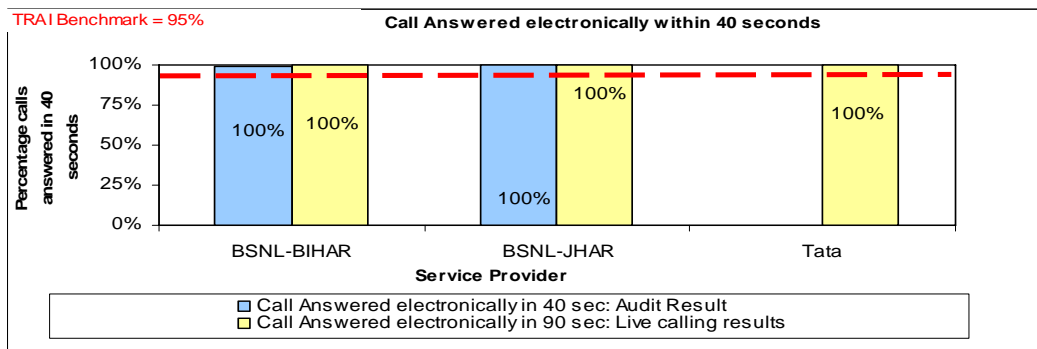


BSNL in both Bihar and Jharkhand falls short of "requests for additional services" to be attended within 24 hours Live calling could not be carried out for BSNL in Jharkhand owing to few cases of supplementary services requests and customers not responding.

Response time to customer for assistance - Calls answered electronically within 20 seconds (Comparison between one month audit live calling results)



BSNL at 79% in Bihar and at 70% in Jharkhand falls short of TRAI specified benchmark for live calling results. Customer care data for TATA was not available at the exchange in Jamshedpur

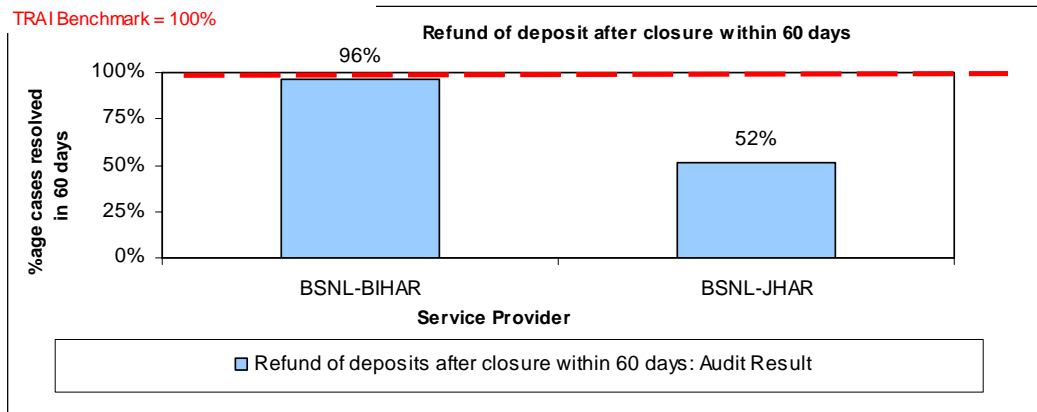


All the service providers meet the TRAI specified benchmark for calls answered electronically within 40 seconds for live calling results.

Response time to customer for assistance - Calls answered by the operator within 60 seconds (Comparison between one month audit results and live calling results)

There is no Voice to Voice customer care facility available to BSNL subscribers in Bihar and Jharkhand. For TATA 100% of the calls made during live calling were answered in 60 seconds by the operator.

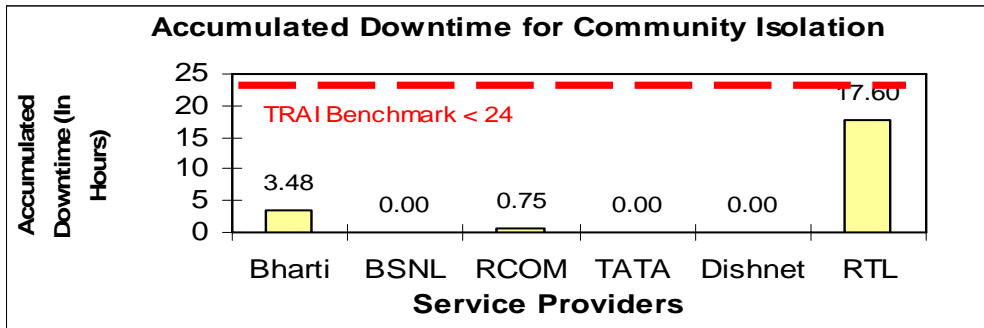
Time taken to refund of deposits after closure



BSNL in both Bihar (96%) and Jharkhand (52%) falls short of TRAI specified benchmark of 100 percent refunds to be made within 60 days.

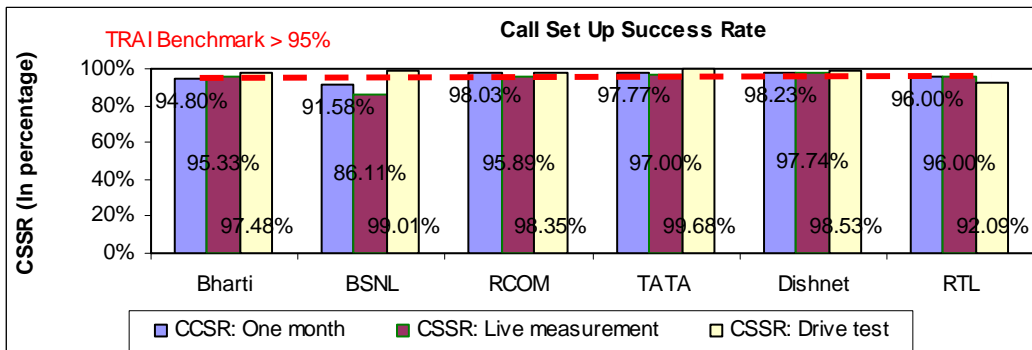
6.2 Graphical/Tabular Representations for Cellular Mobile Services

Accumulated Downtime



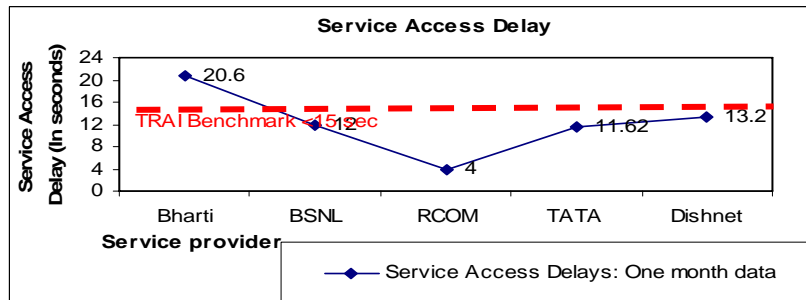
Only BSNL, TATA and Dishnet did not experience a downtime in the circle in the month of audit. All other operators experienced a downtime in their network ranging from 0.75 hours for RCOM to more than 17 hours for RTL.

Call Set-up Success Rate (CSSR)



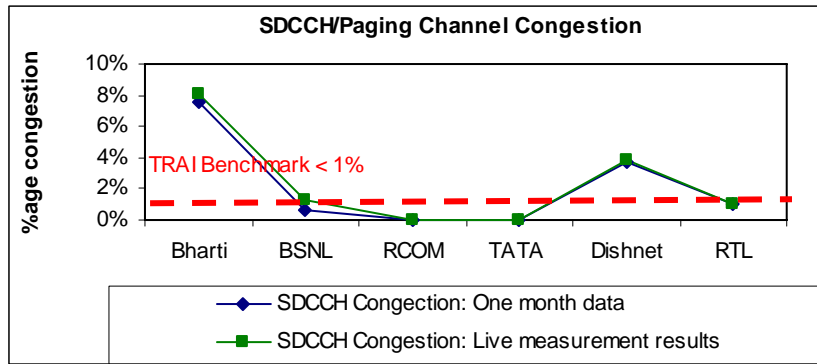
All the operators except Bharti and BSNL are found to be meeting the TRAI benchmark of CSSR greater than 95% for the audit month. During the three day live measurement BSNL was not found not be meeting the benchmark. In the drive test RTL was found not be meeting the TRAI benchmark with a CSSR of 92.09%.

Service Access Delay



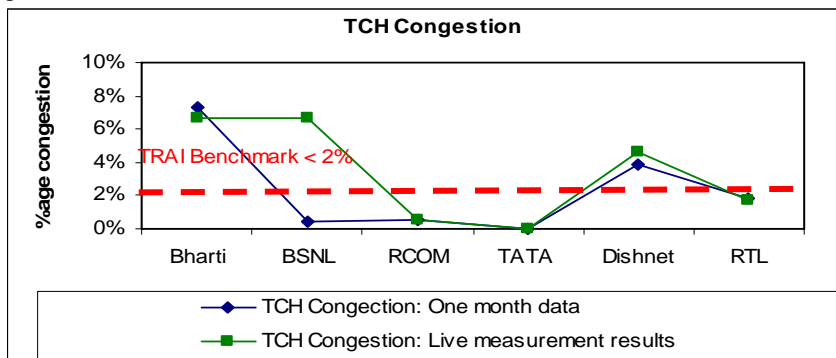
All the operators except Bharti are meeting the benchmark. The auditors measured this parameter using a standard drive test tool kit. The highest service access delay was measured for Bharti at more than 20 seconds and the lowest was for RCOM at 4 seconds.

SDCCH / Paging Channel Congestion



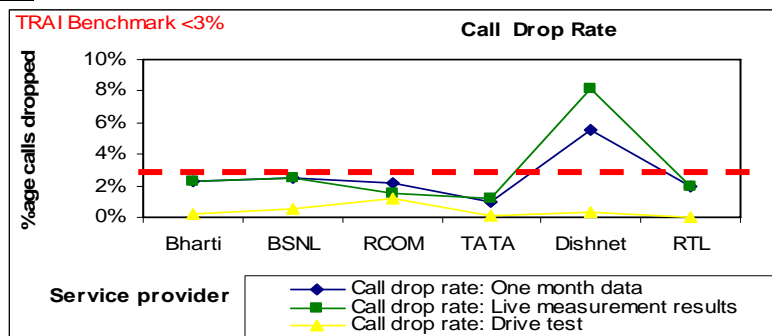
All the operators except Bharti and Dishnet meet the benchmark for the three day live as well as the monthly measurement period. The highest congestion was observed for Bharti followed by Dishnet while the lowest congestion was for TATA and RCOM.

TCH Congestion



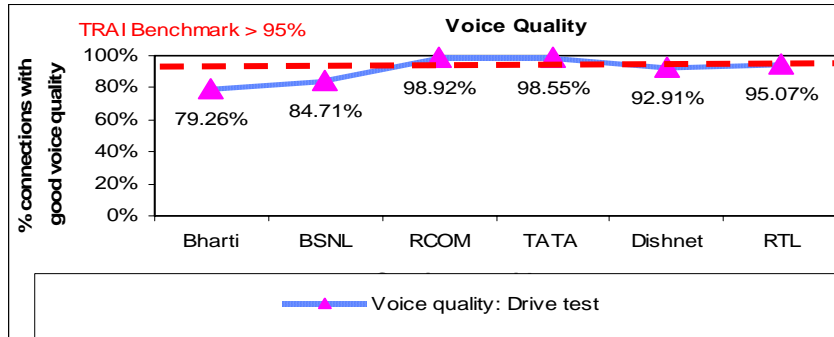
All the operators except Bharti and Dishnet meet the TRAI benchmark for the monthly audit period. However, in addition to both of these BSNL also does not meet the TRAI specified benchmark for the three day live measurement period.

Call Drop Rate



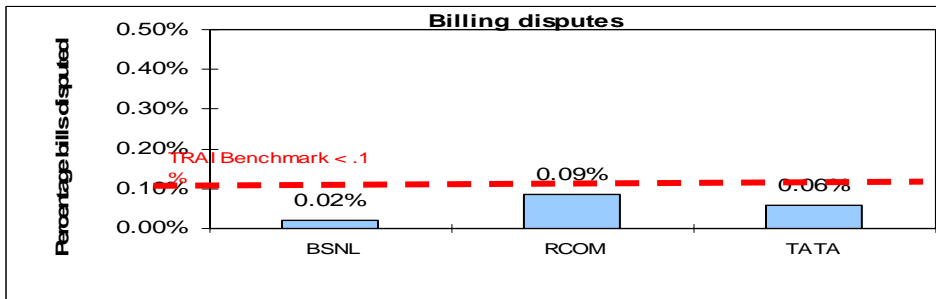
All the operators except Dishnet meet the TRAI benchmark. The operator with the least call drop rates taking into consideration the figures for drive tests, live measurement and the month of audit is TATA.

