Objective Assessment of Quality of Services for (QoS) for Basic Wireline, Cellular Mobile (Wireless) and Broadband Service Providers - Rajasthan Circle

Report: March - 2009

Prepared for: **Telecom Regulatory Authority of India**

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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 Half Yearly periods. IMRB International Auditors carried out Audits across Rajasthan, Himachal Pradesh, Jammu and Kashmir, Orissa, North East, Assam, Andhra Pradesh and Kerala circles in the second Half Yearly period 2008. **This report details the performance of various service providers in Rajasthan 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 Rajasthan circle that was covered in the Quarter 3 (July – September 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 August 2008 – November 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 Rajasthan circle for Basic (Wireline), Cellular Mobile services, and Broadband services

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2.0 Objectives and Methodology

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

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

1. **Verification of the data submitted by service providers:** This involved verification of the quarterly Performance Monitoring Reports (PMR's) and monthly Point of Interconnect (POI) Congestion reports being submitted by various service providers. The raw data in the records maintained by service providers was audited to assess the book keeping methodology.

2. **Live measurement for three days:** Network performance of service providers was assessed for three days in the month in which the Audit was carried out. Live figures from the server/ NMS software were recorded for various network related parameters.

3. **Data verification for the month in which Audits were carried out:** Subsequent to the visits for Audit during the live measurement at various Exchanges/ISP Nodes/Exchanges, data for all the network and Non network related parameters was collected from various service providers for the complete month in which the Audit was carried out. Raw data/records pertaining to these were also verified on sample basis to check the veracity of data provided by the operators.

4. **Drive tests:** Operator assisted and Independent drive test were conducted in three cities as per the norms stated in the tender.

5. **Live calling:** Live testing was done on a sample basis to check efficiency of 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)

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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 80 exchanges (16 Urban and 64 Rural) exchanges were audited.

- For rest of the service providers (TATA, Reliance, Bharti and HFCL) 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 Rajasthan circle

- Bharti Hexacom
- Shyam Telelinkteleservices ltd
- Reliance communications
- BSNL
- TATA Tele services
- Idea Cellular
- Vodafone Essar Ltd.

3.3 Sampling for Broadband service providers

- Audits for various Broadband service providers were conducted at the service provider's central node. Since most of the private operators have a centralized system of monitoring their network data was obtained for all the Point of Presence (POPs) present in the circle.

- For BSNL, Audit was conducted at the central node in Rajasthan 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

- For BSNL, the data pertaining to network related parameters was obtained by IMRB Auditors at the central node in Bangalore.

- Following Broadband service providers were Audited in Rajasthan circle: - Bharti Airtel Ltd., Sify, BSNL, VSNL (TATA Communications), Reliance Communications and Shyam Telelink.

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 April to June 2008 was carried out for all 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 ASSISSTED 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 Cellular Mobile services is explained in Annexure II}

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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)				
-	*Within 60 seconds > 60%*	YES	YES	YES	YES
-	*Within 90 seconds > 90%*	YES	YES	YES	YES
(V)	Bandwidth Utilization/ Throughput:				
▪	*A)Bandwidth Utilization*				
-	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	
▪	*B) Broadband Connection Speed (Download)*	YES	YES	YES	YES
(vi)	Service availability / Uptime	YES	YES	YES	
vii)	Packet Loss	YES	YES	YES	
(viii)	Network Latency for wired broadband access)				
-	*User reference point at POP / ISP Gateway Note to International Gateway (IGSP/NIXI)*	YES	YES	YES	
-	*User reference point at ISP Gateway Node to International nearest NAP port abroad (Satellite)*	YES	YES	YES	
-	*User reference point at ISP Gateway Node to International nearest NAP port abroad (Satellite)*	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 September 2008 to November 2008 in Rajasthan 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	Bharti	BSNL	RCOM	Shyam Telelink
1	**Provision of telephone after registration of demand**					
1.1	Connections completed within 7 days	100%	100%	89%	100%	98%
2	**Fault incidence/clearance statistics**					
3	Fault incidences(No. of faults/100 subscribers/month)	<3	3.3	7.71	2.9	2.27
3.1	Faults repaired within 24 hours	>90%	95%	56%	98%	78%
3.2	Faults repaired within three working days	100%	100%	99%	98%	78%
4	Mean time to Repair (MTTR)	<8 hours	7.0	6.9	5.4	7.1
5	Call Completion Rate (CCR)	>55%	91%	85%	DNA	92%
6	**Metering and billing credibility**					
6.1	Billing complaints per 100 bills issued	<0.1%	0.06%	0.09%	0.07%	0.09%
6.2	%age of billing complaints resolved within 4 weeks	100%	100%	99%	100%	100%
7	**Customer care/helpline promptness**					
7.1	Shift requests attended					
	Shift requests attended within 3 days	95%	99%	70%	NA	100%
7.2	Closure request attended					
	Closure within 24 hours	95%	100%	68%	99%	100%
7.3	Supplementary (additional) service requests attended					
	Additional facility provided within 24 hours	95%	99%	84%	100%	98%
8	**Response time to customer for assistance**					
8.1	% age call answered through IVR in 20 seconds	80%	100%	100%	100%	DNA
	% age call answered through IVR in 40 seconds	100%	100%	100%	100%	DNA
8.2	% age calls answered by operator in 60 seconds	80%	97%	81%	97%	DNA
	% age calls answered by operator in 90 seconds	95%	99%	95%	99%	DNA
9	**Time taken for refund of deposits after closure**					
9.1	%age cases where refund received within 60 days	100%	100%	98%	100%	NA

{*Note: For BSNL data pertains to the sample 5% of exchanges audited during the period of to September to November 2008, whereas for rest of the operators figures pertain to all the exchanges present in the circle}

** Methodology not in line with QoS   ▇ Figures provided on All India basis   ▇ Not meeting the benchmark   **B'mar**k = TRAI Benchmark, **DNA** = Details not available, **NA:** Not Applicable

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Critical findings and Key take outs: Basic (Wireline) services

The Basic (Wireline) services audit for Rajasthan circle broadly indicates that none of the service provider could meet all the benchmarks as specified by Telecom Regulatory Authority of India.

The live calling results were found to be different from the 1 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) it was found that the operators who are reporting the same to TRAI were meeting the benchmark.

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

Provision of telephone after registration of demand

- Bharti and RCOM were found to be meeting the TRAI benchmark of 100% for provisioning of telephone within 7 working days for the month in which the Audit was carried out. BSNL (89%) and Shyam Telelink (98%) marginally fall short of the TRAI specified benchmark.
- BSNL has scored low on Service provisioning/activation time , 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 95% (highest) of subscribers of Bharti teleservices claimed that the connection was provided within the time period of 7 days followed by, Shyam telelink (86%), BSNL (81%) and RCOM (65%)

Fault incidence / clearance statistics

- As per the 1-month audit data findings, BSNL at 56% and Shyam telelink at 78% fall short of TRAI specified benchmark of >90% of faults to be repaired within 24 hours. Highest score on the same was observed for RCOM at 98% followed by Bharti 95%. 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 (99%) , RCOM (98%) and Shyam Telelink (78%) fall short of the TRAI specified benchmark of 100%
- The live calling scores (for fault repair within 24 hrs) were observed to be highest for Shyam Telelink at 62% followed by BSNL at 41%. However relatively lower scores were observed were RCOM and Bharti at 12% and 32% respectively. As mentioned earlier a part of it could be attributed to low sample (10% of total faults registered in month prior to Audit)

Traffic statistics (CCR)

- All the service providers meet the TRAI specified benchmark for CCR both during live measurements and month in which audit was carried out.
- During Audit process at RCOM, it was observed that service provider does not have the technical capability to measure Call Completion Rate (CCR) as per TRAI norms. The reason primarily is the difference between its network as compared to BSNL. The service

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provider measures and reports to TRAI Answer Seizure Ratio (ASR) which is claimed to be a better indicator of network congestion for the kind network owned by the operator.

Metering and billing credibility

- All the service providers are meeting the TRAI specified benchmark of <0.1% billing complaints.
- However during verification of records of service providers namely Reliance and Bharti it was found that definition of billing complaints remains to be lenient as only those cases where an internal ticket is opened i.e. cases where refund is provided by the operator are being taken into consideration. Hence, there is a need felt to have some clarity on the definition of billing complaints.

Customer care/helpline promptness

- For "shift requests attended within 3 days" audit data, BSNL (70%) fall short of TRAI specified benchmark of 95%
- For closure requests within 24 hours only BSNL with 68% requests attended, marginally falls short of the benchmark of 95%
- For supplementary service requests, all the operators (except BSNL) were found to be meeting the TRAI specified benchmark for the month in which audit was carried out.

Response time to customer for assistance

- For customer care number through electronic IVR menu parameter all the subscribers comfortably meet the benchmark for calls answered within 20 and 40 seconds for one month data
- During verification of records for Bharti, it was observed that the service provider does not have a mechanism of recording number of calls which are answered by IVR; only the calls answered by the operator are recorded. The service provider does not report the figure in the PMR submitted to TRAI.
- For customer care number through the operator parameter all the subscribers comfortably meet the benchmark for calls answered within 60 and 90 seconds for one month data
- Data on number of calls made and received at the call centre was not provided by Shyam Telelink. The service provider claimed that the same is not maintained by the operator.
- Live calling results carried out to check the efficiency of calls answered by the operator reveal that BSNL and RCOM fall short of the TRAI specified benchmark both for calls answered within 60 and 90 seconds

Time taken for refund of deposits after closure

- BSNL marginally falls short of the TRAI specified benchmark with a score of 98% on Time taken for refund of deposits after closure.

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Level 1 service

To test the efficiency of level 1 services (Trunk booking, Child helpline, Women helpline, Airline booking, Fire, Police, Railways) offered by various service providers. At least 200 calls were made for each service provider to different numbers and time taken to answer the call was noticed. For BSNL and Bharti approximately 99 % of calls made were answered in 60 seconds.

It should be noted that other private operators offer level 1 service primarily for emergency services like fire, police etc

Summary of Live Measurement Results – Basic Wireline Services

Traffic statistics - Call Completion Rate	Benchmark	Bharti	BSNL	Shyam Tele
Call Completion Rate (CCR) in the local network	>55%	99%	89%	98%

- For basic wireline services there was only one parameter (Call Completion Rate – Benchmark > 55%) for which live measurement was applicable.
- All the service providers were comfortably meeting the TRAI specified benchmark, lowest scores during live measurements were observed for BSNL at 89% and highest was observed for Bharti at 99%

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

Parameters	Benchmark	Vodafone	Shyam Telelink	TATA	IDEA	BSNL	Bharti Hexacom	RCOM
Accumulated downtime for community isolation	< 24 hrs.	6.85	12.95	0.00	19.52	23.67	22.68	0.60
Call Set Up Success Rate (CSSR)	> 95%	99.32%	98.73%	98.40%	98.85%	97.80%	93.64%	99.49%
Service Access Delay*	9 to 20 seconds (< = 15 seconds for 100 calls)	9.7 sec	5.8 sec	7.3 sec	3.13 sec	7.2 sec	14.04 sec	3.56 sec
Blocked Call Rate								
SDCCH /Paging Channel Congestion	<1%	0.33%	0.00%	0.00%	0.32%	0.18%	2.22%	0.00%
TCH Congestion	< 2%	0.22%	0.00%	0.09%	0.42%	1.27%	2.76%	0.51%
Call drop rate	< 3%	0.97%	0.45%	0.84%	1.31%	2.20%	1.71%	0.59%
Percentage connections with good voice quality*	> 95%	96%	99%	97%	92%	91%	91%	99%
Service coverage*								
In door	>-75dbm	Complied	Complied	Complied	Complied	Complied	Complied	Complied
In vehicle	>-85dbm							
Out door - in city	>-95dbm							
POI congestion	< 0.5%	Complied	Complied	Complied	Complied	Complied	Complied	Complied
Calls answered electronically								
Percentage calls answered within 20 seconds	80%	100%	DNP	100%	100%	98%	100%	99%
Percentage calls answered within 40 seconds	95%	100%	DNP	100%	100%	98%	100%	99%
Calls Answered by the operator								
Percentage calls answered within 60 seconds	80%	96%	DNP	95%	98%	66%	95%	92%
Percentage calls answered within 90 seconds	95%	98%	DNP	97%	100%	77%	96%	95%
Billing Complaints								
Billing complaints per 100 bills issued	<0.1%	0.08%	0.09%	0.09%	0.09%	0.09%	No Billing Complaints received	0.09%
Percentage billing complaints resolved within 4 weeks	100%	100%	100%	100%	100%	100%		100%
Period of refunds/payments due to customers from the date of resolution of complaints	<4 weeks	100%	100%	100%	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'mar**k = TRAI Benchmark, **DNA** = Details not available, **NA:** Not Applicable

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Critical findings: Cellular Mobile Services

The audit for cellular mobile service providers were conducted at their respective MSCs in the Rajasthan 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 Hexacom	1900 – 2000	1900 – 2000
BSNL	1900 – 2000	1900 – 2000
RCOM	1800 – 1900	1800 – 1900
Idea Cellular	1900 – 2000	1900 – 2000
Shyam Telelink	1900 – 2000	1900 – 2000
TATA	1900 – 2000	1900 – 2000
Vodafone	2000 – 2100	2000 – 2100

The TCBH reported by all the service providers matched the network busy hour calculated by IMRB auditors for the Rajasthan circle.

Accumulated Downtime:

In the Rajasthan circle, there were outages that led to a community being isolated at a particular point in time for all the operators except TATA. BSNL had the maximum outage in the month of audit with an outage of more than 23 hours observed. Bharti Hexacom's outage was found to be more than 22 hours for the month of audit.

Call Set-up Success Rate (CSSR):

All the operators except Bharti Hexacom were comfortably meeting the benchmark on this parameter. During the audits the maximum CSSR was observed for RCOM with 99.49% of their calls getting completed. Bharti Hexacom has a CSSR level of 93.64%. All the operators were found to be calculating the parameter as per the norm specified by TRAI. CSSR was established as the ratio of total number of successful call attempts (establishment) to the total number of call attempts made.

Service Access Delay:

This parameter is reported to TRAI basis the period 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 in the Rajasthan 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. The highest service access delay was observed for Bharti Hexacom at 14.04 seconds followed by Vodafone at 9.7 seconds, all of which comfortably met the TRAI benchmark of < = 15 seconds for a sample of 100 calls.

Network Congestion parameters:

SDCCH / Paging Channel Congestion, TCH and POI are part of the network congestion parameters. All the operators except Bharti Hexacom for SDCCH and Traffic channel congestion are meeting the TRAI specified benchmarks on the congestion parameters. Bharti does not meet the TRAI specified benchmark with a SDCCH congestion of 2.22% and a Traffic Channel congestion of 2.76% which was found during the one month data collected for the month of audit. Shyam Telelink leads the way in network congestion parameters with almost negligible paging as well as traffic channel congestion. The calculation methodology of these parameters was found to be in complete accordance with what has been specified by TRAI. 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 call attempts for all operators. Also, all of service providers were found to be meeting the TRAI specified benchmark. The lowest call drop rate was of Shyam Telelink at 0.45% while the relative highest (although it easily met the benchmark) was for BSNL at 2.20%.

% connections with good voice quality:

Almost all of the operators are measuring these parameters via their periodic drive tests. However, for Vodafone these parameters can be obtained at their switch as well. During the audit it was found that all the service providers were measuring this parameter as per the TRAI guidelines. Drive test was conducted by IMRB with the help of service providers to measure this parameter. In the drive test it was found that Idea with 92%, Bharti Hexacom and BSNL with 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 were 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. However, in case of Reliance 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, all the service providers except BSNL (both for percentage calls answered within 60 and 90 seconds) meet the benchmark for the month of audit. Also, for Shyam Telelink no break up call center details was available both for voice to voice and for calls answered by the operator.

Billing performance

All the operators were found to be meeting the benchmark of < 0.1% complaints registered per 100 bills issued and the benchmark of 100% billing complaints being resolved within 4 weeks. In all cases where customers were due for refund, all the service providers meet the TRAI benchmark of 100% with 4 weeks. Bharti Hexacom claimed that in more than 190000 bills issued by it in the month of audit, it did not receive any complaint.

