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

Final Report: October - 2008

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

By: **eTechnology Group@IMRB**

A specialist unit of IMRB International

IMRB international

Preface

TRAI, the regulatory watch dog for the Quality of Service for the telecom services – Basic (Wireline), Cellular Mobile (Wireless) and Broadband has commissioned this study with the objective of measuring Quality of Services under the parameters as per the published notifications. The study, from the execution perspective, has been divided into two modules – Survey module and Audit module.

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

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

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

The Survey and Audit modules for various circles within the Zones, due the sheer scale of data collection, have been distributed across various quarterly periods. IMRB International Auditors carried out Audits across Delhi, Chennai and Kolkata circles in the period of January – May 2008. **This report details the performance of various service providers in Delhi circle against Quality of Services benchmarks for various parameters laid down by TRAI in respective regulations for Basic (Wireline), Cellular (Mobile) and Broadband services**

Table of contents

IMRB
international

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 has 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 Delhi circle that was covered in the Quarter 1 (Jan – March 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 February 2008 – May 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 Delhi circle for Basic (Wireline), Cellular Mobile services, and Broadband services

IMRB international

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 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 if 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 collection 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 the city 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)

IMRB
international

3.0 Sampling methodology

3.1 Sampling for Basic (Wireline) services

- For MTNL the sample of exchanges was selected was spread across 10% of SDCA's in the entire service. Overall 12 exchanges were audited for MTNL in Delhi circle

- For rest of the service providers (TATA, Reliance and Bharti Airtel) 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 Delhi circle

- Bharti Airtel Ltd. - 17
- Idea - 3
- Tata teleservices ltd - 1
- Reliance communications - 9
- MTNL GSM - 3
- MTNL CDMA - 3
- Vodafone Essar Ltd. - 8

3.3 Sampling for Broadband service providers

- Audits for various Broadband service providers were conducted at the service provider's central node in the Delhi circle. 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 MTNL, Audit was conducted at the central node in Delhi 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

- Following Broadband service providers were Audited in Delhi circle: - Bharti Airtel Ltd., Hathaway, Sify, Reliance, MTNL and VSNL (TATA communications Ltd.)

IMRB
international

4 Audit methodology

4.1 Basic (Wireline) Services

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

Sl. No.	Parameters	One month data collection	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 July to September 2007 was carried out for all the network and non network related parameters.

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

4.2 Cellular Mobile Services

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

S.no	Parameter	AS REPORTED IN PMR	AS FOUND IN ACTUAL RECORDS AFTER VERIFICATION	AS FOUND IN DATA COLLECTION 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		

4.3 Broadband Services

In a nutshell, the audit methodology was as follows:

	Parameters	Verification of PMR	Three day live measurement	Data Collection 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}

IMRB
international

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. This was especially observed for network related parameters for Broadband services where 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 MTNL, where required data was not available with the exchanges and hence data could not be collected for the same.

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.

IMRB
international

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 February 2008 to May 2008 in Delhi circle. The executive summary encapsulates the key findings of the Audit by providing: -

- A *"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 collection – Basic (Wireline) Services

S.no	Parameters	B'mark	Bharti	MTNL	RCOM	TATA teleservices*
1	**Provision of telephone after registration of demand**					
1.1	Connections completed within 7 days	100%	100%	96%	17%	35%
2	**Fault incidence/clearance statistics**					
3	Fault incidences	<3	10.1	7.9	<3	15
3.1	Faults repaired within 24 hours	>90%	95%	80%	88%	90%
3.2	Faults repaired within three working days	100%	95%	96%	100%	90%
4	**Mean time to Repair (MTTR)**	<8 hours	9.9	6.5	5.53	7.6
5	**Call Completion Rate (CCR)**	>55%	60%	99%	DNA	100%
6	**Metering and billing credibility**					
6.1	Billing complaints per 100 bills issued	<0.1%	0.01%	0.09%	0.05%	0.00%
6.2	%age of billing complaints resolved within 4 weeks	100%	100%	84%	100%	NA
7	**Customer care/helpline promptness**					
7.1	Shift requests attended					
	Shift requests attended within 3 days	95%	96%	87%	NA	82%
7.2	Closure request attended					
	Closure within 24 hours	95%	100%	86%	95%	79%
7.3	Supplementary (additional) service requests attended					
	Additional facility provided within 24 hours	95%	100%	97%	100%	99%
8	**Response time to customer for assistance**					
8.1	% age call answered through IVR in 20 seconds	80%	Not recorded by the operator	Details not available at the exchanges	100%	100%
	% age call answered through IVR in 40 seconds	100%			100%	100%
8.2	% age calls answered by operator in 60 seconds	80%	95%		95%	90%
	% age calls answered by operator in 90 seconds	95%	97%		98%	94%
9	**Time taken for refund of deposits after closure**					
7.1	%age cases where refund received within 60 days	100%	100%	97%	NA	NA

{*Note: For MTNL data pertains to the sample 5% of exchanges audited during the period of February to May 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

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

The Basic (Wireline) services audit for Delhi circle broadly indicates that almost all the service providers are not meeting some of the benchmarks, as mandated by TRAI (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 carried out for Call Completion Rate (CCR) all the service providers who are reporting the parameter to TRAI were found to be meeting the Benchmark.

Also results of verification of the records for the period of July to September show that there was slight variation in the figures reported in the PMR and those found in actual records for MTNL. The reason can largely be attributed to the fact that MTNL has a decentralized system for Book keeping, and results pertain only to sample 5% of exchanges spread over 10% of Short Distance Charging Area (SDCA's) in Delhi circle. For all the other service providers there was no or very little deviation observed from data reported in the PMR.

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

Provision of telephone after registration of demand

- RCOM and TATA have performed low on the parameter with 17% and 35% of total connection provided within 7 days. However, during verification of records it was observed that both of them are including technically non feasible cases while calculating the score.
- Bharti and MTNL cores on the same for the month of audit were observed to be 100% and 96% respectively.
- Bharti emerged out the frontrunner for live calling scores with 95% of its subscribers called claiming that connection was provided in 7 days followed by TATA and MTNL at 94% and 87% respectively.

Fault incidence / clearance statistics

- Bharti, MTNL and TATA teleservices fall short of TRAI specified benchmark for fault incidences.
- Also, for Mean Time to Repair (MTTR) Bharti does not meet the benchmark. MTNL meets the benchmark cumulatively for all the sample exchanges covered but some of the exchanges were not complying with the benchmark when taken at an individual level.
- As per the 1-month audit data findings, Bharti was the only operator which was found to be meeting the benchmark for 'Faults repaired within 24 hours'.
- For one month results MTNL, Reliance and TATA teleservices have reported 80%, 88% and 90% of total faults repaired within 24 hrs.
- The live calling scores were observed to be lowest for Reliance with only 30% of 30 subscribers called claiming that fault was repaired within 24 hours. As mentioned earlier the same can be attributed to some extent to the low sample sizes. Highest score on the same was observed for Bharti at 70%
- For fault repair within 3 working days only Reliance is able to meet the TRAI specified benchmark for the month of Audit. For live calling scores Bharti emerges to be the leader at 90% whereas Reliance again scores lowest with only 57% of its subscribers claiming that fault reported by them was repaired in stipulated period of time.

Traffic statistics (CCR)

- All the service providers were found to be meeting TRAI benchmark for Call Completion Rate during the three days live measurement and for one month in which data was obtained.
- During Audit process at Reliance, 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 networks as compared to MTNL. The service 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 were found to be meeting the benchmark of less than 0.1% for percentage bills disputed.
- However during verification of records of various service providers it was found that definition of billing complaints remains to be lenient as only those cases where an internal ticket is opened by the operator i.e. those cases where refund is provided to the operator are being taken into consideration. Hence there is a need felt to have more clarity on the definition of billing complaints.
- As per audit data findings for one month MTNL was found to be not complying the sub-parameter '%age of billing complaints resolved within 4 weeks'.

Customer care/helpline promptness

- For "shift requests attended within 3 days" audit data, MTNL and TATA teleservices do not meet the benchmark. For Reliance there were no requests for shifts by the customers for the month in which audit was carried out.
- MTNL and TATA teleservices with scores of 86% and 79% fall short of the Benchmark for "closure requests attended within 24 hours" in the month in which audit was carried out. It should be noted that such requests for TATA teleservices were relatively less than other operators.
- For supplementary service requests, all the service providers were found to be meeting the benchmark for the month in which audit was carried out.

Response time to customer for assistance

- For MTNL, response time data was not available for most of the exchanges as service provider claimed that data is managed centrally at service providers head quarter at Kidwai Bhawan, New Delhi.
- During verification of records for Airtel, 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 electronic IVR menu all the service providers meet the TRAI specified benchmark for live calling results
- As per results of one month audit TATA (94%) marginally falls short of the benchmark for calls answered by the operator in 90 seconds
- As per live calling results, MTNL scored the lowest with 58% calls answered by the operator in 60 seconds. However all the 100 calls made for MTNL were answered by the operator in 90 seconds.

IMRB
international

Time taken for refund of deposits after closure

- MTNL was found to be falling short of the benchmark marginally (by 3%) for sample exchanged audited.

Level 1 services

To test the efficiency of level 1 services (Trunk booking, Child helpline, Women helpline, Airline booking) offered by various service providers, 300 calls were made to different numbers provided by service providers and time taken to answer the call was noticed. TATA emerged out to be the most efficient with 100% of the total calls that were made being answered in 60 seconds followed by Reliance with 98.67% calls answered in 60 seconds. Bharti and MTNL's score on the same was observed to be 86.67% and 88% respectively.

Summary of Live Measurement Results – Basic Wireline Services

Live measurement results for CCR

Traffic statistics - Call Completion Rate	Benchmark	Bharti	MTNL	RCOM	Tata
Call Completion Rate (CCR) in the local network	>55%	100%	96%	DNA	100%

- For basic wireline services there was only one parameter (Call Completion Rate – Benchmark > 55%) for which live measurement was applicable.
- Bharti, TATA and MTNL meet the TRAI benchmark (>55%) for live measurement on CCR with a score of 100%, 100% and 96% respectively.

IMRB international

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

Parameters	Benchmark	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Accumulated downtime for community isolation	< 24 hrs.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Call Set Up Success Rate (CSSR)	> 95%	98.92%	92.76%	98.96%	98.31%	99.86%	97.38%	98.35%
Service Access Delay*	9 to 20 seconds (< = 15 seconds for 100 calls)	8.60	4.05	6.97	8.30	9.00	3.98	Not Measured
Blocked Call Rate								
SDCCH /Paging Channel Congestion	<1%	0.23%	0.05%	0.33%	0.00%	0.26%	0.00%	0.00%
TCH Congestion	< 2%	0.21%	2.47%	0.86%	0.05%	1.09%	0.00%	0.34%
Call drop rate	< 3%	1.00%	1.57%	0.71%	0.69%	0.66%	0.49%	1.67%
Percentage connections with good voice quality*	> 95%	96.49%	94.49%	95.94%	95.41%	94.53%	98.57%	93.80%
Service coverage*								
In door	>-75dbm	Complied	Complied	Complied	Complied	Complied	Complied	
In vehicle	>-85dbm							
Out door - in city	>-95dbm							
POI congestion	< 0.5%	0%	0%	0%	0%	0%	0%	Not Measured
Calls answered electronically								
Percentage calls answered within 20 seconds	80%	100%	98%	DNP	100%	100%	100%	100%
Percentage calls answered within 40 seconds	95%	100%	100%	DNP	100%	100%	100%	100%
Calls Answered by the operator								
Percentage calls answered within 60 seconds	80%	95%	55%	DNP	45%	91%	93%	99%
Percentage calls answered within 90 seconds	95%	98%	65%	DNP	49%	98%	95%	100%
Billing Complaints								
Billing complaints per 100 bills issued	<0.1%	0.04%	0.07%	0.01%	0.03%	0.00%	0.07%	0.08%
Percentage billing complaints resolved within 4 weeks	100%	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%	NA	100%	100%	NA

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

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

15

Critical findings: Cellular Mobile Services

The audit for cellular mobile service providers were conducted at their respective MSCs in the Delhi circle apart from Reliance Communication whose audit was conducted at their central NOC at Mumbai. For almost all network parameters, all the service providers meet the TRAI specified benchmark. 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
Airtel	1900 – 2000	1900 – 2000
MTNL – GSM	2000 – 2100	2000 – 2100
MTNL – CDMA	1200 – 1300	1200 – 1300
RCOM	1100 – 1200	1100 – 1200
Idea	2000 – 2100	2000 – 2100
TATA	1900 – 2000	1900 – 2000
Vodafone	1900 – 2000	1900 – 2000

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

Accumulated Downtime:

In the Delhi circle, although there were outages in various BTS across all the service providers, none of them actually led to a community being isolated at a particular point in time. There were several other contiguous BTS of all service providers which maintained the service availability.

Call Set-up Success Rate (CSSR):

All the operators except MTNL – GSM (92.76%) are comfortably meeting the benchmark on this parameter. During the audits relatively higher CSSR was observed for Idea at 99.86%. RCOM relatively had the lowest CSSR among all services providers who meet the benchmark at 97.38. All the operators were found to be calculating the parameter as per the norm specified by TRAI. CCSR was established as the ratio of total number of successful call attempts (establishment) to the total number of call attempts made.

Service Access Delay:

This parameter is reported to TRAI basis the 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 Delhi 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 service access delay was observed between 3.98 seconds to 9.00 seconds for all the operators which comfortably met the TRAI benchmark of < = 15 seconds for a sample of 100 calls. However, MTNL CDMA claims that they are not measuring this parameter.

Network Congestion parameters:

SDCCH / Paging Channel Congestion, TCH and POI are part of the network congestion parameters. MTNL - GSM does not meet the TRAI specified benchmark with a Traffic Channel congestion of 2.47% which was found during the data collected for the month of audit. RCOM leads the way in network congestion parameters with almost negligible paging and 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 the 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 established for all operators. Also, all of service providers were found to be meeting the TRAI specified benchmark. However, for MTNL – GSM & CDMA (although both of them met the TRAI benchmark) the call drop rate was found to be relatively higher than the other operators. The lowest call drop rate was found to be of RCOM.

% connections with good voice quality:

All of the operators are measuring these parameters via their periodic drive tests. However, for Vodafone these parameters can be obtained at their switch also. 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 MTNL (GSM & CDMA) and Idea did not meet the TRAI benchmark. However, all the operators were able to meet the benchmark for the quarter for which the PMR verification was being conducted.

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 most of the drive test route (for which the audit was conducted). This can be due to the fact that a metro circle is one of the major areas in which a licensed service provider wants to capture the maximum share. A detailed explanation about the areas where coverage signal strength was found to be low is given in the 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. In case of calls answered by operators, all the service providers except MTNL GSM & TATA meet the benchmark for the month of audit.

IMRB
international

Billing performance

All the operators were found to be meeting the benchmark of < 0.1% complaints registered per 100 bills issued. However, all the operators except TATA, whose customers were contacted for live calling, fail to meet the TRAI benchmark of billing complaint resolution in 4 weeks. In all cases where customers were due for refund, all the service providers meet the TRAI benchmark of 100% with 4 weeks.