Voice quality

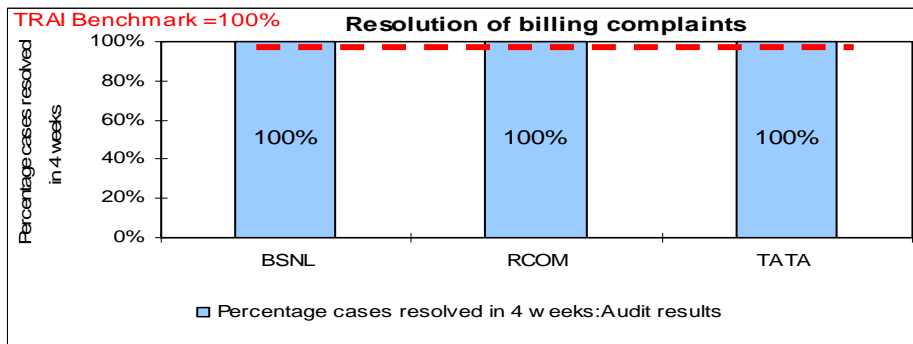


BSNL, Bharti and Dishnet do not meet the TRAI benchmark as found out during the drive test. The lowest percentage of connections with good voice quality was observed across Bharti with 79.26% followed BSNL at 84.71%. RCOM has the highest number of connections with good voice quality at 98.92%.

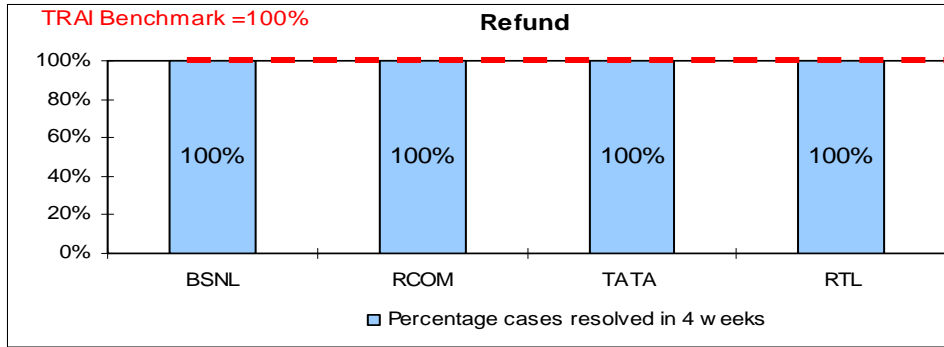
Billing Disputes



All the operators meet the TRAI benchmark for the month of audit. Also, Bharti and RTL did not receive a single complaint for any of the bills generated during the period. Dishnet claims that they have only postpaid subscribers in the circle.

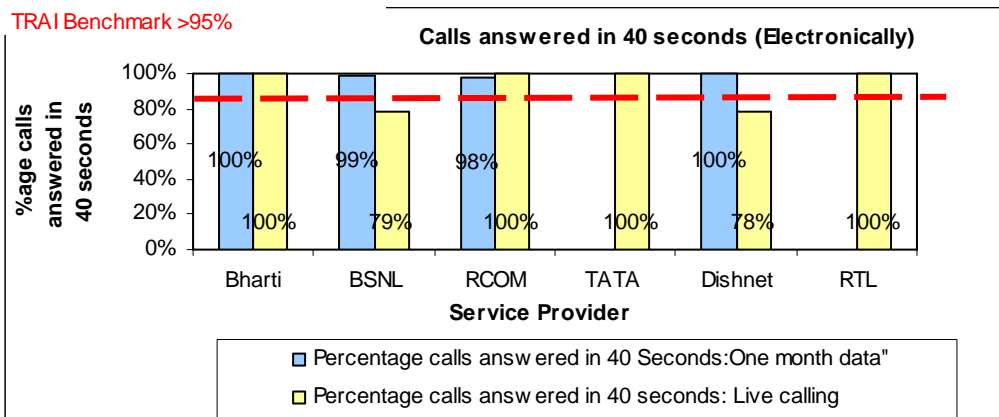
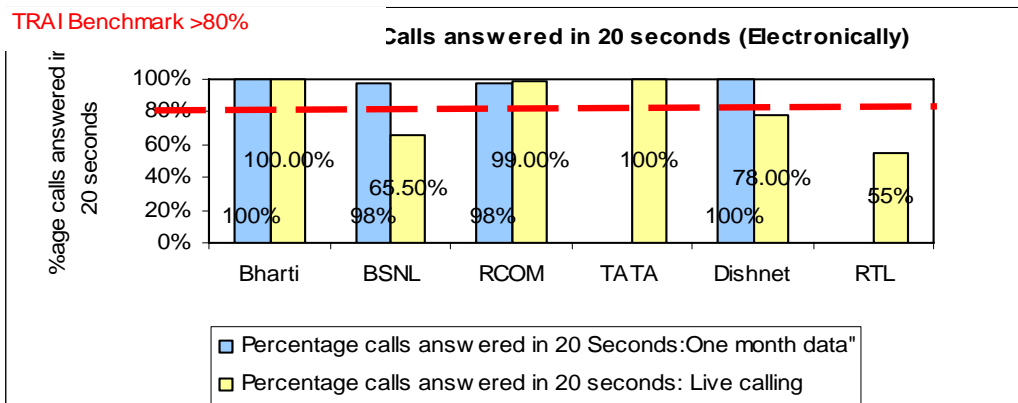


All the operators meet the TRAI benchmark of resolving 100% of the cases related to resolution of billing complaints for the month in which data was collected. However, the operators consider only those as billing complaints where they have issued an internal ticket which essentially means that a refund is due to the customer.

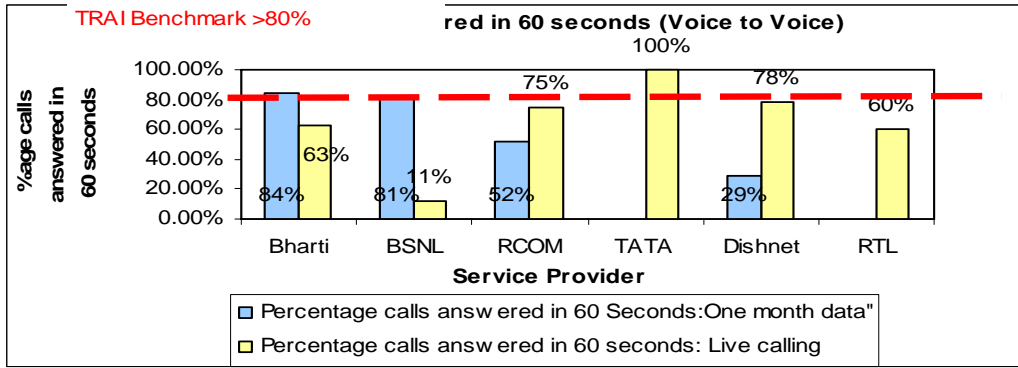


All the operators were found to giving the refunds to their subscribers within the stipulated time period except BSNL.

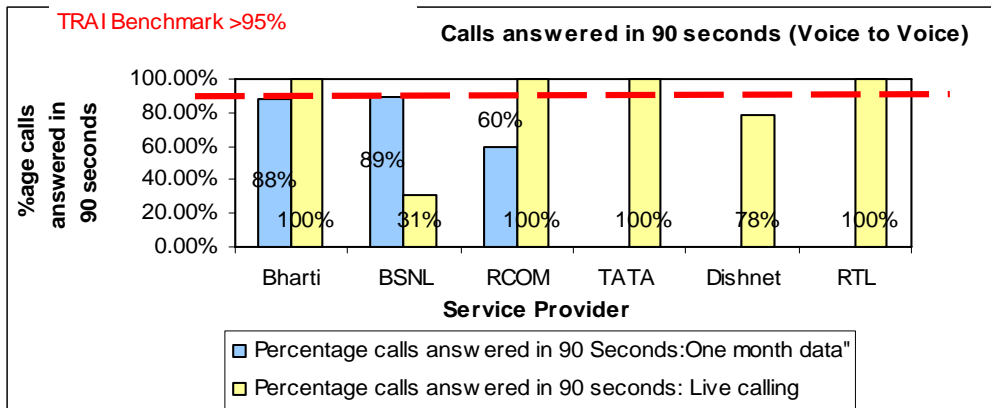
Customer Care / Helpline:



All the operators meet the TRAI benchmark for IVR (Electronic) answering of customers' calls for the one month data. Aircel, BSNL and RTL do not meet the TRAI benchmark on the live calling that was carried out during the audit. Also, TATA and RTL claimed that it has no data available with them at a circle level.



However, during the live calling, except for TATA none of the operators meet the TRAI benchmark. BSNL performs abysmally on this aspect as only 18 out of its 157 calls were established during the living calling. Also, RCOM and Dishnet do not meet the benchmark for the one month audit period of calls answered within 60 seconds.



Except for RTL for monthly measurement none of the operators meet the TRAI benchmark for percentage calls answered by the operator within 90 seconds. For live calling aspect, BSNL and Dishnet do not meet the TRAI benchmark for the live calling for voice to voice calls answered within 90 seconds.

Inter operator calls assessment

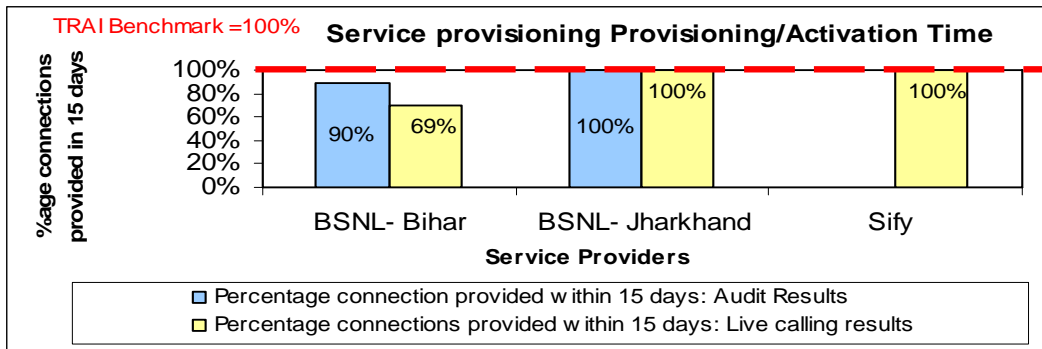
Inter operator call Assessment (To/From)	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Bharti	NA	93.5%	61%	94%	97%	97%
BSNL	94%	NA	86%	96%	98%	97%
TATA	97%	96.5%	86%	NA	97%	97%
Aircel	99%	95.5%	97%	98%	NA	98%
RCOM	96%	85.0%	NA	93%	98%	88%
RTL	97%	75.5%	59%	28%	98%	NA

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. The calls from Bharti to all other service providers were established in the range of 94% to 99%. Similarly BSNL's connectivity with all the operators was found to be not that good where only 75.5% to 96.5% of its calls to numbers of other operators got connected. BSNL had major problems in connecting to a RCOM and RTL

number. However, RCOM has maximum difficulty in connecting to a RTL number with 59% of its calls getting connected. TATA had major problems in connecting to RTL with only 28 out of 100 of its calls getting established. RTL had the most problem in connecting to RCOM number with only 88 out of 100 calls getting established.