Inter operator calls assessment

Inter operator call Assessment (To ↓ / From→)	Bharti Hexacom	BSNL	Vodafone	TATA	RCOM	IDEA	Shyam Telelink
Bharti Hexacom	NA	98%	99%	100%	100%	99%	100%
BSNL	95%	NA	92%	89%	95%	93%	93%
Vodafone	100%	99%	NA	99%	99%	99%	99%
TATA	100%	98%	100%	NA	100%	100%	100%
RCOM	100%	97%	100%	100%	NA	100%	100%
IDEA	99%	97%	99%	98%	99%	NA	98%
Shyam Telelink	99%	95%	99%	100%	100%	100%	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. All the operators found connecting to a BSNL number the toughest with only 89 to 95 out of 100 calls getting established. It was also observed that in only 95% of the cases a call from BSNL got connected to a Shyam Telelink number.

Results of Operator assisted Drive test

The drive test was conducted simultaneously for all the operators present in the Rajasthan circle. There was in total of three drive tests conducted in the circle. These tests were conducted in the cities of Jaipur, Bhilwara and Mount Abu. 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 Rajasthan telecom circle were covered.

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

The drive tests in the Rajasthan circle were conducted in the cities of Jaipur, Bhilwara and Mount Abu was conducted along the following route:

	Type of Location	Jaipur	Bhilwara	Mount Abu
Outdoor	Periphery of the city	Sanganeri gate to Rajapark to Malviya Nagar to Mansarovar to Vaishali Nagar to Jhotwara to VKI	Bhilwara Bypass to ITM College to Hiran Magri To Subhash Nagar	BSNL Exg. To Market to Nakki lake to AIR Station to BSNL Exg.
	Congested Area	Gaurav tower to New gate to Jhori Bazar to Jorawar singh gate to Bari Chopper to Chandpole	Railway Station to Market to Bus Stand	Mount Abu Main Market
	Across the City	VKI to Ambabari to Banipark to MI Road to Sanganeri Gate	Pur Road to Riico Industrial Area to Indra Colony to BSNL Exg.	Nakki Lake to BSNL Exg
Indoor	Office Complex	Vodafone Office	BSNL Office	BSNL Office
	Shopping Complex	Gaurav Tower	Apsara Hotel	Arbuda restaurant

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

Drive Test – Jaipur

	VODAFONE		Shyam Telelink		TATA		IDEA		BSNL		Bharti Hexacom		Reliance CDMA	
	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	98.66%	94.23%	100.00%	98.88%	99.51%	96.24%	99.63%	90.23%	95.50%	90.21%	89.29%	91.61%	99.85%	98.59%
CSSR	100.00%	99.19%	100.00%	100.00%	100.00%	100.00%	100.00%	99.21%	100.00%	99.17%	100.00%	98.18%	100.00%	100.00%
Blocked Call Rate	0.00%	0.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.79%	0.00%	0.83%	0.00%	1.82%	0.00%	0.00%
Call drop rate	0.00%	0.82%	0.00%	2.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.85%	0.00%	2.80%	0.00%	0.00%
Hands off success rate	Complied		Complied		Complied		Complied		Complied		Complied		Complied	

Drive Test – Bhilwara

	VODAFONE		Shyam Telelink		TATA		IDEA		BSNL		Bharti Hexacom		Reliance CDMA	
	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	97.54%	96.76%	98.92%	98.85%	98.83%	95.32%	86.29%	87.27%	80.69%	77.58%	81.15%	84.60%	99.76%	98.16%
CSSR	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	96.55%	96.84%	90.32%	97.14%	100.00%	97.09%	100.00%	100.00%
Blocked Call Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.45%	3.16%	9.68%	2.86%	0.00%	2.91%	0.00%	0.00%
Call drop rate	0.00%	0.00%	0.00%	0.00%	0.00%	1.15%	0.00%	4.35%	7.14%	2.94%	0.00%	1.02%	0.00%	1.59%
Hands off success rate	Complied		Complied		Complied		Complied		Complied		Complied		Complied	

Drive Test – Mount Abu

	VODAFONE		Shyam Telelink		TATA		IDEA		BSNL		Bharti Hexacom		Reliance CDMA	
	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	96.25%	95.60%	99.91%	99.63%	99.92%	99.80%	99.60%	99.48%	76.33%	77.43%	94.79%	94.79%	99.95%	97.56%
CSSR	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	97.14%	100.00%	89.74%	100.00%	100.00%	100.00%	100.00%	100.00%
Blocked Call Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.86%	0.00%	10.26%	0.00%	0.00%	0.00%	0.00%	0.00%
Call drop rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	8.57%	0.00%	0.00%	1.89%	0.00%	10.00%
Hands off success rate	Complied		Complied		Complied		Complied		Complied		Complied		Complied	

☐ Not meeting the benchmark

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

ALL SERVICE PROVIDERS

Jaipur: There was interference and low signal strength recorded for all operators in the outdoor areas of Bajaj Nagar, Bardawas, SFS, Malviya Nagar, VKI, Vindhya Nagar while in the indoor areas inadequate coverage was not found in any of the areas.

Bhilwara: There was interference and low signal strength recorded for all the operators in the outdoor areas of bypass road, railway station, transport nagar, Ashram, Sanganeri gate while in the indoor areas there was no inadequate coverage or interference recorded.

Mount Abu: There was interference and low signal strength recorded for all operators in the outdoor areas near Gomukh and Brahmakumari only while in the indoor areas no interference and inadequate coverage was recorded.

Conclusions:

1. Bharti Hexacom and BSNL do not meet the TRAI benchmark in all the three cities whereas Vodafone does not meet the benchmark in outdoor areas in Jaipur
2. Idea does not meet the benchmark for voice quality in Jaipur and Bhilwara
3. BSNL in indoor areas in Mount Abu performs relatively poorly
4. Idea and BSNL does not meet the TRAI benchmark in Bhilwara on blocked call rate. Bharti Hexacom also does not meet the benchmark on blocked call rate for outdoor areas in Bhilwara
5. Idea (outdoor) and BSNL (indoor) do not meet the benchmark on call drop rate in Bhilwara

Summary of Live Measurement Results – Cellular Mobile Services

Parameter	Benchmark	VODAFONE	Shyam Telelink	TATA	IDEA	BSNL	Bharti Hexacom	RCOM
CSSR	> 95%	99.36%	98.90%	98.37%	99.02%	98.50%	97.17%	99.47%
SDCCH / Paging Channel Congestion	< 1%	0.23%	0.00%	0.00%	0.28%	0.15%	1.05%	0.00%
TCH Congestion	< 2%	0.18%	0.00%	0.04%	0.25%	1.30%	1.05%	0.53%
Call drop rate	< 3%	1.09%	0.43%	0.87%	1.21%	1.50%	1.27%	0.84%
POI congestion	< 0.5%	Complied	Complied	Complied	Complied	Complied	Complied	Complied

■ Not meeting the benchmark

During the three day live measurement, all the operators were found to be meeting the TRAI benchmark on all the parameters.

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Summary of TCH Drop during one month

Parameter	VODAFONE	Shyam Telelink	TATA	IDEA	BSNL	Bharti Hexacom	RCOM
Total number of cells	12763	2497	2613	6953	6189	14959	1017
No. of cells exceeding 3% TCH drop	1156	101	152	1121	1246	2135	7
% of cells exceeding 3% TCH Drop	9%	4%	6%	16%	20%	14%	1%

20% of BSNL cells exceed 3% TCH drop. The same is as high as 16% for IDEA and 14% for Bharti. Only 1% RCOM cells exceed 3% TCH drop.

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

S.No	Parameters	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
1	**Service provisioning uptime**							
1.1	Total connections registered		795	3581	54	No new registrations	85	1608
1.2	Percentage connections provided within 15 days	100%	100%	96%	100%		99%	100%
2	**Fault repair restoration time**							
2.1	Total number of faults registered/calls made		2075	8621	59	222	193	6044
2.2	Percentage faults repaired by next working days	> 90%	99%	71%	90%	92%	91%	78%
2.3	Percentage faults repaired within three working days	99%	100%	100%	100%	99%	99%	100%
3	**Billing performance**							
3.1	Total bills generated		11906	7844	Prepaid	347	678	17078
3.2	Billing complaints per 100 bills issued	<2%	0.00%	2.82%		0.29%	0.29%	0.91%
3.3	%age of billing complaints resolved within 4 weeks	100%	No billing complaints	88%		100%	100%	100%
3.4	Time taken for refund of deposits after closure	100%		92%	No cases	NA	100%	No cases
4	**Customer care/helpline assessment**							
4.1	Percentage calls answered within 60 seconds	> 60%	86%	81%	96%	95%	94%	Details not maintained
4.2	Percentage calls answered within 90 seconds	>80%	92%	95%	100%	97%	96%	
5	**Bandwidth utilisation/Throughput**							
5.1	Total number of intra network links tested		57	23 BRAS, TI 24, T2624,DSLAM 5960	412	16	No Core Distribution Router present in Rajasthan circle	65
5.2	Total number if intra network links crossing 90%		10	0	0	0		0
	Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)							
5.3	Total number of upstream links		3 (Links physically located in Delhi)	141	27	50	1(NIXI)	2
5.4	Number of links > 90%		0	8	0	0	0	0
5.5	Percentage bandwidth utilised on upstream links	<80%	79%	70%	79%	60%	50%	63%
6	**Broadband download speed**	>80%	Complied	Complied	Complied	Complied	Complied	Complied
7	**Service availability/uptime**	>98%	99.92%	100.00%	100.00%	97.72%	99.02%	99.89%
8	**Packet loss**	<1%	0%	0%	0%	0%	0%	0%
9	**Network Latency**							
9.1	POP/ISP Node to NIXI to IGSP	<120msec	31	Complied	<30	Complied	Complied	35
9.2	ISP node to NAP port	<350msec	102	Complied	<300	Complied	Complied	151

** Methodology not in line with QoS   ▮ Figures provided on All India basis   ▮ Not meeting the benchmark   **B'mar**k = 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 in the circles being audited in the second half yearly period. Some service providers claimed that they were submitting the PMR basis their inference of the QoS parameters. Also, there were differences observed in level of reporting for e.g. Sify, and BSNL (for network related parameters) claimed to be category "A" service provider and consider all India as one circle. In fact the findings reported herewith for some of the parameters for these operators are on an all India basis.

However, we need to take a larger view of the picture and ignore some differences in measurement methodologies and level of reporting. 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 key conclusions (Parameter wise) emerging out from the Audit exercise of six Broadband service providers are highlighted below

Service provisioning/Activation time

- BSNL (96%) and RCOM (99%) marginally fall short of TRAI benchmark of 100% connections to be provided within 15 days.
- For Live calling carried out Shyam Tele link scores the lowest with 84% subscribers claiming that connection was provided within 15 days. For rest of the service providers scores are observed to be >85%.

Fault Repair/Restoration time

- BSNL (71%), Shyam (78%) and Sify (90%) are falling below the benchmark for fault repair within next working day.
- For fault repair within three working days all operators are meeting the TRAI specified benchmark of 99%
- TRAI can consider including Mean Time to Repair (MTTR) for faults as one of the parameters for measuring Quality of Services (QoS) in future for Broadband services as well.
- Also, Sify was found to be reporting only those fault complaints which are booked at the call centre. All the fault complaints booked at the cable operator's end are not taken into consideration while reporting in PMR

Billing performance

- All the service providers except BSNL were found to be meeting the benchmark of percentage billings complaints received and time taken for resolution of 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.
- It should also be noted that the definition of billing complaints/disputes can be considered as lenient as service providers namely Bharti and Reliance include only those complaints where an internal ticket is opened and refund is made to the customer. Hence there is a need felt to have some clarity on the definition of billing complaints.

Customer Care/Helpline Assessment

- All the operators meet the TRAI specified benchmark for calls answered by the operator in 60 and 90 seconds for the month in which audit was carried out
- Shyam Telelink does not have a mechanism to record the details of calls received and answered by the operator currently
- For live calling BSNL falls short of TRAI specified benchmark for calls answered by the operator in 60 seconds (47%) and 90 (65%) seconds.

Bandwidth Utilisation:

- All the service providers were found to be using Multiple Router Traffic Grapher (MRTG) to measure the bandwidth utilisation at intra network links.
- However, it was noticed that some of the service providers are reporting Average bandwidth utilised during the complete period to TRAI instead of Bandwidth utilised during Time Consistent Busy Hour (TCBH) as they claim that the peak hours generally range from 11.00AM in the morning to 4.00 PM in the evening owing to high corporate usage during the period. Also, it was observed that there are multiple links and busy hour may vary for each link.
- All the service providers were found to be reporting combined bandwidth utilisation for corporate and household customers as there is no mechanism available to provide it separately for different users.
- For Intra network link, data for Sify, BSNL and VSNL (TATA Communications) was obtained on all India basis. None of the links tested for these operators was found to be having above 90% bandwidth utilization for the month in which audit was carried out
- Also It was observed that all the links (tested during three day live measurement) in the access segment for most of the service providers were found be below 80%.
- Infact for large service providers having Metro E network, bandwidth utilisation during peak hours was found to less than 50% during peak hours for some if the links randomly tested during three days live measurement.
- Also, service providers distributing services through cable operators (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), all the operators meet the TRAI specified benchmark. For Bharti upstream links to NIXI and IGSP all physically located in New Delhi

Download speed

- 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. These measurements were carried out by IMRB auditors on a sample basis during visits at PoPs and ISP Node
- However, no historic data was available for verification of records for month of Audit as well as quarter ending April to June 2008 with 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.

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Service Availability/Uptime:

- All the service providers (except VSNL i.e. TATA Communications) are meeting the benchmark on service availability/uptime for the month in which audit was carried out.
- However, it was observed that type of sites being taken into consideration for calculating network uptime varies from operator to operator.
  - o For e.g. TATA communications (VSNL) considers all the sites in the access network (including DSLAM, Building Nodes etc) for calculating network uptime whereas BSNL does not consider downtime for DSLAM's while reporting to TRAI. Again for service providers distributing through cable operators (Sify), it was observed that downtime for equipment at the cable operator's premises is not being taken into consideration for calculating service availability.
  - o The same is in line with the guideline provided by TRAI as service availability aims at measuring time for which Broadband access network (Including ISP Node) was not in a state of failure for all users.
  - o However, it should be noted that parameter ignores cases in which Broadband access network may be in state of failure for some/part users. Hence it is recommended that TRAI can take into consideration including *"Customer uptime"* as a parameter for measuring Quality of Services (QoS) for various service providers.

Packet Loss and Network Latency

- It was observed that almost all the service providers 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 all the operators except BSNL. However, it should be noted that the network related data for BSNL for verification was obtained from their central node in Bangalore.
- Also, while conducting ping tests it was observed that service providers (except BSNL) were found to be unaware of the standard prescribed by TRAI i.e. one ping test constitute of 1000 pings of 64 byte packet each to be carried out daily during Time consistent Busy Hour(TCBH).
- Due to non availability of the records of old ping tests, verification process could not conducted for most of the private operators.
- However, ping tests conducted/smoked ping results during live measurements revealed that all the service providers are meeting the benchmark prescribed by TRAI.

Summary of Live Measurement Results – Broadband Services

Parameters	Benchmark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Service Availability Uptime	**>98%**	99.99%	100.00%	100.00%	97.82%	89.72%	99.74%
No of **Intra network links** found to be above 90% (Out of sample links tested)		0	0	0	0	0	0
Total Bandwidth utilization at all upstream links	**< 80%**	72%	83%	68%	60%	69%	70%
Data Download Speed	**> 80%**	Complied	Complied	Complied	Complied	Complied	Complied
Packet Loss (Percentage)	**< 1%**	<1%	<1%	<1%	<1%	<1%	<1%
From user reference point at POP/ISP Node to IGSP NIXI (msec)	**<120msec**	30.41	Complied	<30	Complied	Complied	35.1
From user reference point at ISP Gateway Node to nearest NAP Port (Terrestrial) (In msec)	**<350msec**	99.66	Complied	<300	Complied	Complied	161

** Methodology not in line with QoS   ☐ Figures provided on All India basis   ☐ Not meeting the benchmark   **B'mar**k = TRAI Benchmark, **DNA** = Details not available, **NA:** Not Applicable

- All the service providers (except VSNL and RCOM) are meeting the benchmark on service availability/uptime for three day live measurements. As explained earlier, it was observed that type of sites being taken into consideration for calculating network uptime varies from operator to operator.
- It should be considered that VSNL which does not meet the benchmark is considering all the types of sites (including DSLAM's and Building Nodes) for calculating service availability.
- 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 all of the operators
- For Bandwidth utilization on upstream links, all the service providers are 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 141 gateway links present at different places in India 19 were found to be > 90 %.
- For network latency all the service providers comfortably meet the TRAI specified benchmark for ping tests carried out during live measurements.