Inter Operator Call Assessment

Inter operator call Assessment (From / To)	Bharti	MTNL - GSM	Vodafone	TATA	RCOM	Idea	MTNL - CDMA
Bharti	NA	100%	98%	100%	100%	100%	100%
MTNL - GSM	100%	NA	100%	98%	98%	96%	NA
Vodafone	100%	100%	NA	100%	99%	100%	100%
TATA	99%	100%	97%	NA	100%	100%	100%
Idea	100%	100%	100%	98%	100%	NA	100%
RCOM	100%	97%	99%	100%	NA	98%	97%
MTNL - CDMA	100%	NA	99%	98%	100%	98%	NA

Relatively, most of operators find connecting to MTNL (both CDMA and GSM) & TATA a little difficult as compared to other operators. Airtel has maximum problems connecting to a TATA number. MTNL (GSM & CDMA) has problems connecting to RCOM, Vodafone faces difficulty in connecting to a TATA number whereas TATA faces difficulty in connecting to MTNL (both CDMA and GSM) & Idea numbers. Idea has problems in connecting to a MTNL and RCOM number whereas RCOM has problems connecting to a MTNL number.

Live Measurement Results

Parameters	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
CSSR	99.12%	95.11%	98.95%	98.58%	99.87%	97.08%	98.28%
Percentage SDCCH Congestion	0.11%	0.03%	0.18%	0.00%	0.29%	0.00%	Not Measured
Percentage TCH Congestion	0.09%	0.89%	0.88%	0.02%	0.99%	0.00%	0.02%
POI Congestion	0%	0%	0%	0%	0%	0%	Not Measured
Call Drop Rate	0.96%	1.51%	0.64%	0.63%	0.66%	0.87%	1.63%

During the three day live measurement conducted across operators during the audits, all the operators were found to be meeting the TRAI on each of the above parameters. However, MTNL CDMA operator claimed that it is not maintaining paging channel congestion and POI congestion parameters.

Results of Operator assisted Drive test

The drive test was conducted simultaneously for all the operators present in the Delhi circle. 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 Delhi were covered.

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

The drive test in the city of Delhi was conducted along the following route:

Area Type	Type of Location	Area
Outdoor	Periphery of the city	Narela, GT bye pass, Rajghat, Sarai Kale Khan
	Congested Area	Karol Bagh, Idgah, Sabzi Mandi, Azadpur
	Across the City	MRB Office, South Extension, Rajendra Place, Karol Bagh
Indoor	Office Complex	IMRB Office
	Shopping Complex	Ansal Plaza

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

Operator	Bharti		MTNL - GSM		Vodafone		TATA		Idea		RCOM		MTNL - CDMA	
Parameter	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
Voice quality	96.08%	96.65%	96.47%	93.79%	95.93%	95.94%	98.10%	94.76%	97.12%	93.74%	100.00%	98.51%	88.00%	92.80%
CSSR	100.00%	100.00%	94.44%	91.23%	100.00%	98.32%	100.00%	100.00%	100.00%	98.94%	100.00%	100.00%	100.00%	100.00%
Call drop rate	0.00%	0.00%	2.94%	2.88%	0.00%	0.85%	0.00%	0.00%	0.00%	1.08%	0.00%	0.00%	2.70%	1.70%
Hands off success rate	100.00%	100.00%	100.00%	98.57%	100.00%	98.56%	100.00%	100.00%	100.00%	100.00%	100.00%	99.92%	100.00%	100.00%

Not meeting the benchmark

IMRB
international

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

MTNL GSM – For MTNL the following are the outdoor areas which recorded either inadequate coverage or interference: Ring Road near Civil Lines, Sarai Kale Khan, Near DND Flyover, GT Highway near Alipur & Narela, Habitat Center to Sai Mandir, Shankar Road, Rajghat, Shakti Nagar, Azadpur, Talkatora, PUSA road.

Vodafone - There was interference and low signal strength recorded in the outdoor areas of Gole Market and India Gate (the operator claimed that the low signal strength was observed due to an NDMC site acquisition issue)

MTNL CDMA – There was interference and low signal strength recorded for Aircel in the outdoor areas near Alipur, Jahangirpuri, Civil Lines, CP - Outer Circle, Sabzi Mandi, Azadpur, South Extension, Kotla and Lodhi Road

IDEA - There was interference and low signal strength recorded for Reliance only in the outdoor areas near Khyber Pass Market, Police Station, CP Outer Circle, Police Station near Gole Market and Dayal Singh College

TATA - There was interference and low signal strength recorded for TATA only in the outdoor areas near Alipur, Gurdwara, Udyog-Nagar, Mori Gate, CP Outer Circle - Sadar Bazar and Lodhi Colony

Airtel & RCOM– There was none of the areas where interference and low signal strength was recorded for both Airtel & RCOM along the whole route during the drive test.

Conclusions:

1. MTNL both GSM and CDMA are found to be having high call drop rates with respect to other operators
2. MTNL (both GSM and CDMA), TATA and IDEA do not meet the voice quality benchmarks for outdoor areas whereas MTNL CDMA does not meet the TRAI benchmark even for the indoor areas
3. MTNL GSM also does not meet the TRAI benchmark of 95% on CSSR during the drive test
4. The area around Alipur was found to be a problem for quite a few of the operators. Also, most of the operators have problem in some particular areas (i.e. most of the areas are not common for multiple operators)

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

S.no	Parameters	B'mark	Bharti	MTNL	Sify	Hathaway	VSNL	RCOM
1	**Service provisioning time**							
1.1	Total connections registered/calls made		13627	5739	1880	1026	833	1204
1.2	Percentage connections provided within 15 days	100%	94%	70%	100%	100%	100%**	75%**
2	**Fault repair restoration time**							
2.1	Total number of faults		26925	34319	2571	507	11010	982
2.2	Percentage faults repaired by next working days	> 90%	97%	78%	91%	100%	78%**	94%
2.3	Percentage faults repaired within three working days	> 99%	99%	94%	100%	100%	90%**	99%
3	**Billing performance**							
3.1	Total bills generated/calls made		295720	226468	Prepaid	575	6868	4618
3.2	Billing complaints per 100 bills	<2%	0.02%	0.08%		1.39%	2.43%	0.35%
3.3	%age of billing complaints resolved within 4 weeks	100%	94%	100%		100%	100%	100%
3.4	Time taken for refund of deposits after closure	100%	99%	100%	100%	100%	100%	100%
4	**Customer care/helpline**							
4.1	Percentage calls answered within 60 seconds	> 60%	78%	98%	100%	88%	93%	94%
4.2	Percentage calls answered within 90 seconds	>80%	86%	98%	100%	100%	98%	96%
5	**Bandwidth utilization/Throughput**							
5.1	Total number of **intra network links (POP to ISP Node)**		684	7	400	61	5 (POP's in Delhi)	3 (POP's in Delhi)
5.2	Total number if intra network links crossing 90%		0	0	5	0	0	0
	Upstream Bandwidth (ISP							
5.3	Total number of upstream links		2	7	28	4	35	1 (Delhi to NIXI)
5.4	Number of links > 90%		0	0	0	0	0	0
5.5	Percentage bandwidth utilised on upstream links	<80%	75%	86%	64%	81%	74%	51%
6	**Broadband download speed**	>80%	Complied	Complied	Complied	Complied	Complied	Complied
7	**Service availability/uptime**	>98%	99.78%	99.85%	100.00%	99.65%	97.78%	98.85%
8	**Packet loss**	<1%	<1%	<1%	<1%	<1%	<1%	1%**
9	**Network Latency**							
9.1	POP/ISP Node to NIXI/ IGSP	<120msec	< 30	<120	<45	<20	<90	<30
9.2	ISP node to nearest NAP port	<350msec	< 100	<300	<300	< 100	<200	<290

`*For Sify all the connections provided to retail broadband customers are prepaid, hence the service provider claims that there are no billing related complaints

** 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. 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 key conclusions (Parameter wise) emerging out from the Audit exercise of six Broadband service providers are highlighted below

Service provisioning/Activation time

- Bharti, MTNL and Reliance were found to be not meeting the benchmark as far as the performance for one month data collection is concerned.
- However, all the service providers are falling below the benchmark for the results of Live calling process undertaken by IMRB interviewers. MTNL is the lowest scorer with only 58% of subscribers claiming that they were provided connections within 15 days. As in case of wireline some part of difference can also be attributed to low sample sizes undertaken for live calling.
- As far as the book keeping methodology is concerned it was observed that Reliance is including the cases where it is technically not feasible to provide the connections to the subscriber within 15 days while reporting to TRAI.
- Also, VSNL considers all types of connections as Broadband which includes connections subscribed with download speed of less than 256Kpbs, which is not in line with the QoS regulation for Broadband.

Fault Repair/Restoration time

- MTNL and TATA communications (VSNL) are falling below the benchmark for fault repair within next working day and fault repair within 3 working days.
- 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.
- None of the service providers were found to be meeting the benchmark for Fault repair/Restoration for Live calling results. Some part of variation can also be attributed to low sample size
- As far as book keeping methodology is concerned, TATA Communications (VSNL) was found to be considering even billing complaints as fault complaints while reporting to TRAI. This may be one of the reasons for service provider's ordinary performance for the parameter.
- All the service providers were found to be providing Rebate as per the norms stipulated by TRAI except TATA communications (VSNL), where rebate was being provided for the number of days for which the connection was inactive.

Billing performance

- For percentage bills disputed VSNL exceeds the TRAI specified Benchmark of < 2 % marginally by 0.43%
- All the service providers (except Bharti) were found to be meeting the benchmark of 4 weeks for resolution of billing complaints. Sify however claims that all its retail broadband customers are prepaid and hence there are no billing complaints
- It should also be noted that the definition of billing complaints/disputes can be considered as lenient as most of the service providers 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 the parameter.

Customer Care/Helpline Assessment

- All the service providers meet the TRAI specified benchmark for one month data collection and both for calls answered by the operator within 60 and 90 seconds.
- For live calling results MTNL and Reliance fall short of benchmark for calls answered within 60 seconds by the operator with scores of 16% and 50% respectively.
- For live calling MTNL also fall short of TRAI specified benchmark for calls answered within 90 seconds with a score of 52%

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 (VSNL, Airtel) are reporting Average bandwidth utilised during the period to TRAI instead Bandwidth utilised during Time Consistent Busy Hour (TCBH) as service providers 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, service providers claimed that there are different links and peak hour vary for all the links.
- 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.
- Delhi being a metro city, 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 Bandwidth utilisation on upstream links, most the service providers are meeting the benchmark and have excess capacities available on their upstream links. Hathaway and MTNL which had greater than 80% utilization for the month of audit are currently buying upstream bandwidth from VSNL and Reliance and claim that it can be increased whenever required.
- Service providers distributing services through cable operators (Sify and Hathaway) claim that it is not possible to measure the Bandwidth available from Cable operator to their bases stations. Hence, it is believed that last mile availability will suffer as operators have relatively less control over the operations of cable operator.
- For Reliance there is only one upstream link for domestic peering to NIXI in Delhi, the service provider has its links for international peering physically located in Chennai and Mumbai

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.
- However, no data was available for verification of records for month of Audit as well as quarter ending July to September 2007 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.
- Hence, IMRB Auditors also carried out live calling to understand the download speed available to the customer Bharti, RCOM, MTNL and VSNL (for connections upto 2 mpbs)were found to be not complying the benchmark for sample calls made.

Service Availability/Uptime:

- All the service providers are meeting the benchmark on service availability/uptime.
- 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. 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, Hathaway), 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.
- Also, it was observed that Reliance is calculating total downtime hour's basis Mean Time to Repair (MTTR) for various faults reported by customers, which is not in line with QoS methodology. Ideally, MTTR for repairing various sites or equipments which went down during the period should be considered.

Packet Loss and Network Latency

- It was observed that although most of 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.
- Also, while conducting ping tests it was observed that service providers 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.
- Due to non availability of the records of old ping tests, verification process could not conducted for the private operators. Only latency graphs (available from smoke ping tool) could be verified for some of the operators. Smoked ping tool was found to be configured for sending 5 pings of 56 bytes each every 300 seconds.

IMRB
international

- However, ping tests conducted/smoked ping results during live meaurements revealed (from three user reference points) that all the service providers are meeting the benchmark prescribed by TRAI.
- Also, it was observed that Reliance is calculating packet loss basis number of faults reported by customers which was not in line with methodology prescribed by TRAI.

Summary of Live Measurement Results – Broadband Services

Parameters	Benchmark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Service Availability Uptime	>98%	99.99%	98.73%	100.00%	99.90%	98.27%	DNA**
No of **Intra network links** found to be above 90%		0	0	0	0	0	0
Total Bandwidth utilization at all upstream links	< 80%	81%	77%	64%	85%	74%	50%
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	<120	28	< 30	<90	<30
From user reference point at ISP Gateway Node to nearest NAP Port (Terrestrial) (In msec)	<350msec	<100	<300	270	< 80	<200	< 290

** 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 are meeting the benchmark on service availability/uptime for three day live measurement. As explained earlier, it was observed that type of sites being taken into consideration for calculating network uptime varies from operator to operator. RCOM is calculating total downtime hour's basis Mean Time to Repair (MTTR) for various faults reported by customers, which is not in line with QoS methodology. Hence the service provider claims that the report for service availability is generated cumulatively on monthly basis which rendered live measurements infeasible during the visit by IMRB auditors.

The testing for Bandwidth utilisation 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 utilisation on upstream links (ISP Node to IGSP/NIXI), most the service providers (except Bharti and Hathaway) are meeting the benchmark during the three day live measurement and have excess capacities available on their upstream links.

Also, all the operators were found to be meeting the TRAI benchmark on packet loss and network latency parameters for three day live measurement for live ping tests/smoke ping results carried.

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

6.1 Graphical/Tabular representations for Basic (Wireline) services

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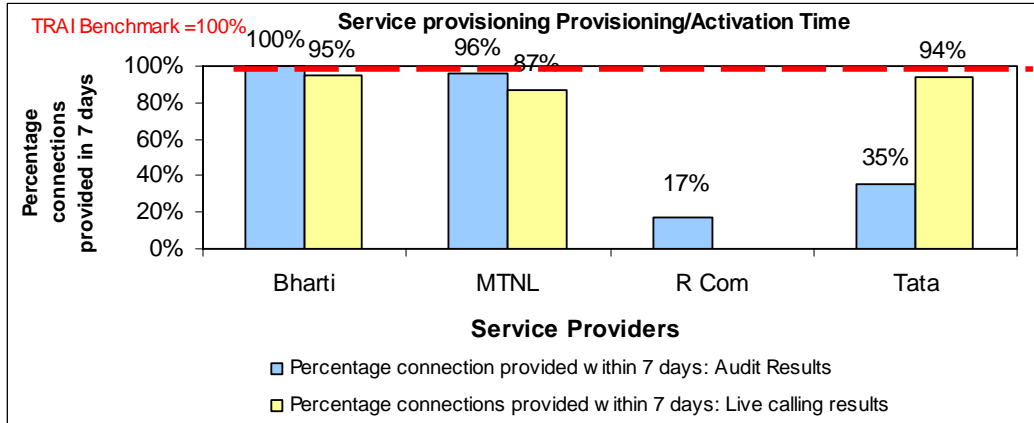

Reliance, MTNL and TATA teleservices do not meet the benchmark for service provisioning for one month data collection with scores of 17% and 35% respectively. However it should be noted that Reliance is including all those cases in service provisioning where it was technically not feasible to provide the connection. Bharti and Tata do well on live calling results with scores of greater than 90%. For Reliance live calling was not possible as service provider was unable to furnish the detail.