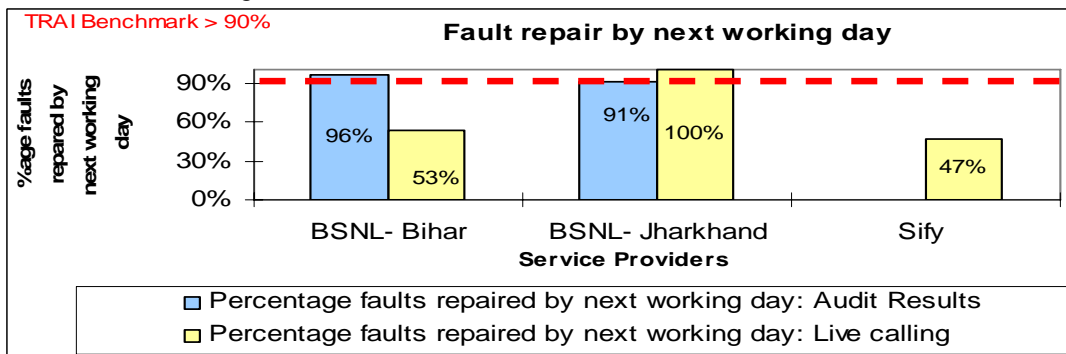
6.3 Graphical/Tabular Representations for Broadband services

Service provisioning/Activation time (Comparison between one month audit results and live calling results)



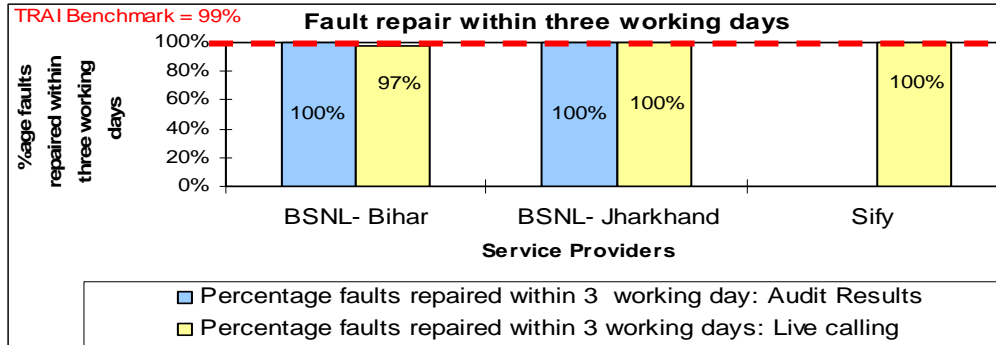
BSNL in Bihar falls short of the benchmark with 90% score for the month of Audit. For Sify there were no new connections registered during the month in which audit was carried out. Live calling scores are observed to be relatively poor for BSNL Bihar at 69%.

Fault repair/Restoration time (By next working day)- Comparison between one month audit results and live calling results



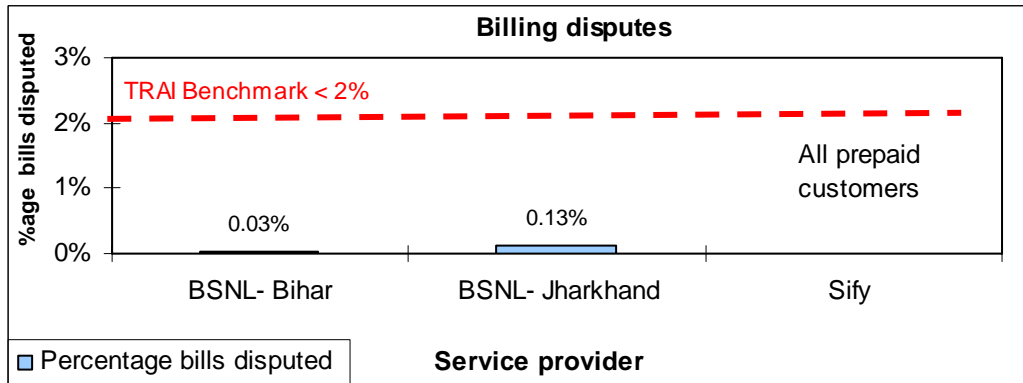
BSNL meets the benchmark for one month data verification for fault repair within 24 hours. For live calling scores are observed to be low for Sify and BSNL Bihar at 47% and 53% respectively. Sify however claimed that there were no faults reported in the month of audit in Bihar circle.

Fault repair/Restoration time within three working days (Comparison between one month audit results and live calling results)



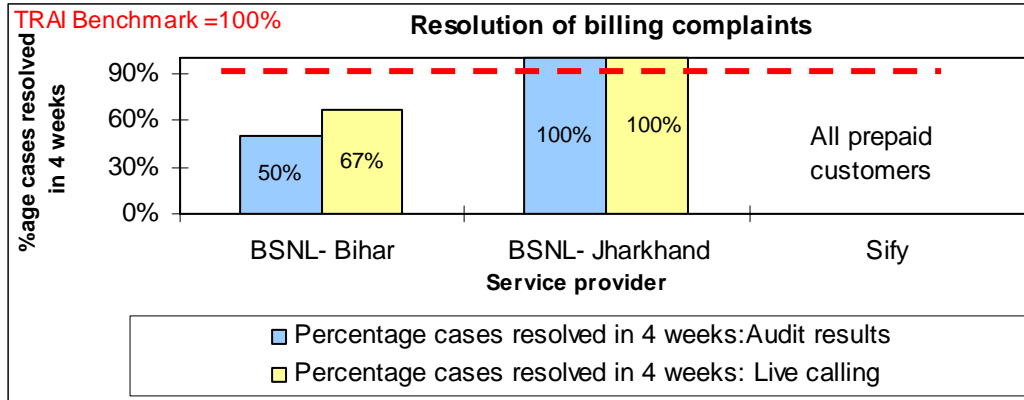
Live calling scores for fault repair within three working days is observed to be good for all the service providers with scores ranging from 97% to 100%. For Sify there were no faults reported in the month in which audit was carried out from Bihar circle.

Percentage bills disputed



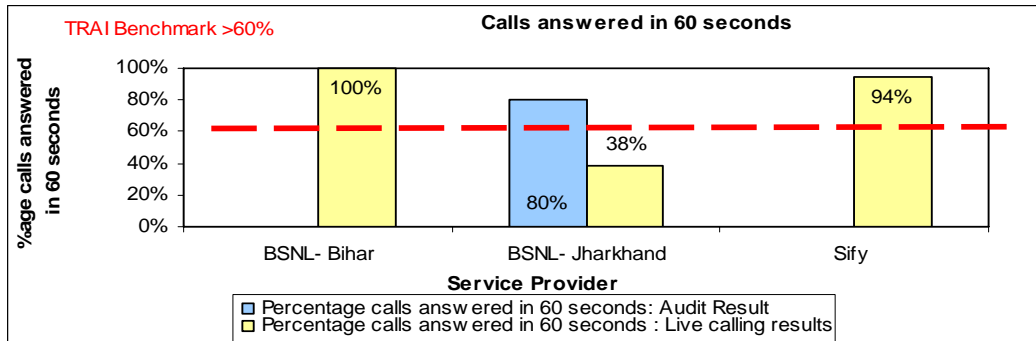
All the operators meet the benchmark on percentage bills disputed in Bihar and Jharkhand circle. Sify claims that all its retail customers are prepaid customers and hence there are no billing complaints.

Resolution of billing complaints (Comparison between one month audit results and live calling results)

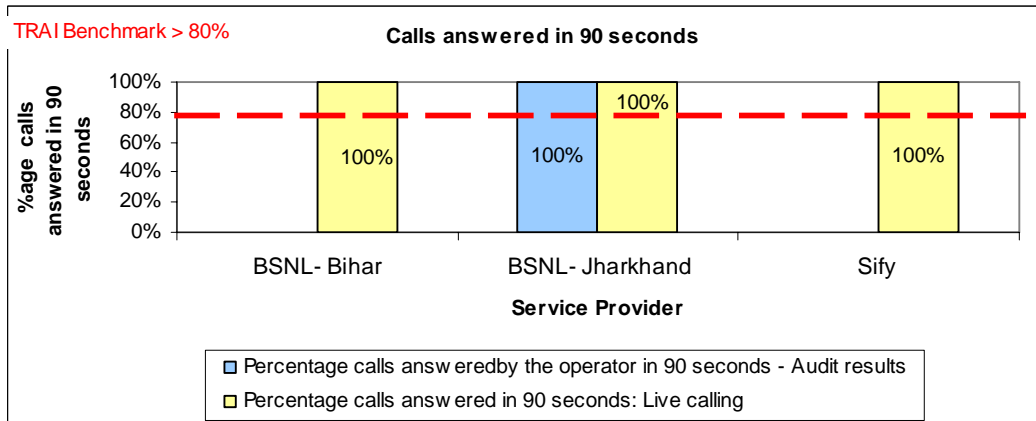


Live calling sample for billing complaints remained low for BSNL in Bihar owing to few billing complaints reported in month prior to visit of audit. Only 2 out of 3 subscribers called claimed that complaint was resolved in time period stipulated by TRAI

Response time to customer for assistance - Calls answered by the operator within 60 seconds (Comparison between one month audit results and live calling results)



All the service providers (except BSNL in Jharkhand for live calling) meet the benchmark as more than 60% of the calls made to customer care were answered by the operator in 60 seconds both for live calling and the month in which Audit was carried out.



All the service providers meet the benchmark as more than 80% of the calls made to customer care were answered by the operator in 90 seconds both for live calling and the month in which Audit was carried out. Sify claimed there isn't any call received at the call centre from Bihar and Jharkhand circle.

Details of call answered within 60 and 90 seconds were not available in Bihar for BSNL. Out of the total 24108 calls received at the call centre 45 percent were answered in 5 seconds, 6% percent were answered in 5 to 10 seconds and rest 49% were answered in greater than 10 seconds.

Bandwidth utilization at Intra network links (Comparison between one month audit results and live measurement results)

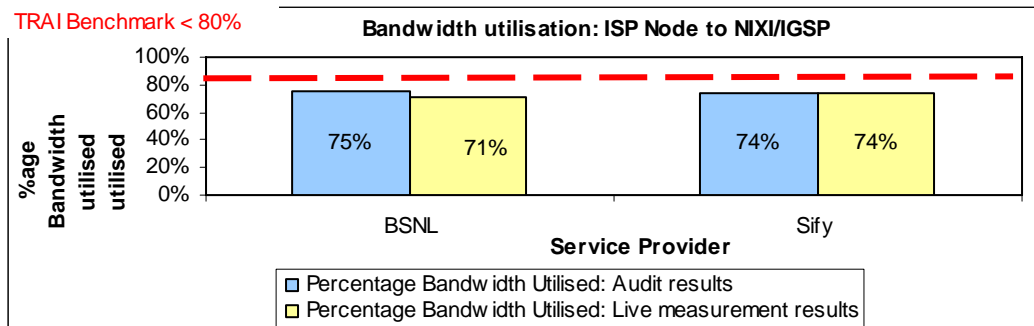
Bandwidth Utilization	B'mark	BSNL	Sify
One month data audit			
Total number of intra network links		BRAS-23,T1-24, T2-610, DSLAM-5456*	400*
No of Intra network found to be above 90%	<80%	Uplink Traffic in Chennai BRAS is > 90%	4*
Live measurement for three days			
No of Intra network Links tested		20* (Bandwidth checked for all uplinks from BRAS^ to core router)	37*
No of Intra network found to be above 90%	<80%	0	0

*Reported on All India Basis , ^BRAS: Broadband Remote Access Server

As far as bandwidth utilization on the intra network links is concerned all the operators seem to performing well as all the sample intra network links (Access segment) tested during live measurement were found to be below 90%.

For Sify, bandwidth utilization at the end customer level (from POP to cable operator) remains unreported which may be a concern as some cable operators may be distributing more connections than their equipped capacity.

Bandwidth utilization at Upstream links (Comparison between one month audit results and live measurement results)



Both Sify and BSNL meet the TRAI specified benchmark cumulatively for all gateways in India.

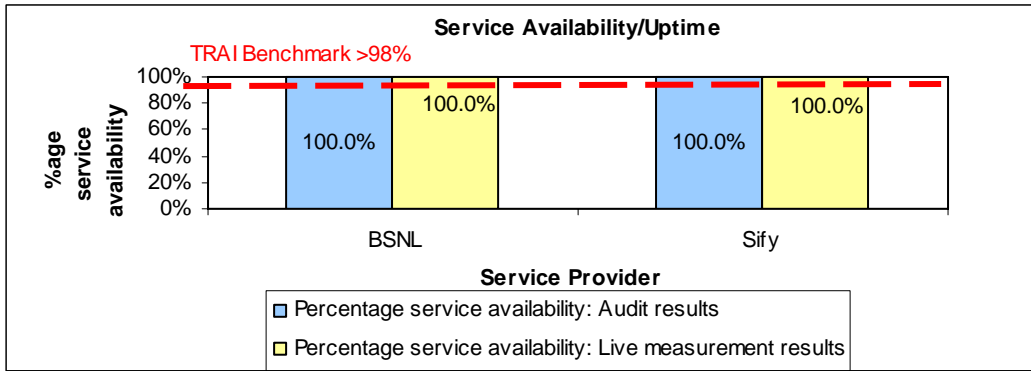
Broadband connection speed available to sample subscribers – Live calling results

Download Speed	Benchmark	BSNL Bihar	BSNL- Jharkhand	Sify
Percentage speed observed cumulatively for sample calls made	>80%	70%	65%	62%

Since verification of records was not possible because of unavailability of historic data with the operators, IMRB auditors also conducted live calling to check speed available at the last mile.

