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

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

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# Preface

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

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

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

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

The Survey and Audit modules for various circles within the Zones, due the sheer scale of data collection, have been distributed across various quarterly periods. IMRB International Auditors carried out Audits across Tamil Nadu, Karnataka, West Bengal, Bihar & Jharkhand, Haryana, Punjab and Uttar Pradesh (East) circles in the period of May – August 2008. **This report details the performance of various service providers in Punjab circle against Quality of Services benchmarks for various parameters laid down by TRAI in respective regulations for Basic (Wireline), Cellular (Mobile) and Broadband services**

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# 1.0 **Background**

The Telecom Regulatory Authority of India (TRAI) has a critical mandate to protect the interest of telecom consumers in addition to various other functions bestowed upon it. As part of the license conditions to telecom operators, it has the power and authority to measure the Quality of Service provided by various govt. (BSNL & MTNL) and private telecom operators. The parameters that need to be measured for Basic (Wireline) and Cellular Mobile (Wireless) services have been specified in the TRAI notification on Quality of Services of Basic (Wireline) and Cellular Mobile (Wireless) services dated 1st July, 2005. The parameters for Broadband Service have been specified in the TRAI notification for Quality of Services of Broadband Service Regulation, 2006

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

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

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

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

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

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

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

# 2.0 Objectives and Methodology

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

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

4. **Drive tests:** Operator assisted and Independent drive test were conducted in three 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)

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# **3.0 Sampling methodology**

### 3.1 Sampling for Basic (Wireline) services

- For BSNL the sample of exchanges was selected was spread across 10% of SDCA's in the entire service. Overall 80 exchanges (16 Urban and 64 Rural) exchanges were audited.

- For rest of the service providers (TATA, Reliance, Bharti and HFCL) data was collected pertaining to all the exchanges present in the circle/service area

### 3.2 Sampling for Cellular Mobile (Wireless) service providers

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

- Bharti Airtel Ltd. – 14 MSCs
- Spice Communications Pvt. Ltd. – 5 MSCs
- Tata teleservices ltd –3 MSCs
- Reliance communications – 3 MSCs
- BSNL – 5 MSCs
- Vodafone Essar Ltd. – 4 MSCs
- HFCL – 1 MSCs

### 3.3 Sampling for Broadband service providers

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

- For BSNL, Audit was conducted at the central node in Punjab and data submitted by various exchanges/POPs providing Broadband service was verified and collected. This was done in such a way that atleast 5% of POPs spread across 10% of SDCA's were covered

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

- Following Broadband service providers were Audited in Punjab circle: - Bharti Airtel Ltd., Hathaway, Sify, BSNL, VSNL (TATA communications Ltd.) and HFCL. For VSNL one month data provided herewith includes entire North region i.e. Chandigarh, Delhi, Punjab and Rajasthan as the service provider reports it cumulatively to TRAI

# 4 Audit methodology

## 4.1 Basic (Wireline) Services

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

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

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

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

## 4.2 Cellular Mobile Services

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

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

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

## 4.3 Broadband Services

In a nutshell, the audit methodology was as follows:

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

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

## 4.4 Audit Limitations

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

1. **Complete data not being maintained:** In certain cases lack of availability of the data with the service providers rendered verification of raw data unfeasible and verification was done to the extent possible. For e.g. for network related parameters for Broadband services service providers could not produce old raw data files for ping tests, download speed etc

2. **Difference in measurement methodology:** For some cases, calculation methodology for some of the parameters was found to be different across various service providers.

3. **Technical unfeasibility:** There were cases observed where service providers expressed technical unfeasibility to provide the data required as according them their current system does not support the data being maintained/ recorded in the desired form. For e.g. Service providers were unable to provide data on service access delay and signal coverage from OMC for cellular mobile services. Hence, data was collected from the results of recent drive tests being conducted by various service providers

4. **Decentralized system for book keeping:** In certain cases, book keeping of records was found to be decentralized. This was largely observed for call centre performance for BSNL, where required data was not available with the exchanges and hence data could not be collected for the same. Also for some service providers who have call centralized call centres located at places away from ISP Nodes/Exchanges detailed raw data i.e. call by call detail was not available for verification. Hence verification of records was done to the extent possible in such cases.

5. **Difference in level of reporting to TRAI:** Some of the large Broadband service providers were observed to be reporting their performance on various parameters to TRAI at an all India level. They claimed that since they are providing gateway service to other small service providers, they are "Category A" service providers and consider entire India as one circle. Data for some of the parameters was provided by these operators on All India basis.