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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)
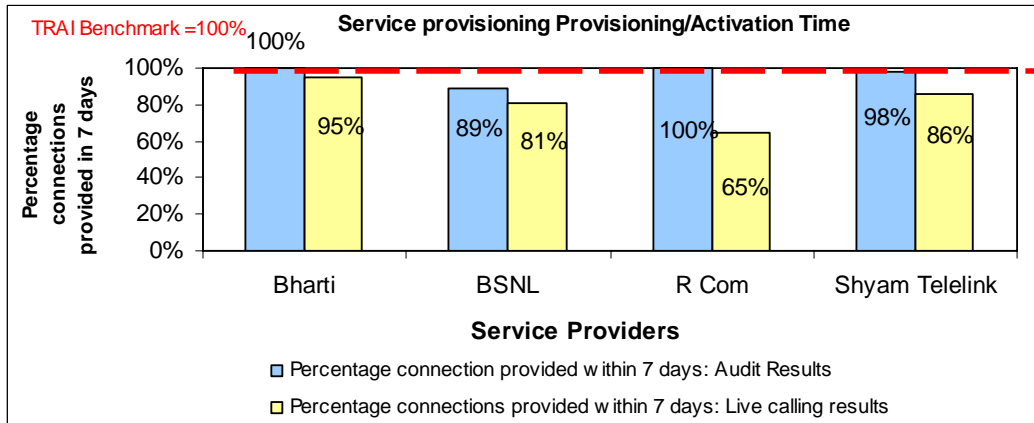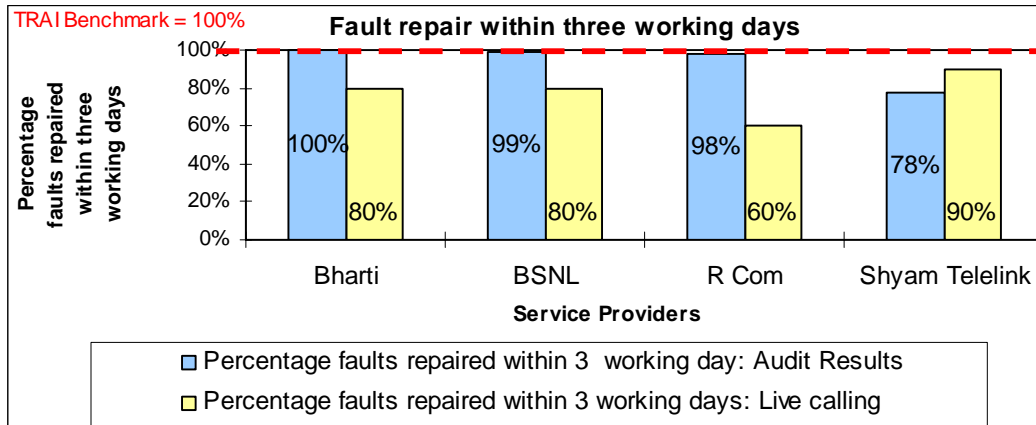

BSNL (89%) and Shyam Telelink (98%) fall short of TRAI specified benchmark for connections registered within 7 days. It should be noted that BSNL's score is deemed to be good as BSNL was found to be providing connections in rural as well as urban areas.
Live calling scores for all the operators were observed to be varying from 65% for RCOM to 95% for Bharti

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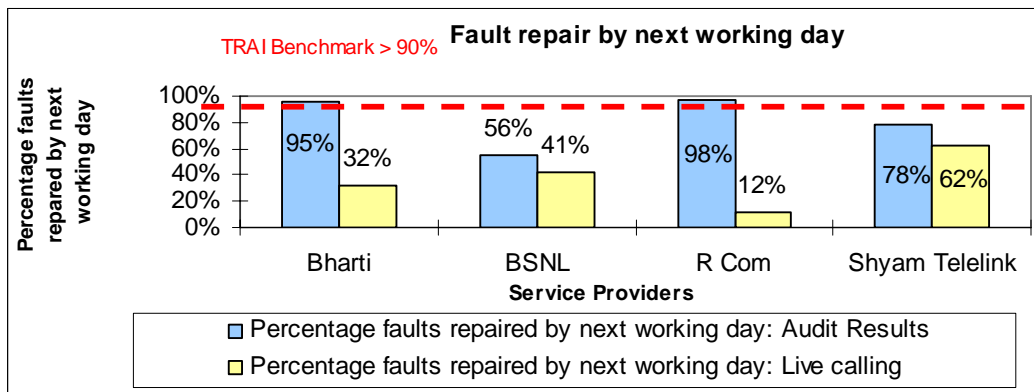

For fault repair by next working day BSNL and Shyam Telelink fall short of the TRAI specified benchmark. For live calling scores only 12% of RCOM subscribers called claimed that the faults reported by them where cleared by next working day. Shyam Telelink score for live calling is observed to be highest with a score of 62%.

Fault repair within three working days

TRAI Benchmark = 100%

☐ Percentage faults repaired within 3 working day: Audit Results
☐ Percentage faults repaired within 3 working days: Live calling

BSNL (by 1%), RCOM (by 2%) and Shyam telelink (by 22%) fall short of TRAI specified benchmark for fault repair within 3 working days. Interestingly Shyam Telelink leads the way for live calling results with 90% of subscribers claiming that fault was repaired by three working days followed by Bharti and BSNL at 80%

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

Call Completion Rate

TRAI Benchmark > 55%

☐ Call Completion Rate: Audit Results ☐ Call Completion Rate: Live Measurement
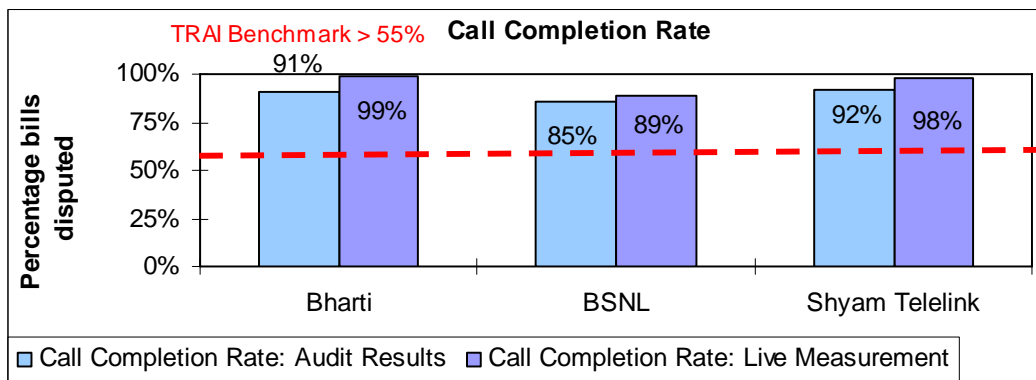
All the service providers were found to be meeting TRAI benchmark (55%) for Call Completion Rate both for live measurements and month in which the audit was carried out. As mentioned earlier Reliance does not have the technical capability to measure CCR and does not even report the same to TRAI.

Percentage bills disputed

Percentage of Billing Complaints

TRAI Benchmark < 0.1%

☐ Percentage bills disputed
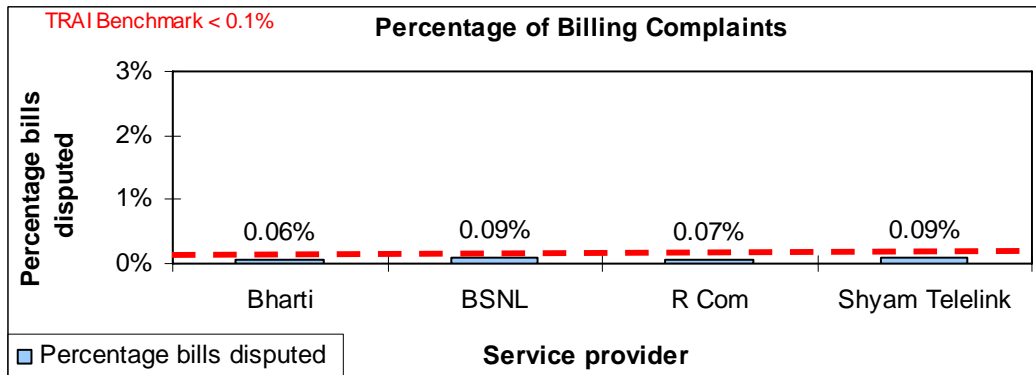
All the service providers meet the TRAI specified benchmark as percentage billing complaints remain <0.1% for all the operators

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

**Resolution of billing complaints**

TRAI Benchmark =100%
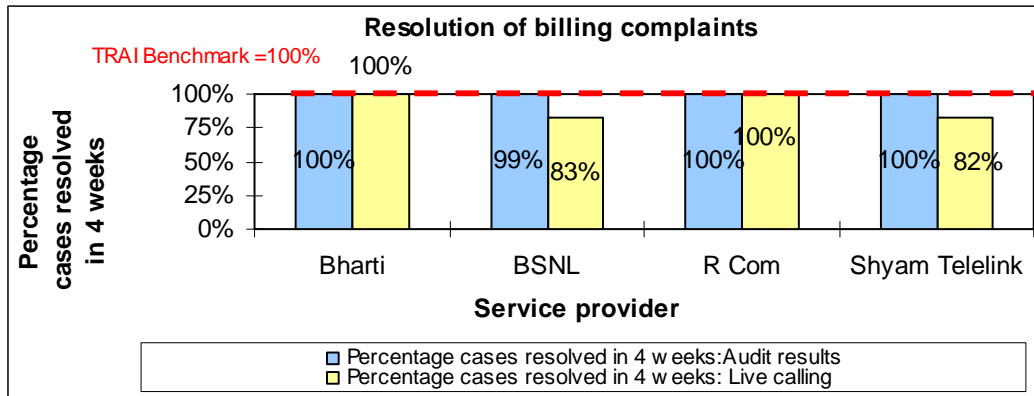
All the service providers (except BSNL at 99%) meet the TRAI specified benchmark for resolution of billing complaints within 4 weeks for the month of audit. For live calling results 82% of Shyam, 83 % of BSNL subscribers and 100% of subscribers called for Bharti and RCOM claimed that their complaint was resolved within 4 weeks. However sample calls made were low (<10) for RCOM and Bharti owing to less billing complaints reported by customers.

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

TRAI Benchmark = 95%

**Shift Request Attended in 3 days**
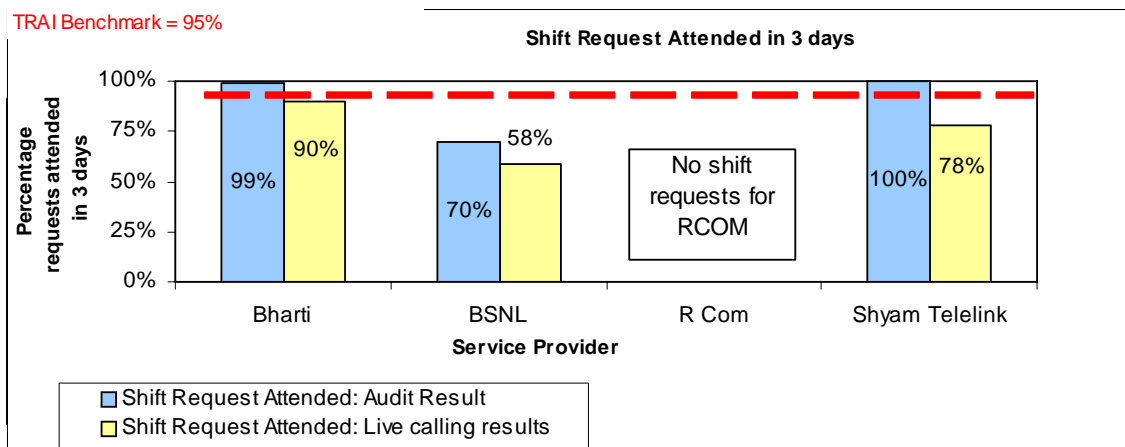
For shift requests attended within 3 days BSNL fall short of TRAI specified benchmark. For live calling Bharti leads with 90% subscribers claiming that request was attended in stipulated time followed by Shyam Telelink and BSNL at 78% and 58% respectively.

Closure requests attended within 24 hours
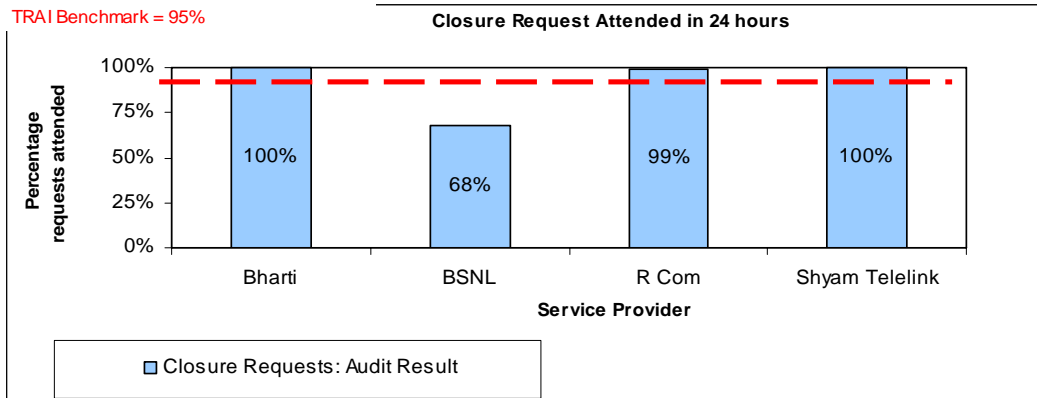
BSNL (at 68%), falls short of the benchmark of 95% closure requests attended within 24 hours for the month of Audit

Supplementary requests (Additional services) attended within 24 hours (Comparison between one month audit results and live calling results)
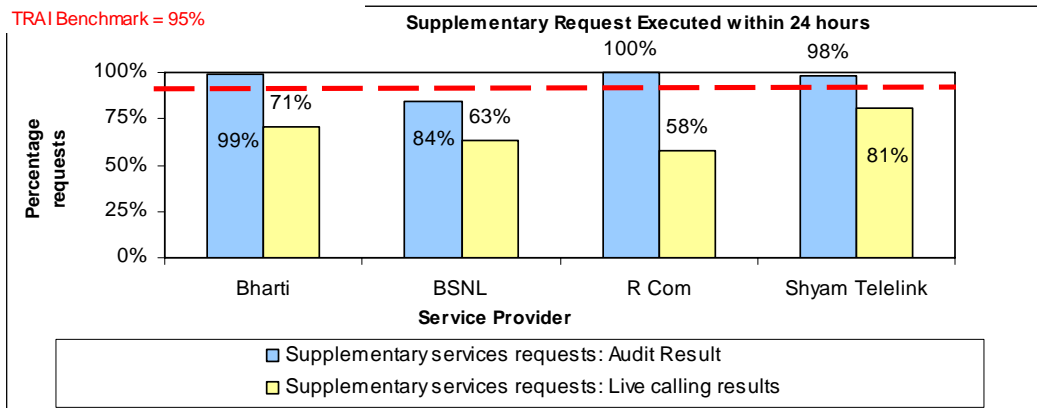
BSNL falls short of the TRAI specified benchmark of 95% "requests for additional services" to be attended within 24 hours for the month of Audit. For Live calling results Shyam Telelink leads with a score of 81%. The lowest score on live calling is observed for RCOM at 58%
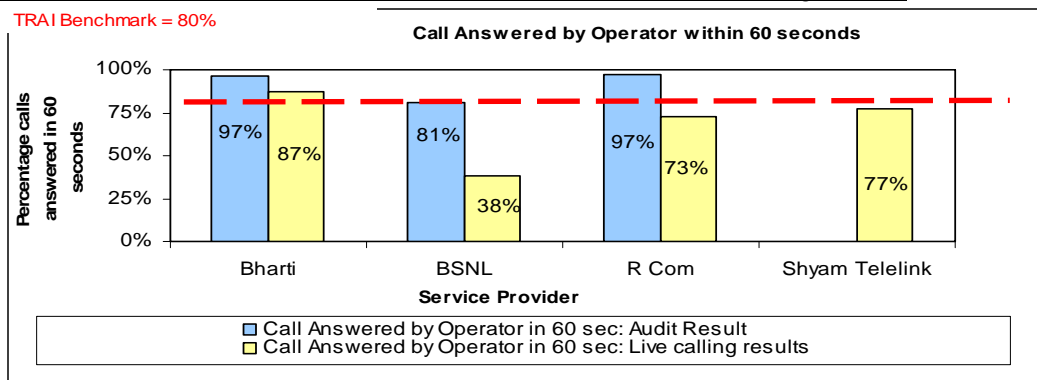
Response time to customer for assistance - Calls answered electronically within 20 and 40 seconds (Comparison between one month audit live calling results)