Live calling results reveal that none of the operator could meet the TRAI specified benchmark. (Cumulatively for sample calls made to the customers)

Service availability/Uptime (Comparison between one month audit results and live measurement results)



Both BSNL and Sify meet the benchmark with uptime of more than 98% for the month of Audit and Live measurements.

Compliance reports: Results of Verification of Records for October to December 2007

7.1 Basic (Wireline) services

	Parameter	B'mark	BSNL - Bihar		BSNL - Jharkhand		TATA	
			PMR	IMRB	PMR	IMRB	PMR	IMRB
1	Provision of telephone after registration of demand							
1.1	Percentage connections completed within 7 days	100%	100%	13%	98%	48%	100%	100%
2	Fault incidence/clearance statistics							
2.1	Fault incidence	<5	5.3	10.06	4.9	6.06	0	0.23
2.2	Faults repaired within 24 hours	>90%	77%	49%	84%	81%	NA	Negligible faults owing to low subscriber base
2.3	Mean time to repair	<8 hrs						
3	Call Completion Rate (CCR)	>55%	61%	37%	53%	29%	61%	55%
4	Metering and billing credibility							
4.1	Billing complaints per 100 bills issued	<0.1%	0.02%	0.31%	0.07%	0.01%	0	No details available for verification
4.2	%age of billing complaints resolved within 4 weeks	100%	95%	100%	94%	60%	NA	No details available for verification
5	Customer care/helpline promptness							
5.1	Shift requests (Total number received)							
	Percentage shift requests attended within 3 days	95%	100%	8%	96%	41%	No cases	
5.2	Closure request attended (Total number received)							
	Closure within 24 hours	95%	87%	52%	98%	38%	No cases	
5.3	Supplementary (additional) service requests attended (Total number received)							
	Additional facility provided within 24 hours	95%	88%	91%	99%	33%	100%	100%
6	Response time to customer							
6.1	% age call answered through IVR in 20 seconds	80%	NR	100%	NR	100%	100%	No data available for verification
	% age call answered through IVR in 40 seconds	100%	NR	100%	NR	100%	100%	
6.2	% age calls answered by operator in 60 seconds	80%	NR	No voice to voice service	NR	No voice to voice service	66%	
	% age calls answered by operator in 90 seconds	95%	NR		NR		70%	
7	%age cases where refund received within 60 days	100%	100%	100%	100%	54%	NA	0%

(Note: - For BSNL, verification process was carried out at 5% of the total exchanges spread across 10% of SDCA's. This may be one of the reasons for variation in figures reported in PMR as figures reported are basis sample and not complete universe. Also key takeouts from verification of records has already been explained in Critical findings)



Figures do not match with those reported in PMR



Figures verified on all India basis

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

7.2 Cellular Mobile services

	Parameter	B'mark	SERVICE PROVIDER											
			Bharti		BSNL		RCOM		TATA		Aircel		RTL	
			PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB
A	Network Performance													
1	Accumulated Downtime	< 24 hrs.	0 hr	7.67hr	21 hr	18.30hr	0.49hr	0.49hr	0.88hr	0.88hr	0 hr	0 hr	17.86hr	17.86hr
2	Call set up success rate	> 95%	96.86%	93.70%	98.60%	88.49% (Bihar) 95.15% (Jharkhand)	99.30%	99.30%	97.70%	97.70%	95.94%	95.92%	97.00%	97.00%
3	Service Access delay	9 to 20 sec	9.4 s	9.4 s	12 s	DNA	4.1s	4.1 s	5.72 s	5.72 s	8 s	8 s	Complied	
4	Blocked call rate													
	<i>SDCCH Congestion</i>	< 1 %	6.09%	6.09%	0.30%	0.40%	0%	0%	0%	0%	0.86%	4.02%	0.94%	0.94%
	<i>TCH Congestion</i>	< 2 %	4.13%	4.13%	0.90%	0.50%	0%	0%	0.27%	0.27%	0.90%	3.53%	1.91%	1.91%
5	Call drop rate	< 3 %	2.40%	2.80%	1.10%	3.13%	0.80%	0.80%	1.17%	1.24%	0.82%	7.46%	1.42%	1.42%
6	%age connections with good voice quality	> 95%	96.93%	86.47%	98.50%	98.50%	97.30%	97.30%	Complied		98.47%	98.47%	95.26%	95.26%
7	Service coverage		Complied		Complied		Complied		Complied		Complied		Complied	
8	POI congestion	< 0.5%	Complied		Complied		2.20%	2.20%	Complied		Complied		Complied	
B	Customer Care													
	Calls answered electronically													
	<i>Within 20 seconds</i>	> 80%	100.00%	100.00%	89.00%	96.83%	97.30%	97.30%	100%	100%	100.00%	100.00%	Verification not possible because operator does not have previous data	
	<i>Within 40 seconds</i>	> 95%	100.00%	100.00%	98.00%	98.65%	97.30%	97.30%	100%	100%	Not Measured			
	Calls answered by the operator													
	<i>Within 60 seconds</i>	> 80%	86.00%	86.00%	88.00%	81.33%	96.20%	96.20%	66.50%	66.50%	34%	34%	Verification not possible because operator does not have previous data	
	<i>Within 90 seconds</i>	> 95%	90.00%	90.00%	98.00%	92.00%	97.10%	97.10%	69.90%	69.90%	Not Measured			
C	Billing complaints													
	Billing complaints/100 bills	< 0.1	0.20%	0.11%	0.00%	0.00%	0.08%	0.08%	0.03%	0.24%	No postpaid subscribers of service provider		0%	0%
	%age complaints resolved within 4 weeks	100%	100%	100%	100.00%	100.00%	100%	100%	100%	100%			100%	100%
	Period of refunds due to customers	100%	100%	100%	100%	100%	100%	100%	100%	100%			100%	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

7.3 Broadband services

Parameter	B'mark	BSNL Bihar		BSNL – Jharkhand		Sify	
		PMR	IMRB	PMR	IMRB	PMR	IMRB
Service provisioning							
Percentage connections provided within 15 days	100%	94%	52%	100%	100%	100%	100%
Fault repair restoration time							
Percentage faults repaired by next working days	> 90%	90%	98%	91%	90%	91%	91%
Percentage faults repaired within three working days	99%	98%	100%	98%	100%	99%	99%
Billing performance							
Billing complaints per 100 bills issued	<2%	0.96%	0.3%	0.03%	0.08%	Prepaid	
%age of billing complaints resolved in 4 weeks	100%	95.00%	100%	99.78%	100.00%		
%age cases in which refund of deposits after closure was made in 60 days	100%	100%	100%	100%	100%		
Customer care/helpline assessment (Voice to Voice)							
Percentage calls answered within 60 seconds	> 60%	94.00%	Break of calls answered within 60 and 90 seconds not available	84.40%	75.32%	88%	88%
Percentage calls answered within 90 seconds	> 80%	98.00%		95.00%	96%	98%	98%
Bandwidth utilization/Throughput							
<i>Intra network links (POP to ISP Node)</i>							
Total number of intra network links > 90%				0		5	5
<i>Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)</i>							
Percentage bandwidth utilised on upstream links	< 80%			78%		85%	85%
Broadband download speed				No raw data available for verification			
Service availability/uptime	> 98%			Complied		100%	100%
Packet loss	<2%					No raw data available for verification	
Network Latency				Complied			
POP/ISP Node to NIXI	< 120 msec			Complied			
ISP node to NAP port (Terresrtial)	< 350 msec			Complied			

⁴⁴ Methodology not in Line with QoS regulation, Data verified on All India basis, NR – Not reported DNA- Details Not Available for verification, B'mark = TRAI Benchmark Figures do not match those in PMR ,

7.4 Conclusions

7.4.1 Basic Wireline Services

1. The figures for BSNL vary because the audit was conducted only in sample exchanges (5% spread across 10% of SDCA's) and the PMR figure is reported by the operator on the overall circle level.
2. For TATA data pertaining to call centre and billing was not available at the exchange in Jamshedpur
3. Also Fault incidences, CCR and MTTR were found to be high for some of the exchanges for BSNL which has resulted in a high average on these parameters.

7.4.2 Cellular Mobile services

1. The figures for BSNL & Bharti do not match for accumulated downtime and CSSR.
2. Except from RCOM and RTL, figures for all other operators do not match from call drop rate.
3. Bharti does not meet the benchmark on SDCCH and TCH congestion
4. Bharti's figures for connections with good voice quality do not match
5. BSNL figures for customer care / helpline assessment do not match.
6. RCOM's figure for IVR related aspects is reported on an all India level

7.4.3 Broadband services

1. For BSNL there was slight variation observed in the results. Prime reason for same is that the audit was carried out for sample POP's whereas the figures reported are for all the POP's in the circle.
2. Interestingly the details of calls answered within 60 seconds and 90 seconds were no available at the PoPs in Bihar. Out of the total calls received 48% were answered in 5 seconds, 16% were answered within 5 to 10 seconds and rest were answered in >10 seconds.
3. Complete data for Sify was verified on an all India level.
4. Historic data for Broadband download speed and Ping test conducted to check the latency and packet loss was not available for Sify
5. Although Sify claimed that they conduct random ping tests and latency to check the packet loss but there is no book keeping which is maintained at their end.

8. Annexure - I

8.1 Parameter wise performance reports for Basic Wireline services

One month data verification results for Service provisioning

Service provisioning/Activation time	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Number of connections registered during the period		121	28	0
Total number of connections provided within 7 days		29	21	0
Percentage of connections provided within 7 days	100%	24%	75%	NA
Total number of connections provided after 7 days		71	7	0
Percentage of connections provided after 7 days		59%	25%	NA

Live calling results for Service provisioning

Service Provisioning/Activation Time	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of service registration calls made		77	22	0
Number of cases in which connection was provided in 7 Days		30	16	0
Percentage cases in which connection was provided in 7 days	100%	39%	73%	NA
Number of cases in which connection was provided after 7 days		47	6	0
Percentage cases in which connection was provided after 7 days		61%	27%	NA
Percentage cases in which connection was provided after 7 days		61%	27%	NA

One month data verification results for Fault repair/Restoration time

Fault Repair/Restoration time	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total number of faults registered during the period		5826	1459	17
Total number of faults repaired by next working day		3749	1238	17
Percentage of faults repaired by next working day	>90%	64%	85%	100%
Total number of fault repaired within three working days		4836	1411	17
Percentage faults repaired within three working days	100%	83%	97%	100%

Live calling results for Fault repair/Restoration time

Fault Repair	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of calls made		508	406	10
Number of cases where faults were repaired by next working day		308	349	10
Percentage cases where faults were repaired by next working day	>90%	61%	86%	100%
Number of cases where faults were repaired within 3 days		394	383	10
Percentage cases where faults were repaired within 3 days	100%	78%	94%	100%

One month data verification results for CCR

Traffic statistics - Call Completion Rate	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total local call attempts		1676339	2123281	24164
Total number of successful local calls		600192	784558	14511
Call Completion Rate (CCR) in the local network	>55%	36%	37%	60%

Live measurement results for CCR

Traffic statistics - Call Completion Rate	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total local call attempts		3246888	2474098	746110
Total number of successful local calls		1319746	969586	571961
Call Completion Rate (CCR) in the local network	>55%	41%	39%	77%

One month data verification results for Billing performance

Billing Performance	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Billing disputes				
Total bills generated during the period		32375	13244	Details not available at the exchange
Total number of bills disputed		36	2	
Percentage bills disputed	0.10%	0.11%	0.02%	
Resolution of billing complaints				
Total complaints resolved in 4 weeks from date of receipt		35	0	Details not available at the exchange
Percentage complaints resolved within 4 weeks of date of receipt	100%	97%	0%	

Live calling results for billing performance

Resolution of billing complaints	Benchmark	BSNL-BIHAR	BSNL-JHAR
Total Number of calls made		15	1
Number of cases resolved in 4 weeks		15	1
Percentage cases resolved in four weeks	100%	100%	100%

One month data verification for Customer Care – Shifts

Customer Care - Shift Requests	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of shift requests received		53	11	0
Total number requests attended in 3 days		14	7	0
Total number requests attended beyond 3 days		36	4	0
Shifts not attended		3	0	0
Percentage of requests attended in 3 days	95%	26%	64%	NA
Percentage of requests attended beyond 3 days		68%	36%	NA
Percentage of shifts not attended		6%	0%	NA