# 5 Executive Summary

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

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

## 5.1 Service provider performance report based on one month data verification – Basic (Wireline) Services

| S.no | Parameters | B'mark | Bharti | BSNL | RCOM | HFCL | Tata |
|------|------------|--------|--------|------|------|------|------|
| 1 | Provision of telephone after registration of demand | | | | | | |
| 1.1 | Connections completed within 7 days | 100% | 100% | 66% | 74% | 99% | 97% |
| 2 | Fault incidence/clearance statistics | | | | | | |
| 3 | Fault incidences(No. of faults/100 subscribers/month) | <3 | 3.13 | 10.83 | | 6.06 | 1 |
| 3.1 | Faults repaired within 24 hours | >90% | 99% | 58% | 96% | 97% | 70% |
| 3.2 | Faults repaired within three working days | 100% | 99% | 91% | 100% | 100% | 100% |
| 4 | Mean time to Repair (MTTR) | <8 hours | 3.50 | 14.00 | 3.23 | 5.60 | 17.70 |
| 5 | Call Completion Rate (CCR) | >55% | 97% | 60% | DNA | 56% | 90% |
| 6 | Metering and billing credibility | | | | | | |
| 6.1 | Billing complaints per 100 bills issued | <0.1% | 0.01% | 0.05% | 0.02% | 0.14% | 0.04% |
| 6.2 | %age of billing complaints resolved within 4 weeks | 100% | 100% | 82% | 100% | 100% | Only one billing compliant not resolved in time |
| 7 | Customer care/helpline promptness | | | | | | |
| 7.1 | Shift requests attended | | | | | | |
| | Shift requests attended within 3 days | 95% | 100% | 58% | 100% | 96% | NA |
| 7.2 | Closure request attended | | | | | | |
| | Closure within 24 hours | 95% | 100% | 92% | 100% | 100% | NA |
| 7.3 | Supplementary (additional) service requests attended | | | | | | |
| | Additional facility provided within 24 hours | 95% | 99% | 36% | 98% | 100% | 100% |
| 8 | Response time to customer for assistance | | | | | | |
| 8.1 | % age call answered through IVR in 20 seconds | 80% | Not measured by the operator | Details not available at the respective exchanges | 100% | 100% | 100% |
| | % age call answered through IVR in 40 seconds | 100% | | | 100% | 100% | 100% |
| 8.2 | % age calls answered by operator in 60 seconds | 80% | 87% | | 99% | 95% | 90% |
| | % age calls answered by operator in 90 seconds | 95% | 93% | | 100% | 97% | 93% |
| 9 | Time taken for refund of deposits after closure | | | | | | |
| 9.1 | %age cases where refund received within 60 days | 100% | DNA | 100% | 100% | 100% | NA |

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

** 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 Punjab circle broadly indicates that none of the service provider could meet all the benchmarks as specified by Telecom Regulatory Authority of India.

The live calling results were found to be different from the 1 month audit data collection in certain places. To some extent the difference can be attributed to the smaller sample size undertaken for the live calling. For live measurements conducted to assess Call Completion Rate (CCR) it was found that the operators who are reporting the same to TRAI were meeting the benchmark.

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

*Provision of telephone after registration of demand*

- Only Bharti was found to be meeting the TRAI benchmark of 100% for provisioning of telephone within 7 working days for the month in which the Audit was carried out. HFCL (99%) and TATA (97%) marginally fall short of the TRAI specified benchmark. It should be noted that Reliance which does not meet the benchmark is including Technically Non Feasible (TNF) cases while calculating the parameter.
- BSNL has scored low on Service provisioning/activation time (at 66%) , one of the reasons for the same was observed to be the fact that the service provider provides connection at all the locations and SDCA's in the circle whereas private service providers normally provide connections in areas which are technically feasible for the operator, especially for retail customers.
- As far as live calling scores are concerned 97% (highest) of subscribers of TATA teleservices claimed that the connection was provided within the time period of 7 days followed by, HFCL(92%) Bharti (89%) and BSNL (83%), RCOM (78%)

*Fault incidence / clearance statistics*

- As per the 1-month audit data findings, BSNL at 58% and TATA at 70% fall short of TRAI specified benchmark of >90% of faults to be repaired within 24 hours. Highest score on the same was observed for Bharti at 99% followed by HFCL and RCOM at 97% and 96% respectively. The reason for low score by BSNL could be the fact that service providers also has presence in rural areas where fault repair may sometimes take time due to operational difficulties.
- For fault repair within 3 working days BSNL(91%) and Bharti (99%) fall short of the TRAI specified benchmark of 100%
- The live calling scores (for fault repair within 24 hrs) were observed to be highest for Bharti at 83% followed by TATA at 77%. However relatively lower scores were observed were RCOM and HFCL at 13% and 43% respectively. As mentioned earlier a part of it could be attributed to low sample (10% of total faults registered in month prior to Audit).

*Traffic statistics (CCR)*

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

reason primarily is the difference between its network as compared to BSNL.  The service 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 (except HFCL) meet the TRAI specified benchmark of <0.1% billing complaints.
- However during verification of records of service providers namely Reliance and Bharti it was found that definition of billing complaints remains to be lenient as only those cases where an internal ticket is opened i.e. cases where refund is provided by the operator are being taken into consideration. Hence, there is a need felt to have some clarity on the definition of billing complaints.