**Call Answered electronically within 40 seconds**

TRAI Benchmark = 95%
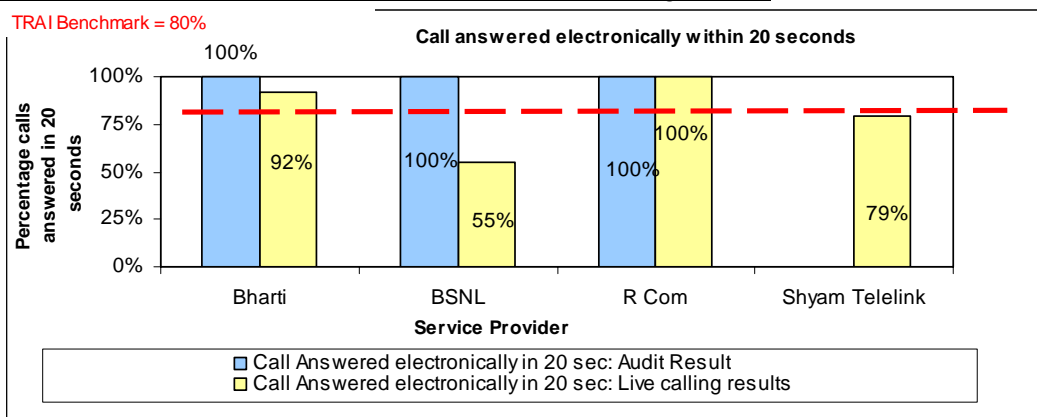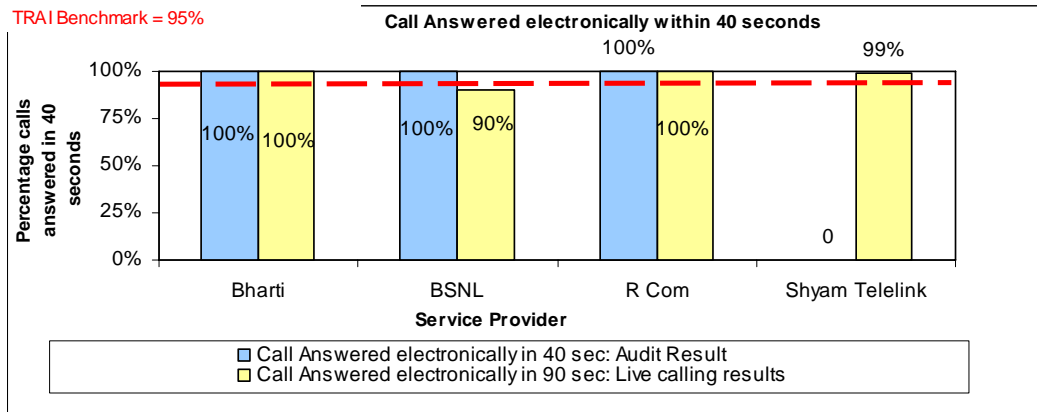
BSNL falls short of TRAI specified benchmark for live calling scores for calls answered electronically within 20 and 40 seconds. Shyam also falls short on percentage calls answered electronically within 20 seconds.

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

TRAI Benchmark = 80%

Call Answered by Operator within 60 seconds

Shyam Telelink, RCOM and BSNL fall short of TRAI specified benchmark for calls answered by the operator within 60 seconds on the live calling aspect
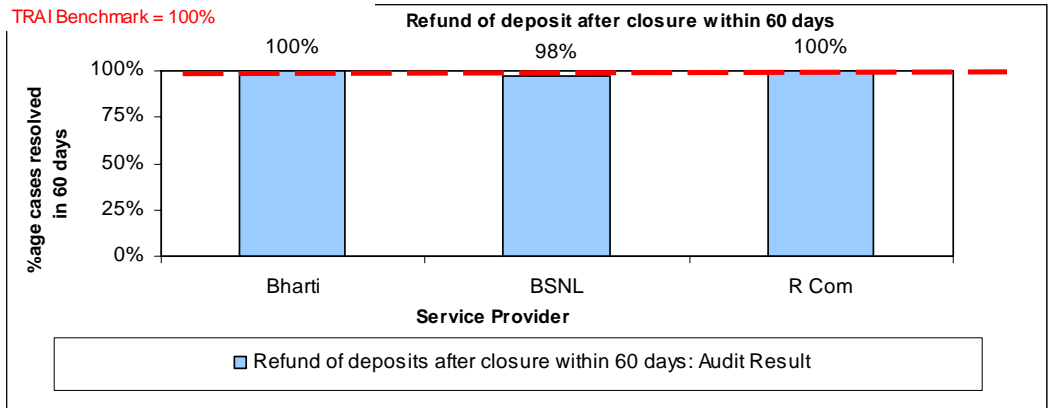
Response time to customer for assistance - Calls answered by the operator within 90 seconds (Comparison between one month audit results and live calling results)

TRAI Benchmark = 95%

Call Answered by Operator within 90 seconds
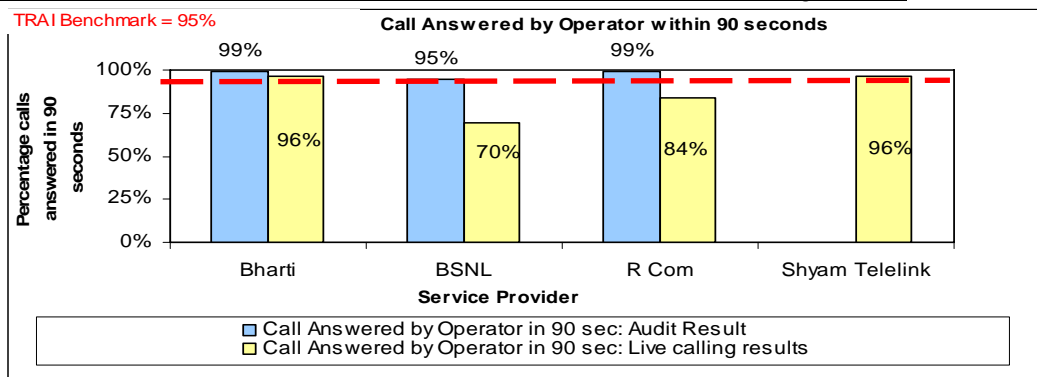
Only Bharti and Shyam Telelink manage to meet the benchmark for Live calling for calls answered by the operator within 90 seconds

Time taken to refund of deposits after closure

TRAI Benchmark = 100%

Refund of deposit after closure within 60 days

100%   98%   100%

%age cases resolved in 60 days

100%
75%
50%
25%
0%

Bharti   BSNL   R Com

Service Provider

☐ Refund of deposits after closure within 60 days: Audit Result

All operators except BSNL meet the TRAI specified Benchmark. No cases for refunds were recorded for Shyam Telelink

6.2 Graphical/Tabular Representations for Cellular Mobile Services

Accumulated Downtime

Accumulated Downtime for Community Isolation
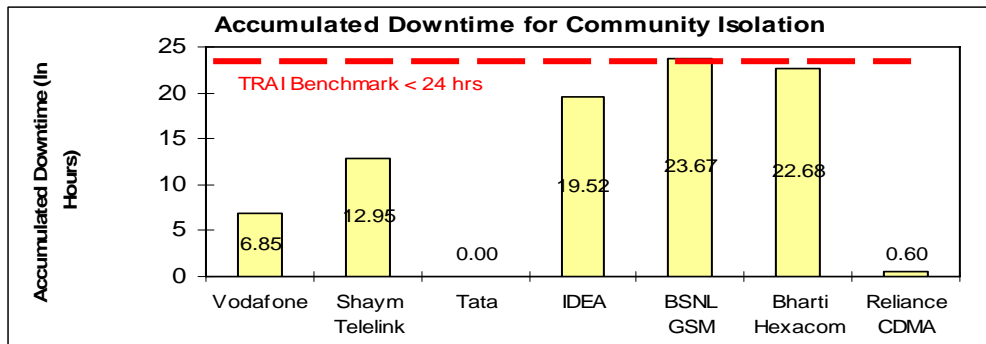
Except TATA all other operators experienced a downtime in the Rajasthan circle in the month of audit. All of these operators experienced a downtime in their network ranging from 0.6 hours for RCOM to 23.67 hours for BSNL.

Call Set-up Success Rate (CSSR)

Call Set Up Success Rate
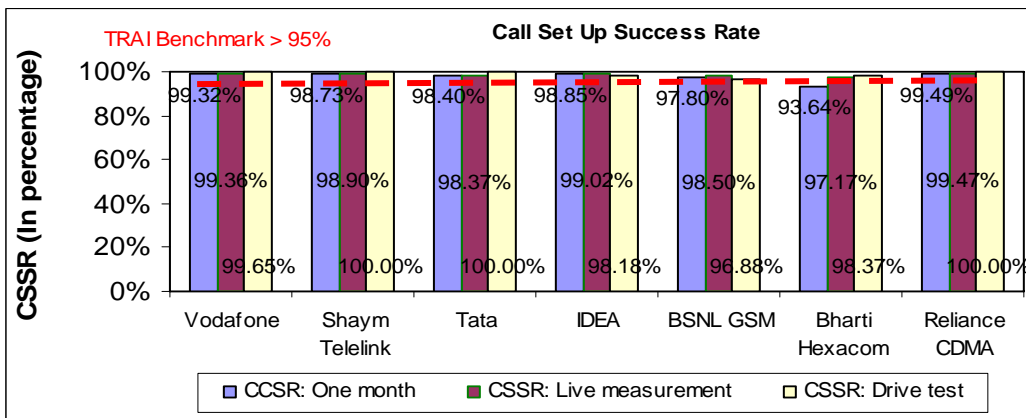
All the operators except Bharti Hexacom for one month data collection and verification are meeting the benchmark for the audit month, live measurement as well as the drive test.

Service Access Delay

Service Access Delay
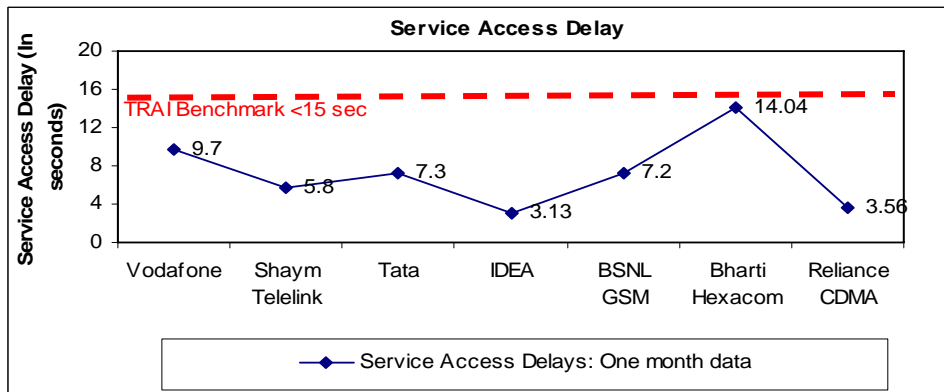
All the operators are meeting the benchmark. The auditors measured this parameter using a standard drive test tool kit. The highest service access delay was measured for Bharti Hexacom at 14.04 seconds and the lowest was for Idea at 3.13 seconds.

SDCCH / Paging Channel Congestion

All the operators except Bharti Hexacom meet the benchmark for the month and the three day live measurement period. During the monthly measurements and verification TATA, Shyam Telelink and RCOM do not record any paging channel congestion.

TCH Congestion
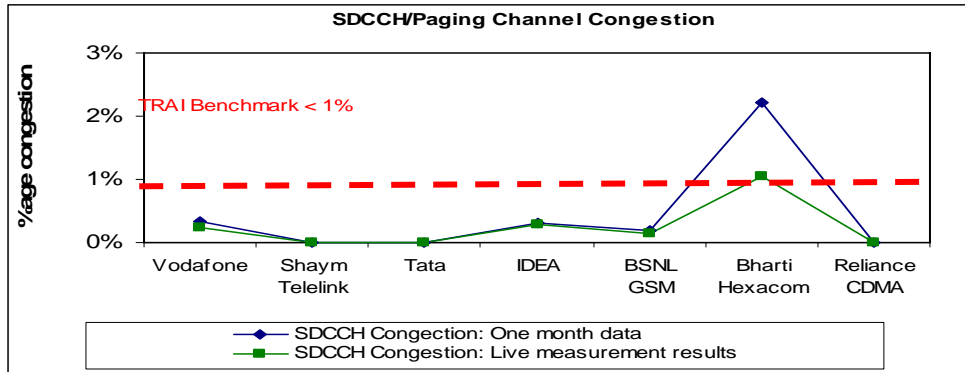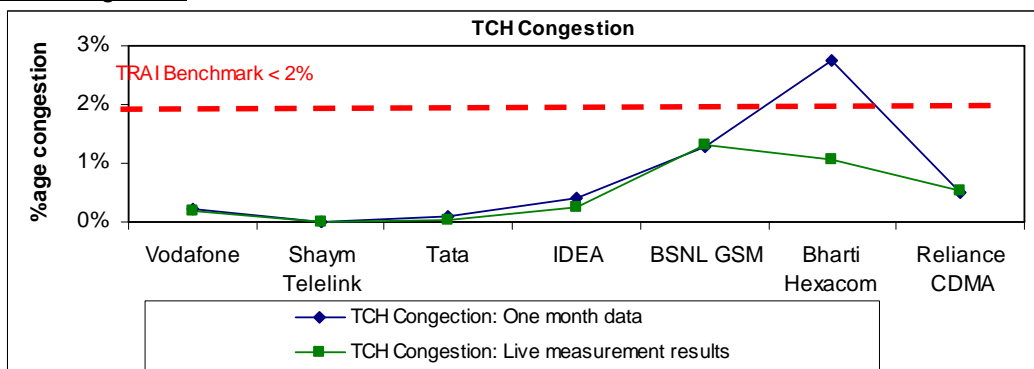

All the operators except Bharti Hexacom for one month data collection and verification meet the TRAI benchmark for both the monthly audit as well as the three day live measurement period. On an overall basis, the relatively lower congestion is observed for Vodafone, TATA and Shyam Telelink

Call Drop Rate
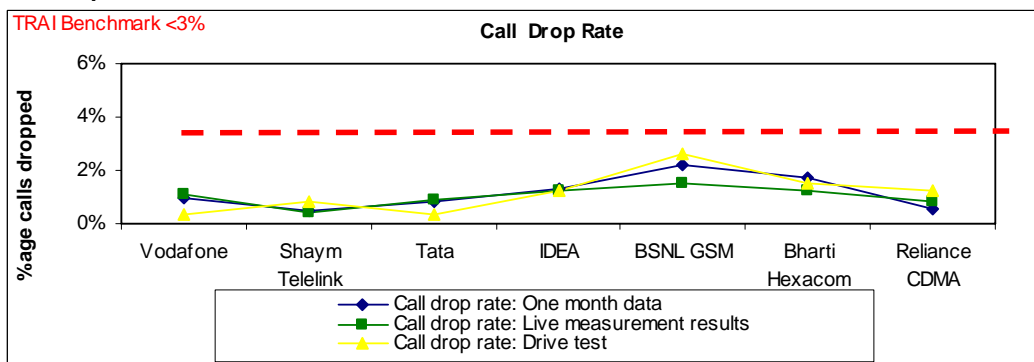
All the operators meet the TRAI benchmark. The operators with the least call drop rates taking into consideration the figures for drive tests, live measurement and the month of audit are Shyam Telelink, RCOM and TATA.