Live calling results for Customer Care – Shifts

Customer Care - Shift Requests	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total number of call to shift requests		44	11	0
Total number of requests attended in 3 days	95%	20	8	0
Total number of requests attended beyond 3 days		23	3	0
Shifts not attended		1	0	0
Percentage of requests attended in 3 days		45%	73%	NA
Percentage of requests attended beyond 3 days		52%	27%	NA
Percentage of shifts not attended		2%	0%	NA

One month data verification Audit results for Customer Care – Closures

Customer Care - Closure Requests	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of closure requests received		275	75	0
Total closure attended within 24 hours	95%	143	40	0
Total number of requests attended beyond 24 hours		124	35	0
Closure requests not attended		8	0	0
Percentage of closure attended within 24 hours		52%	53%	NA
Percentage of closure attended beyond 24 hours		45%	47%	NA
Percentage of closures not attended		3%	0%	NA

One month data verification for Customer Care – Supplementary requests

Customer Care - Supplementary Requests	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of supplementary requests received		170	39	0
Total number of requests attended within 24 hours	95%	45	25	0
Total number of requests attended beyond 24 hours		122	14	0
Supplementary requests not attended		3	0	0
Percentage of requests attended within 24 hours		26%	64%	NA
Percentage of requests attended beyond 24 hours		72%	36%	NA
Percentage of supplementary requests not attended		2%	0%	NA

Live calling results for Customer Care – Supplementary requests

Customer Care - Supplementary Requests	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of supplementary requests received		17	0	0
Total number requests attended within 24 hours	95%	10	0	0
Total number requests attended beyond 24 hours		3	0	0
Supplementary requests not attended		4	0	0
Percentage of requests attended within 24 hours		59%	NA	NA
Percentage of requests attended beyond 24 hours		18%	NA	NA
Percentage of supplementary requests not attended		24%	NA	NA

One month data audit for calls answered electronically

Customer Care Assessment	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of calls dialed on toll free number		20292	282	
Total Number of calls answered by IVR in 20 seconds	80%	20198	282	Details not available at the exchange
Percentage calls answered in 20 seconds		100%	100%	
Calls answered within 40 seconds				
Total Number of calls answered by IVR in 40 seconds	95%	20198	282	Details not available at the exchange
Percentage calls answered in 40 seconds		100%	100.00%	

Live calling results for calls answered electronically

Customer Care Assessment	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of calls dialed on toll free number		483	150	50
Calls answered within 20 seconds				
Total Number of calls answered by IVR in 20 seconds	80%	382	105	50
Percentage calls answered in 20 seconds		79%	70%	100%
Calls answered within 40 seconds				
Total Number of calls answered by IVR in 40 seconds	95%	483	150	50
Percentage calls answered in 40 seconds		100%	100%	100%

One month data verification Audit results for Refund of deposits after closure

Resolution of billing complaints	Benchmark	BSNL-BIHAR	BSNL-JHAR	Tata
Total Number of cases requiring refund		1392	62	0
Number of cases where refund was made in < 60 days		1342	32	0
Percentage cases where refund was made in < 60 days	100%	96%	52%	NA

Level 1 services	Bharti – Jharkhand	BSNL - Bihar	TATA
TOTAL Calls Made	266	300	200
Answered in 60 seconds	196	172	185
Percentage calls answered in 60 seconds	74%	57%	92%

8.2 Parameter wise performance reports for Cellular Mobile services

Accumulated Downtime	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total Downtime (In hours)	3.48	0.00	0.75	0.00	0.00	17.60

Audit Results for CSSR

CSSR	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total number of call attempts	388600968	54054547	DNP	481900270	111527310	DNP
Total number of successful calls	368405435	49504549	DNP	471153894	109554412	DNP
CSSR	94.80%	91.58%	98.03%	97.77%	98.23%	96.00%

Live measurement results for CSSR

CSSR	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total number of call attempts	81586022	54996002	DNP	50246748	58048759	DNP
Total number of successful calls	77778267	47354738	DNP	48740058	56734536	DNP
CSSR	95.33%	86.11%	95.89%	97.00%	97.74%	96.00%

Drive test results for CSSR (Average of three drive tests)

CSSR	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total number of call attempts	556	403	605	308	613	392.00
Total number of successful calls	542	399	595	307	604	361.00
CSSR	97.48%	99.01%	98.35%	99.68%	98.53%	92.09%

DNP – the figure was obtained directly from the system.

Service Access Delay	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
One month data collection	20.6	12	4	11.62	13.2	Complied

Audit results for SDCCH and TCH Congestion

Traffic Statistics	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
SDCCH Congestion						
Total number of SDCCH Attempts	35364537	5022611	DNP	621844	4716443	7873947.00
Total Number of SDCCH Congestions	2661919	34445	DNP	0	DNP	76770.00
Percentage SDCCH Congestion	7.53%	0.69%	0.00%	0.00%	3.74%	0.97%
TCH Congestion						
Total number of TCH Attempts	13536217	223912	DNP	2472238	3465907	6589526.00
Total Number of TCH Congestions	993873	DNP	DNP	0	DNP	117781.00
Percentage TCH Congestion	7.34%	0.39%	0.56%	0.00%	3.90%	1.79%

Live measurement results for SDCCH and TCH Congestion

Traffic Statistics	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
SDCCH Congestion						
Total number of SDCCH Attempts	35861565	2511818	DNP	620684	2084375	8060500.00
Total Number of SDCCH Congestions	2895936	33624	DNP	0	DNP	79370.00
Percentage SDCCH Congestion	8.08%	1.34%	0.00%	0.00%	3.86%	0.98%
TCH Congestion						
Total number of TCH Attempts	15567285	49787943	DNP	2064005	1046003	6721127.00
Total Number of TCH Congestions	1031902	3345691	DNP	0	DNP	113632.00
Percentage TCH Congestion	6.63%	6.72%	0.51%	0.00%	4.57%	1.69%

DNP – the figure was obtained directly from the system.

Audit Results for Call drop rate

Call drop rate	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total number of calls established	368405435	47829067	DNP	471153894	3308082	2283719.00
Total number of calls dropped	8477385	1201550	DNP	4617308	182373	45742.00
Call drop rate	2.30%	2.51%	2.21%	0.98%	5.51%	2.00%

Live measurement results for Call drop rate

Call drop rate	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total number of calls established	44098883	4791781	DNP	48740058	2048506	2396813.00
Total number of calls dropped	1001860	119572	DNP	565385	167779	45933.00
Call drop rate	2.27%	2.50%	1.54%	1.16%	8.19%	1.92%

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

Call drop rate	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total number of calls established	542	399	420	706	604	351.00
Total number of calls dropped	1	2	5	1	2	0.00
Call drop rate	0.18%	0.50%	1.19%	0.14%	0.33%	0.00%

DNP – the figure was obtained directly from the system.

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

Voice quality	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total number of sample calls	914962	236001	33940	108312	896635	654794
Total number of calls with good voice quality	725159	199919	33572	106740	833043	622520
%age calls with good voice quality	79.26%	84.71%	98.92%	98.55%	92.91%	95.07%

POI congestion	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
POI traffic offered on all individual POI's	DNP	DNP	DNP	DNP	DNP	DNP
Served traffic for all individual POI's	DNP	DNP	DNP	DNP	DNP	DNP
Traffic failed on all individual POI's	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

DNP – the figure was obtained directly from the system.

Audit results for customer care (Electronically)

Customer Care Assessment	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total Number of calls received by	DNP	20325	40324997	DNP	3520758	Details not available with the service provider – call centre outsourced
Total Number of calls answered in 20 seconds	DNP	19845	39476257	Operator said the same is centralized and details cannot be provided here	3520758	
Percentage calls answered in 20 seconds	100.00%	97.64%	97.90%		100.00%	
Calls answered within 40 seconds						
Total Number of calls answered in 40 seconds	DNP	20165	39476257	Operator said the same is centralized and details cannot be provided here	3520758	
Percentage calls answered in 40 seconds	100.00%	99.21%	97.90%		100.00%	

Live calling results for customer care (Electronically)

Customer Care Assessment	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total Number of calls received by the operator	100	200	100	100	100	100

Calls answered within 20 seconds						
Total Number of calls answered in 20 seconds	100	131	99	100	78	55
Percentage calls answered in 20 seconds	100.00%	65.50%	99.00%	100%	78.00%	55%
Calls answered within 40 seconds						
Total Number of calls answered in 40 seconds	100	157	100	100	78	100
Percentage calls answered in 40 seconds	100.00%	78.50%	100.00%	100.00%	78.00%	100.00%

Audit results for customer care (Voice to Voice)

Customer Care Assessment	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total Number of calls received by the operator	3662250	71041	128422	DNP	DNP	345060
Calls answered within 60 seconds						
Total Number of calls answered in 60 seconds	3078731	57898	66908	Operator said the same is centralized and details cannot be provided here	DNP	345060
Percentage calls answered in 60 seconds	84.07%	81.50%	52.10%		29.00%	100%
Calls answered within 90 seconds						
Total Number of calls answered in 90 seconds	3236274	63226	76703	Operator said the same is centralized and details cannot be provided here	DNP	345060
Percentage calls answered in 90 seconds	88.37%	89.00%	59.73%		Not Measured	100%

Live calling results for customer care (Voice to Voice)

Customer Care Assessment	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total Number of calls made	100	157	100	100	100	100
Number calls answered within 60 seconds	63	18	75	100	78	60
Percentage calls answered in 60 seconds	63%	11%	75%	100%	78%	60%
Number calls answered within 90 seconds	100	49	100	100	78	100
Percentage calls answered in 90 seconds	100%	31%	100%	100%	78%	100%

DNP – the figure was obtained directly from the system.

Audit Results for Billing performance

Billing Performance	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Billing disputes						
Total bills generated during the period	12991	46485	41327	30772	NA	1527
Total number of bills disputed	0	9	36	18	NA	0.00
Percentage bills disputed	0.00%	0.02%	0.09%	0.06%	NA	0.00
Resolution of billing complaints						

Total complaints resolved in 4 weeks from date of receipt	NA	9	36	18	NA	NA
Percentage complaints resolved within 4 weeks of date of receipt	NA	100%	100%	100%	NA	NA
Refund						
Total number of cases requiring refund of deposits	NA	6	36	65	NA	7
Total number of cases where refund was made within 60 days	NA	6	36	65	NA	7
Percentage cases in which refund was receive within 60 days	NA	100%	100%	100%	NA	100%

Live calling results for resolution of billing complaints

Resolution of billing complaints	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Total Number of calls made	NA	27	NA	26	NA	NA
Number of cases resolved in 4 weeks	NA	23	NA	26	NA	NA
Percentage cases resolved in four weeks	NA	85%	NA	100%	NA	NA

Inter operator call Aseessment (To/From)	Bharti	BSNL	RCOM	TATA	Dishnet	RTL
Bharti	NA	93.5%	61%	94%	97%	97%
BSNL	94%	NA	86%	96%	98%	97%
TATA	97%	96.5%	86%	NA	97%	97%
Aircel	99%	95.5%	97%	98%	NA	98%
RCOM	96%	85.0%	NA	93%	98%	88%
RTL	97%	75.5%	59%	28%	98%	NA

8.3 Parameter wise performance reports for Broadband services

One month data verification results for Service provisioning

Service provisioning/Activation time	B'mark	BSNL- Bihar	BSNL- Jharkhand	Sify
No of connections registered during the period		396	478	0
Total number registered during 15 days		355	478	0
Percentage of connections provided within 15 days	100%	89.6%	100.0%	NA

Live calling results for Service provisioning

Service Provisioning/Activation Time	B'mark	BSNL- Bihar	BSNL- Jharkhand	Sify
Total Number of calls made		307	100	84
Number of cases in which connection was provided in 15 Days		213	100	84
Percentage cases in which connection was provided in 15 days	100%	69%	100%	100%

One month data verification results for Fault repair

Fault Repair/Restoration time	B'mark	BSNL- Bihar	BSNL- Jharkhand	Sify
Total number of faults registered during the period		777	676	0
Total number of faults repaired by next working day		747	614	0
Percentage of faults repaired by next working day	>90%	96%	91%	NA
Total number of faults repaired within three working days		777	676	0
Percentage of faults repaired within three working days	>99%	100%	100%	NA