### *Customer care/helpline promptness*

- For "shift requests attended within 3 days" audit data, BSNL (58%) fall short of TRAI specified benchmark of  95%
- For closure requests within 24 hours only BSNL with 92% requests attended, marginally falls short of the benchmark of 95%
- For supplementary service requests, all the operators (except BSNL) were found to be meeting the TRAI specified benchmark for the month in which audit was carried out.

### *Response time to customer for assistance*

- For customer care number through electronic IVR menu parameter all the subscribers comfortably meet the benchmark for calls answered within 20 and 40 seconds for one month data
- For BSNL, call centre data was not available at the exchanges as service provider has a centralized call centre.
- During verification of records for Bharti, it was observed that the service provider does not have a mechanism of recording number of calls which are answered by IVR; only the calls answered by the operator are recorded. The service provider does not report the figure in the PMR submitted to TRAI.
- For one month audit data, both Bharti and TATA with a score of 93% marginally fall short of the TRAI specified benchmark of calls answered by the operator in 90 seconds.
- Live calling results carried out to check the efficiency of calls answered by the operator, all the service provider comfortably meet the TRAI specified benchmark both for calls answered within 60 seconds and 90 seconds

### *Time taken for refund of deposits after closure*

- BSNL, RCOM and HFCL meet the benchmark for time taken to refund of deposits. Also there were no such cases of refunds for TATA teleservices.

### *Level 1 services*

To test the efficiency of level 1 services (Trunk booking, Child helpline, Women helpline, Airline booking, Fire, Police, Railways) offered by various service providers. At least 200 calls were made for each service provider to different numbers and time taken to answer the call was noticed. For BSNL approximately 88% of calls made were answered in 60 seconds.

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For rest of the operators scores were observed to be 95% for HFCL and 98% for TATA and RCOM and 100% for Bharti. It should be noted that most of the private operators offer level 1 service primarily for emergency services like fire, police etc

## Summary of Live Measurement Results – Basic Wireline Services

| Traffic statistics - Call Completion Rate | Benchmark | Bharti | BSNL | HFCL | Tata |
|---|---|---|---|---|---|
| Call Completion Rate (CCR) in the local network | >55% | 99% | 69% | 57% | 90% |

- For basic wireline services there was only one parameter (Call Completion Rate – Benchmark > 55%) for which live measurement was applicable.
- All the service providers were comfortably meeting the TRAI specified benchmark, lowest scores during live measurements were observed for HFCL at 57% and highest was observed for Bharti at 99%

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

| Parameters | Benchmark | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|---|
| Accumulated downtime for community isolation | < 24 hrs. | 0.00 | 1.11 | 17.25 | 0.00 | 14.73 | 1.35 | 0.00 |
| Call Set Up Success Rate (CSSR) | > 95% | 98.05% | 99.30% | 99.10% | 98.21% | 97.03% | 99.44% | 94.54% |
| Service Access Delay* | 9 to 20 seconds (< = 15 seconds for 100 calls) | 9.54 | 4.10 | 12.38 | 4.71 | 8.90 | 5.50 | 3.76 |
| Blocked Call Rate | | | | | | | | |
| SDCCH /Paging Channel  Congestion | <1% | 0.13% | 0.00% | 4.85% | 0.00% | 0.12% | 0.02% | 0.92% |
| TCH Congestion | < 2% | 0.39% | 0.48% | 0.00% | 0.00% | 0.18% | 0.01% | 1.90% |
| Call drop rate | < 3% | 1.44% | 0.70% | 0.71% | 1.18% | 0.31% | 1.26% | 1.32% |
| Percentage connections with good voice quality* | > 95% | 95.50% | 99.34% | 99.10% | 97.12% | 96.84% | 97.19% | 85.08% |
| Service coverage* | | | | | | | | |
| In door | >-75dbm | Complied | Complied | Complied | Complied | Complied | Complied | Complied |
| In vehicle | >-85dbm | | | | | | | |
| Out door - in city | >-95dbm | | | | | | | |
| POI congestion | < 0.5% | Complied | Complied | Complied | Complied | Complied | Complied | Complied |
| Calls answered electronically | | | | | | | | |
| Percentage calls answered within 20 seconds | 80% | 100.00% | 97.90% | Electronic segregation facility NA | 100.00% | DNP | 96.80% | 57.17% |
| Percentage calls answered within 40 seconds | 95% | 100.00% | 97.90% | | 100.00% | DNP | 97.20% | 78.67% |
| Calls Answered by the operator | | | | | | | | |
| Percentage calls answered within 60 seconds | 80% | 96.70% | 95.54% | 95.15% | 95.81% | DNP | 89.13% | 62.89% |
| Percentage calls answered within 90 seconds | 95% | 97.19% | 96.11% | 97.26% | 96.84% | DNP | 95.10% | 72.67% |
| Billing Complaints | | | | | | | | |
| Billing complaints per 100 bills issued | <0.1% | 0.04% | 0.09% | 0.08% | 0.04% | DNP | 0.09% | 0.00% |
| Percentage billing complaints resolved within 4 weeks | 100% | 100% | 100% | 100% | 100% | DNP | 100% | No refunds due to customers |
| Period of refunds/payments due to customers from the date of resolution of complaints | <4 weeks | 100% | 100% | 100% | 26% | DNP | 93% | |