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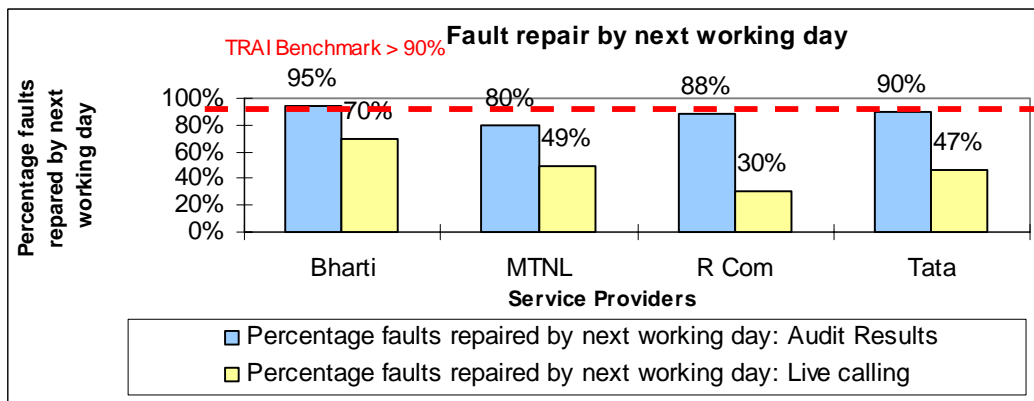

MTNL and Reliance do not meet the benchmark for fault repair by next working day with scores of 80% and 88% respectively. For live calling results score were lowest for RCOM with only 30% of total customers called claiming that fault was repaired by next working day

Fault repair within three working days

TRAI Benchmark = 100%
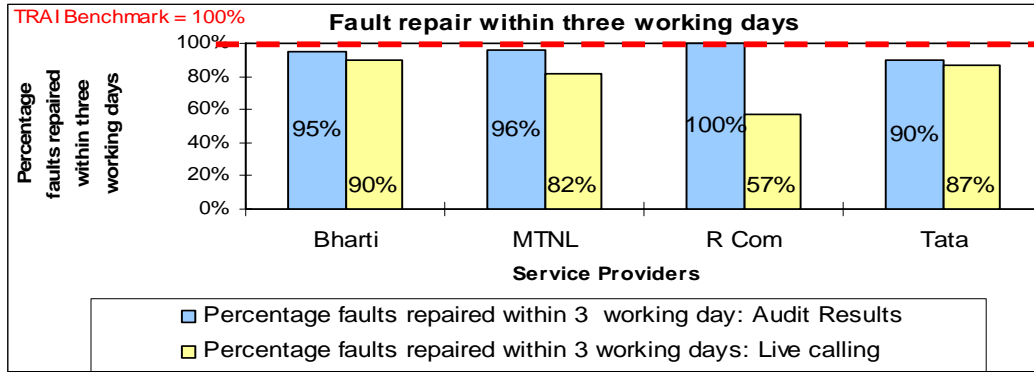
Reliance is the only operator which meets the benchmark for fault complaints within three working days. But live calling scores remain lowest for RCOM with only 57% of 30 subscribers called claiming that fault was repaired within 3 working days.

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

TRAI Benchmark > 55% **Call Completion Rate**
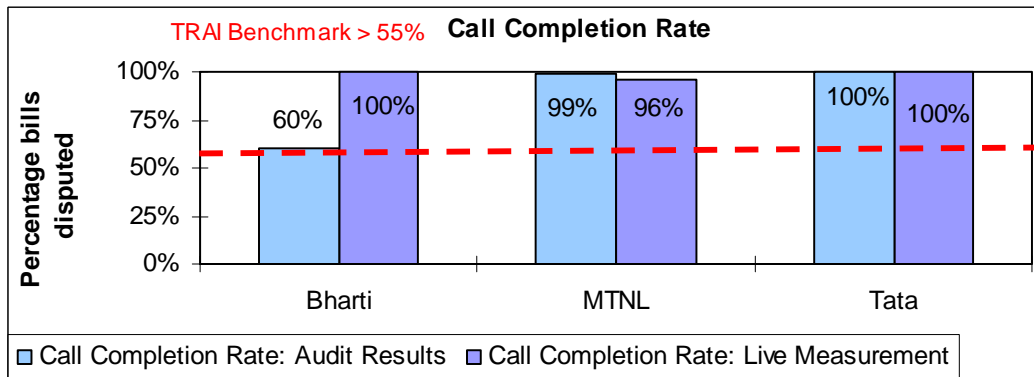
All the service providers were found to be meeting TRAI benchmark (55%) for Call Completion Rate for three day live measurement and one month data collection

Percentage bills disputed

TRAI Benchmark < 0.1% **Percentage of Billing Complaints**
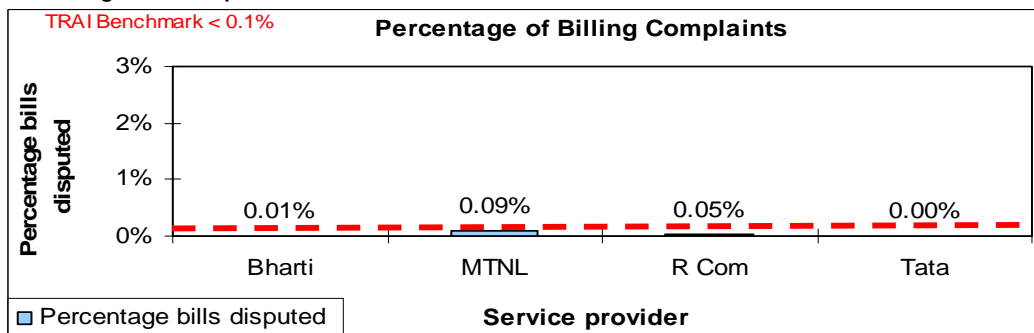
All the service providers were found to be meeting TRAI benchmark for percentage bills disputed

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

As per audit data findings for one month data MTNL is falling short of TRAI specified benchmark for Resolution of billing complaint. Also although Reliance and TATA h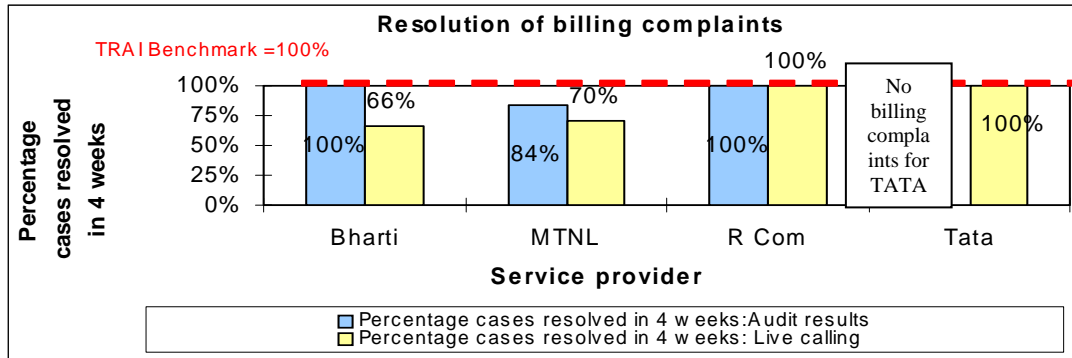ave 100% scores for live calling it should be noted that the sample sizes were really low (3 and 2 for Reliance and TATA respectively) as service providers claimed that there were very few billing complaints during the month prior to visit of Audit.

Shift requests attended (Comparison between one month audit results and live calling results)
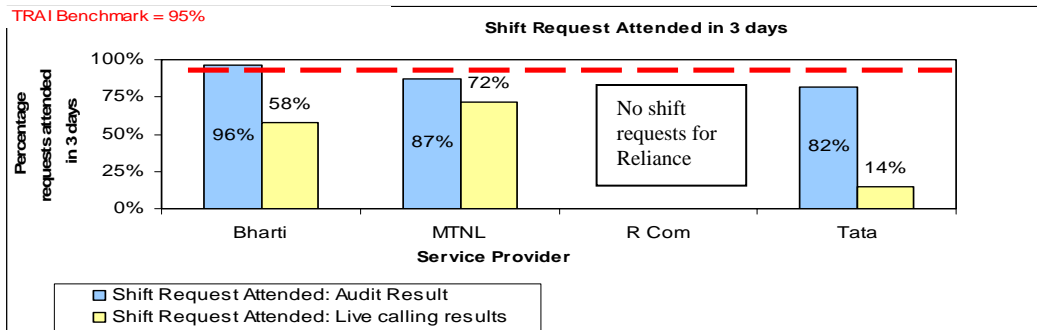
Only Bharti meets the benchmark for shift requests attended within 3 days. It should also be noted that shift requests for TATA was relatively less as compared to Bharti and MTNL. Also, service provider's score for live calling (14%) is calculated on a low base of 7 calls made.

Closure requests attended within 24 hours
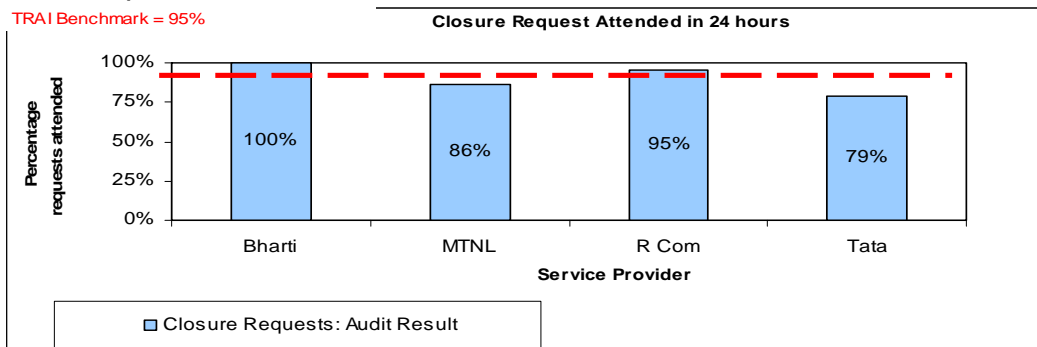
MTNL and TATA teleservices fall short of TRAI specified benchmark for closure requests attended within 24 hours

Supplementary (Additional) services requests attended within 24 hours (Comparison between one month audit results and live calling results)
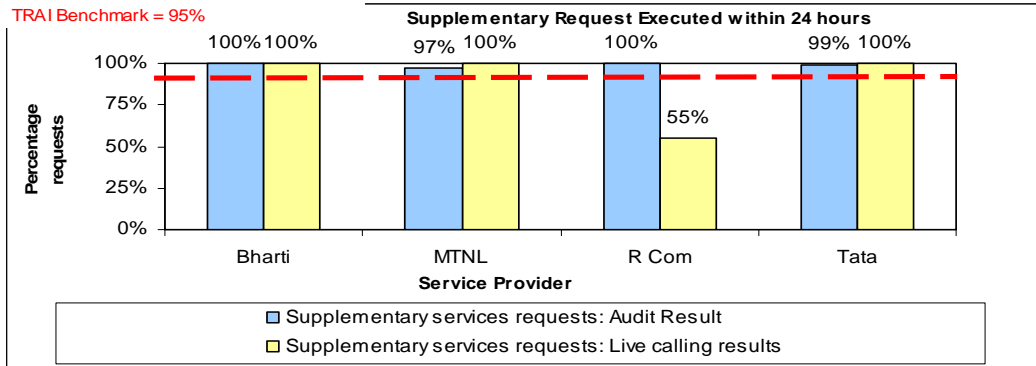
All the service providers meet the TRAI specified benchmark for Supplementary (Additional) services requests for the month in which data was collected

Response time to customer for assistance - Calls answered electronically within 20 seconds (Comparison between one month audit results and live calling results)
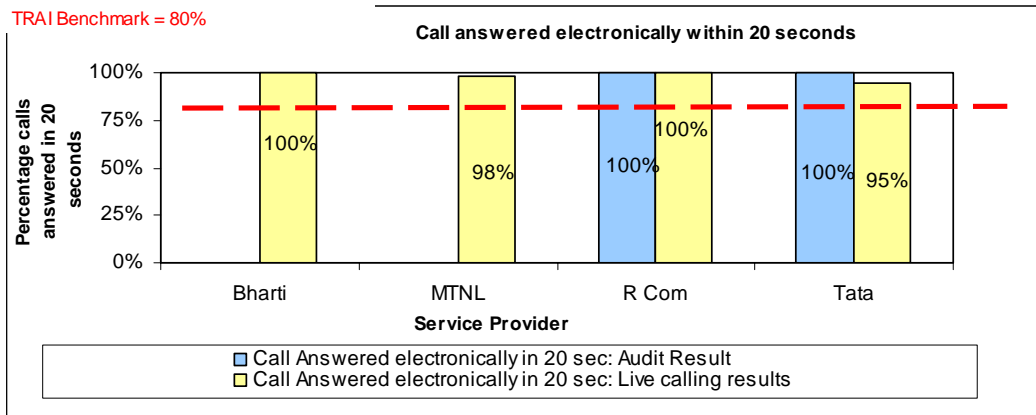
As per live calling results, all the service providers meet the TRAI specified benchmark for live calling and one month data collection for calls answered electronically in 20 seconds. Details of number of calls made to IVR were not available from **Bharti claimed that only the calls which are answered by the operator are recorded in the system.**

Response time to customer for assistance - Calls answered by the operator within 60 seconds (Comparison between one month audit results and live calling results)
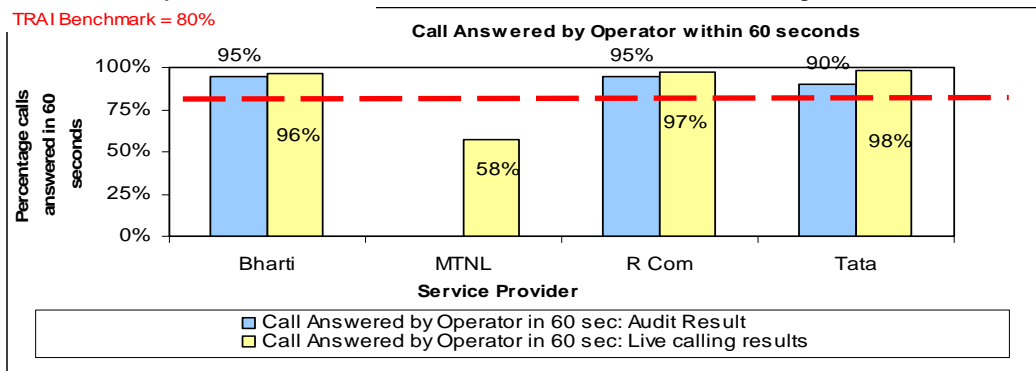
As per live calling results, the score on the parameter call answered by operator within 60 seconds only MTNL falls short of TRAI specified benchmark with only 58% of 100 calls made answered by the operator within 60 seconds. **For MTNL details of call centre were not available at the exchanges as it is maintained centrally at Headquarters in Kidwai Bhawan, New Delhi.**

Response time to customer for assistance - Calls answered by the operator within 90 seconds (Comparison between one month audit results and live calling results)
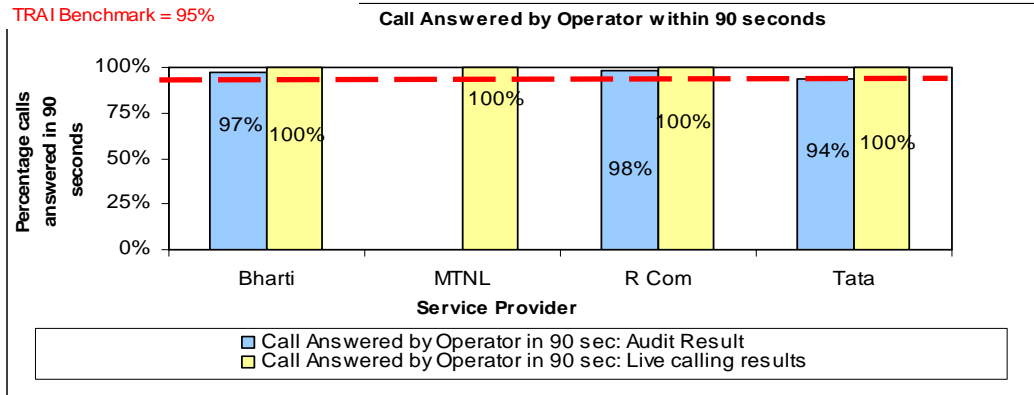
TATA (for one month) and MTNL (for live calling) fall short of TRAI specified benchmark for calls answered by the operator in 90 seconds.