Voice quality
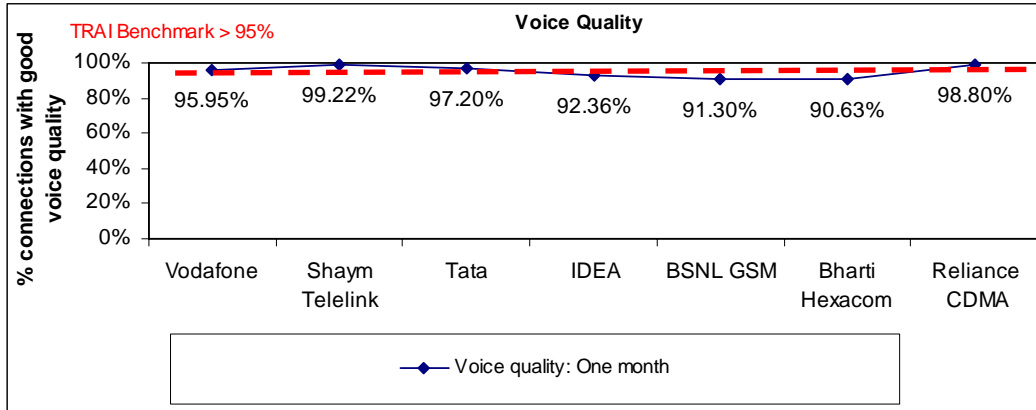
Idea, BSNL and Bharti Hexacom do not meet the TRAI benchmark as found out during the drive test. The lowest percentage of connections with good voice quality was observed across Bharti Hexacom at a level of 90.63% followed BSNL at 91.30% and Idea at 92.36%.

Billing Disputes
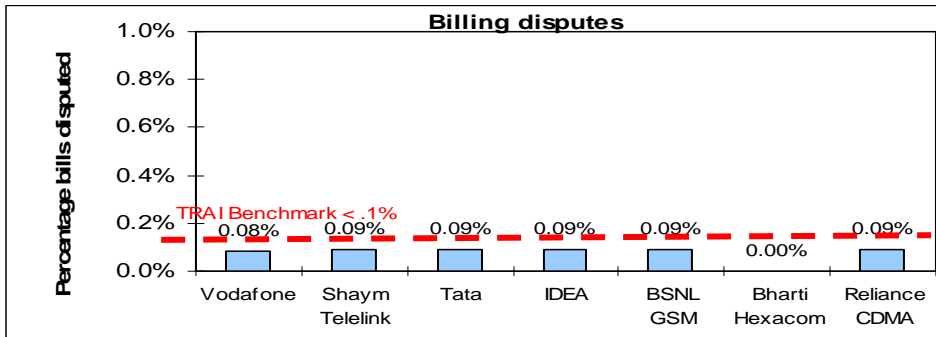
All the operators meet the TRAI benchmark on percentage billing disputes per 100 bills. Bharti Hexacom did not receive any billing complaint from its postpaid subscribers.
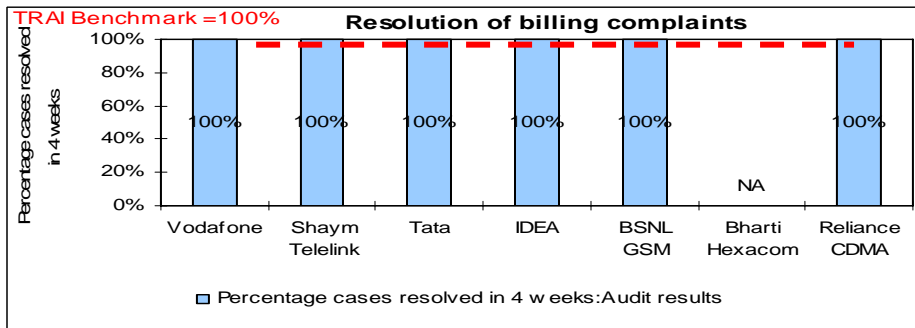
All the operators meet the TRAI benchmark of resolving 100% of the cases related to resolution of billing complaints for the month in which data was collected. However, the operators consider only those as billing complaints where they have issued an internal ticket which essentially means that a refund is due to the customer.

Refund

TRAI Benchmark =100%
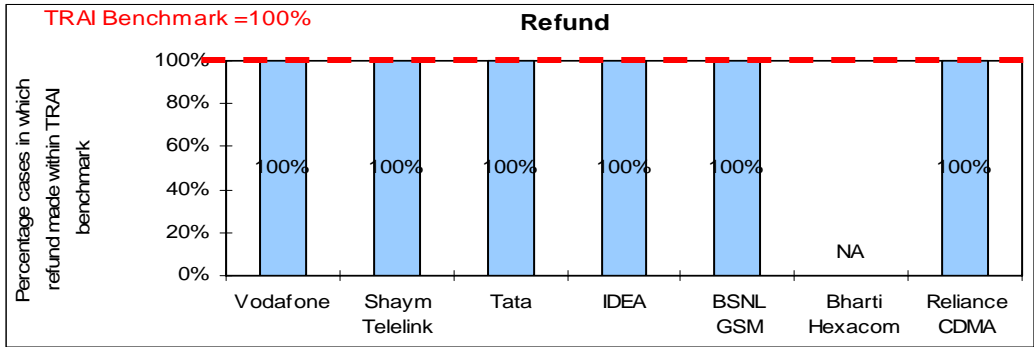
All the operators were found to giving the refunds to their subscribers within the stipulated time period.

Live calling for billing Complaints

Resolution of billing complaints	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total Number of calls made	80	100	60	16	100	50	70
Number of cases resolved in 4 weeks	79	90	55	12	72	48	63
Percentage cases resolved in four weeks	98.75%	90.00%	91.67%	75.00%	72.00%	96.00%	90.00%

None of the operators were able to meet the TRAI benchmark for the live calling aspect. Only 72% BSNL and 75% Idea subscribers say that their complaints were resolved within 4 weeks.

Customer Care / Helpline:

TRAI Benchmark >80%

Calls answered in 20 seconds (Electronically)

- □ Percentage calls answered in 20 Seconds:One month data"
- □ Percentage calls answered in 20 seconds: Live calling

TRAI Benchmark >95%

Calls answered in 40 seconds (Electronically)

- □ Percentage calls answered in 40 Seconds:One month data"
- □ Percentage calls answered in 40 seconds: Live calling
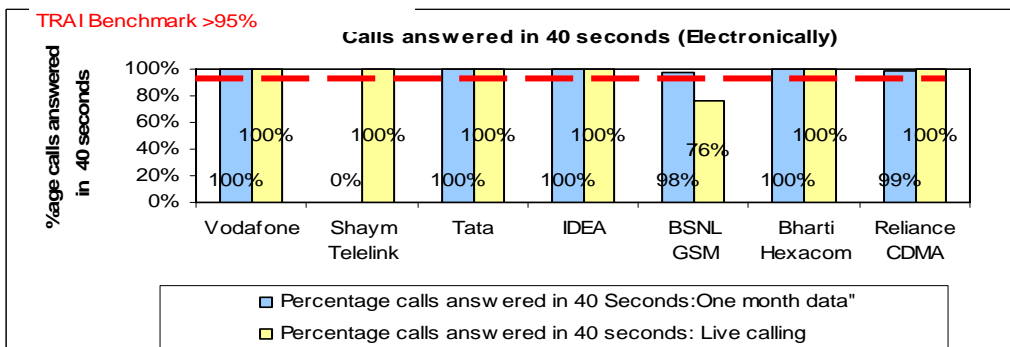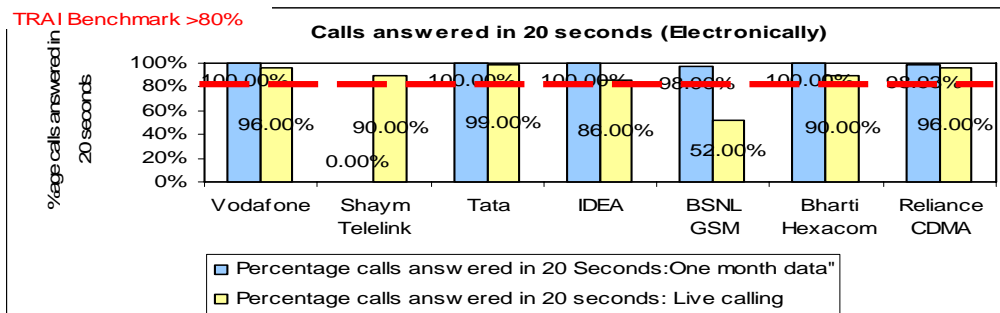
All the operators except BSNL for live calling (both for 20 and 40 seconds) meet the TRAI benchmark for IVR (Electronic) answering of customers' calls for the one month data as well as the live calling that was carried out during the audit.
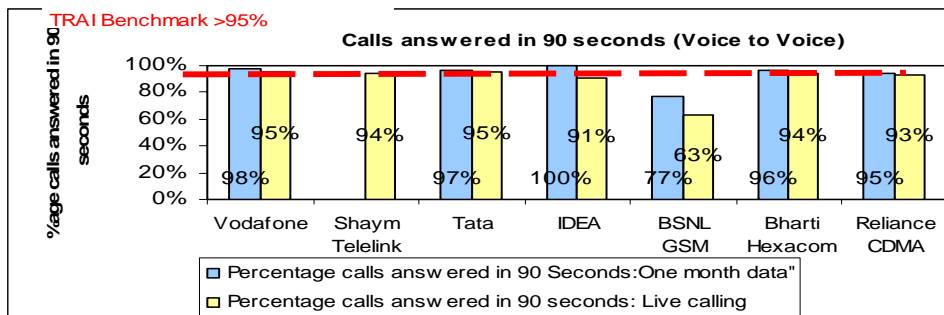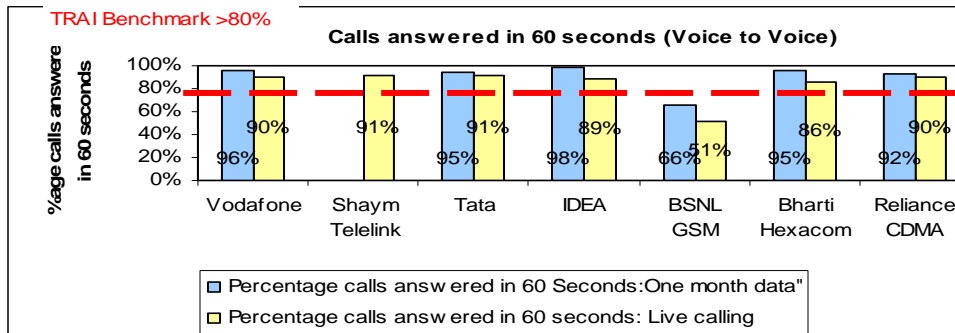
Except for BSNL for both live calling and one month audit for 60 as well as 90 seconds and for Shyam Telelink, Idea, Bharti Hexacom and RCOM for live calling figures, all other operators meet the TRAI benchmark for both the one month data as well as the live calling for voice to voice calls answered within 60 seconds.

Inter operator calls assessment

Inter operator call Assessment (To ↓ / From→)	Bharti Hexacom	BSNL	Vodafone	TATA	RCOM	IDEA	Shyam Telelink
Bharti Hexacom	NA	98%	99%	100%	100%	99%	100%
BSNL	95%	NA	92%	89%	95%	93%	93%
Vodafone	100%	99%	NA	99%	99%	99%	99%
TATA	100%	98%	100%	NA	100%	100%	100%
RCOM	100%	97%	100%	100%	NA	100%	100%
IDEA	99%	97%	99%	98%	99%	NA	98%
Shyam Telelink	99%	95%	99%	100%	100%	100%	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. All the operators found connecting to a BSNL number the toughest with only 89 to 95 out of 100 calls getting established. It was also observed that in only 95% of the cases a call from BSNL got connected to a Shyam Telelink number.

6.3 Graphical/Tabular Representations for Broadband services

<u>Service provisioning/Activation time (Comparison between one month audit results and live calling results)</u>
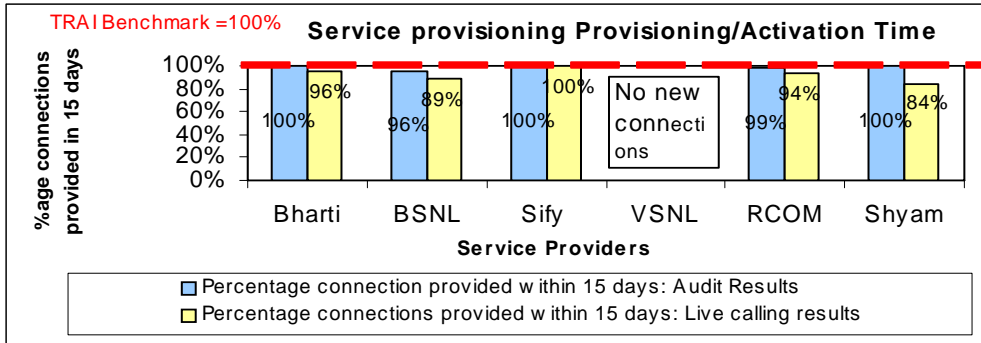
BSNL and RCOM fall short of the benchmark for the month of Audit. Lowest live calling scores are observed for Shyam Telelink at 84% and Highest is observed for Sify at 100%

<u>Fault repair/Restoration time (By next working day)- Comparison between one month audit results and live calling results</u>
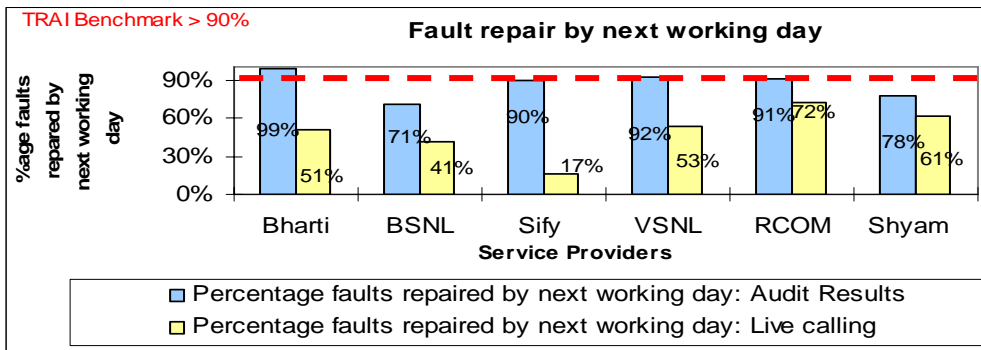
Highest scores on live calling are observed for RCOM at 72% followed Shyam Telelink at 61%. Lowest score on live calling is observed for Sify at 17%

<u>Fault repair/Restoration time within three working days (Comparison between one month audit results and live calling results</u>
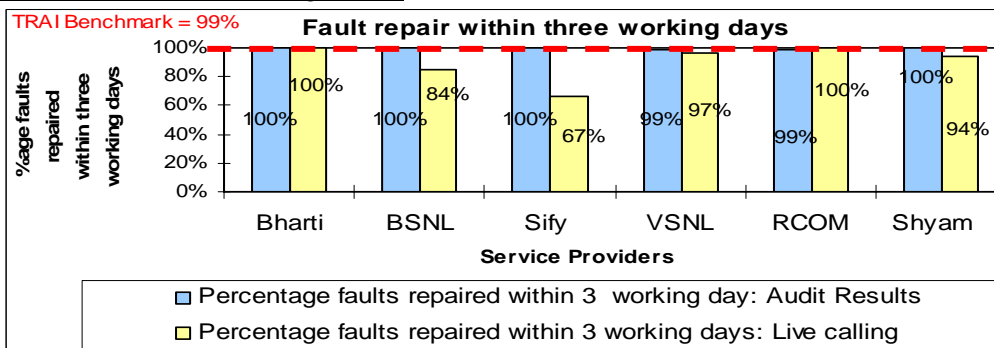
All the service providers are meeting or close to meeting the benchmark both for one month data audit. Live calling scores have also shown considerable improvement when compared to scores observed for live calling for fault repair by next working day

Percentage bills disputed
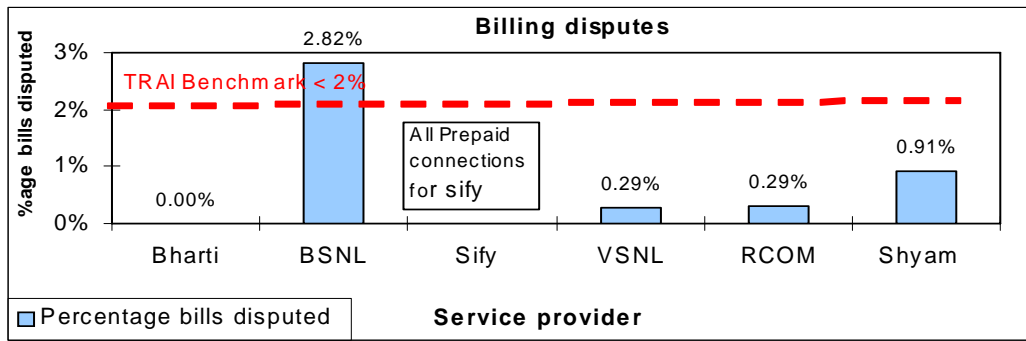
All the operators except (BSNL) meet the benchmark on percentage bills disputed, Sify claims that all its retail customers are prepaid customers and hence there are no billing complaints.