Live calling results for fault repair

Fault Repair	B'mark	BSNL- Bihar	BSNL- Jharkhand	Sify
Total Number of calls made		118	30	30
Number of cases in which faults were repaired by next working day		63	30	14
Percentage cases in which faults were repaired by next working day	>90%	53%	100%	47%
Number of cases in which faults were repaired within three working days		52	30	30
Percentage cases in which faults were repaired within three working days	>99%	44%	100%	100%

One month data verification results for billing performance

Billing Performance	B'mark	BSNL- Bihar	BSNL- Jharkhand	Sify
Billing disputes				
Total bills generated during the period		6804	7541	Prepaid
Total number of bills disputed		2	10	
Percentage bills disputed	<2%	0.03%	0.13%	
Resolution of billing complaints				
Total complaints resolved in 4 weeks from date of receipt		1	10	Prepaid
Percentage complaints resolved within 4 weeks of date of receipt	100%	50%	100%	
Refund of deposits after closure				
Total number of cases requiring refund of deposits		5	0	0
Total number of cases where refund was made within 60 days		4	0	0
Percentage cases in which refund was receive within 60 days	100%	80%	NA	NA

Live calling results for billing complaints

Resolution of billing complaints	B'mark	BSNL- Bihar	BSNL- Jharkhand	Sify
Total Number of calls made		3	29	Prepaid
Number of cases resolved in 4 weeks		2	29	
Percentage cases resolved in four weeks	100%	67%	100%	

Live calling results for call centre

Customer Care Assessment	B'mark	BSNL- Bihar	BSNL- Jharkhand	Sify
Total Number of calls made		100	50	50
Calls answered within 60 seconds				
Number calls answered within 60 seconds		100	19	47
Percentage calls answered in 60 seconds	>60%	100%	38%	94%
Calls answered within 90 seconds				
Number calls answered within 90 seconds		100	50	50
Percentage calls answered in 90 seconds	>80%	100%	100%	100%

One month data verification results for Service Availability/Uptime

Service Availability Uptime	B'mark	BSNL	Sify
Total Operational Hours		53568	744
Total Downtime		2	0
Total time when the service was available		53566	744
Service Availability Uptime in Percentage	>98%	100.0%	100.0%

Three day live measurement results for Service Availability/Uptime

Service Availability Uptime	B'mark	BSNL	Sify
Total Operational Hours		1728	72
Total Downtime		0	0
Total time when the service was available		1728	72
Service Availability Uptime in Percentage	>98%	100.00%	100.00%

One month data verification results for Bandwidth utilisation

Bandwidth Utilization	B'mark	BSNL	Sify
Total number of intra network links		BRAS-23,T1-24,T2-610, DSLAM-5456	400
No of Intra network found to be above 90%		Uplink Traffic in Chennai BRAS is > 90%	4
Total number of upstream links		97	28
No of upstream links found to be above 90%		1	0
Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs)		17233	2830
Total International Bandwidth utilised during peak hours		12877	2097
Percentage Bandwidth utilisation during peak hours (In mpbs)	>90%	75%	74%

Live measurement results for Bandwidth utilisation

Bandwidth Utilization	B'mark	BSNL	Sify
Total number of intra network links		BRAS-23,T1-24,T2-610, DSLAMS-5456	400
No of Intra network Links tested		20	37
No of Intra network found to be above 90%		0	0
Total number of upstream links		97	28
No of Intra network found to be above 90%		10 to 20	0
Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs)		18157	2830
Total International Bandwidth utilised during peak hours		12909	2082
Percentage Bandwidth utilisation during peak hours (In mpbs)	>90%	71%	74%

9 Annexure – II Detailed Explanation of Audit methodology (Parameter wise)

9.1 For Basic wireline services

1. Provision of telephone after registration of demand	
Computational Methodology as per QoS definition	Percentage connections provided within 7 working days = (No. of connections provided within seven working days/ Total number of connections registered during the period of 3 months) * 100 Technically Non Feasible (TNF) cases such as unavailability of telephone infrastructure/ equipment in the Area or Spare Capacity for activating telephone connection shall be excluded from the calculation of this parameter.
Benchmark	100% cases in <7 days, subject to technical feasibility
Audit Procedure	IMRB Auditors verified and collected data pertaining to number of applications received at the service provider's level in the following time frames:- - Number of connections provided within 7 days - Number of connections provided after 7 days - Number of connections were request is still pending Live calling :- - Interviewers ensured that operator should provide list of all new numbers added in one month prior to IMRB staff visit. - Live calling team called up at least 10% of the customers who applied for new connections during the month prior to Audit - Checked and Recorded whether the connection was provided within 7 days of registration on demand

2. Fault incidence/clearance related statistic	
Computational Methodology	Fault incidence = (No. of faults reported by the customer per month/ Total Number of Subscribers for that particular month)*100
Benchmark	Total number of faults registered per month: By 31st March 2007: <5 and By 31st March 2008: <3, averaged over the quarter Fault repair by next working day: By next working day: >90% and within 3 days: 100%, averaged over a month.
Audit Procedure	IMRB Auditors to verify and collect data pertaining to number of fault received at the service provider's level in the following time frames:- Number of faults cleared within 24 hours Number of cleared in more than 1 day but less than 3 days Number of cleared in more than 3 days but less than 7 days Number of cleared in more than 7 days but less than 15 days Number of cleared in more than 15 days Live calling :- -Live calling to be done to verify 'Fault repair by next working day' parameter -Interviewers ensured that operator provided a list of all the subscribers who reported faults in one month prior to IMRB staff visit. -Calls were made to up to 10% or 30 complainants for the concerned exchange, whichever is less - Auditors checked and recorded whether the fault was corrected within the timeframes as mentioned in the benchmark.

4. Metering and billing credibility – billing complaints	
Computational Methodology	Percentage incidence of billing complaints = (No. of billing complaints reported by the customer per month/ Total Number of Subscribers for that particular month)*100 Percentage resolution of billing complaints = (No. of billing complaints resolved over a particular period of time/Total No. of billing complaints of that period of time)*100
Benchmark	Percentage incidence of billing complaints: Not more than 0.1% of the bills issued Percentage resolution of billing complaints: 100% within a period of 4 weeks
Audit Procedure	<p>IMRB Auditors to verify and collect data pertaining to</p> <ul style="list-style-type: none"> - Number of Billing complaints received at the service provider's level - Last billing cycle stated should be such that due date for payment of bills must be beyond the date when this form is filled. - Include all types of bills generated for customers. This could include online as well as other forms of bills presentation including printed bills - Billing complaint is any of written complaint/ personal visit/ telephonic complaint related to: Excess metering/ wrong tariff scheme charged, Late receipt of bills/ Not received at all, Wrong name and address, Payment made in time but charged penalty/ not reflected in next bill, Last payment not reflected in bill, Adjustment/ waiver not done, Anything else related to bills, Toll free numbers charged etc. <p>Live calling : -</p> <ul style="list-style-type: none"> - IMRB Auditors collected the list of all the subscribers who have made billing complaints in the month prior to the Audit. - 100 such subscribers per service provider were called to check the time taken to resolve the billing complaint. However, in some cases where number of billing complaints were less the sample size could not be achieved

5. Customer care promptness (Shifts, Closures and Additional facility)	
Computational Methodology	Supplementary (Additional) services requests: A few of the supplementary services that are considered for the audit purpose: Clip (caller line identification presentation) facility , STD, ISD, Call forwarding, Voice Mail etc.
Benchmark	Shifting of telephone line : Less than 3 days Processing of closure request: Less than 24 hours Supplementary (Additional) services requests: Less than 24 hours
Audit procedure	<p>IMRB Auditors collected and verified data pertaining to</p> <p>Shifting Request: (Following key points were taken care of while verifying the data)</p> <ul style="list-style-type: none"> - Date of filing form should be at least 3 working days after the date of month appraised. - All the holidays are excluded and only working days are considered - The number of shift requests per month does not include the pending connections of the previous months. <p>Processing of closure request (Following key points were taken care of while verifying the data)</p> <ul style="list-style-type: none"> - The operator includes all Requests for volunteer Permanent Closure and External (shifts to other exchanges) Shift requests received at their exchange. - DNP (due to Non – payment) cases are excluded - All holidays are excluded for calculating 24 hours. - Closure requests attended in the previous months are excluded - The period for closure starts from the time of submission of application by the subscriber. <p>Supplementary (Additional) services requests</p> <ul style="list-style-type: none"> - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services. - Do not include holidays. - Collect the list of all cases of all subscribers requested for additional facility in past 48 hours prior to IMRB staff visit. - The period starts from the time of submission of application by the subscriber. <p>Live calling was done in 10% of such cases to check the time taken to attend all such requests</p>

6. Response time to customer (Electronically and Voice to Voice)	
Computational Methodology	Percentage of calls answered in a specified time = (Total no. of calls answered within that specified time / Total no. of calls dialed for a particular service)*100
Benchmark	(i) % age of calls answered (electronically): within 20 seconds = 80% of the calls over a period within 40 seconds = 95% of the calls over a period (ii) % age of calls answered by operator / voice to voice): within 60 seconds = 80% of the calls over a period within 90 seconds = 95% of the calls over a period
Audit Procedure	-IMRB auditors made test calls from the exchanges to the operator's customer care / helpline / toll free numbers. They will record the time taken to connect a customer's call both to the IVR as well as to a customer care executive. - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services. - Time to answer the call by the operator should be taken from the time auditor has pressed the requisite button for being assisted by the operator. <u>Live calling:</u> - - Overall sample size is 2*50 calls per service provider per circle at different points of time, evenly distributed across the selected exchanges – 50 calls between 1000 HRS to 1300 HRS and 50 calls between 1500 HRS to 1700 HRS - Time to answer the call by the operator was assessed from the time interviewer pressed the requisite button for being assisted by the operator. - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.

7. Time taken to refund of deposits after closure	
Computational Methodology	Percentage of cases needing refund in a specified time = (Total no. of cases where refund was made within a particular time / Total no. of cases requiring refunds)*100
Benchmark	Time taken to refund = 100% within 60 days
Audit Procedure	IMRB Auditors verified and collected data pertaining to - Cases requiring refund of deposits after closure are to be included - Time taken starts from the date on which the closure is made by the service provider and ends at the date on which refund is received by the customer <u>Live calling :</u> - - Collect the details of all the cases for which the refund was provided by the operator prior to the month of Audit - Overall 100 number of live calls are to be made in a licensed service area/circle for each service provider (Distributed across number of exchanges selected)

8. Call completion rate	
Computational Methodology	Call Completion Rate: Call Completion Rate (CCR) is defined as the percentage of total calls that are connected out of the total calls presented to exchange. This could be due to:- Other exchange not working / lines blocked Calling exchange is blocked $CCR = [(Call\ attempts - Calls\ blocked)/Call\ attempts] \times 100$
Benchmark	Call Completion Rate (CCR) within local network: More than 55%
Audit Procedure	IMRB Auditors verified and collected data pertaining to Sample Traffic Data during Time Consistent Busy Hour (TCBH). These details were collected separately for - Three days in which live measurement was carried out - For the complete month in which audit was carried out

9.2 For Cellular Mobile services

1. Accumulated Downtime of the Network	
Computational Methodology as per QoS definition	<p>The total time for which the network is down for a particular service provider resulting in a community isolation</p> <p>Computational Methodology: Accumulated downtime = Summation of Significant Downtime*</p> <p>* Significant Downtime to be defined as duration of network outages that result in groups of customers in PLMN being isolated for more than an hour at a stretch. Planned outages during low/ no traffic hours for maintenance/ modernisation/ network enhancement work etc. should be ignored</p>
Benchmark	< 24 hrs
Audit Procedure	<p>IMRB auditors collected and verified data pertaining to:</p> <ul style="list-style-type: none"> The fault alarm details at the OMC (MSC) for the network outages (due to own network elements and infrastructure service provider end outages) used for arriving at the benchmark reported to TRAI were audited Outages could be in MSC, BSC, BTS or in trunk. In case of BTS failure we have included only those that resulted in community isolation

2. Call Set-Up Success Rate (CSSR)	
Computational Methodology as per QoS definition	<p>The ratio of calls established to total calls is known CSSR.</p> <p>Call Established means the following events have happened in call setup:-</p> <ul style="list-style-type: none"> ↪ call attempt is made ↪ the TCH is allocated ↪ the call is routed to the outward path of the concerned MSC <p>Computational Methodology: $\text{Calls Established} / \text{Total Call Attempts} * 100$</p>
Benchmark	> 95%
Audit Procedure	<p>IMRB auditors collected and verified data pertaining to</p> <ul style="list-style-type: none"> ↪ The cell-wise data generated through counters/ MMC available in the switch for traffic measurements was verified by the auditors ↪ CSSR calculation was measured using OMC generated data only ↪ Measurement was done only in Time Consistent Busy Hour (TCBH) period for all days of the week