Time taken to refund of deposits after closure
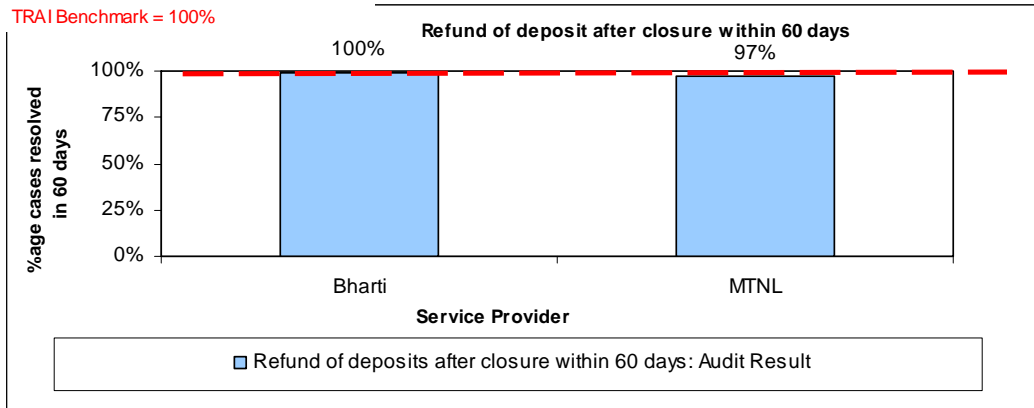
For 'Refund after closure' parameter, Bharti's scores are 100% whereas it is just 97% for MTNL. Total number of cases for refunds of deposits **were nil for both Rcom and TATA** teleservices.

6.2 Graphical Representations for Cellular Mobile Services

Accumulated Downtime

All of the operators did not experience any downtime in the network.

Call Set-up Success Rate (CSSR)
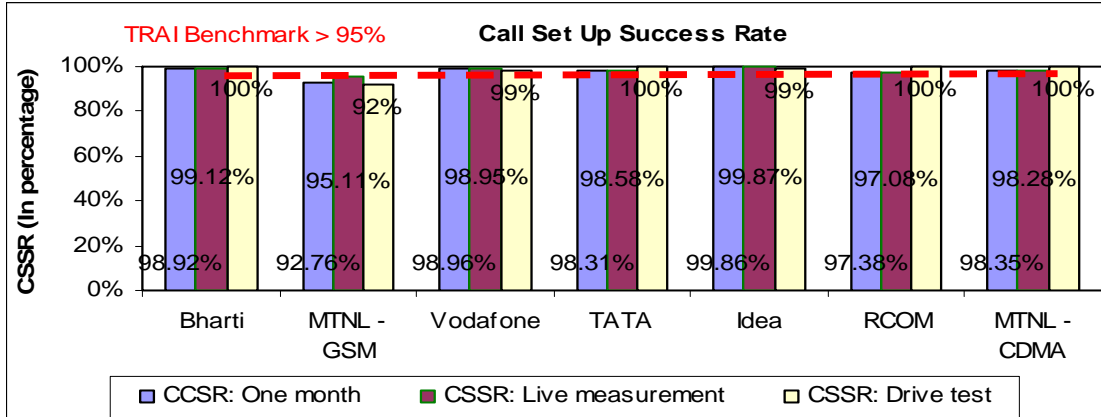
All the operators except MTNL – GSM for one month data collection and verification and the drive test are meeting the benchmark for the audit month, live measurement as well as the drive test.

Service Access Delay
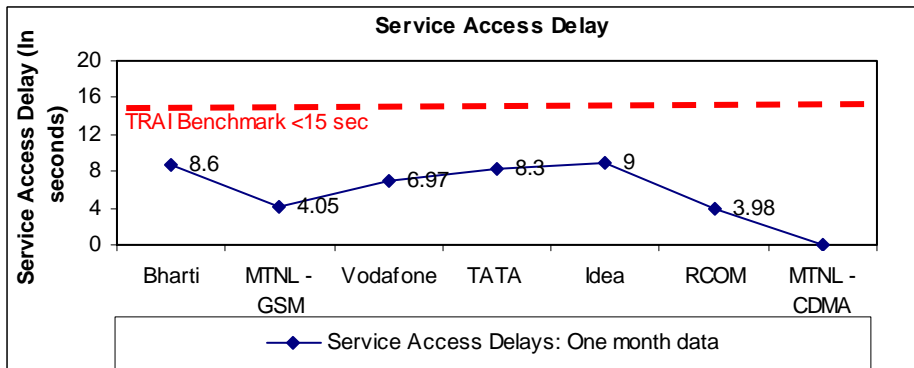
All the operators are meeting the benchmark. The auditors measured this parameter using a standard drive test tool kit. However, MTNL CDMA claimed to be neither reporting to TRAI no measuring this parameter.

SDCCH / Paging Channel Congestion
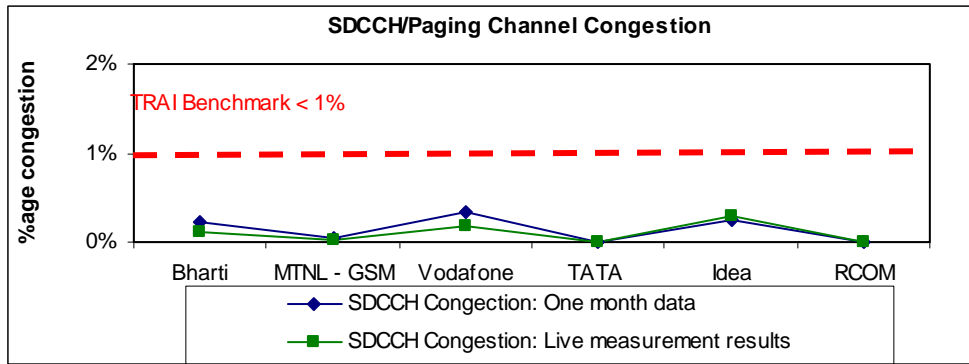
All the operators meet the TRAI benchmark for the month of audit as well as the three day live measurement. The relatively higher congestion is observed across Idea and Vodafone while the lowest congestion is observed for RCOM followed by TATA. MTNL – CDMA claims to be not measuring this parameter also.

TCH Congestion
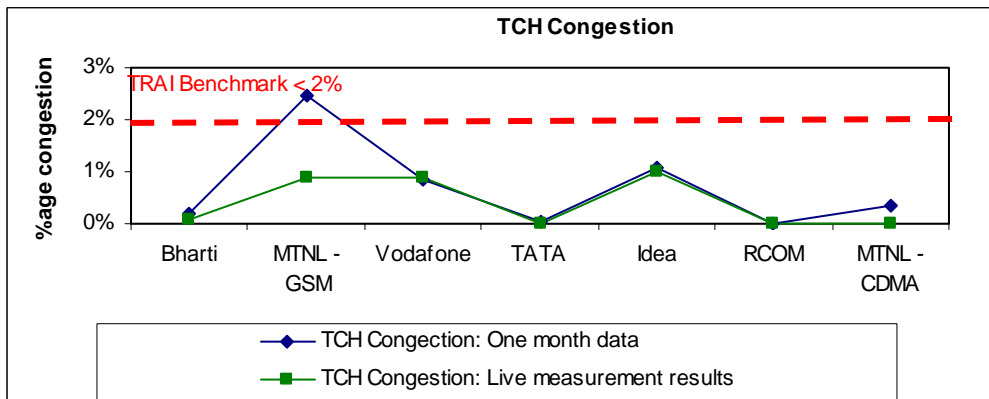
All the operators except MTNL GSM for the month of audit meet the TRAI specified benchmark both for three day live measurement as well as the month of data collection and verification. The maximum TCH congestion observed is for MTNL - GSM.

Call Drop Rate
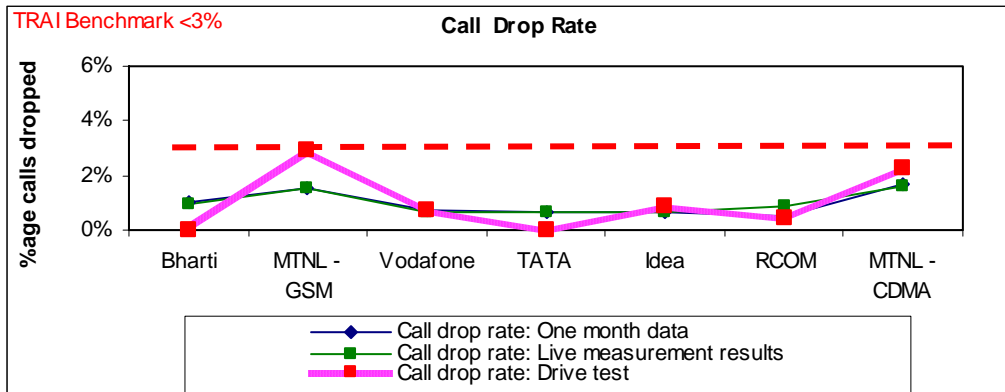
All the operators meet the TRAI benchmark. The operator with the highest call drop rate taking into consideration the figures for live measurement, drive test and the month of audit is MTNL (both CDMA and GSM). Relatively lower call drop rate is observed for TATA.

Voice quality
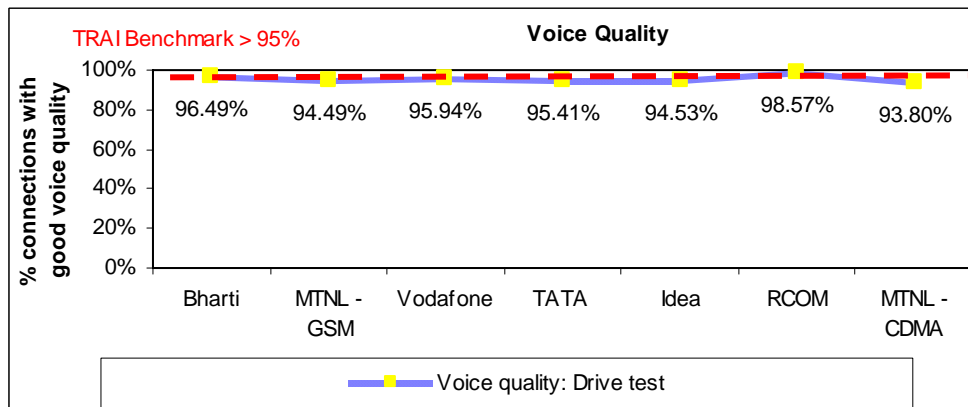
MTNL (both CDMA & GSM) along with Idea do not meet the TRAI benchmark as found out during the drive test. However, all the operators meet the benchmark over a quarterly period when the results of all the drive tests conducted during that quarter are averaged.

Billing Disputes
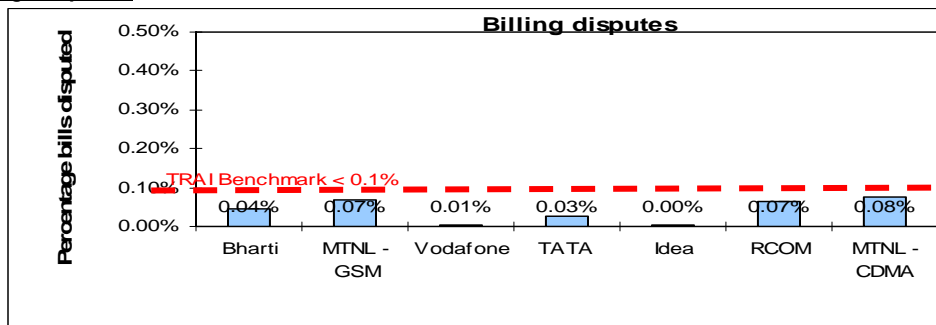
All the operators meet the TRAI benchmark for %age billing complaints

Resolution of billing complaints

TRAI Benchmark =100%

Percentage cases resolved in 4 weeks

Bharti 100%, MTNL - GSM 100%, Vodafone 100%, TATA 100%, Idea 100%, RCOM 100%, MTNL - CDMA 100%

☐ Percentage cases resolved in 4 weeks:Audit results
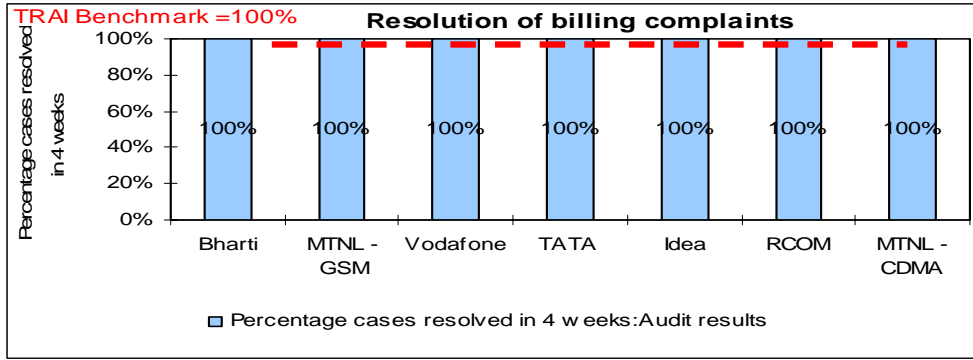
All the operators meet the TRAI benchmark of resolving 100% of the cases related to billing complaints. However, the operators consider only those as billing complaints where they have issued an internal ticket which essentially means that a refund is due to the customer.