Resolution of billing complaints (Comparison between one month audit results and live calling results)
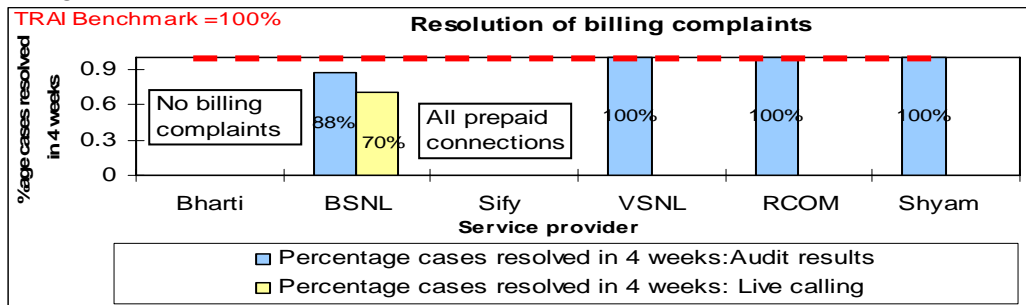
BSNL was the only operator for whom live calling was carried out to check the veracity of resolution of billing complaints. For rest of the service providers live calling could not be carried out owing to low sample of billing complaints

Response time to customer for assistance - Calls answered by the operator within 60 seconds (Comparison between one month audit results and live calling results)
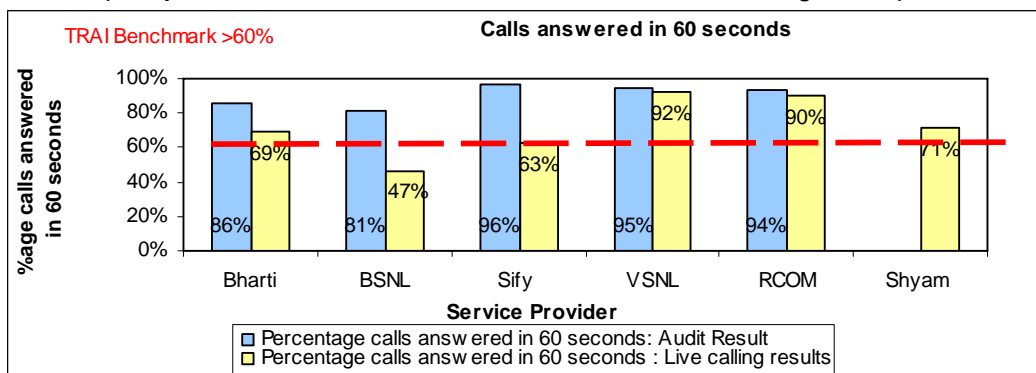
BSNL does not meet the TRAI specified benchmark for calls answered within 60 seconds by the operator live calling carried out by IMRB auditors. Shyam Telelink does not maintain the data for calls answered and received by the operator

Response time to customer for assistance - Calls answered by the operator within 90 seconds (Comparison between one month audit results and live calling results)
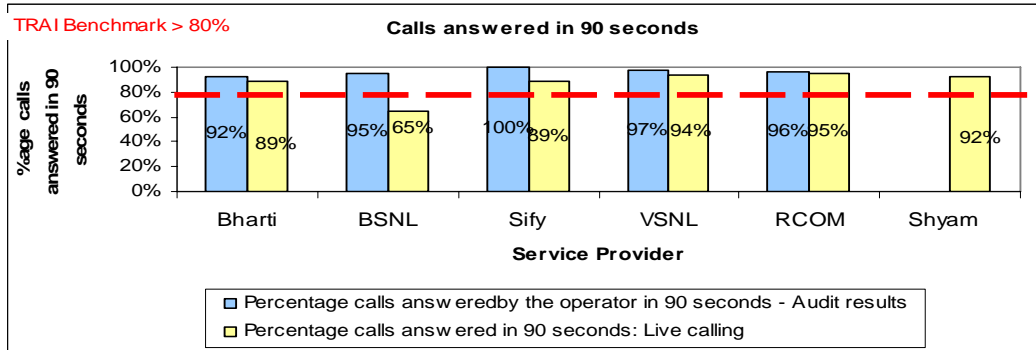
BSNL does not meet the TRAI specified benchmark for calls answered within 90 seconds by the operator during live calling carried out by IMRB auditors.

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

Bandwidth Utilization	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
One month Audit Results							
Total number of intra network links		57	23 BRAS, TI 24, T2624,DSLAM 5960	412	16	No Core Distribution Router in Rajasthan	65
No of Intra network found to be above 90%	**<80%**	10	0	0	0		0
Live measurement Results							
No of Intra network Links tested		20	23 BRAS	412	16	No Core Distribution Router in Rajasthan	0
No of Intra network found to be above 90%	**<80%**	0	0	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%.

However, the level from which the bandwidth utilization at Intra network links is being reported varied because of the difference in networks. For e.g. Bharti was found to be reporting Bandwidth from links running from each RSU (Collection of DSLAM's) to the main node in a circle. Whereas VSNL (TATA Communications) considers the links between core distribution routers (lo9cated at 8 locations in India) and Routers being used for National long distance connectivity (Located at Chennai, Ernakkulam and Mumbai)

For operators distributing through cable operators, bandwidth utilisation 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 then their equipped capacity.

Bandwidth utilization at Upstream links (Comparison between one month audit results and live measurement results)
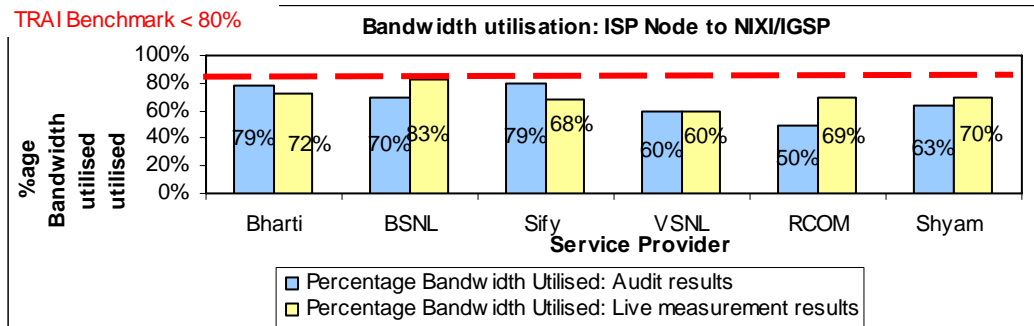
Sify, BSNL and VSNL (TATA Communications) meet the TRAI specified benchmark cumulatively for all gateways in India. For Bharti upstream links (to IGSP/NIXI) are physically located in Delhi.

Service availability/Uptime (Comparison between one month audit results and live measurement results)
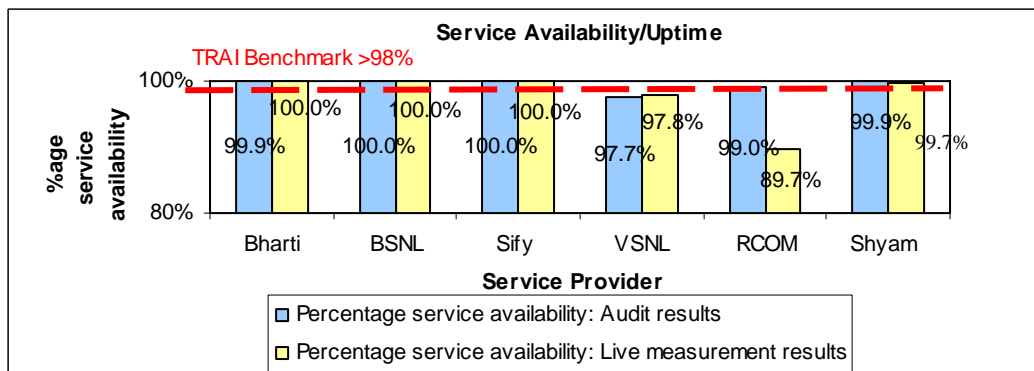
Most of the service providers meet the benchmark with uptime of more than 98% for the month of Audit. VSNL (TATA communications) and RCOM marginally fall short of the benchmark during live measurements and month in which audit was carried out. However it should be considered that the service provider is taking into consideration all types of sites (including DSLAM, Building Nodes) for calculating downtime.

Compliance reports: Results of Verification of Records for April to June 2008

7.1 Basic (Wireline) services

			Bharti		BSNL		RCOM		Shyam Telelink	
			PMR	IMRB	PMR	IMRB*	PMR	IMRB	PMR	IMRB
1	**Provision of telephone after registration of demand**									
1.1	Percentage connections completed within 7 days	100%	100%	100%	100%	89%	73%	100%	87%	87%
2	**Fault incidence/clearance statistics**									
2.1	Fault incidence	<5	4	4.4	6	9.2	0.17	0.17	2.7	2.7
2.2	Faults repaired within 24 hours	>90%	96%	96%	93%	52%	100%	100%	92%	92%
2.3	Mean time to repair	<8 hrs	7.6	7.6	8	7.5	1.98	2.6	5	5
3	Call Completion Rate (CCR)	>55%	59%	59%	61%	85%	71%	71%	92%	92%
4	**Metering and billing credibility**									
4.1	Billing complaints per 100 bills issued	<0.1%	0.00%	0.04%	<0.1%	0.17%	0.00%	0.03%	0.00%	0.09
4.2	%age of billing complaints resolved within 4 weeks	100%	100%	100%	82%	96%	100%	100%	100%	100
5	**Customer care/helpline promptness**									
5.1	Shift requests (Total number received)									
	Percentage shift requests attended within 3 days	95%	98%	97%	100%	62%	No Cases		100%	100%
5.2	Closure request attended (Total number received)									
	Closure within 24 hours	95%	100%	100%	100%	71%	98%	98%	100%	100%
5.3	Supplementary (additional) service requests attended (Total number received)									
	Additional facility provided within 24 hours	95%	98%	100%	100%	87%	100%	100%	89%	89%
6	**Response time to customer**									
6.1	% age call answered through IVR in 20 seconds	80%	100%	100%	100%	100%	100%	100%	Not Reported by the Operator. No mechanism available to measure	
	% age call answered through IVR in 40 seconds	100%	100%	100%	100%	100%	100%	100%		
6.2	% age calls answered by operator in 60 seconds	80%	93%	92%	81%	81%	96%	94%		
	% age calls answered by operator in 90 seconds	95%	96%	96%	95%	95%	98%	97%		
7	%age cases where refund received within 60 days	100%	96%	100%	100%	96%	100%	100%	100%	DNA

* These have been calculated cumulatively on the basis of figures reported by various exchanges

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

IMRB international

7.2 Cellular Mobile services

Parameter	SERVICE PROVIDER													
	Vodafone		Shaym Telelink		TATA		IDEA		BSNL		Bharti Hexacom		Reliance CDMA	
	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB
Network Performance														
Accumulated Downtime	22.15	22.15	12.99	12.99	0.4	0.4	23.7	23.7	23.38	23.38	22.68	22.68	0.7	0.7
Call set up success rate	97.28%	97.28%	98.63%	98.63	98.77%	98.77%	98.99%	98.99%	97.50%	97.50%	88.34%	88.34%	99.08%	99.08%
Service Access delay	Not Reported		Not Reported		5.33 sec	5.33 sec	6.36 sec	6.36 sec	7 sec	7 sec	8.07 sec	8.07 sec	3.71 sec	3.71 sec
Blocked call rate														
SDCCH Congestion	0.78%	0.78%	0.54%	0.54%	0.00%	0.00%	0.73%	0.73%	0.20%	0.20%	4.78%	4.78%	0%	0%
TCH Congestion	0.56%	0.56%	0.44%	0.44%	0.34%	0.34%	0.62%	0.62%	1.20%	1.20%	5.36%	5.36%	0%	0%
Call drop rate	1.09%	1.09%	0.78%	0.78%	0.92%	0.92%	1.66%	1.66%	2.50%	2.50%	1.73%	1.73%	1.02%	1.02%
%age connections with good voice quality	98.00%	98.00%	99.20%	99.20%	98.86%	98.86%	97.52%	97.52%	97.70%	97.70%	97.99%	97.99%	99.53%	99.53%
Service coverage	Complied		Complied		Complied		Complied		Complied		Complied		Complied	
POI congestion	Complied		Complied		Complied		Complied		Complied		1.27%	1.27%	Complied	
Customer Care														
Calls answered electronically														
Within 20 seconds	99.97%	99.97%	Not Reported		100.00%	100.00%	100%	100%	99.30%	99.30%	100%	100%	99.30%	99.30%
Within 40 seconds	100.00%	100.00%			100.00%	100.00%	100%	100%	99.70%	99.70%	100%	100%	99.30%	99.30%
Calls answered by the operator														
Within 60 seconds	98.36%	98.36%	Not reported		89%	89%	90%	90%	78%	78%	96.9%	96.9%	92%	92%
Within 90 seconds	99.52%	99.52%			92%	92%	94%	94%	90%	90%	97.5%	97.5%	95%	95%
Billing complaints														
Billing complaints/100 bills	0.08%	0.08%	0.09%	0.09%	0.06%	0.06%	0.09%	0.09%	0.09%	0.09%	0.00%	0.00%	0.09%	0.09%
%age complaints resolved within 4 weeks	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	NA	100%	100%
Period of refunds due to customers	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	NA	NA	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	Bharti		BSNL		Sify		VSNL	
		PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB
Service provisioning									
Percentage connections provided within 15 days	100%	100%	100%	100%	84%	100%	100%	100%	100%
Fault repair restoration time									
Percentage faults repaired by next working days	> 90%	99%	99%	96%	71%	87%	87%	75%	75%
Percentage faults repaired within three working days	99%	100%	100%	100%	100%	94%	94%	89%	89%
Billing performance									
Billing complaints per 100 bills issued	<2%	0.01%	0.01%	0.20%	0.32%	Prepaid		2.02%	2.02%
%age of billing complaints resolved in 4 weeks	100%	100%	100%	98.40%	81.00%			100%	100%
%age cases in which refund of deposits after closure was made in 60 days	100%	100.00%	100.00%	100%	100%				0%
Customer care/helpline assessment (Voice to Voice)									
Percentage calls answered within 60 seconds	> 60%	69%	69%	88.60%	81.00%	86%	86%	85%	85%
Percentage calls answered within 90 seconds	> 80%	78%	78%	95.20%	95.00%	94%	94%	92%	92%
Bandwidth utilization/Throughput									
Intra network links (POP to ISP Node)									
Total number of intra network links > 90%		0	0	NR	0	5	5		
Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)									
Percentage bandwidth utilized on upstream links	< 80%	70%	70%	NR	78%	85%	85%	60%	60%
Broadband download speed		**No raw data available for verification**							
Service availability/uptime	> 98%	99.93%	100%	NR	100%	100%	100%	97%	97%
Packet loss	<2%	No raw data available for old ping test results		NR	Complied*	No raw data available old ping test results			
Network Latency									
POP/ISP Node to NIXI	< 120 msec			NR	Complied*				
ISP node to NAP port (Terresrtrial)	< 350 msec			NR	Complied*				