3. Service Access Delay	
Computational Methodology as per QoS definition	<p>Service Access delay is a summation of following parts in the call flow:</p> <ul style="list-style-type: none"> ↳ Time to connect calls ↳ Time to confirm instruction to connect ↳ Time to release calls ↳ Time to alert mobile set <p>Computational Methodology: <u>Time to connect calls</u> = Time between "<u>Origination</u>" and "<u>Service Connect</u>" message from BTS to Mobile <u>Time to confirm instruction to connect</u>* = Time between "<u>Origination</u>" and "Base Station Acknowledgment" Note: Time measured here is a sub-part of first measurement <u>Time to release call</u> = Time between "<u>Release on Reverse Link</u>" and "<u>Release on Forward Link</u>" <u>Time to alert a mobile</u> = This is measured as a mean of two measurements (i+ii/2):</p> <ul style="list-style-type: none"> ● First paging attempt = Time between receiving a call request at PLMN and alerting the mobile ● Final paging attempt = Time between receiving a call request at PLMN and hearing start of "Not reachable" announcement
Benchmark	Between 9 to 20 seconds depending on number of paging attempts (Average of 100 calls < = 15 sec.)
Audit Procedure	<p>IMRB Auditors collected and verified records pertaining to:</p> <ul style="list-style-type: none"> ↳ Audit of the details of Layer 3 Message diagnostics generated from periodic Drive tests conducted at different parts of the network used to arrive at the benchmarks reported to TRAI was conducted ↳ Validating that at least 100 sample calls should have been by the service provider made during Time consistent busy hour (TCBH) for the quarter using standard drive test equipment. (Note: measurement using engineering handsets was not deemed acceptable) ↳ The component 'first paging attempt' was checked whether it was measured by the operator using a protocol analyser.

4. Network Congestion Parameters	
Computational Methodology as per QoS definition	<p>It means a call is not connected because there is no free channel to serve the call attempt. This parameter represents congestion in the network. It happens at three levels:</p> <ul style="list-style-type: none"> ↳ SDCCH Level: Stand-alone dedicated control channel ↳ TCH Level: Traffic Channel ↳ POI Level: Point of Interconnect <p>Computational Methodology:</p> <ul style="list-style-type: none"> ↳ SDCCH / TCH Congestion% = $[(A1 \times C1) + (A2 \times C2) + \dots + (An \times Cn)] / (A1 + A2 + \dots + An)$ <ul style="list-style-type: none"> ● Where:-A1 = Number of attempts to establish SDCCH / TCH made on day 1 ● C1 = Average SDCCH / TCH Congestion % on day 1 ● A2 = Number of attempts to establish SDCCH / TCH made on day 2 ● C2 = Average SDCCH / TCH Congestion % on day 2 ● An = Number of attempts to establish SDCCH / TCH made on day n ● Cn = Average SDCCH / TCH Congestion % on day n ↳ POI Congestion% = $[(A1 \times C1) + (A2 \times C2) + \dots + (An \times Cn)] / (A1 + A2 + \dots + An)$ <ul style="list-style-type: none"> ● Where:-A1 = POI traffic offered on all POIs (no. of calls) on day 1 ● C1 = Average POI Congestion % on day 1 ● A2 = POI traffic offered on all POIs (no. of calls) on day 2 ● C2 = Average POI Congestion % on day 2 ● An = POI traffic offered on all POIs (no. of calls) on day n ● Cn = Average POI Congestion % on day n
Benchmark	<p>SDCCH Congestion: < 1% TCH Congestion: < 2% POI Congestion: < 0.5%</p>
Audit Procedure	<p>IMRB Auditors collected and verified records pertaining to:</p> <ul style="list-style-type: none"> ↳ Audit of the details of SDCCH and TCH congestion percentages computed by the operator (using OMC–Switch data only) was conducted ↳ The operator should be measuring this parameter during Time consistent busy hour (TCBH) only SDCCH ↳ The POI details were verified from the switch for all the links of the operators

5. Call Drop Rate	
Computational Methodology as per QoS definition	<p>The dropped call rate is the ratio of successfully originated calls that were found to drop to the total number of successfully originated calls that were correctly released</p> <ul style="list-style-type: none"> ↳ Total calls dropped = All calls ceasing unnaturally i.e. due to handover or due to radio loss ↳ Total calls established = All calls that have TCH allocation during busy hour <p>Computational Methodology: Total Calls Dropped / Total Calls Established x 100</p>
Benchmark	< 3%
Audit Procedure	<p>IMRB Auditors collected and verified records pertaining to:</p> <ul style="list-style-type: none"> ↳ Audit of traffic data of the relevant quarter kept in OMC-R at MSCs and used for arriving at CDR was conducted. ↳ The operator should only be considering those calls which are dropped during Time consistent busy hour (TCBH) for all days of the relevant quarter

6. Percentage Connections with Good Voice Quality	
Computational Methodology as per QoS definition	<p>Definition:</p> <ul style="list-style-type: none"> ↳ for GSM service providers the calls having a value of 0 – 4 are considered to be of good quality (on a seven point scale) ↳ For CDMA the measure of voice quality is Frame Error Rate (FER). FER is the probability that a transmitted frame will be received incorrectly. Good voice quality of a call is considered when it FER value lies between 0 – 4 % <p>Computational Methodology:</p> <ul style="list-style-type: none"> ↳ % Connections with good voice quality = (No. of voice samples with good voice quality / Total number of samples) x 100
Benchmark	> 95%
Audit Procedure	<p>IMRB Auditors collected and verified records pertaining to:</p> <p>Audit would be conducted based on the details of periodic drive tests conducted at different part of the network during Time consistent busy hour (TCBH) and used to arrive at the benchmarks reported to TRAI.</p> <p>Procedures that were to be followed by operator for obtaining relevant details for computing this parameter were audited</p> <ul style="list-style-type: none"> ↳ Operator to conduct <u>at least one</u> drive test using standard drive test equipment every week during TCBH ↳ Each drive test should evenly cover the following 5 types of locations: ↳ 3 Outdoor (Periphery of the city, Congested Area, Across the City), and 2 Indoor (Office Complex and Shopping Complex) ↳ 2 minute long calls to be initiated and held throughout the drive test ↳ The speed of the vehicle should be kept at around 50km/hr. (around 30 km/hr in case of geographically small cities) – This was ensured during the drive tests conducted by IMRB Auditors ↳ RxQual / FER samples generated during the drive test collected by the operator were verified ↳ <i>Measurements using Engineering handsets were not acceptable</i> ↳ All the operators were not maintaining this data at the switch level

7. Service Coverage	
Computational Methodology as per QoS definition	<p>Definition:</p> <ul style="list-style-type: none"> ↳ The level of signal available in a particular part of a city is known as signal strength. <p>Computational Methodology:</p> <ul style="list-style-type: none"> ↳ Service Coverage for route type x = $[(N1 \times CSS1) + (N2 \times CSS2) + \dots + (Nn \times CSSn)] / (N1 + N2 + \dots + Nn)$ ↳ Where:- N1 = Number of calls on type of route x made in drive test 1 ↳ CSS1 = Average coverage signal strength on type of route x in drive test 1 (in dBm) ↳ N2 = Number of calls on type of route x made in drive test 2 ↳ CSS2 = Average coverage signal strength on type of route x in drive test 2 (in dBm) ↳ Nn = Number of calls on type of route x made in drive test n ↳ CSSn = Average coverage signal strength on type of route x in drive test n (in dBm)
Benchmark	<p>Indoor >= -75 dBm In-vehicle >= -85 dBm Outdoor – in city >= -95 dBm</p>
Audit Procedure	<p>IMRB Auditors collected and verified call centre records pertaining to:</p> <ul style="list-style-type: none"> ↳ Audit was conducted based on the details of periodic drive tests conducted at different part of the network during Time consistent busy hour (TCBH) which were used to arrive at the benchmarks reported to TRAI. ↳ Procedures were verified that were to be followed by operator for obtaining relevant details for computing this parameter:- <ul style="list-style-type: none"> ↳ Operator to conduct at least one drive test using standard drive test equipment* every week during Time consistent busy hour (TCBH). ↳ Each drive test should evenly cover the following 5 types of locations: – <ul style="list-style-type: none"> ↳ 3 Outdoor (Periphery of the city, Congested Area, Across the City), and ↳ 2 Indoor (Office Complex and Shopping Complex) ↳ <i>Measurements using Engineering handsets were not acceptable</i>

8. Response time to customer (Electronically and Voice to Voice)	
Computational Methodology	<p>To connect to IVR: The time taken to connect a person (as soon as he presses call) to the IVR of the service provider</p> <p>To connect to operator: The time taken to connect a person (as soon as he presses 9) to the customer care executive</p> <p>Computational Methodology: Percentage of calls answered in a specified time = $(\text{Total no. of calls answered within that specified time} / \text{Total no. of calls dialed for a particular service}) * 100$</p>
Benchmark	<p>(i) %age of calls answered (electronically):</p> <ul style="list-style-type: none"> ↳ within 20 seconds = 80% ↳ within 40 seconds = 95% <p>(ii) %age of calls answered by operator (voice to voice):</p> <ul style="list-style-type: none"> ↳ within 60 seconds = 80% ↳ within 90 seconds = 95%

<p>Audit Procedure</p>	<p>-IMRB auditors made test calls from the exchanges to the operator's customer care / helpline / toll free numbers. They will record the time taken to connect a customer's call both to the IVR as well as to a customer care executive.</p> <p>- All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.</p> <p>- Time to answer the call by the operator should be taken from the time auditor has pressed the requisite button for being assisted by the operator.</p> <p>Live calling: -</p> <p>- Overall sample size is 2*50 calls per service provider per circle at different points of time, evenly distributed across the selected exchanges – 50 calls between 1000 HRS to 1300 HRS and 50 calls between 1500 HRS to 1700 HRS</p> <p>- Time to answer the call by the operator was assessed from the time interviewer pressed the requisite button for being assisted by the operator.</p> <p>- All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.</p>
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9.1 Billing complaints per 100 bills issued	
<p>Computational Methodology as per QoS definition</p>	<p>Billing complaints includes any of the following complaints related to billing from the point of view of customer:</p> <ul style="list-style-type: none"> • Local call charges billed as STD/ISD or vice-versa • Toll free numbers charged • Wrong roaming charges • Call made/received disputed • Wrongly charged extra for some service (SIM replacement charged twice, service not used but charged etc.) • Cheque submitted on time but charged penalty for paying beyond due date (in case customer is not at fault i.e. all those that operator cannot prove that he/she is not lying) • Payment made but not reflected (may be wrongly adjusted to another customer etc.) <p>Billing complaints per 100 bills issued = Total billing complaints** received during the relevant quarter / Total bills generated* during the relevant quarter</p> <p><i>* All types of bills generated for customers i.e. printed bills, online bills and any other forms of bills generated are to be included</i></p> <p><i>** Only dispute related issues (including those that may arise because of a lack of awareness at the subscribers' end) are to be included. It does not include any provisional issues (such as delayed dispatch of billing statements, etc.) in which the operator has opened a ticket internally.</i></p>
<p>Benchmark</p>	<p>< 0.1% billing complaints per 100 bills</p>
<p>Audit Procedure</p>	<p>IMRB auditors collected and verified data pertaining to</p> <ul style="list-style-type: none"> - Number of bills generated - Number of billing complaints received - %age complaints per 100 bills

9.2 Resolution of billing complaints	
Computational Methodology as per QoS definition	<p>%age of billing complaints resolved within 4 weeks=(Complaints resolved in 4 weeks from date of receipt / Total billing complaints received during the relevant period) x 100</p> <p><i>Only dispute related issues (including those that may arise because of a lack of awareness at the subscribers' end) are to be included. It does not include any provisional issues (such as delayed dispatch of billing statements, etc.) in which the operator has opened a ticket internally.</i></p> <p><i>Date of resolution in this case would refer to the date when a communication has taken place from the operator's end to inform the complainant about the final resolution of the issue / dispute.</i></p>
Benchmark	100% cases to be resolved within 4 weeks
Audit Procedure	<p>IMRB Auditors collected and verified data pertaining to</p> <ul style="list-style-type: none"> - Total number of billing complaints/bills disputed - Number of complaints resolved in 4 weeks <p>Live calling :- Overall 100 number of live calls made in a licensed service area/circle for each service provider. However in certain cases the sample could not be achieved as bills disputed (prior to the month of Audit) were found to be less than 100</p>