Refund

TRAI Benchmark =100%

Percentage cases resolved in 60 days

Bharti 100%, MTNL - GSM 100%, Vodafone 100%, TATA No cases for TATA, Idea 100%, RCOM 100%, MTNL - CDMA No cases for MTNL

☐ Percentage cases resolved in 4 weeks
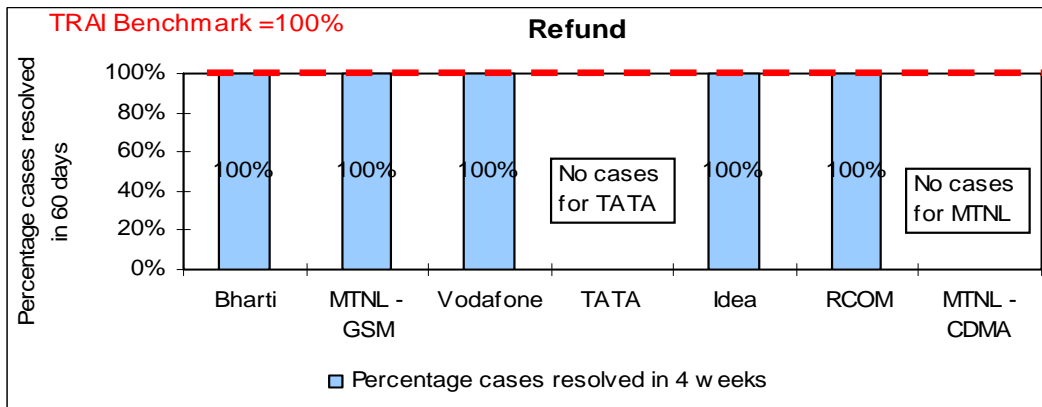
All the operators meet the TRAI benchmark of 100% on this parameter.

Customer Care / Helpline:

answered in 20 seconds (Electronically)

TRAI Benchmark >80%

%age calls answered in 20 seconds

Bharti 100.00% / 98.00%, MTNL - GSM 98.07% / 99.00%, Vodafone 98.00%, TATA 100.00% / 100.00%, Idea 100.00% / 91.00%, RCOM 100% / 100%, MTNL - CDMA 99.92% / 98%

☐ Percentage calls answered in 20 Seconds:One month data"
☐ Percentage calls answered in 20 seconds: Live calling
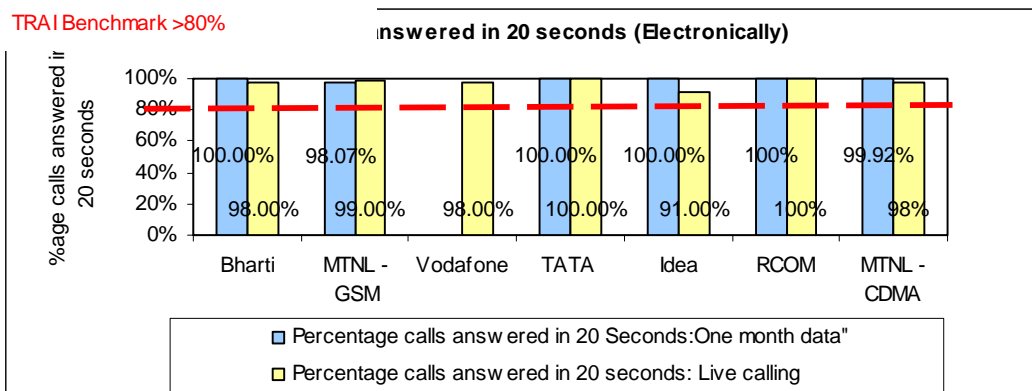
All the operators meet the TRAI benchmark for IVR (Electronic) answering of customers' calls.

Calls answered in 60 seconds (Voice to Voice)

TRAI Benchmark >80%

Legend:
- ☐ Percentage calls answered in 60 Seconds:One month data"
- ☐ Percentage calls answered in 60 seconds: Live calling
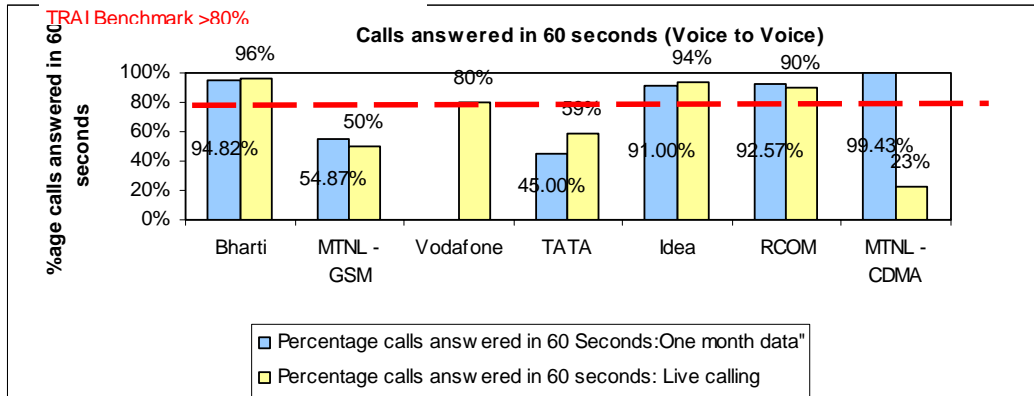
All the service providers except MTNL GSM & TATA (live calling & month of audit) and MTNL CDMA (live calling) meet the TRAI specified benchmark. However, MTNL CDMA operator claimed that there is a shift in their call center location to a place at Rohini which is causing it not to meet the benchmark for the live calling purposes

Calls answered in 90 seconds (Voice to Voice)

TRAI Benchmark >95%

Legend:
- ☐ Percentage calls answered in 90 Seconds:One month data"
- ☐ Percentage calls answered in 90 seconds: Live calling
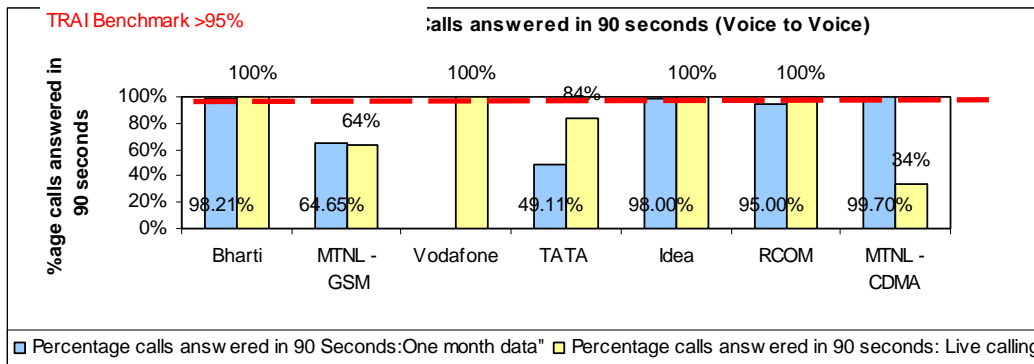
However, except for TATA & MTNL GSM (both for live calling and month of audit) and MTNL CDMA (live calling) all other operators meet the TRAI benchmark for the one month data.

Resolution of billing complaints	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Number of calls made	100	100	100	100	100	100	100
Number of cases resolved in 4 weeks	74	20	51	62	50	98	95
Percentage cases resolved in four weeks	74%	20%	51%	62%	50%	98%	95%

None of the operators are meeting the TRAI benchmark of 100% complaints being resolved within 4 weeks when live calling was done across all the operators. MTNL GSM is the worst performing operating with only 20% subscribers claiming that their billing complaint was resolved within 4 weeks.

Inter Operator Call Assessment

Inter operator call Assessment (From / To)	Bharti	MTNL - GSM	Vodafone	TATA	RCOM	Idea	MTNL - CDMA
Bharti	NA	100%	98%	100%	100%	100%	100%
MTNL - GSM	100%	NA	100%	98%	98%	96%	NA
Vodafone	100%	100%	NA	100%	99%	100%	100%
TATA	99%	100%	97%	NA	100%	100%	100%
Idea	100%	100%	100%	98%	100%	NA	100%
RCOM	100%	97%	99%	100%	NA	98%	97%
MTNL - CDMA	100%	NA	99%	98%	100%	98%	NA

Relatively, most of operators find connecting to MTNL (both CDMA and GSM) & TATA a little difficult as compared to other operators. Airtel has maximum problems connecting to a TATA number. MTNL (GSM & CDMA) has problems connecting to RCOM, Vodafone faces difficulty in connecting to a TATA number whereas TATA faces difficulty in connecting to MTNL (both CDMA and GSM) & Idea numbers. Idea has problems in connecting to a MTNL and RCOM number whereas RCOM has problems connecting to a MTNL number.

6.3 Graphical/Tabular representations for Broadband services

Service provisioning/Activation time (Comparison between one month audit results and live calling results)
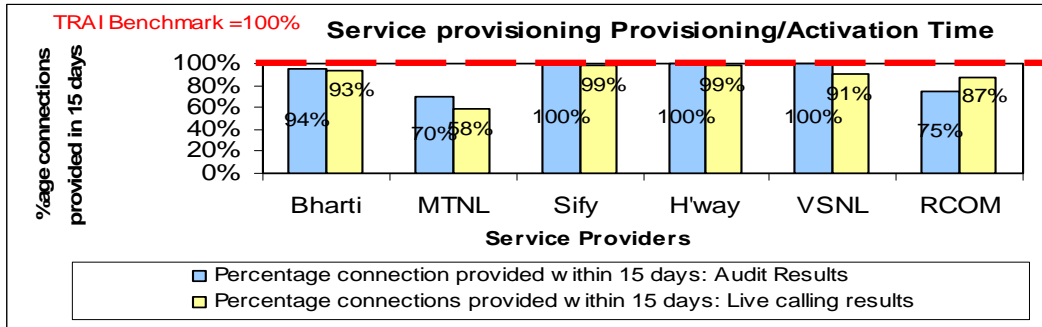
Reliance, MTNL and Bharti score below the benchmark of 100% connections to be provided within 15 days for the month of audit. But verification of records for Reliance reveals that most of the delayed connections are either for the internal customers or due to the non availability of equipment at the customers end. Also, there is slight variation observed in the results of live calling as none of the operator was observed to be meeting the benchmark.

Fault repair/Restoration time - By next working day (Comparison between one month audit results and live calling results)
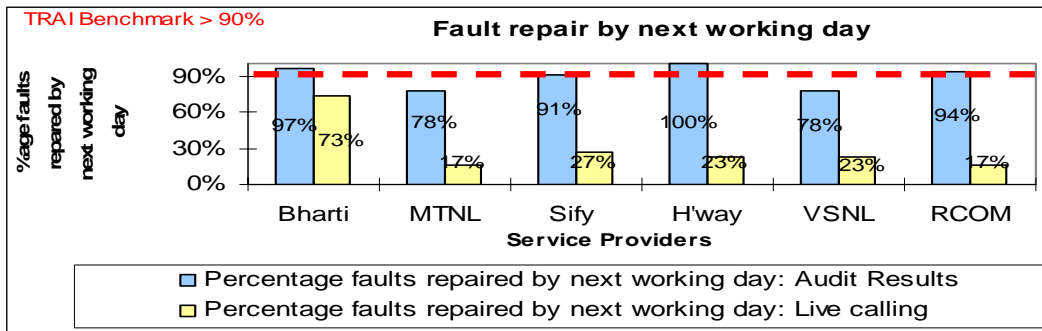
MTNL and VSNL fall below the benchmark for data collected during the month of Audit. For live calling results scores were observed to be low for all the service providers.

Fault repair/Restoration time - Within three working days (Comparison between one month audit results and live calling results)
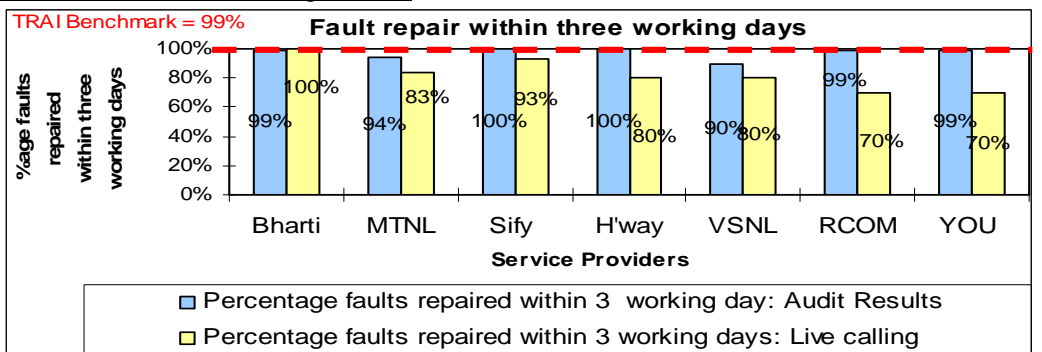
MTNL and VSNL fall significantly below the benchmark with scores of 94% and 90% on fault repair within three working days for one month data collection results.

Percentage bills disputed (One moth data collection)
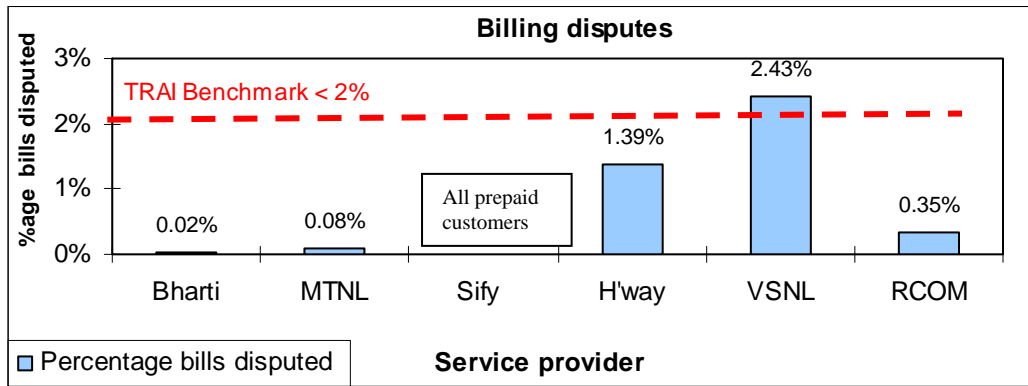
All the operators except VSNL meet the benchmark on percentage bills disputed in Delhi circle. Sify claims that all its retail customers are prepaid customers and hence there are no billing complaints

Resolution of billing complaints (Comparison between one month audit results and live calling results)
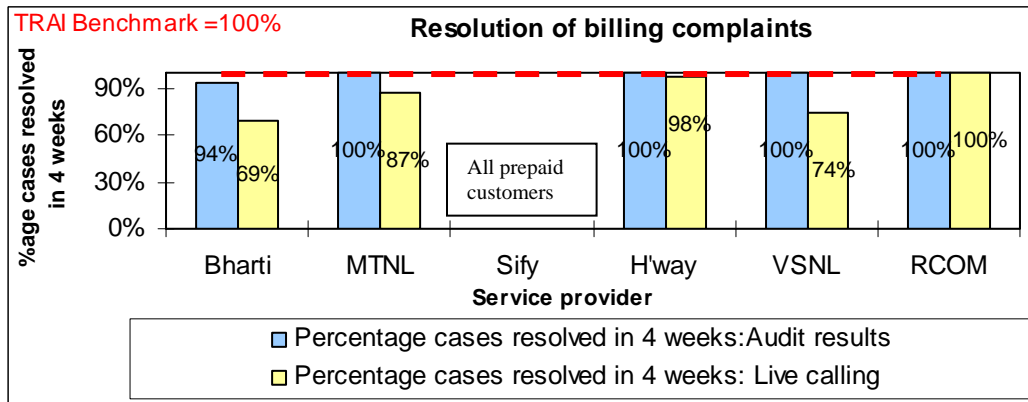
None of the operator meets the benchmark for resolution of complaints for live calling results in Delhi circle. However, it should be that sample calls made were low because of fewer complaints reported for various service providers.