^^ 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

{*For BSNL records pertaining to network latency and packet loss were verified for the period of April – June 2008 at the central node in Bangalore},

Broadband services…..Ctd

Parameter	Benchmark	RCOM	
		PMR	IMRB
Service provisioning time			
Percentage connections provided within 15 days	100%	46%	46%
Fault repair restoration time			
Percentage faults repaired by next working days	> 90%	100%	100%
Percentage faults repaired within three working days	99%	100%	100%
Billing performance			
Billing complaints per 100 bills issued	<2%	0.23%	0.23%
%age of billing complaints resolved in 4 weeks	100%	100%	100%
%age cases in which refund of deposits after closure was made in 60 days	100%	100%	100%
Customer care/helpline assessment (Voice to Voice)			
Percentage calls answered within 60 seconds	> 60%	87%	87%
Percentage calls answered within 90 seconds	> 80%	91%	91%
Bandwidth utilisation/Throughput			
Intra network links (POP to ISP Node)		0	0
Total number of intra network links > 90%		0	0
Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)			
Percentage bandwidth utilised on upstream links	< 80%	<80%	<80%
Broadband download speed		No raw data available for verification	
Service availability/uptime	> 98%	97.82%	97.82%
Packet loss	<2%	No raw data available for verification	
Network Latency			
POP/ISP Node to NIXI	< 120 msec		
ISP node to NAP port (Terresrtrial)	< 350 msec		

^^ Methodology not in Line with QoS regulation, [   ] Data verified on All India basis, DNA- Details Not Available for verification, B'mark = TRAI Benchmark [   ] Figures do not match those in PMR {*For BSNL records pertaining to network latency and packet loss were verified for the period of Oct – Dec 2008 at the central node in Bangalore),

7.4 Conclusions

7.4.1 Basic Wireline Services

1. For RCOM parameters related to customer care are reported on an all India level
2. Variation observed in figures for BSNL is owing to the fact that only 5% of the total exchanges were audited for the operator whereas the data provided in the PMR is basis all the exchanges in the circle
3. By and large not much variation is observed in the data reported by the operators and those verified by IMRB

7.4.2 Cellular Mobile services

1. The figures reported by all the operators on all parameters completely match the figures obtained on verification
2. Bharti Hexacom does not meet the benchmark for CSSR, SDCCH, TCH and PoI congestion
3. TATA, Idea and BSNL do not meet the benchmark on percentage of calls answered by the operator with 90 seconds. BSNL also does not meet the benchmark for percentage calls answered within 60 seconds by the operator.

7.4.3 Broadband services

1. Complete data for Sify was verified on an all India level
2. For BSNL there is slight variation observed in for some parameters when compared to the figures reported in PMR. But the reason is largely the fact that data was obtained for sample 5% of exchanges whereas reporting is done for 100% of exchanges.
3. Most of the service providers (except BSNL) were also found to be unaware of TRAI specified guideline for carrying out ping tests of 1000 packets of 64 bytes each.
4. Historic data for Broadband download speed and Ping test conducted to check the latency and packet loss was not available for verification for all the service providers except BSNL
5. Although all the service providers 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. Records of old ping tests were found to be maintained only by BSNL

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	Bharti	BSNL	R Com	Shyam Tele
Number of connections registered during the period		1976	688	108	1608
Total number of connections provided within 7 days		1976	611	108	1578
Percentage of connections provided within 7 days	100%	100%	89%	100%	98%

Live calling results for Service provisioning

Sevice Provisioning/Activation Time	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of service registration calls made		100	415	100	100
Number of cases in which connection was provided in 7 Days		95	335	65	86
Percentage cases in which connection was provided in 7 days	100%	95%	81%	65%	86%

One month data verification results for Fault repair/Restoration time

Fault Repair/Restoration time	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total number of faults registered during the period		831	15961	498	6044
Total number of faults repaired by next working day		789	8888	487	4700
Percentage of faults repaired by next working day	>90%	95%	56%	98%	78%

Live calling results for Fault repair/Restoration time

Fault Repair	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of calls made		100	1700	100	100
Number of cases where fauls were repaired by next working day		32	704	12	62
Percentage cases where faults were repaired by next working day	>90%	32%	41%	12%	62%
Number of cases where faults were repaired within 3 days		80	1359	60	90
Percentage cases where faults were repaired within 3 days	100%	80%	80%	60%	90%

One month data verification results for CCR

Traffic statistics - Call Completion Rate	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total local call attempts		17441216	1023203	DNA	103969815
Total number of successful local calls		15843268	873261	DNA	95965770
Call Completion Rate (CCR) in the local network	>55%	91%	85%	DNA	92%

Live measurement results for CCR

Traffic statistics - Call Completion Rate	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total local call attempts		54666	235411	DNA	387651
Total number of successful local calls		53998	209137	DNA	381142
Call Completion Rate (CCR) in the local network	>55%	99%	89%	DNA	98%

One month data verification results for Billing performance

Billing Performance	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Billing disputes					
Total bills generated during the period		9269	362505	8268	172078
Total number of bills disputed		6	323	6	155
Percentage bills disputed	0.10%	0.06%	0.09%	0.07%	0.09%
Resolution of billing complaints					
Total complaints resolved in 4 weeks from date of receipt		6	321	6	155
Percentage complaints resolved within 4 weeks of date of receipt	100%	100%	99%	100%	100%

Live calling results for Billing performance

Resolution of billing complaints	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of calls made		3	178	2	50
Number of cases resolved in 4 weeks		3	148	2	41
Percentage cases resolved in four weeks	100%	100%	83%	100%	82%

One month data verification for Customer Care – Shifts

Customer Care - Shift Requests	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of shift requests received		116	415	DNA	64
Total number requests attended in 3 days		115	290	DNA	64
Total number requests attended beyond 3 days		1	49	DNA	0
Shifts not attended		0	8	DNA	0
Percentage of requests attended in 3 days	95%	99%	70%	DNA	100%
Percentage of requests attended beyond 3 days		1%	12%	DNA	0%
Percentage of shifts not attended		0%	2%	DNA	0%

Live calling results for Customer Care – Shifts

Customer Care - Shift Requests	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total number of call to shift requests		50	221	DNA	50
Total number of requests attended in 3 days	95%	45	129	DNA	39
Total number of requests attended beyond 3 days		5	90	DNA	11
Shifts not attended		0	0	DNA	0
Percentage of requests attended in 3 days		90%	58%	DNA	78%
Percentage of requests attended beyond 3 days		10%	41%	DNA	22%
Percentage of shifts not attended		0%	0%	DNA	0%

One month data verification Audit results for Customer Care – Closures

Customer Care - Closure Requests	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of closure requests received		715	1268	88	3456
Total closure attended within 24 hours	95%	715	863	87	3456
Total number of requests attended beyond 24 hours		0	327	1	0
Closure requests not attended		0	0	0	0
Percentage of closure attended within 24 hours		100%	68%	99%	100%
Percentage of closure attended beyond 24 hours		0%	26%	1%	0%
Percentage of closures not attended		0%	0%	0%	0%

Live calling results for Customer Care – Supplementary requests

Customer Care - Supplementary Requests	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of supplementary requests received		100	599	100	100
Total number requests attended within 24 hours	95%	71	380	58	81
Total number requests attended beyond 24 hours		29	216	42	19
Supplementary requests not attended		0	39	0	0
Percentage of requests attended within 24 hours		71%	63%	58%	81%
Percentage of requests attended beyond 24 hours		29%	36%	42%	19%
Percentage of supplementary requests not attended		0%	7%	0%	0%

Live calling results for calls answered electronically

Customer Care Assessment	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of calls dialed on toll free number		100	1065	100	100
Calls answered within 20 seconds					
Total Number of calls answered by IVR in 20 seconds	80%	92	585	100	79
Percentage calls answered in 20 seconds		0.92	55%	100%	79%
Calls answered within 40 seconds					
Total Number of calls answered by IVR in 40 seconds	95%	100	959	100	99
Percentage calls answered in 40 seconds		100%	90%	100%	99%

Live calling results for calls answered by the operator

Customer Care Assessment	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of calls dialed on toll free number		100	1064	100	100
Calls answered within 60 seconds					
Total Number of calls answered by operator in 60 seconds	80%	87	407	73	77
Percentage calls answered in 60 seconds		87%	38%	73%	77%
Calls answered within 90 seconds					
Total Number of calls answered by operator in 90 seconds	95%	96	740	84	96
Percentage calls answered in 90 seconds		96%	70%	84%	96%

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

Resolution of billing complaints	Benchmark	Bharti	BSNL	R Com	Shyam Tele
Total Number of cases requiring refund		16	4342	2	NA
Number of cases where refund was made in < 60 days		16	4236	2	NA
Percentage cases where refund was made in < 60 days	100%	100%	98%	100%	NA

Level 1 Services

Level 1 services	Bharti	BSNL
TOTAL Calls Made	208	283
Answered in 60 seconds	205	277
Percentage calls answered in 60 seconds	99%	99%

8.2 Parameter wise performance reports for Cellular Mobile services

Audit Results for Accumulated Downtime for community Isolation

Accumulated Downtime	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total Downtime (In hours)	6.85	12.95	0.00	19.52	23.67	22.68	0.60

Audit Results for CSSR

CSSR	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total number of call attempts	12494838	60848803	919927929	48826159	74537301	478061845	46256617
Total number of successful calls	12409873	60076706	905251464	48263748	72897480	447657112	46020589
CSSR	99.32%	98.73%	98.40%	98.85%	97.80%	93.64%	99.49%

Live measurement results for CSSR

CSSR	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total number of call attempts	11909908	6083927	93501643	53142855	14801519	452512439	60768552
Total number of successful calls	11833685	6016760	91974527	52622905	14579496	439706337	60445251
CSSR	99.36%	98.90%	98.37%	99.02%	98.50%	97.17%	99.47%

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

CSSR	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total number of call attempts	285	348	285	329	352	306	248
Total number of successful calls	284	348	285	323	341	301	248
CSSR	99.65%	100.00%	100.00%	98.18%	96.88%	98.37%	100.00%

Service Access Delay	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
One month data collection	9.7	5.8	7.3	3.13	7.2	14.04	3.56

5.4.1 Audit results for SDCCH and TCH Congestion

Traffic Statistics	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
SDCCH Congestion							
Total number of SDCCH Attempts	13714410	931956	1075118	95882973	3692564	863296802	DNP
Total Number of SDCCH Congestions	DNP	0	0	DNP	DNP	DNP	DNP
Percentage SDCCH Congestion	0.33%	0.00%	0.00%	0.32%	0.18%	2.22%	0.00%
TCH Congestion							
Total number of TCH Attempts	12494838	4842939	919927929	48826159	2323823	464808172	DNP
Total Number of TCH Congestions	DNP	0	827935	NA	NA	NA	DNP
Percentage TCH Congestion	0.22%	0.00%	0.09%	0.42%	1.27%	2.76%	0.51%

5.4.2 Live measurement results for SDCCH and TCH Congestion

Traffic Statistics	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
SDCCH Congestion							

Total number of SDCCH Attempts	13315227	94611	1068182	133845594	3709237	999222927	DNP
Total Number of SDCCH Congestions	DNP	0	0	NA	NA	NA	DNP
Percentage SDCCH Congestion	0.23%	0.00%	0.00%	0.28%	0.15%	1.05%	0.00%
TCH Congestion							
Total number of TCH Attempts	11587893	69450	93501643	53142855	2326342	442517458	DNP
Total Number of TCH Congestions	DNP	0	37401	NA	NA	NA	DNP
Percentage TCH Congestion	0.18%	0.00%	0.04%	0.25%	1.30%	1.05%	0.53%

* DNP: Details Not Provided

Audit Results for Call drop rate

Call drop rate	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total number of calls established	12467350	4072928	905251464	48263748	72897480	447657112	64039079
Total number of calls dropped	120933	18430	7589630	633299	1603744	7639753	374849
Call drop rate	0.97%	0.45%	0.84%	1.31%	2.20%	1.71%	0.59%

Live measurement results for Call drop rate

Call drop rate	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total number of calls established	11888344	429464	91974527	52622905	14579496	439706337	60445251
Total number of calls dropped	129882	1830	798297	636936	218692	5585141	510071
Call drop rate	1.09%	0.43%	0.87%	1.21%	1.50%	1.27%	0.84%

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

Call drop rate	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total number of calls established	284	348	285	323	347	328	248
Total number of calls dropped	1	3	1	4	9	5	3
Call drop rate	0.35%	0.86%	0.35%	1.24%	2.59%	1.52%	1.21%

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

Voice quality	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total number of sample calls	526508	23387	18343	524663	434626	740653	15055
Total number of calls with good voice quality	505201	23205	17829	484580	396815	671221	14875
%age calls with good voice quality	95.95%	99.22%	97.20%	92.36%	91.30%	90.63%	98.80%

POI congestion	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
POI traffic offered on all individual POI's	DNP	145645	37276.6	23271	1090484	6586529	DNP
Served traffic for all individual POI's	DNP	145645	8596.05	7621	20751	844379	DNP
Traffic failed on all individual POI's	Complied	0.00%	Complied	0.14%	0.00%	0.00%	Complied

Inter operator call Assessment (To ↓ / From→)	Bharti Hexacom	BSNL	Vodafone	TATA	RCOM	IDEA	Shaym Telelink
Bharti Hexacom	NA	98%	99%	100%	100%	99%	100%

IMRB international

BSNL	95%	NA	92%	89%	95%	93%	93%
Vodafone	100%	99%	NA	99%	99%	99%	99%
TATA	100%	98%	100%	NA	100%	100%	100%
RCOM	100%	97%	100%	100%	NA	100%	100%
IDEA	99%	97%	99%	98%	99%	NA	98%
Shyam Telelink	99%	95%	99%	100%	100%	100%	NA

Audit results for customer care (Electronically)

Customer Care Assessment	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total Number of calls received by	15048690	DNP	455318	3492143	1917715	DNP	32484741
Calls answered within 20 seconds							
Total Number of calls answered in 20 seconds	15048528	DNP	455318	3492143	1879361	DNP	32135956
Percentage calls answered in 20 seconds	100.00%	DNP	100.00%	100.00%	98.00%	100.00%	98.93%
Calls answered within 40 seconds							
Total Number of calls answered in 40 seconds	15048690	DNP	455318	3492143	1879999	DNP	32135956
Percentage calls answered in 40 seconds	100.00%	DNP	100.00%	100.00%	98.03%	100.00%	98.93%

Live calling results for customer care (Electronically)

Customer Care Assessment	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total Number of calls received by the operator	100	100	100	100	100	100	100
Calls answered within 20 seconds							
Total Number of calls answered in 20 seconds	96	90	99	86	52	90	96
Percentage calls answered in 20 seconds	96.00%	90.00%	99.00%	86.00%	52.00%	90.00%	96.00%
Calls answered within 40 seconds							
Total Number of calls answered in 40 seconds	100	100	100	100	76	100	100
Percentage calls answered in 40 seconds	100.00%	100.00%	100.00%	100.00%	76.00%	100.00%	100.00%

Audit results for customer care (Voice to Voice)

Customer Care Assessment	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total Number of calls received by the operator	3897641	DNP	267812	1421172	969354	3253351.00	**263515**
Calls answered within 60 seconds							
Total Number of calls answered in 60 seconds	3752113	DNP	254421	1396031	640688	3103585.00	**243748**
Percentage calls answered in 60 seconds	96.27%	DNP	95.00%	98.23%	66.09%	95.40%	92.50%
Calls answered within 90 seconds							

Total Number of calls answered in 90 seconds	3828155	DNP	259778	1415214	746115	3126709.00	249509
Percentage calls answered in 90 seconds	98.22%	DNP	97.00%	99.58%	76.97%	96.11%	94.68%

Live calling results for customer care (Voice to Voice)

Customer Care Assessment	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total Number of calls made	100	100	100	100	100	100	100
Calls answered within 60 seconds							
Number calls answered within 60 seconds	90	91	91	89	51	86	90
Percentage calls answered in 60 seconds	90.00%	91.00%	91.00%	89.00%	51.00%	86.00%	90.00%
Calls answered within 90 seconds							
Number calls answered within 90 seconds	95	94	95	91	63	94	93
Percentage calls answered in 90 seconds	95.00%	94.00%	95.00%	91.00%	63.00%	94.00%	93.00%