9.3 Period of refunds / payments due to customers	
Computational Methodology as per QoS definition	<p>Period of all refunds = Maximum value of 'Time taken to refund' where:-Time taken to refund = Date of refund – date of lodging complaint</p>
Benchmark	100% cases in less than 4 weeks
Audit Procedure	<p>Audit of refund details and complaints (only those resulting in refunds) resolution details used for arriving at the figures reported to TRAI to be conducted. Operator to provide details of:-</p> <ul style="list-style-type: none"> • <u>Dates of lodging</u> of all billing complaints resolved in favour of customer and resulting in requirement of a refund by the operator • <u>Dates of refund</u> pertaining to all billing complaints received during the relevant quarter <p>Also random live checks of all subscribers entitled for refund were conducted</p>

9.3 For Broadband services

1. Service provisioning/Activation time	
Computational Methodology as per QoS definition	<p>Service provisioning time refers to the time taken from the date of receipt of an application to the date when the service is activated</p> <p>Percentage connections provided within X working days = No of connections provided within X working days/ Total number of connections registered during the period * 100</p> <p>Technically Non Feasible (TNF) cases such as unavailability of Broadband infrastructure/ equipment in the Area or Spare Capacity i.e. Broadband Ports including equipment to be installed at the customer premises for activating Broadband connection shall be excluded from the calculation of this parameter.</p> <p>Also, problems relating to customer owned equipment such as PC, LAN Card/ USB Port and internal wiring or non-availability of such equipment shall be excluded from the calculation of this parameter.</p>
Benchmark	100 % cases in =<15 working days.
Audit Procedure	<p>IMRB auditors collected and verified data pertaining to</p> <ul style="list-style-type: none"> -Number of applications received at the service provider's level -Number of connections provided within 15 days -Number of connections provided after 15 days <p>Live calling : Atleast 10% of the subscribers who had requested for new connections in month prior to Audit were called to check whether connection was provided in 15 days</p>

2. Fault repair/Restoration time	
Computational Methodology as per QoS definition	<p>This refers to the time taken to restore the existing customer service to operational level from the time that a problem or fault is reported</p> <p>Percentage faults repaired in X working days = (Total no of faults repaired in X working days /Total number of faults reported during the period)*100</p> <p>The time period for fault repair starts from the time when the fault is reported to the service provider either through customer care help line or in person by the subscriber</p> <p>Only the complaints registered till the close of the business hours of the day are to be taken into account. All the complaints registered after the business hours are to be considered as being registered in the next day business hours</p>
Benchmark	By next working day: > 90% and within 3 working days: 99%
Audit Procedure	<p>IMRB auditors collected and verified data pertaining to</p> <ul style="list-style-type: none"> -Number of applications received at the service provider's level -Number of connections provided within 15 days -Number of connections provided after 15 days <p>Live calling : Atleast 10% of the subscribers who had requested for new connections in month prior to Audit were called to check whether connection was provided in 15 days</p>

3. Billing complaints per 100 bills issued	
Computational Methodology as per QoS definition	<p>Billing complaints includes any of the following complaints related to billing from the point of view of customer:</p> <ul style="list-style-type: none"> • Wrongly charged extra for some service • Cheque submitted on time but charged penalty for paying beyond due date • Payment made but not reflected (may be wrongly adjusted to another customer etc.) <p>Billing complaints per 100 bills issued = Total billing complaints** received during the relevant quarter / Total bills generated* during the relevant quarter</p> <p><i>* All types of bills generated for customers i.e. printed bills, online bills and any other forms of bills generated are to be included</i></p> <p><i>** Only dispute related issues (including those that may arise because of a lack of awareness at the subscribers' end) are to be included. It does not include any provisional issues (such as delayed dispatch of billing statements, etc.) in which the operator has opened a ticket internally.</i></p>
Benchmark	< 2% billing complaints per 100 bills
Audit Procedure	<p>IMRB auditors collected and verified data pertaining to</p> <ul style="list-style-type: none"> - Number of bills generated - Number of billing complaints received - %age complaints per 100 bills

3.1. Resolution of billing complaints	
Computational Methodology as per QoS definition	<p>%age of billing complaints resolved within 4 weeks=(Complaints resolved*** in 4 weeks from date of receipt / Total billing complaints** received during the period 2008) x 100</p> <p><i>Only dispute related issues (including those that may arise because of a lack of awareness at the subscribers' end) are to be included. It does not include any provisional issues (such as delayed dispatch of billing statements, etc.) in which the operator has opened a ticket internally.</i></p> <p><i>Date of resolution in this case would refer to the date when a communication has taken place from the operator's end to inform the complainant about the final resolution of the issue / dispute.</i></p>
Benchmark	100% cases to be resolved within 4 weeks
Audit Procedure	<p>IMRB Auditors collected and verified data pertaining to</p> <ul style="list-style-type: none"> - Total number of billing complaints/bills disputed - Number of complaints resolved in 4 weeks <p>Live calling :-</p> <ul style="list-style-type: none"> -Overall 100 number of live calls are to be made in a licensed service area/circle for each service provider. However in certain cases the sample could not be achieved as bills disputed (prior to the month of Audit) were found to be less than 100

3.2 Time taken to refund after closure	
Computational Methodology as per QoS definition	Time taken to refund = Date of refund – Date of closure Date of closure is considered to be the date on which the connection is discontinued in the service provider database of active customers
Benchmark	100% cases in less than 60 days
Audit Procedure	IMRB Auditors collected and verified data pertaining to -Number of cases requiring refund of deposits -Number of cases where refund was made within 60 days -%age cases where refund was made within 60 days

4. Response time to customer for assistance	
Computational Methodology as per QoS definition	%age of calls answered by operator (voice to voice) within n seconds = (Number of calls where <u>time taken for operator to respond</u> * >= n sec / Total number of calls where an attempt to route to the operator was made) x 100 <u>Time taken for operator to respond</u> = Time when an operator responds to a call – Time when the relevant code to reach the operator is dialled
Benchmark	Calls answered within 60 seconds > 60 % Calls answered within > 80%
Audit Procedure	IMRB Auditors collected and verified call centre records pertaining to -Number of calls received by the operator -Number and %age calls answered within 60 seconds -Number and percentage calls answered within 90 seconds Live calling : - Overall 100 number of live calls at different points of time were made in a licensed service area/circle for each service provider to assess the efficiency of the call centre

5. Bandwidth Utilization	
Computational Methodology as per QoS definition	Percentage Bandwidth available on the link = Total Bandwidth* utilised in TCBH for the period/ Total Bandwidth Available during the period*100 Multi Router Traffic Grapher (MRTG) is to be used to measure the details of Bandwidth utilisation by service providers
Benchmark	-- < 80% link(s)/route bandwidth utilization during peak hours (TCBH). -- If on any link(s)/route bandwidth utilization exceeds 90%, then network is considered to have congestion. For this additional provisioning of bandwidth on immediate basis, but not later than one month is mandated.
Audit Procedure	IMRB Auditors collected and verified call centre records pertaining to (1) POP to ISP gateway Node [Intra – network] Links -Auditors to verify and collect data pertaining to Total Bandwidth available and Total Bandwidth utilised during TCBH at some of the sample intra network links (POP to ISP Node) on each of the three days of live measurement separately - Total Bandwidth available and Total bandwidth utilised during at the sample links TCBH for the complete month of audit - Total number of intra network links having >90% bandwidth utilisation during the month of Audit (ii) ISP Gateway Node to IGSP / NIXI Node upstream Link's) for international connectivity -Total number of upstream links for International connectivity -Total number of links having Bandwidth > 90%Total Bandwidth available and Total Bandwidth utilised on all the upstream links during TCBH (POP to ISP Node) on each of the three days of live measurement separately -Total Bandwidth available and Total bandwidth utilised at all the international links during TCBH for the complete month of audit (Also obtain details separately for the days)

Broadband download speed	
Computational Methodology as per QoS definition	This refers to the ratio of size of the file to be downloaded and total time required for error free transmission of the file
Benchmark	Subscribed broadband connection speed to be met >80% from ISP Node to user
Audit Procedure	<p>Live calling : -</p> <ul style="list-style-type: none"> -Details of live customers were obtained from the service providers -Overall 50 number of live calls were made during peak hours in a licensed service area/circle for each service provider to assess the download speed available to subscribers. Tool provided by the on the service providers website was used for the same -Details of total committed download speed and speed available to the users were recorded for each of the subscriber - Percentage download speed available was calculated as = Sum of total speed available for 50 customers/Total committed download speed for 50 customers*100

Service availability/Uptime	
Computational Methodology as per QoS definition	<p>Service availability/uptime is the measure of the degree to which the broadband access network including ISP Node is operable and not in a state of failure or outage at any point of time for all users</p> <p>Service availability/Uptime = $(\text{Total operational hours} - \text{Total Downtime hrs}) * 100 / \text{Total operational hours}$</p> <p>Total downtime for all users, including the LAN switches, Routers, Servers, Etc at ISP Node and connectivity to upstream service provider are to be included</p> <p>Planned outages for routine maintenance of the system are excluded from the calculation of service availability/uptime</p>
Benchmark	<ul style="list-style-type: none"> - 90% for quarter ending June 2007 - 98% with effect from quarter ending September 2007 and onwards
Audit Procedure	<p>IMRB Auditors collected and verified call centre records pertaining to</p> <ul style="list-style-type: none"> -Total operational hrs -Total downtime hrs <p>The above mentioned data was obtained and verified separately for three days in which the live measurement was carried out, Month in which audit was carried out Also, verification of old records(July to September 2007) was verified</p>

Packet loss	
Computational Methodology as per QoS definition	<p>Packet loss is the percentage of packets lost to total packets transmitted between two designated Customer Premises Equipments/Router ports. It is the measurement of packet lost from the broadband customer (User) configuration/User reference point at POP/ISP Node to IGSP/NIXI Gateway and to the nearest NAP port abroad</p> <p>The packet loss is measured by computing the percent packet loss of 1000 pings of 64 byte packet each.</p> <p>Service provider needs to carry out such tests daily during Time Consistent Busy Hour(TCBH) and report the average results for the month in the performance monitoring report to TRAI</p> <p>Minimum sample reference points for each service area shall be three in number or multiple reference points if required</p> <p>Hence Packet loss is computed by the formula - (Total number of ping packets lost during the period/Total number of ping packets transmitted)* 100</p>
Benchmark	<1 %
Audit Procedure	<p>IMRB Auditors collected and verified call centre records pertaining to</p> <ul style="list-style-type: none"> - Records maintained for ping tests conducted during the period of July to September 2007 - Smoked ping test (wherever available) results for the period of July to September 2007 - Results of live ping tests conducted during three day live measurement and month of Audit (During peak hours) - Live ping tests were conducting by selecting a minimum of three user reference test points at POP/ISP Node in each circle

Network Latency	
Computational Methodology as per QoS definition	<p>Latency is the measure of duration of a round trip for a data packet between specific source and destination Router Port/Customer Premises Equipment (CPE). The round trip delay for the ping packets from ISP premises to the IGSP premises to the IGSP/NIXI gateway and to the nearest NAP port abroad are measured by computing delay for 1000 pings of 64 bytes each (Pings are to be sent subsequent to acknowledgement received for the same for previous ping)</p> <p>Service provider needs to carry out such tests daily during Time Consistent Busy Hour(TCBH) and report the average results for the month in the performance monitoring report to TRAI</p> <p>Minimum sample reference points for each service area shall be three in number or multiple reference points if required</p> <p>Hence the formula for network latency would be Network latency for X days= Total round trip time for all the ping packets transmitted in X days /No of days during the period</p>
Benchmark	<p>< 120 msec from user reference point at POP/ISP Node to International Gateway</p> <p>< 350 msec from User reference point at ISP Gateway Node to International nearest NAP port (Terrestrial)</p> <p>< 800 msec from User reference point at ISP Gateway Node to International nearest Nap port (Sattelite)</p>
Audit Procedure	<p>IMRB Auditors collected and verified call centre records pertaining to</p> <ul style="list-style-type: none"> - Records maintained for ping tests conducted during the period of July to September 2007 - Smoked ping test (wherever available) results for the period of July to September 2007 - Results of live ping tests conducted during three day live measurement and month of Audit (During peak hours) - Live ping tests were conducting by selecting a minimum of three user reference test points at POP/ISP Node in each circle