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

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

### Critical findings: Cellular Mobile Services

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

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

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

### Busy Hour of Various Service Providers

| Service Provider | Reported Time Consistent Busy Hour | Network Busy Hour found in 3 day live measurement |
|---|---|---|
| Bharti | 2000 – 2100 | 2000 – 2100 |
| BSNL | 2000 – 2100 | 2000 – 2100 |
| RCOM | 1100 – 1200 | 1100 – 1200 |
| HFCL | 2000 – 2100 | 2000 – 2100 |
| TATA | 2000 – 2100 | 2000 – 2100 |
| Vodafone | 2000 – 2100 | 2000 – 2100 |
| Spice | 2000 – 2100 | 2000 – 2100 |

The TCBH reported by all the service providers matched the network busy hour calculated by IMRB auditors for the Punjab circle. The auditors came to this conclusion by studying the traffic reports that were generated from the switch during the audit.

*Accumulated Downtime:*

In the Punjab circle, there were outages observed in various BTS across all the service providers, actually leading to a community being isolated at a particular point in time except for TATA, BSNL and Bharti. HFCL had the maximum outage in the month of audit with an outage of more than 17 hours observed. Spice's outage was found to be 14.73 hours for the month of audit. The community isolation of Vodafone and RCOM was just above one hour in the month of audit.

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

All the operators except BSNL (which was marginally below the TRAI benchmark) were comfortably meeting the benchmark on this parameter. During the audits the maximum CSSR was observed for Vodafone with 99.44% of their calls getting completed. BSNL had 94.54% CSSR which was the lowest among all services providers and was below the benchmark. 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 Punjab comfortably meet the TRAI specified benchmark. Also, all the operators follow the TRAI specified mechanism for measuring the parameter. During the drive test, none of the operators were found to be using engineering hand sets. The highest service access delay was observed for HFCL at 12.38 seconds followed closely by Bharti at 9.54 seconds, all of which comfortably met the TRAI benchmark of < = 15 seconds for a sample of 100 calls.

### Network Congestion parameters:

SDCCH / Paging Channel Congestion, TCH and POI are part of the network congestion parameters. All the operators except HFCL for SDCCH / Paging channel congestion are meeting the TRAI specified on the congestion parameters. HFCL does not meet the TRAI specified benchmark with a SDCCH / Paging Channel congestion of 4.85% which was found during the one month data collected for the month of audit. TATA leads the way in network congestion parameters with almost negligible paging and very minimal traffic channel congestion. The calculation methodology of these parameters was found to be in complete accordance with what has been specified by TRAI. There was almost 0 POI congestion on almost all individual POI links between a service provider vis-à-vis other service.

### Call Drop Rate:

During the audit it was found that all the service providers were measuring this parameter as per the TRAI guidelines. The call drop rate was measured as the ratio of total calls dropped (unexpected seizure) to the total number of call attempts for all operators. Also, all of service providers were found to be meeting the TRAI specified benchmark. The lowest call drop rate was of Spice with only 0.31% call drop and the relative highest (although it easily met the benchmark) was for Bharti with 1.44%.

### % connections with good voice quality:

Almost all of the operators are measuring these parameters via their periodic drive tests. However, for Vodafone these parameters can be obtained at their switch as well. During the audit it was found that all the service providers were measuring this parameter as per the TRAI guidelines. Drive test was conducted by IMRB with the help of service providers to measure this parameter. In the drive test it was found that BSNL with 85.08% did not meet the TRAI benchmark.

### Service coverage:

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

## Customer Care / Helpline Assessment

For the IVR aspect all the service providers except BSNL with 57.17% (calls answered within 20 seconds) and 78.67% (calls answered within 40 seconds) meet the TRAI benchmark. However, in case of Reliance no breakup of IVR calls by circle is present. The figure reported is for all India level. Also, RCOM claimed that whatever calls cannot be routed to the IVR is directly routed to the voice to voice operator. In case of calls answered by operators, all the service providers except BSNL (62.89% calls answered within 60 seconds and 78.67% calls answered within 90 seconds) meet the benchmark for the month of audit. Also, the customer care / helpline details were not provided to IMRB auditors by Spice.

## Billing performance

All the operators were found to be meeting the benchmark of < 0.1% complaints registered per 100 bills issued. In all cases where customers were due for refund, all the service providers except TATA and Vodafone meet the TRAI benchmark of 100% with 4 weeks.  The billing details were not provided by Spice for the month of audit.