Time taken to refund of deposits after closure
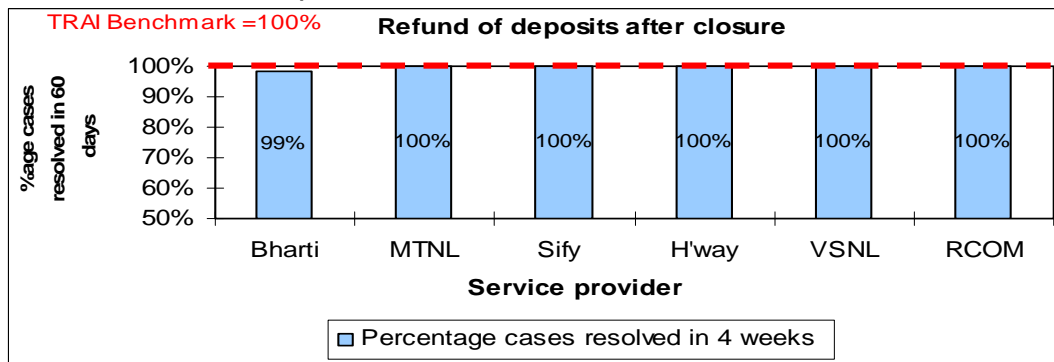
All the operators except Bharti (99%) meet the benchmark as in all the cases of closures which require refund, the same was made within 4 weeks.

Response time to customer for assistance (Calls answered by the operator within 60 seconds)
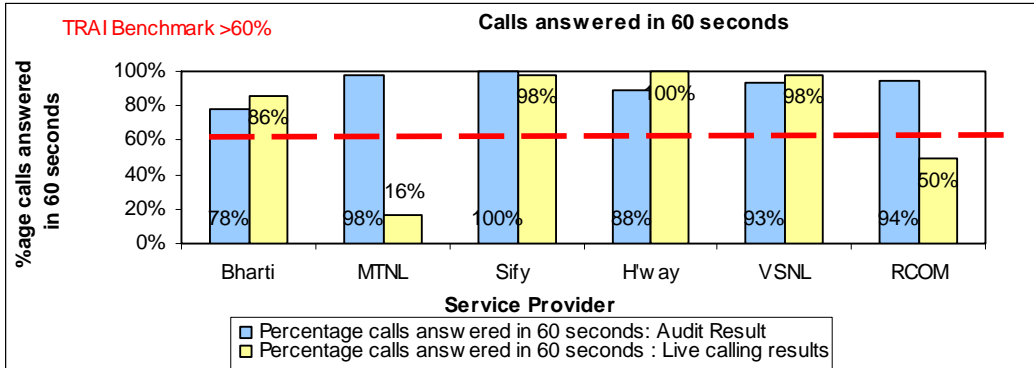
MTNL and Reliance do not meet the benchmark for live calling results with only 16% and 50% of calls were answered by the operator within 60 seconds respectively. Also, as Reliance and VSNL have a centralized call centre, the results shown are combined for all the circles in which they are operating.

Response time to customer for assistance (Calls answered by the operator within 90 seconds)
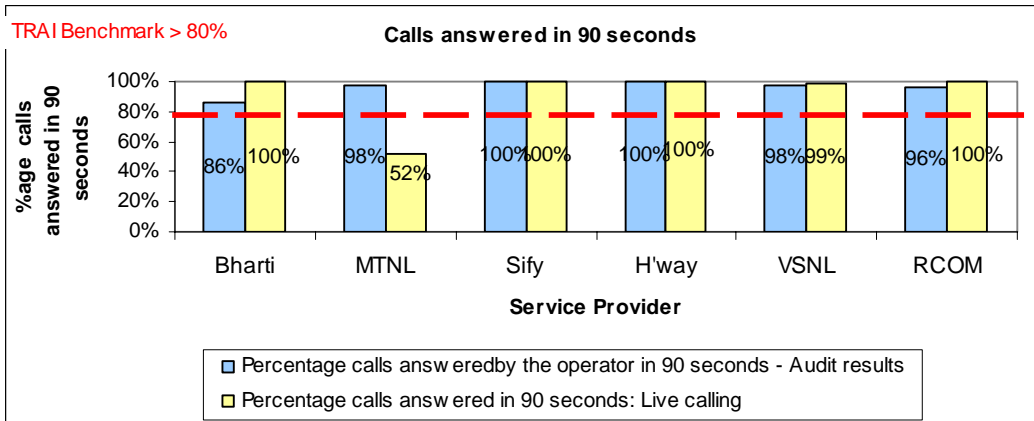
MTNL is the only operator which falls below the benchmark for live calling results with 52% score for calls answered by operator within 90 seconds

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

Bandwidth Utilisation	Benchmark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Three day live measurement							
No of Intra network Links tested		25	5	18 (PoPs in Delhi)	10	0	3 (From Core Distribution Router in Delhi to Router for NLD connectivity in Delhi)
No of Intra network found to be above 90%	<80%	0	0	0	0	0	0

Bandwidth Utilization	Benchmark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Data collected in the month of Audit							
Total number of intra network links		684	7	400	61	5	3
No of Intra network found to be above 90%	<80%	0	0	0	0	0	0

As far as bandwidth utilization on the intra network links is concerned all the operators seem to performing well as all the intra network links tested during live measurement were found to be below 90%. Delhi being metro city operators seems to be wary about the bandwidth utilization. However, the level from which the bandwidth utilization is being reported varied because of the difference in networks. 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 three day live measurement)
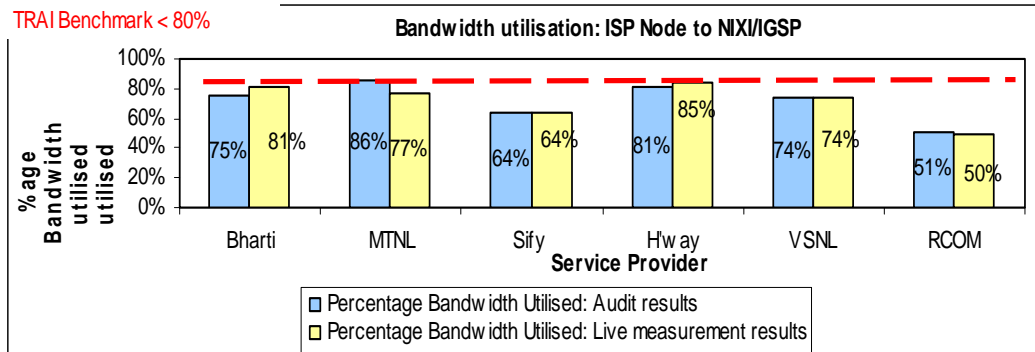
MTNL (for the month of Audit), Hathaway (live measurements and one month) and Bharti (live measurements) fall short of TRAI specified benchmark of less than 80% for Bandwidth utilization on upstream links. However all the service providers claimed that they have plans to increase the bandwidth.

Broadband connection speed available to sample subscribers (Live calling results for sample calls)

Download Speed	Benchmark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Percentage speed observed	>80%	68%	62%	81%	82%	>80% for 256 kpbs and <50% for upto 2mpbs	73%

All the service providers were observed to be meeting the benchmark for one month data collection and live measurements conducted at POPs/ISP Node. Since verification of records was not possible because of unavailability of historic data with the operators, IMRB auditors also conducted live calling to check speed available at the last mile. Live calling results reveal that only Sify and Hathaway are meeting the benchmark on download speed available to the customer. VSNL meets the benchmark but only for sample calls made for 256 kpbs connections. However, all the service providers have made available the tool for measuring download speed on their websites.

Service availability/Uptime (Comparison between one month audit results and three day live measurement)
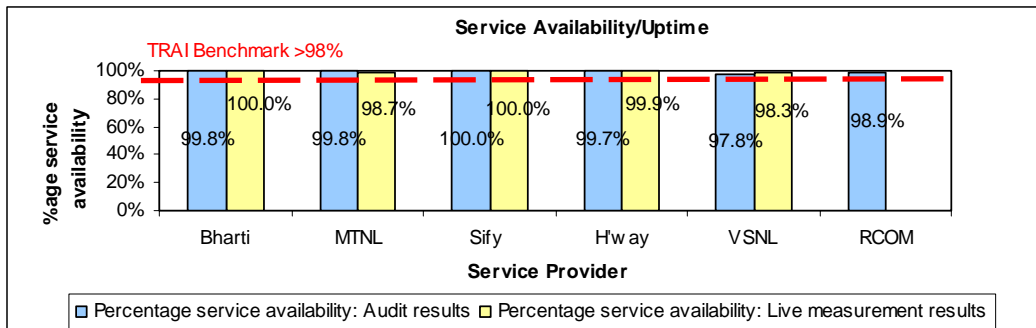
All the service providers meet the benchmark with uptime of more than 98%. Also, live measurement details could not be obtained for Rcom as service provider has different methodology (based on faults reported by the customer and not network or site downtime) for calculating the above parameter.

7.0 Compliance reports: Results of Verification of Records for July to September 2007

7.1 Basic (Wireline) services

S. N.	Parameter	B'mark	Bharti		MTNL		Rcom		TATA	
			PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB
1	Percentage connections completed within 7 days	100%	100%	100%	100%	100%	23%	23%	100%	100%
2	Fault incidence/clearance statistics									
2.1	Faults repaired within 24 hours	>90%	95%	95%	90%	87%	100%	100%	19%	54%
2.2	Mean time to repair	<8 hrs	12	12	8.01	5.7	5.5	5.5	DNA	
3	Call Completion Rate (CCR)	>55%	60%	0%	48%	97%	0%	0%	Not reported in PMR	
4	Metering and billing credibility									
4.1	Billing complaints per 100 bills issued	<0.1%	0.00%	0.01%	0.05%	0.09%	0.09%	0.09%	0.07%	0.07%
4.2	%age of billing complaints resolved within 4 weeks	100%	0%	0%	96%	96%	0%	0%	0%	0%
5	Customer care/helpline promptness									
5.1	Shift requests (Total number received)									
	Percentage shift requests attended within 3 days	95%	97%	97%	87%	83%	100%	100%	99%	99%
5.2	Closure request attended									
	Closure within 24 hours	95%	81%	81%	98%	87%	100%	100%	100%	100%
5.3	Supplementary (additional) service requests attended)									
	Additional facility provided within 24 hours	95%	92%	92%	98%	98%	98%	98%	96%	96%
6	Response time to customer for assistance									
6.1	% age call answered through IVR in 20 seconds	80%	Not reported by service provider		99%	DNA	99%	99%	100%	100%
	% age call answered through IVR in 40 seconds	100%			100%		99%	99%	100%	100%
6.2	% age calls answered by operator in 60 seconds	80%	94%	94%	91%		95%	95%	78%	78%
	% age calls answered by operator in 90 seconds	95%	99%	99%	98%		100%	100%	82%	82%
7	%age cases where refund after closure was provided within 60 days	100%	25%	25%	100%	88%	No cases for refund observed			

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

Figures do not match with those reported in PMR   Figures verified on all India   B'mark = TRAI Benchmark, DNA = Details not available

7.2 Cellular Mobile services

Parameter	Benchmark	SERVICE PROVIDER													
		Bharti		MTNL - GSM		Vodafone		TATA		Idea		Reliance		MTNL - CDMA	
		PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB
Network Performance															
Accumulated Downtime	< 24 hrs.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Call set up success rate	> 95%	98.74%	98.74%	95.45	95.45	99.12%	99.12%	97.90%	97.90%	98.98%	98.98%	99.45%	99.45%	97.63%	97.63%
Service Access delay	9 to 20 seconds (<=15 seconds for 100 calls)	8.60	8.60	14.80	14.80	7.48	7.48	10.50	10.50	9.00	9.00	3.98	3.98	Not Measured	
Blocked call rate															
SDCCH Congestion	<1%	0.22%	0.22%	0.25%	0.25%	0.01%	0.01%	0%	0%	0.08%	0.08%	0.00%	0.00%	Not Measured	
TCH Congestion	< 2%	0.16%	0.16%	1.41%	1.41%	0.02%	0.02%	0.06%	0.06%	1.12%	1.12%	0.00%	0.00%	0%	0%
Call drop rate	< 3%	1.19%	1.19%	2.37%	2.37%	0.88%	0.88%	1.52%	1.52%	0.83%	0.83%	0.51%	0.51%	1.36%	1.36%
%age connections with good voice quality	> 95%	97.58%	97.58%	95.47%	95.47%	97.70%	97.70%	95.79%	95.79%	98.17%	98.17%	98.97%	98.97%	96.89%	96.89%
Service coverage	>-75dbm >-85dbm >-95dbm	Complied		Complied		Complied		Complied		Complied		Complied		Not Measured	
POI congestion	< 0.5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Not Measured	
Customer Care															
Calls answered electronically															
Within 20 seconds	80%	99.99%	99.99%	92.67%	92.67%	NA	NA	100%	100%	100%	100%	99.50%	99.50%	99.97%	99.97%
Within 40 seconds	95%	100%	100%	95.67%	95.67%	NA	NA	100%	100%	100%	100%	99.50%	99.50%	99.99%	99.99%
Calls answered by the operator															
Within 60 seconds	80%	96.78%	96.78%	86.00%	86.00%	Details not available with the operators		76.00%	76.00%	92.00%	92.00%	79.36%	79.36%	98.76%	98.76%
Within 90 seconds	95%	98.31%	98.31%	91.40%	91.40%			81.00%	81.00%	98.00%	98.00%	84.07%	84.07%	99.18%	99.18%
Billing complaints															
Billing complaints/100 bills	<0.1%	0.068	0.068	0.010	0.010	0.008	0.008	0.046	0.046	0.005	0.005	0.080	0.077	0.09	0.09
%age complaints resolved within 4 weeks	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Period of refunds due to customers	<4 weeks	100%	100%	100%	100%	100%	100%	Not reported for the verification period		100%	100%	100%	100%	Refunds made through adjustment in bills	