Audit Results for Billing performance

Billing Performance	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Billing disputes							
Total bills generated during the period	111356	172078	97249	18438	257587	192642	119219
Total number of bills disputed	90	155	86	17	224	0	109
Percentage bills disputed	0.08%	0.09%	0.09%	0.09%	0.09%	0.00%	0.09%
Resolution of billing complaints							
Total complaints resolved in 4 weeks from date of receipt	90	155	86	17	224	NA	109
Percentage complaints resolved within 4 weeks of date of receipt	100%	100%	100%	100%	100%	NA	100%
Refund of deposits after closure							
Total number of cases requiring refund of deposits	3	15	249	16	553	NA	109
Total number of cases where refund was made within 60 days	3	15	249	16	553	NA	109
Percentage cases in which refund was receive within 60 days	100%	100%	100%	100%	100%	NA	100%

Live calling results for resolution of billing complaints

Resolution of billing complaints	Vodafone	Shaym Telelink	Tata	IDEA	BSNL GSM	Bharti Hexacom	Reliance CDMA
Total Number of calls made	80	100	60	16	100	50	70
Number of cases resolved in 4 weeks	79	90	55	12	72	48	63
Percentage cases resolved in four weeks	98.75%	90.00%	91.67%	75.00%	72.00%	96.00%	90.00%

8.3 Parameter wise performance reports for Broadband services

<u>One month data verification results for Service provisioning</u>

Service provisioning/Activation time	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
No of connections registered during the period		795	3581	54	NA	85	1608
Total number registered during 15 days		795	3426	54	NA	84	1608
Percentage of connections provided within 15 days	100%	100.0%	95.7%	100.0%	NA	98.8%	100.0%

<u>Live calling results for Service provisioning</u>

Service Provisioning/Activation Time	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Total Number of calls made		100	707	12	NA	50	50
Number of cases in which connection was provided in 15 Days		96	627	12	NA	47	42
Percentage cases in which connection was provided in 15 days	**100%**	96%	89%	100%	NA	94%	84%

<u>One month data verification results for Fault repair</u>

Fault Repair/Restoration time	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Total number of faults registered during the period		2075	8621	59	222	193	6044
Total number of faults repaired by next working day		2054	6087	53	205	175	4700
Percentage of faults repaired by next working day	**>90%**	99%	71%	90%	92%	91%	78%
Total number of faults repaired within three working days		2075	8621	59	220	191	6044
Percentage of faults repaired within three working days	**>99%**	100%	100%	100%	99%	99%	100%

<u>Live calling results for fault repair</u>

Fault Repair	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Total Number of calls made		100	673	18	60	50	100
Number of cases in which faults were repaired by next working day		51	279	3	32	36	61
Percentage cases in which faults were repaired by next working day	**>90%**	51%	41%	17%	53%	72%	61%
Number of cases in which faults were repaired within three working days		100	568	12	58	50	94
Percentage cases in which faults were repaired within three working days	**>99%**	100%	84%	67%	97%	100%	94%

One month data verification results for billing performance

Billing Performance	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Billing disputes							
Total bills generated during the period		11906	7844	Prepaid	347	678	17078
Total number of bills disputed		0	221		1	2	155
Percentage bills disputed	**<2%**	0.00%	2.82%		0.29%	0.29%	0.91%
Resolution of billing complaints							
Total complaints resolved in 4 weeks from date of receipt		NA	194	Prepaid	1	2	155
Percentage complaints resolved within 4 weeks of date of receipt	**100%**	NA	88%		100%	100%	100%
Refund of deposits after closure							
Total number of cases requiring refund of deposits		NA	24	NA	NA	1	NA
Total number of cases where refund was made within 60 days		NA	22	NA	NA	1	NA
Percentage cases in which refund was receive within 60 days	**100%**	NA	92%	NA	NA	100%	NA

Live calling results for billing complaints

Resolution of billing complaints	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Total Number of calls made		NA	115	Prepaid	NA	NA	NA
Number of cases resolved in 4 weeks		NA	81		NA	NA	NA
Percentage cases resolved in four weeks	**100%**	NA	70%		NA	NA	NA

Live calling results for call centre

Customer Care Assessment	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Total Number of calls made		100	575	100	100	100	100
Calls answered within 60 seconds							
Number calls answered within 60 seconds		69	268	63	92	90	71
Percentage calls answered in 60 seconds	**>60%**	69%	47%	63%	92%	90%	71%
Calls answered within 90 seconds							
Number calls answered within 90 seconds		89	374	89	94	95	92
Percentage calls answered in 90 seconds	**>80%**	89%	65%	89%	94%	95%	92%

One month data verification results for Service Availability/Uptime

Service Availability Uptime	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Total Operational Hours		8414640	53568	744	1172880	720	46800
Total Downtime		6731	2	0	26760	7.03	53.5
Total time when the service was available		8407909	53566	744	1146120	712.97	46746.5
Service Availability Uptime in Percentage	**>98%**	99.9%	100.0%	100.0%	97.7%	99.0%	99.9%

Three day live measurement results for Service Availability/Uptime

Service Availability Uptime	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Total Operational Hours		841464	5184	72	110520	72	4680
Total Downtime		50	0	0	2407	7.4	12.35
Total time when the service was available		841414	5184	72	108113	64.6	4668.05
Service Availability Uptime in Percentage	**>98%**	99.99%	100.00%	100.00%	97.82%	89.72%	99.74%

One month data verification results for Bandwidth utilisation

Bandwidth Utilisation	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Intra-network links (POP to ISP Node)							
Total number of intra network links		57	23 BRAS, TI 24, T2624,DSLAM 5960	412	16		65
No of Intra network found to be above 90%		10	0	0	0		0
International Bandwidth							
Total number of upstream links		3	141	27	50	1(NIXI)	2
No of Intra network found to be above 90%		0	8	0	0	0	0
Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs)		9633	27048	2830	39974	1000	38
Total International Bandwidth utilised during peak hours		7605	18934	2238	23939	495	24
Percentage Bandwidth utilisation during peak hours (In mpbs)	**>90%**	79%	70%	79%	60%	50%	63%

Live measurement results for Bandwidth utilisation

Bandwidth Utilization	B'mark	Bharti	BSNL	Sify	VSNL	RCOM	Shyam
Intra-network links							
Total number of intra network links		57	23 BRAS, TI 24, T2624,DSLAM 5960	412	16		65
No of Intra network Links tested		20	23 BRAS	0	0		0
No of Intra network found to be above 90%		0	0	0	0		
International Bandwidth							
Total number of upstream links		3	141	27	50	1(NIXI)	6
No of Intra network found to be above 90%		0	19	0	0	0	0
Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs)		9633	22010	2830	39974	1000	114
Total International Bandwidth utilized during peak hours		6979	18326	1934	23930	692	80
Percentage Bandwidth utilization during peak hours (In mpbs)	>90%	72%	83%	68%	60%	69%	70%

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	IMRB Auditors to verify and collect data pertaining to - 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. **<u>Live calling : -</u>** - 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 t he 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	**IMRB Auditors collected and verified data pertaining to** **Shifting Request: (Following key points were taken care of while verifying the data)** - 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. **Processing of closure request (Following key points were taken care of while verifying the data)** - 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. **Supplementary (Additional) services requests** - 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. **Live calling was done in 10% of such cases to check the time taken to attend all such requests**

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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. **Live calling: -** - 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 **Live calling : -** - 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] X 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	The total time for which the network is down for a particular service provider resulting in a community isolation **Computational Methodology: Accumulated downtime = Summation of Significant Downtime*** *** 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**
Benchmark	< 24 hrs
Audit Procedure	**IMRB** auditors collected and verified data pertaining to: • 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	The ratio of calls established to total calls is known CSSR.
	Call Established means the following events have happened in call setup:-
	    ↳ call attempt is made
	    ↳ the TCH is allocated
	    ↳ the call is routed to the outward path of the concerned MSC
	Computational Methodology: Calls Established / Total Call Attempts * 100

Benchmark	> 95%

Audit Procedure	**IMRB** auditors collected and verified data pertaining to
	    ↳ 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	Service Access delay is a summation of following parts in the call flow:
	    ↳ Time to connect calls
	    ↳ Time to confirm instruction to connect
	    ↳ Time to release calls
	    ↳ Time to alert mobile set
	
	Computational Methodology:
	Time to connect calls = Time between "Origination" and "Service Connect" message from BTS to Mobile
	Time to confirm instruction to connect* = Time between "Origination" and "Base Station Acknowledgment"
	Note: Time measured here is a sub-part of first measurement
	Time to release call = Time between "Release on Reverse Link" and "Release on Forward Link"
	Time to alert a mobile = This is measured as a mean of two measurements (i+ii/2):
	    ● 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	**IMRB Auditors collected and verified records pertaining to**:
	  ↳ 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.

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4. Network Congestion Parameters	

Computational Methodology as per QoS definition	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:
	    ↳ SDCCH Level: Stand-alone dedicated control channel
	    ↳ TCH Level: Traffic Channel
	    ↳ POI Level: Point of Interconnect
	
	Computational Methodology:
	    ↳ **SDCCH / TCH Congestion% = [(A1 x C1) + (A2 x C2) +…….+ (An x Cn)] / (A1 + A2 +…+ An)**
	        ● 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 x C1) + (A2 x C2) +…….+ (An x Cn)] / (A1 + A2 +…+ An)**
	        ● 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	**SDCCH Congestion: < 1%** **TCH Congestion: < 2%** **POI Congestion: < 0.5%**

Audit Procedure	**IMRB Auditors collected and verified records pertaining to**:
	    ↳ 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	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
	    ↳ **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
	
	Computational Methodology:
	    Total Calls Dropped / Total Calls Established x 100

Benchmark	**< 3%**

Audit Procedure	**IMRB Auditors collected and verified records pertaining to**:
	    ↳ 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	Definition: ↳ 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 % **Computational Methodology:** ↳ **% Connections with good voice quality =** (No. of voice samples with good voice quality / Total number of samples) x 100
Benchmark	**> 95%**
Audit Procedure	**IMRB Auditors collected and verified records pertaining to**: 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. Procedures that were to be followed by operator for obtaining relevant details for computing this parameter were audited ↳ 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 ↳ *Measurements using Engineering handsets were not acceptable* ↳ All the operators were not maintaining this data at the switch level

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7. Service Coverage	

Computational Methodology as per QoS definition	Definition:
	  ↳ The level of signal available in a particular part of a city is known as signal strength.
	Computational Methodology:
	  ↳ Service Coverage for route type x = [(N1 x CSS1) + (N2 x CSS2) + …..+ (Nn x CSSn)] / (N1 + N2 +………..+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	**Indoor >= -75 dBm** **In-vehicle >= -85 dBm** **Outdoor – in city >= -95 dBm**

Audit Procedure	**IMRB Auditors collected and verified call centre records pertaining to**:
	  ↳ 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:-
	      ↳ 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: –
	         ↳ 3 Outdoor (Periphery of the city, Congested Area, Across the City), and
	         ↳ 2 Indoor (Office Complex and Shopping Complex)
	  ↳ *Measurements using Engineering handsets were not acceptable*

8. Response time to customer (Electronically and Voice to Voice)	
Computational Methodology	**To connect to IVR:** The time taken to connect a person (as soon as he presses call) to the IVR of the service provider **To connect to operator:** The time taken to connect a person (as soon as he presses 9) to the customer care executive **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%
	  ↳ within 40 seconds = 95%
	(ii) %age of calls answered by operator (voice to voice):
	  ↳ within 60 seconds = 80%
	  ↳ within 90 seconds = 95%

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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. **Live calling: -** - 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.

9.1 Billing complaints per 100 bills issued	
Computational Methodology as per QoS definition	Billing complaints includes any of the following complaints related to billing from the point of view of customer: • 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.) **Billing complaints per 100 bills issued =** Total billing complaints** received during the relevant quarter / Total bills generated* during the relevant quarter * *All types of bills generated for customers i.e. printed bills, online bills and any other forms of bills generated are to be included* ** *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.*
Benchmark	< 0.1% billing complaints per 100 bills
Audit Procedure	**IMRB** auditors collected and verified data pertaining to - Number of bills generated - Number of billing complaints received - %age complaints per 100 bills

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9.2 Resolution of billing complaints	
Computational Methodology as per QoS definition	**%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 *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.* *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.*
Benchmark	100% cases to be resolved within 4 weeks
Audit Procedure	**IMRB Auditors collected and verified data pertaining to** - Total number of billing complaints/bills disputed - Number of complaints resolved in 4 weeks **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 than100

9.3 Period of refunds / payments due to customers	
Computational Methodology as per QoS definition	**Period of all refunds = Maximum value of 'Time taken to refund'** where:-Time taken to refund = Date of refund – date of lodging complaint
Benchmark	100% cases in less than 4 weeks
Audit Procedure	**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:-** • **Dates of lodging of all billing complaints resolved in favour of customer and resulting in requirement of a refund by the operator** • **Dates of refund pertaining to all billing complaints received during the relevant quarter** **Also random live checks of all subscribers entitled for refund were conducted**

9.3 For Broadband services

1. Service provisioning/Activation time	
Computational Methodology as per QoS definition	Service provisioning time refers to the time taken from the date of receipt of an application to the date when the service is activated **Percentage connections provided within X working days** = No of connections provided within X working days/ Total number of connections registered during the period * 100 **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. 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.
Benchmark	100 % cases in =<15 working days.
Audit Procedure	**IMRB** auditors collected and verified data pertaining to -Number of applications received at the service provider's level -Number of connections provided within 15 days -Number of connections provided after 15 days **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

2. Fault repair/Restoration time	
Computational Methodology as per QoS definition	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 **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 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 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
Benchmark	By next working day: > 90% and within 3 working days: 99%
Audit Procedure	**IMRB** auditors collected and verified data pertaining to -Number of applications received at the service provider's level -Number of connections provided within 15 days -Number of connections provided after 15 days **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

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3. Billing complaints per 100 bills issued	
Computational Methodology as per QoS definition	Billing complaints includes any of the following complaints related to billing from the point of view of customer: • 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.) **Billing complaints per 100 bills issued =** Total billing complaints** received during the relevant quarter / Total bills generated* during the relevant quarter * *All types of bills generated for customers i.e. printed bills, online bills and any other forms of bills generated are to be included* ** *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.*
Benchmark	< 2% billing complaints per 100 bills
Audit Procedure	**IMRB** auditors collected and verified data pertaining to - 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	**%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 *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.* *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.*
Benchmark	100% cases to be resolved within 4 weeks
Audit Procedure	**IMRB Auditors collected and verified data pertaining to** - Total number of billing complaints/bills disputed - Number of complaints resolved in 4 weeks **Live calling : -** **-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 than100

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 time taken for operator to respond* >= n sec / Total number of calls where an attempt to route to the operator was made) x 100 Time taken for operator to respond = 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** **(I)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)

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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	**Live calling : -** -Details of live customers were obtained from the service providers -Overall **50 number** of live calls at 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	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 Service availability/Uptime = (**Total operational hours – Total Downtime hrs)*100 / Total operational hours** 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 Planned outages for routine maintenance of the system are excluded from the calculation of service availability/uptime
Benchmark	- 90% for quarter ending June 2007 - 98% with effect from quarter ending September 2007 and onwards
Audit Procedure	**IMRB Auditors collected and verified call centre records pertaining to** -Total operational hrs -Total downtime hrs 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

Packet loss	
Computational Methodology as per QoS definition	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 The packet loss is measured by computing the percent packet loss of **1000 pings of 64 byte packet each**. 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 Minimum sample reference points for each service area shall be three in number or multiple reference points if required **Hence Packet loss is computed by the formula - (Total number of ping packets lost during the period/Total number of ping packets transmitted)* 100**
Benchmark	<1 %
Audit Procedure	**IMRB Auditors collected and verified call centre records pertaining to** - 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	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) 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 Minimum sample reference points for each service area shall be three in number or multiple reference points if required **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**
Benchmark	< 120 msec from user reference point at POP/ISP Node to International Gateway < 350 msec from User reference point at ISP Gateway Node to International nearest NAP port (Terrestrial) < 800 msec from User reference point at ISP Gateway Node to International nearest Nap port (Sattelite)
Audit Procedure	**IMRB Auditors collected and verified call centre records pertaining to** - 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

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