## Inter operator calls assessment

| Inter operator call Assessment (To/From) | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Bharti | NA | 94% | 100% | 100% | 100% | 98% | 89% |
| BSNL | 100% | 91% | 90% | 81% | 100% | 82% | NA |
| Vodafone | 100% | 95% | 100% | 100% | 100% | NA | 86% |
| TATA | 100% | 100% | 98% | NA | 100% | 94% | 100% |
| HFCL | 92% | 88% | NA | 100% | 100% | 100% | 84% |
| RCOM | 100% | NA | 96% | 96% | 100% | 96% | 97% |
| Spice | 100% | 100% | 100% | 100% | NA | 93% | 92% |

In the inter-operator call assessment, calls were made from the test sims of service provider whose audit was being conducted to all the other service providers. The calls from Bharti to all other service providers were established in the range of 92% to 100%. Similarly BSNL's connectivity with all the operators was found to be in the range of 84% to 100%. It had maximum difficulty in connecting to an HFCL number. However, Vodafone has maximum difficulty in connecting to a BSNL number with only 82% of its calls getting connected. TATA had problems in connecting to BSNL with only 81 out of 100 of its calls getting established. Also, RCOM's connectivity to HFCL was not good with only 88 out of 100 calls getting connected. Spice did not have any problem in connecting to any of the operators with all 100% of its calls getting established.

*Results of Operator assisted Drive test*

The drive test was conducted simultaneously for all the operators present in the Punjab circle. There was in total of three drive tests conducted in the circle. These tests were conducted in the cities of Ludhiana, Kapurthala and Patiala. 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 Punjab were covered.

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

| Mysore | Type of Location | Ludhiana | Kapurthala | Patiala |
|---|---|---|---|---|
| Outdoor | Periphery of the city | Nanaksar, Jalandhar By Pass, Clock Tower, Dhami Hospital, Ansal Plaza, Along the Canal, Gill Road, Daba Village, sherpur Chowk, Samrala Chowk, Nanaksar | Sanik School - Circular Road - Markted Chowk - Amritsar Road - Guru nanak Nagar - Sanik School | Rajpura By pass-Heera Bagh- Marka Colony - Ragho Majra - Sangrur Road - Bhakra Colony - Thapar College - Dukh Nawaran Sahib - Rajpura By Pass |
| | Congested Area | Chwwani Mohalla, Clock Tower, Old Bus Stand, Civil Hospital, CMC, Baba Than Singh Chowk, Samrala Chowk | Ashok Vihar Phase 1 - Ashok Vihar Phase -2 - Hotel Ramneek Chowk | Sehran Wala Gate - Dharampura Bazar - AC Market - Choti Barandari |
| | Across the City | PAU to Jagraon Bridge to Cheema Chowk to Samrala Chowk to Jamalpur Chowk, Jalandhar Bypass chowk to Jagraon Bridge to Dholewal Chowk to Sherpur chowk | Jalandhar Road - Mall Road - Amritsar Road, FCI - Mall Road - Kartarpur Road | Thapar Institute to Dukhnivaran ro Punjabi University,  Sir hind road to Dukhnivaran to Kali Mata Mandir to Fountain Chowk to Moti Bagh |
| Indoor | Office Complex | Shanghai Towers | Hotel Ramneek | AC Market |
| | Shopping Complex | Basant Restaurant | Nana Complex | Gopal Sweets |

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

### Drive Test - Ludhiana

| | Bharti | | RCOM | | HFCL | | TATA | | Spice | | Vodafone | | BSNL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor |
| Voice quality | 100.00% | 95.91% | 99.45% | 99.26% | 99.65% | 98.33% | 85.00% | 95.47% | 100.00% | 96.69% | 100.00% | 95.88% | 96.25% | 83.31% |
| CSSR | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |
| Call drop rate | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 1.27% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hands off success rate | NA | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |

### Drive Test – Kapurthala

| | Bharti | | RCOM | | HFCL | | TATA | | Spice | | Vodafone | | BSNL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor |
| Voice quality | 100.00% | 92.29% | 100.00% | 99.31% | 100.00% | 99.87% | 100.00% | 99.71% | 100.00% | 97.55% | 100.00% | 98.71% | 85.57% | 86.55% |
| CSSR | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 90.74% | 97.30% |
| Call drop rate | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hands off success rate | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |

### Drive Test – Patiala

| | Bharti | | RCOM | | HFCL | | TATA | | Spice | | Vodafone | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor | In door | Outdoor |
| Voice quality | 100.00% | 95.74% | 99.90% | 99.18% | 100.00% | 99.15% | 85.00% | 98.01% | 100.00% | 96.50% | 100.00% | 97.52% |
| CSSR | 100.00% | 98.70% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |
| Call drop rate | 0.00% | 0.66% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Hands off success rate | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |

■ Not meeting the benchmark

IMRB international

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

## ALL SERVICE PROVIDERS

*Ludhiana:* There was interference and low signal strength recorded for all operators in the outdoor areas near Dungri Road, Mobatta Fatehganj, Feroz Gandhi Market – Jamalpur, Domariya pul, Kiran Dept store (Shastri Nagar), Reliance Fresh, Koutons, Sethi Medical store, Pindi Street, Near Budda while in the indoor areas across all operators there was adequate coverage found.