Figures do not match with those reported in PMR   Figures verified on all India basis   B'mark = TRAI Benchmark, DNA = Details not available

IMRB international

7.3 Broadband services

S.No	Parameters	B'mark	Bharti		MTNL		Sify		Hathaway		VSNL		RCOM	
			PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB	PMR	IMRB
1	**Service provisioning uptime**													
1.2	Percentage connections provided within	100%	99%	99%	68%	68%	100%	100%	100%	100%	100%	100%	75%	75%
2	**Fault repair restoration time**													
2.2	Percentage faults reported by next	> 90%	93%	93%	73%	73%	87%	87%	>90%	>90%	82%	82%	95%	95%
2.3	Percentage faults reported within three	>99%	98%	98%	94%	94%	94%	94%	>99%	>99%	93%	93%	100%	100%
3	**Billing performance**													
3.1	Total bills generated													
3.2	Billing complaints per 100 bills issued	<2%	0.02%	0.02%	0.09%	0.09%	Prepaid	Prepaid	1.37%	1.37%	1.14%	1.14%	0.50%	0.50%
3.3	%age of billing complaints resolved in 4	100%	100%	100%	99.92%	99.92%			100%	100%	100.00%	100.00%	100%	100%
3.4	%age cases in which refund of deposits	100%	22.47%	22.47%	100%	100%			100%	100%	100%	100%	100%	100%
4	**Customer care/helpline assessment**													
4.1	Total calls received at the call centre													
4.2	Percentage calls answered within 60	> 60%	79%	79%	98.15%	98.15%	86%	86%	80-90%	DNA for verification	77%	77%	99%	86%
4.3	Percentage calls answered within 90 seconds	> 80%	84%	84%	98.96%	98.96%	94%	94%	NA		82%	82%	99%	94%
5	**Bandwidth utilization/Throughput**													
5.1	*Intra network links (POP to ISP Node)*													
	Total number of intra network links > 90%		9	9	0	0	34	34	Not reported		0	0	0	0
	Upstream Bandwidth(ISP Node to NIXI/NAP /IGSP)													
5.2	Percentage bandwidth utilized on upstream links upstream links during the period	< 80%	91%	91%	91%	91%	79%	79%	90%	90%	70%	70%	50%	50%
6	Data download speed		No raw data available for verification											
7	**Service availability/uptime**	> 98%	99.95%	99.95%	99.96%	99.96%	100%	100%	99.50%	99.50%	99.40%	99.40%	99%	99%
8	**Packet loss**	<2%												
9	**Network Latency**		No raw data available for verification. Only old latency graphs which showed average latency for one year were verified for Reliance											
9.1	POP/ISP Node to NIXI	<120												
9.2	ISP node to NAP port (Terresrtrial)	< 350												

Data verified on All India basis, DNA- Details Not Available for verification/Raw data not available for verification, B'mark = TRAI Benchmark

IMRB international

7.4 Compliance Report – Conclusions

7.4.1 Basic Wireline Services

1. The verification figures and the PMR figures match across all the operators except TATA for faults within 24 hours and MTNL. However, the audit of MTNL was carried out amongst its sample exchanges. This is the prime reason for the figures not matching.
2. Reliance was found to be including technically non feasible cases while calculating the performance on time taken to provide new connections. Ideally such cases should be excluded.

7.4.2 Cellular Mobile Services

1. The figures reported by all the operators were found to be true across all parameters after the verification was done by IMRB
2. MTNL GSM, TATA and RCOM do not meet the TRAI benchmark for the customer care (voice to voice)
3. MTNL CDMA was found to be not measuring four of the parameters specified by TRAI. These parameters are service access delay, paging channel congestion, POI congestion and Service coverage.

7.4.3 Broadband Service

1. Complete data for Sify and Reliance was verified on an all India level
2. As mentioned earlier, it was observed that Reliance follows a different methodology for calculating packet loss which is based on faults reported by the customers which is not in line with QoS methodology.
3. VSNL was found to be including even billing complaints while reporting fault repair which has resulted in average performance by the service provider on this parameter. Also it was observed that the service provider considers all the connections less than 256kpbs as Broadband connections which is not in line with QoS methodology.
4. All the service providers were also found to be unaware of TRAI specified guideline for carrying out ping tests of 1000 packets of 64 bytes each.
5. 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
6. 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 non existent or there was no book keeping maintained.

IMRB
international

8. Annexure - I

8.1 Parameter wise performance reports for Basic Wireline services

One month data collection results for Service provisioning

Service provisioning/Activation time	Benchmark	Bharti	MTNL	R Com	Tata
Number of connections registered during the period		28336	2871	3790	261
Total number of connections provided within 7 days		28336	2747	638	92
Percentage of connections provided within 7 days	100%	100%	96%	17%	35%
Total number of connections provided after 7 days		0	8	8	169
Percentage of connections provided after 7 days		0%	0%	0%	65%

Live calling results for Service provisioning

Service Provisioning/Activation Time	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of service registration made		100	361		77
Number of cases in which connection was provided in 7 Days		95	315		72
Percentage cases in which connection was provided in 7 days	100%	95%	87%	No data available for live calling	94%
Number of cases in which connection was provided after 7 days		5	46		4
Percentage cases in which connection was provided after 7 days		5%	13%		5%
Percentage cases in which connection was provided after 7 days		5%	13%		5%

One month data collection results for Fault repair/Restoration time

Fault Repair/Restoration time	Benchmark	Bharti	MTNL	R Com	Tata
Total number of faults registered during the period		33433	62365	1265	464
Total number of faults repaired by next working day		31646	49690	1119	419
Percentage of faults repaired by next working day	>90%	95%	80%	88%	90%
Total number of fault repaired within 3 days		31646	59776	1265	419
Percentage of fault repaired within 3 days	100%	95%	96%	100%	90%

Live calling results for Fault repair/Restoration time

Fault Repair	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of calls made		30	360	30	30
Number of cases where fauls were repaired by next working day		21	178	9	14
Percentage cases where faults were repaired by next working day	>90%	70%	49%	30%	47%
Number of cases where faults were repaired within 3 days		27	295	17	26
Percentage cases where faults were repaired within 3 days	100%	90%	82%	57%	87%

One month data collection results for CCR

Traffic statistics - Call Completion Rate	Benchmark	Bharti	MTNL	R Com	Tata
Total local call attempts		35428592	10877366	DNA	4578441
Total number of successful local calls		21406915	10765925	DNA	4578441
Call Completion Rate (CCR) in the local network	>55%	60%	99%	DNA	100%

Live measurement results for CCR

Traffic statistics - Call Completion Rate	Benchmark	Bharti	MTNL	R Com	Tata
Total local call attempts		103505	2143648	Details not available	368540
Total number of successful local calls		103505	2066661		368540
Call Completion Rate (CCR) in the local network	>55%	100%	96%		100%

One month data collection results for Billing performance

Billing Performance	Benchmark	Bharti	MTNL	R Com	Tata
Billing disputes					
Total bills generated during the period		210275	424562	30683	3055
Total number of bills disputed		11	364	14	0
Percentage bills disputed	0.10%	0.01%	0.09%	0.05%	0.00%
Resolution of billing complaints					
Total complaints resolved in 4 weeks from date of receipt		11	304	14	0
Percentage complaints resolved within 4 weeks of date of receipt	100%	100%	84%	100%	NA

Live calling results for Billing performance

Resolution of billing complaints	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of calls made		50	141	3	2
Number of cases resolved in 4 weeks		33	99	3	2
Percentage cases resolved in four weeks	100%	66%	70%	100%	100%

Audit results for Customer Care – Shifts

Customer Care - Shift Requests	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of shift requests received		3270	1045	0	33
Total number requests attended in 3 days	95%	3136	911	0	27
Total number requests attended beyond 3 days		0	110	0	0
Shifts not attended		0	0	0	0
Percentage of requests attended in 3 days		96%	87%	NA	82%
Percentage of requests attended beyond 3 days		0%	11%	NA	0%
Percentage of shifts not attended		0%	0%	NA	0%

Live calling results for Customer Care – Shifts

Customer Care - Shift Requests	Benchmark	Bharti	MTNL	R Com	Tata
Total number of call to shift requests		50	175	0	7
Total number of requests attended in 3 days	95%	29	126	0	1
Total number of requests attended beyond 3 days		21	48	0	6
Shifts not attended		0	1	0	0
Percentage of requests attended in 3 days		58%	72%	NA	14%
Percentage of requests attended beyond 3 days		42%	27%	NA	86%
Percentage of shifts not attended		0%	1%	NA	0%

Audit results for Customer Care – Closures

Customer Care - Closure Requests	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of closure requests received		6225	2547	770	29
Total closure attended within 24 hours	95%	6225	2190	735	23
Total number of requests attended beyond 24 hours		0	357	35	0
Closure requests not attended		100	0	0	0
Percentage of closure attended within 24 hours		100%	86%	95%	79%
Percentage of closure attended beyond 24 hours		0%	14%	5%	0%
Percentage of closures not attended		2%	0%	0%	0%

Audit results for Customer Care – Supplementary services

Customer Care - Supplementary Requests	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of supplementary requests received		1103	271	792	106
Total number of requests attended within 24 hours	95%	1103	264	792	105
Total number of requests attended beyond 24 hours		0	8	0	0
Supplementary requests not attended		0	0	0	0
Percentage of requests attended within 24 hours		100%	97%	100%	99%
Percentage of requests attended beyond 24 hours		0%	3%	0%	0%
Percentage of supplementary requests not attended		0%	0%	0%	0%

Live calling results for Customer Care – Supplementary requests

Customer Care - Supplementary Requests	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of supplementary requests received		41	213	40	2
Total number requests attended within 24 hours		41	213	22	2
Total number requests attended beyond 24 hours		100	100	18	0
Supplementary requests not attended		0	0	0	0
Percentage of requests attended within 24 hours	95%	100%	100%	55%	100%
Percentage of requests attended beyond 24 hours		27%	47%	45%	0%
Percentage of supplementary requests not attended		0%	0%	0%	0%

Live calling results for calls answered by IVR

Customer Care Assessment	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of calls dialed on toll free number		100	226	100	100
Calls answered within 60 seconds					
Total Number of calls answered by operator in 60 seconds	80%	100	222	97	95
Percentage calls answered in 60 seconds		100%	98%	100%	95%
Calls answered within 90 seconds					
Total Number of calls answered by operator in 90 seconds	95%	100	226	100	100
Percentage calls answered in 90 seconds		100%	100%	100%	100%

Live calling results for calls answered by the operator

Customer Care Assessment	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of calls dialed on toll free number		100	226	100	100
Calls answered within 60 seconds					
Total Number of calls answered by operator in 60 seconds	80%	96	130	97	98
Percentage calls answered in 60 seconds		96%	58%	97%	98%
Calls answered within 90 seconds					
Total Number of calls answered by operator in 90 seconds	95%	100	226	100	100
Percentage calls answered in 90 seconds		100%	100%	100%	100%

Audit results for Refund of deposits after closure

Refund of deposits after closure	Benchmark	Bharti	MTNL	R Com	Tata
Total Number of cases requiring refund		616	4870	0	0
Number of cases where refund was made in < 60 days		613	4726	0	0
Percentage cases where refund was made in < 60 days	100%	100%	97%	NA	NA

Level 1 Services	Bharti	MTNL	RCom	Tata
Total Calls Made	300	300	300	300
Calls answered within 60 seconds	260	264	296	300
Percentage calls answered within 60 seconds	86.67%	88%	98.67%	100%

8.2 Parameter wise performance reports for Cellular Mobile services

Accumulated Downtime	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Downtime (In hours)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CSSR (One month results)	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total number of call attempts	DNP	DNP	59682918	132587144	DNP	DNP	3682870
Total number of successful calls	DNP	DNP	59059949	130351890	DNP	DNP	3744450
CSSR	98.92%	92.76%	98.96%	98.31%	99.86%	97.38%	98.35%
CSSR (LM Results)	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total number of call attempts	DNP	DNP	6295892	173733429	DNP	DNP	3636098
Total number of successful calls	DNP	DNP	6229806	171274071	DNP	DNP	3695489
CSSR	99.12%	95.11%	98.95%	98.58%	99.87%	97.08%	98.28%
CSSR (Drive Test Results)	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total number of call attempts	139	150	144	190	111	245.00	1137
Total number of successful calls	139	138	142	190	110	245.00	1137
CSSR	100%	92%	99%	100%	99%	100%	100%

Service Access Delay	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
DT Results	8.6	4.05	6.97	8.3	9	3.98	Not Measured

Audit results for SDCCH and TCH Congestion

Traffic Statistics	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
SDCCH Congestion							
Total number of SDCCH Attempts	12936031	DNP	342195703	1966854	5906509	DNP	Only paging success ratio is maintained
Total Number of SDCCH Congestions	0.24	DNP	0.338	0	5891415	DNP	
Percentage SDCCH Congestion	0.23%	0.05%	0.33%	0.00%	0.26%	0.00	
TCH Congestion							
Total number of TCH Attempts	5964483	DNP	229887769	565716555	2933600	DNP	13230817
Total Number of TCH Congestions	0.21	DNP	0.17	288453	2901492	DNP	44489
Percentage TCH Congestion	0.21%	2.47%	0.86%	0.05%	1.09%	0.00	0.34%

Live measurement results for SDCCH and TCH Congestion

Traffic Statistics	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
SDCCH Congestion							
Total number of SDCCH Attempts	38710600	DNP	535649440	2012100	6033867	DNP	Only paging success ratio is maintained
Total Number of SDCCH Congestions	0.32	DNP	0.164	0	6016216	DNP	
Percentage SDCCH Congestion	0.11%	0.03%	0.18%	0.00%	0.29%	0.00	

TCH Congestion							
Total number of TCH Attempts	17487436	DNP	309921614	819093324	2899663	DNP	1854906
Total Number of TCH Congestions	0.26	DNP	0	154243	2871047	DNP	305
Percentage TCH Congestion	0.09%	0.89%	0.88%	0.02%	0.99%	0.00	0.02%

* DNP – Details not provided, figures obtained directly from the system

Audit Results for Call drop rate

Call drop rate	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total number of calls established	5933442	DNP	130876345	130351890	DNP	DNP	3682870
Total number of calls dropped	59561	DNP	931200	894744	DNP	DNP	61580
Call drop rate	1.00%	1.57%	0.71%	0.69%	0.66%	0.49%	1.67%

Live measurement results for Call drop rate

Call drop rate	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Number of calls established	17426032	na	181441730	171274071	DNP	DNP	3636098
Total number of calls dropped	168149	NA	1166069	1080063	DNP	DNP	59391
Call drop rate	0.96%	1.51%	0.64%	0.63%	0.66%	0.87%	1.63%

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

Call drop rate	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total number of calls established	139	138	142	95	110	245.00	1137
Total number of calls dropped	0	4	1	0	1	1.00	26
Call drop rate	0.00%	2.90%	0.70%	0.00%	0.91%	0.41%	2.29%