*Kapurthala:* There was none of the areas where interference and low signal strength was recorded for the operators in the outdoor areas as well as in the indoor areas.

*Patiala:* There was interference and low signal strength recorded for all operators in the outdoor areas near Near Bhakhra Police station, Near HDFC Bank, Choti Baradari, Near Verka Plant Sirhind Road, Dhillon Form, Nabha Road, Sunami Gate, Sheesh Mahal while in the indoor areas across Patiala there was no interference and inadequate coverage recorded.

## Conclusions:

1. TATA in indoor and BSNL in outdoor do not meet the benchmark for percentage connections with good voice quality in Ludhiana
2. Bharti in outdoor and BSNL both in indoor and outdoor do not meet the benchmark on percentage connections with good voice quality in Kapurthala while TATA does not meet for indoor areas in Patiala
3. Also, BSNL does not meet the benchmark for CSSR for the city of Kapurthala. Also, in the city there was no call drop observed for any of the operators

## Summary of Live Measurement Results – Cellular Mobile Services

| Parameters | Benchmark | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|---|
| CSSR | > 95% | 98.86% | 98.81% | 99.20% | 98.35% | 96.99% | 99.55% | 94.54% |
| SDCCH / Paging Channel Congestion | < 1% | 0.12% | 0.00% | 5.40% | 0.00% | 0.04% | 0.01% | 0.98% |
| TCH Congestion | < 2% | 0.14% | 0.47% | 0.00% | 0.00% | 0.04% | 0.00% | 2.05% |
| POI congestion | < 0.5% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Call drop rate | < 3% | 1.36% | 0.94% | 0.67% | 0.99% | 0.33% | 1.10% | DNP |

▢ Not meeting the benchmark

During the three day live measurement, all the operators except BSNL were found to be meeting the TRAI benchmark on CSSR. Vodafone leads the way with a CSSR of 99.55% while BSNL has the lowest CSSR in the Punjab circle for the three day live measurement with a call success rate of 94.54%.

Except for HFCL, all the operators met the TRAI benchmark on the SDCCH / paging channel congestion parameter. During the live measurements the maximum SDCCH congestion was observed for HFCL at 5.40%. RCOM and TATA experienced no Paging Channel Congestion. BSNL did not meet the benchmark on traffic channel congestion with a congestion of 2.05%

respectively. Also, there was no POI congestion observed for individual POI links for any of the operators.

Also, during the three days live measurement, all the operators met the benchmark on call drop rates. The maximum call drop rate was observed for Bharti with 1.36% calls getting dropped after establishment followed closely by Vodafone at 1.10%. The lowest call drop rate was observed for Spice with only 0.33% of total calls getting dropped after establishment.

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

| S.No | Parameters | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|------|------------|--------|--------|------|------|-------|------|------|
| 1 | **Service provisioning uptime** | | | | | | | |
| 1.1 | Total connections registered | | 2125 | 707 | 3 | 259 | 1119** | 436 |
| 1.2 | Percentage connections provided within 15 days | 100% | 100% | 96% | 100% | 100% | 99%** | 100% |
| 2 | **Fault repair restoration time** | | | | | | | |
| 2.1 | Total number of faults registered/calls made | | 1768 | 2505 | 3 | 1294 | 15122** | 835 |
| 2.2 | Percentage faults repaired by next working days | > 90% | 96% | 90% | 100% | 92% | 86%** | 99% |
| 2.3 | Percentage faults repaired within three working days | 99% | 100% | 100% | 100% | 99% | 95%** | 100% |
| 3 | **Billing performance** | | | | | | | |
| 3.1 | Total bills generated | | 36650 | 48769 | Prepaid | 193 | 7643 | 18830 |
| 3.2 | Billing complaints per 100 bills issued | <2% | 0.06% | 0.00% | | 1.55% | 2.01% | 0.39% |
| 3.3 | %age of billing complaints resolved within 4 weeks | 100% | 100% | 100% | | 100% | 100% | 100% |
| 3.4 | Time taken for refund of deposits after closure | 100% | Details not available | No cases | | Details not available | 100% | 100% |
| 4 | **Customer care/helpline assessment** | | | | | | | |
| 4.1 | Percentage calls answered within 60 seconds | > 60% | 56% | 87% | 100% | 84% | 78% | 72% |
| 4.2 | Percentage calls answered within 90 seconds | >80% | 66% | 100% | 100% | Details not available | 85% | 80% |
| 5 | **Bandwidth utilisation/Throughput** | | | | | | | |
| 5.1 | Total number of intra network links tested | | 144 | BRAS-23,T1-24,T2-610, DSLAM-5456 | 400 | 3 | 16 | 5 |
| 5.2 | Total number if intra network links crossing 90% | | 0 | Uplink Traffic in Chennai BRAS is > 90% | 4 | 0 | 1 | 0 |
| | *Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)* | | | | | | | |
| 5.3 | Total number of upstream links | | 2 | 97 | 28 | 3 | 28 | 1 |
| 5.4 | Number of links > 90% | | 0 | 1 | 0 | 0 | 0 | 0 |
| 5.5 | Percentage bandwidth utilised on upstream links | <80% | 20% | 75% | 74% | 68% | 64% | 88% |
| 6 | Broadband download speed | >80% | | Complied | Complied | Complied | Complied | Complied |
| 7 | Service availability/uptime | >98% | 99.98% | 100.00% | 100.00% | 99.80% | 97.35% | 99.97% |
| 8 | Packet loss | <1% | <1% | <1% | <1% | <1% | <1% | <1% |
| 9 | **Network Latency** | | | | | | | |
| 9.1 | POP/ISP Node to NIXI to IGSP | <120msec | <60 | <120 | < 45ms | <30 | <80 | 30-40 ms |
| 9.2 | ISP node to NAP port | <350msec | <120 | Complied | <250 ms | <100 | <180 | 260-300 |

** 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. Also, there were differences observed in level of reporting for e.g. Sify, and BSNL (for network related parameters) claimed to be category "A" service provider and consider all India as one circle. In fact the findings reported herewith for some of the parameters for these operators are on an all India basis.

However, we need to take a larger view of the picture and ignore some differences in measurement methodologies and level of reporting. We believe that book keeping is bound to get better as more such Audits will be carried out in subsequent quarters as mandated by TRAI.

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

*Service provisioning/Activation time*

- VSNL (99%) and BSNL (96%) marginally fall short of TRAI benchmark of 100% connections to be provided within 15 days.
- For Live calling carried out Sify scores the lowest with 85% subscribers claiming that connection was provided within 15 days. For rest of the service providers scores are observed to be > 90%.
- Also, VSNL (TATA communications) 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*

- VSNL (TATA communications) and BSNL are marginally falling below the benchmark for fault repair within next working day.
- For fault repair within three working days only VSNL (at 95%) was found to be not meeting the benchmark.
- 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.
- 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.
- Also, Sify was found to be reporting only those fault complaints which are booked at the call centre. All the fault complaints booked at the cable operator's end are not taken into consideration while reporting in PMR

*Billing performance*

- All the service providers except VSNL were found to be meeting the benchmark of 4 weeks for resolution of billing complaints for the month in which data was collected. Sify however claim that all its retail broadband customers are prepaid and hence there are no billing complaints for Sify.
- It should also be noted that the definition of billing complaints/disputes can be considered as lenient as service providers namely Bharti and Reliance include only those complaints where an internal ticket is opened and refund is made to the customer. Hence there is a need felt to have some clarity on the definition of billing complaints.

*Customer Care/Helpline Assessment*

- Bharti (both for calls answered within 60 and 90 seconds) does not meet the benchmark of calls answered by the operator. Also VSNL and HFCL do not meet the benchmark of >90% such calls answered in 90 seconds.

*Bandwidth Utilisation:*

- All the service providers were found to be using Multiple Router Traffic Grapher (MRTG) to measure the bandwidth utilisation at intra network links.
- However, it was noticed that some of the service providers are reporting Average bandwidth utilised during the complete period to TRAI instead of Bandwidth utilised during Time Consistent Busy Hour (TCBH) as they claim that the peak hours generally range from 11.00AM in the morning to 4.00 PM in the evening owing to high corporate usage during the period. Also, it was observed that there are multiple links and busy hour may vary for each link.
- All the service providers were found to be reporting combined bandwidth utilisation for corporate and household customers as there is no mechanism available to provide it separately for different users.
- For Intra network link, data for Sify, BSNL and VSNL (TATA communications) was obtained on all India basis. For VSNL (TATA communications) out of 8 POP locations in India, the link running from core router in Chennai to Delhi was found to be above 90%.
- Similarly for BSNL uplink Traffic from Chennai Broadband Remote Access Server (BRAS) was found to be more than 90% during the month for which the data was obtained.
- It was observed that all the links (tested during three day live measurement) in the access segment for most of the service providers were found be below 80%.
- Infact for large service providers having Metro E network, bandwidth utilisation during peak hours was found to less than 50% during peak hours for some if the links randomly tested during three days live measurement.
- Also, service providers distributing services through cable operators (Sify and Hathaway) claim that it is not possible to measure the Bandwidth available from Cable operator to their base stations. Hence, it is believed that last mile experience may suffer as operators have relatively less control over the operations of cable operator.
- For Bandwidth utilisation on upstream links (From ISP Node to IGSP/NIXI), BSNL, VSNL (TATA Communications Ltd.) and Sify meet the TRAI specified benchmark cumulatively for all the gateways present in India. For HFCL traffic on upstream links (to IGSP) was observed to be 88% which is significantly above the benchmark of 80%

*Download speed*

- Also, during live measurements carried out at Pop's/ISP Node it was observed that all the operators are meeting the TRAI prescribed benchmark of greater than 80% speed available to the customer.
- However, no historic data was available for verification of records for month of Audit as well as quarter ending October to December 2007 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. Only BSNL and HFCL were found to be meeting the benchmark (For sample calls made to subscribers across different locations in Punjab).