* DNP – Details not provided, figures obtained directly from the system

Drive test results for Voice quality

Voice quality	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total number of sample calls	205658	31909	189458	5684	191182	6942.00	22826
Total number of calls with good voice quality	198432	30150	181761	5423	180716	6843.00	21411
%age calls with good voice quality	96.49%	94.49%	95.94%	95.41%	94.53%	98.57%	93.80%

5.7.1 Audit Results for POI Congestion

POI congestion	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
POI traffic offered on all individual POI's	DNP	DNP	2666794	64396931	69931692	DNP	Not Measured
Served traffic for all individual POI's	DNP	DNP	1672525	991032.22	1151049	DNP	
Traffic failed on all individual POI's	0%	0%	0%	0%	0%	0%	

5.7.2 Live measurement results for POI congestion

POI congestion	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
POI traffic offered on all individual POI's	DNP	DNP	259257	84951966	7185068	DNP	Not Measured
Served traffic for all individual POI's	DNP	DNP	158122	1390422.5	115055	DNP	
Traffic failed on all individual POI's	0	0	0%	0%	0%	0	

* DNP – Details not provided, figures obtained directly from the system

Audit results for customer care (Electronically)

Customer Care Assessment	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Number of calls received by	10235738	1847123	DNP	2832440	2628382	DNP	86252
Total Number of calls answered in 20 seconds	10235738	1811510	DNP	2832440	2628382	DNP	86187

Percentage calls answered in 20 seconds	100.00%	98.07%	DNP	100.00%	100.00%	100%	99.92%
Total Number of calls answered in 40 seconds	10235738	1838384	DNP	2832440	2628382	DNP	86234
Percentage calls answered in 40 seconds	100%	100%	DNP	100%	100%	100%	100%

Live calling results for customer care (Electronically)

Customer Care Assessment	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Number of calls received by the operator	100	100	100	100	100	100.00	100
Total Number of calls answered in 20 seconds	98	99	98	100	91	100.00	98
Percentage calls answered in 20 seconds	98.00%	99.00%	98.00%	100.00%	91.00%	100%	98%
Total Number of calls answered in 40 seconds	100	100	100	100	100	100.00	99
Percentage calls answered in 40 seconds	100%	100%	100%	100%	100%	100%	99%

Audit results for customer care (Voice to Voice)

Customer Care Assessment	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Number of calls received by the operator	3486371	503497	DNP	1865287	1828109	812384.00	28132
Total Number of calls answered in 60 seconds	3230727	276269	DNP	839379	1663579	752053.00	27973
Percentage calls answered in 60 seconds	94.82%	54.87%	DNP	45.00%	91.00%	92.57%	99.43%
Total Number of calls answered in 90 seconds	3329104	325510	DNP	915989	1798658	771759.00	28048
Percentage calls answered in 90 seconds	98.21%	64.65%	DNP	49.11%	98.00%	95.00%	99.70%

Live calling results for customer care (Voice to Voice)

Customer Care Assessment	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Number of calls made	100	100	100	100	100	100.00	100
Number calls answered within 60 seconds	96	50	80	59	94	90.00	23
Percentage calls answered in 60 seconds	96%	50%	80%	59%	94%	90%	23%
Number calls answered within 90 seconds	100	64	100	84	100	100.00	34
Percentage calls answered in 90 seconds	100%	64%	100%	84%	100%	100%	34%

Audit Results for Billing performance

Billing Performance	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total bills generated during the period	827187	361814	760858	3347502	343531	3238943.00	79458
Total number of bills disputed	365	240	40	931	11	2132.00	60
Percentage bills disputed	0.04%	0.07%	0.01%	0.03%	0.00%	0.07%	0.08%
Total complaints resolved in 4 weeks from date of receipt	100	240	40	931	11	2132.00	60
Percentage complaints resolved within 4 weeks of date of receipt	100%	100%	100%	100%	100%	100%	100%
Total number of cases requiring refund of deposits	182	160	18	NA	11	2132.00	0
Total number of cases where refund was made within 60 days	182	160	18	NA	11	2132.00	0
Percentage cases in which refund was receive within 60 days	100%	100%	100%	NA	100%	100%	NA

Live calling results for resolution of billing complaints

Resolution of billing complaints	Bharti	MTNL - GSM	Vodafone	TATA	Idea	RCOM	MTNL - CDMA
Total Number of calls made	100	100	100	100	100	100	100
Number of cases resolved in 4 weeks	74	20	51	62	50	98	95
Percentage cases resolved in four weeks	74%	20%	51%	62%	50%	98%	95%

Inter operator call Asessment (From / To)	Bharti	MTNL - GSM	Vodafone	TATA	Rel	Idea	MTNL - CDMA
Bharti	NA	100%	98%	100%	100%	100%	100%
MTNL - GSM	100%	NA	100%	98%	98%	96%	NA
Vodafone	100%	100%	NA	100%	99%	100%	100%
TATA	99%	100%	97%	NA	100%	100%	100%
Idea	100%	100%	100%	98%	100%	NA	100%
RCOM	100%	97%	99%	100%	NA	98%	97%
MTNL - CDMA	100%	NA	99%	98%	100%	98%	NA

8.3 Parameter wise performance reports for Broadband services

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

Service provisioning/Activation time	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
No of connections registered during the period		13627	5739	1880	1026	833	1204
Total number registered during 15 days		12870	4017	1880	1026	833	903
Percentage of connections provided within 15 days	100%	94.4%	70.0%	100.0%	100%	100.0%	75.0%

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

Service Provisioning/Activation Time	B'mark	Bharti	MTNL	Sify	H'Way	VSNL	RCOM
Total Number of calls made		100	100	100	100	100	100
Number of cases in which connection was provided in 15 Days		93	58	99	99	91	87
Percentage cases in which connection was provided in 15 days	100%	93%	58%	99%	99%	91%	87%
Number of cases in which connection was provided beyond 15 days		7	40	1	1	9	13
Percentage cases in which connection was provided after 15 days		7%	40%	1%	1%	9%	13%

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

Fault Repair/Restoration time	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Total number of faults registered during the period		26925	34319	2571	507	11010	982
Total number of faults repaired by next working day		26026	26768	2346	507	8548	923
Percentage of faults repaired by next working day	>90%	97%	78%	91%	100%	78%	94%
Total number of faults repaired within three working days		26678	32259	2573	507	9888	972
Percentage of faults repaired within three working days	99%	99%	94%	100%	100%	90%	99%

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

Fault Repair	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Total Number of calls made		30	30	30	30	30	30
Number of cases in which faults were repaired by next working day		22	5	8	7	7	5
Percentage cases in which faults were repaired by next working day	>90%	73%	17%	27%	23%	23%	17%
Number of cases in which faults were repaired within three working days		30	25	28	24	24	21
Percentage cases in which faults were repaired within three working days	99%	100%	83%	93%	80%	80%	70%

One month data collection results for billing performance

Billing Performance	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Billing disputes							
Total bills generated during the period		295720	226468	Prepaid	575	6868	4618
Total number of bills disputed		48	181		8	167	16
Percentage bills disputed	<2%	0.02%	0.08%		1.39%	2.43%	0.35%
Resolution of billing complaints							
Total complaints resolved in 4 weeks from date of receipt		45	181	Prepaid	8	167	16
Percentage complaints resolved within 4 weeks of date of receipt	100%	94%	100%		100%	100%	100%
Refund of deposits after closure							
Percentage cases in which refund was receive within 60 days	100%	99%	100%	100%	100%	100%	100%

Live calling results for billing complaints

Resolution of billing complaints	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Total Number of calls made		100	100	Prepaid	100	82	11
Number of cases resolved in 4 weeks		69	87		98	61	11
Percentage cases resolved in four weeks	100%	69%	87%		98%	74%	100%

One month data collection results for customer care

Customer Care Assessment	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Total Number of calls received by the operator		192764	147933	4783	18337	427497	232805
Calls answered within 60 seconds							
Total Number of calls answered in 60 seconds		150662	144974	4783	16224	398646	218836
Percentage calls answered in 60 seconds	>60%	78%	98%	100%	88%	93%	94%
Calls answered within 90 seconds							
Total Number of calls answered in 90 seconds		165498	144974	4783	18337	418372	223492
Percentage calls answered in 90 seconds	>80%	86%	98%	100%	100%	98%	96%

Live calling results for call centre

Customer Care Assessment	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Total Number of calls made		100	100	100	100	100	80
Calls answered within 60 seconds							
Number calls answered within 60 seconds		86	16	98	100	98	40
Percentage calls answered in 60 seconds	>60%	86%	16%	98%	100%	98%	50%
Calls answered within 90 seconds							
Number calls answered within 90 seconds		100	52	100	100	99	80
Percentage calls answered in 90 seconds	>80%	100%	52%	100%	100%	99%	100%

One month data collection results for Service Availability/Uptime

Service Availability Uptime	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Total Operational Hours		196722720	185316480	744	744	903600	744
Total Downtime		433205	286720	0	2.6	20048	8.52
Total time when the service was available		196289515	185029760	744	741.4	883552	735.48
Service Availability Uptime in Percentage	>98%	99.8%	99.8%	100.0%	99.7%	97.8%	98.9%

Three day live measurement results for Service Availability/Uptime

Service Availability Uptime	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Total Operational Hours		19672272	18531648	72	72	90432	
Total Downtime		1373	236161	0	0.1	1564	
Total time when the service was available		19670899	18295487	72	71.9	88868	
Service Availability Uptime in Percentage	>98%	99.99%	98.73%	100.00%	99.9%	98.27%	DNA

One month data collection results for Bandwidth utilisation

Bandwidth Utilisation	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Intra-network links (POP to ISP Node)							
Total number of intra network links		684	7	400	61	5	3
No of Intra network found to be above 90%		0	0	0	0	0	0
Upstream Links (ISP Node to IGSP/NIXI/NAP)							
Total number of upstream links		2	5	28	4	35	1
No of Intra network found to be above 90%		0	0	0	0	0	0
Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs)		5809	1937	3218	74	21688	200
Total International Bandwidth utilised during peak hours		4357	1669	2069	59.9	16021	102
Percentage Bandwidth utilisation during peak hours (In mpbs)	<80%	75%	86%	64%	81%	74%	51%

Live measurement results for Bandwidth utilisation

Bandwidth Utilisation	B'mark	Bharti	MTNL	Sify	H'way	VSNL	RCOM
Intra-network links							
Total number of intra network links		684	5	400	61	5	3
No of Intra network Links tested		25	5	400	10	0	3
No of Intra network found to be above 90%		0	0	0	0	0	0
International Bandwidth (ISP Node to IGSP/NIXI/NAP)							
Total number of upstream links		2	3	28	4	35	1
No of Intra network found to be above 90%		0	0	0	0	0	0
Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs)		5809	1727	3218	74	21688	200
Total International Bandwidth utilised during peak hours		4697	1322.6	2052	62.6	16000	100
Percentage Bandwidth utilisation during peak hours (In mpbs)	<80%	81%	77%	64%	85%	74%	50%

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 <u>Live calling : -</u> - 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 <u>Live calling : -</u> -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.

IMRB international

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. Live calling : - - IMRB Auditors collected the list of all the subscribers who have made billing complaints in the month prior to the Audit. -100 such subscribers per service provider were called to check the time taken to resolve the billing complaint. However, in some cases where number of billing complaints were less the sample size could not be achieved

5. Customer care promptness (Shifts, Closures and Additional facility)	
Computational Methodology	Supplementary (Additional) services requests: A few of the supplementary services that are considered for the audit purpose: Clip (caller line identification presentation) facility , STD, ISD, Call forwarding, Voice Mail etc.
Benchmark	Shifting of telephone line : Less than 3 days Processing of closure request: Less than 24 hours Supplementary (Additional) services requests: Less than 24 hours
Audit procedure	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**

IMRB
international

6. Response time to customer (Electronically and Voice to Voice)	
Computational Methodology	Percentage of calls answered in a specified time = (Total no. of calls answered within that specified time / Total no. of calls dialed for a particular service)*100

Benchmark	(i) % age of calls answered (electronically):
	        within 20 seconds = 80% of the calls over a period
	        within 40 seconds = 95% of the calls over a period
	(ii) % age of calls answered by operator / voice to voice):
	        within 60 seconds = 80% of the calls over a period
	        within 90 seconds = 95% of the calls over a period

Audit Procedure	-IMRB auditors made test calls from the exchanges to the operator's customer care / helpline / toll free numbers. They will record the time taken to connect a customer's call both to the IVR as well as to a customer care executive. - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services. - Time to answer the call by the operator should be taken from the time auditor has pressed the requisite button for being assisted by the operator. <u>Live calling: -</u> - Overall sample size is 2*50 calls per service provider per circle at different points of time, evenly distributed across the selected exchanges – 50 calls between 1000 HRS to 1300 HRS and 50 calls between 1500 HRS to 1700 HRS - Time to answer the call by the operator was assessed from the time interviewer pressed the requisite button for being assisted by the operator. - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.

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

8. Call completion rate	
Computational Methodology	Call Completion Rate: Call Completion Rate (CCR) is defined as the percentage of total calls that are connected out of the total calls presented to exchange. This could be due to:- Other exchange not working / lines blocked Calling exchange is blocked CCR = [(Call attempts – Calls blocked)/Call attempts] 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

IMRB
international

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

IMRB
international

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 "<u>Origination</u>" and "<u>Service Connect</u>" message from BTS to Mobile
	Time to confirm instruction to connect* = Time between "<u>Origination</u>" and "Base Station Acknowledgment"
	Note: Time measured here is a sub-part of first measurement
	Time to release call = Time between "<u>Release on Reverse Link</u>" and "<u>Release on Forward Link</u>"
	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 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.

IMRB
international

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 individual 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

IMRB
international

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 at least one 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

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 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%

IMRB
international

Audit Procedure	-IMRB auditors made test calls from the exchanges to the operator's customer care / helpline / toll free numbers. They will record the time taken to connect a customer's call both to the IVR as well as to a customer care executive. - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services. - Time to answer the call by the operator should be taken from the time auditor has pressed the requisite button for being assisted by the operator. <u>Live calling: -</u> - Overall sample size is 2*50 calls per service provider per circle at different points of time, evenly distributed across the selected exchanges – 50 calls between 1000 HRS to 1300 HRS and 50 calls between 1500 HRS to 1700 HRS - Time to answer the call by the operator was assessed from the time interviewer pressed the requisite button for being assisted by the operator. - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.

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* ** *<u>Only</u> 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

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

IMRB
international

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

IMRB
international

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

IMRB
international

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

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

5. Bandwidth Utilization	
Computational Methodology as per QoS definition	Percentage Bandwidth available on the link = Total Bandwidth* utilised in TCBH for the period/ Total Bandwidth Available during the period*100 Multi Router Traffic Grapher (MRTG) is to be used to measure the details of Bandwidth utilisation by service providers
Benchmark	-- < 80% link(s)/route bandwidth utilization during peak hours (TCBH). -- If on any link(s)/route bandwidth utilization exceeds 90%, then network is considered to have congestion. For this additional provisioning of bandwidth on immediate basis, but not later than one month is mandated.
Audit Procedure	**IMRB Auditors collected and verified call centre records pertaining to** **(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)

IMRB
international

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

IMRB international

20

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