*Service Availability/Uptime:*

- All the service providers (except VSNL) are meeting the benchmark on service availability/uptime for the month in which audit was carried out.
- However, it was observed that type of sites being taken into consideration for calculating network uptime varies from operator to operator.
    o For e.g. TATA communications (VSNL) considers all the sites in the access network (including DSLAM, Building Nodes etc) for calculating network uptime whereas BSNL does not consider downtime for DSLAM's while reporting to TRAI. Again for service providers distributing through cable operators (Sify, 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 almost all the service providers are measuring packet loss and latency by conducting random ping tests for their internal performance measurement, but there are no records being maintained or book keeping methodology was non existent for all the operators except BSNL. However, it should be noted that the network related data for BSNL for verification was obtained from their central node in Bangalore.
- Also, while conducting ping tests it was observed that service providers (except BSNL) were found to be unaware of the standard prescribed by TRAI i.e. one ping test constitute of 1000 pings of 64 byte packet each to be carried out daily during Time consistent Busy Hour(TCBH).
- Due to non availability of the records of old ping tests, verification process could not conducted for most of the private operators.

- However, ping tests conducted/smoked ping results during live measurements revealed that all the service providers are meeting the benchmark prescribed by TRAI.

## Summary of Live Measurement Results – Broadband Services

| Parameters | Benchmark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Service Availability Uptime | >98% | 99.96% | 100.00% | 100.00% | 100.0% | 96.75% | 99.96% |
| No of **Intra network links** found to be above 90% (Out of sample links tested) | | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Bandwidth utilization at all upstream links | < 80% | 21% | 71% | 74% | 69% | 64% | 73% |
| 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 | <55 | Complied | <15 ms | <21 | <80 | <80 |
| From user reference point at ISP Gateway Node to nearest NAP Port (Terrestrial) (In msec) | <350msec | <110 | Complied | 240 ms | <100 | <230 | <300 |

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

- All the service providers (except VSNL) are meeting the benchmark on service availability/uptime for three day live measurements. As explained earlier, it was observed that type of sites being taken into consideration for calculating network uptime varies from operator to operator.
- It should be considered that VSNL which does not meet the benchmark is considering all the types of sites (including DSLAM's and Building Nodes) for calculating service availability.
- The testing for Bandwidth utilization during live measurement was carried out on sample basis by IMRB auditors for intra network links. There were no intra network links that were found to have a utilization of more than 90% for all of the operators
- For Bandwidth utilization on upstream links, all the service providers are meeting the benchmark during the three day live measurement and have excess capacities available on their upstream links.
- However, it should be noted that for BSNL out of the total 97 gateway links present at different places in India 10 to 20 were found to be > 90 %.
- For ping tests conducted during live measurements Hathaway was found to be crossing TRAI specified benchmark of <1% packet loss sometimes.
- For network latency all the service providers comfortably meet the TRAI specified benchmark for ping tests carried out during live measurements.

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

## 6.1 Graphical/Tabular Representations for Basic (Wireline) services

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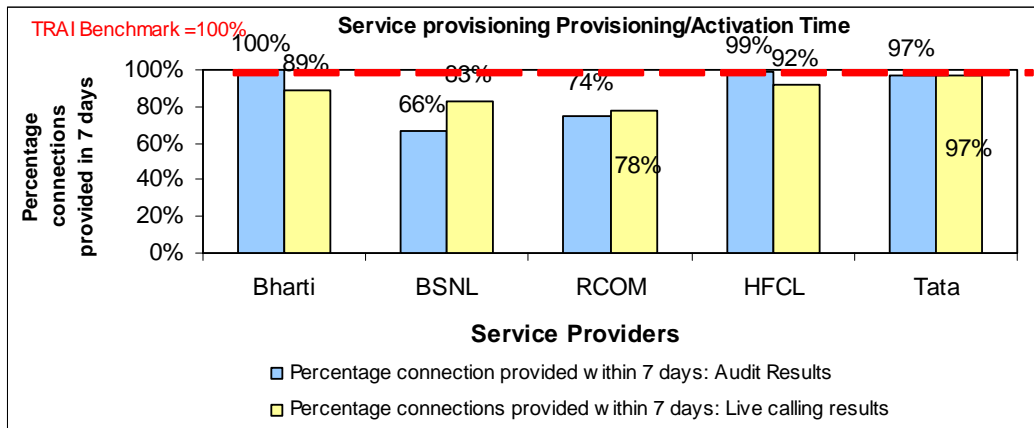


BSNL with 66% connections registered within 15 days falls short of TRAI specified benchmark. But the service provider's score is deemed to be good as BSNL was found to be providing connections in rural as well as urban areas.
Live calling scores for all the operators were observed to be varying from 78% for RCOM to 97% for TATA teleservices

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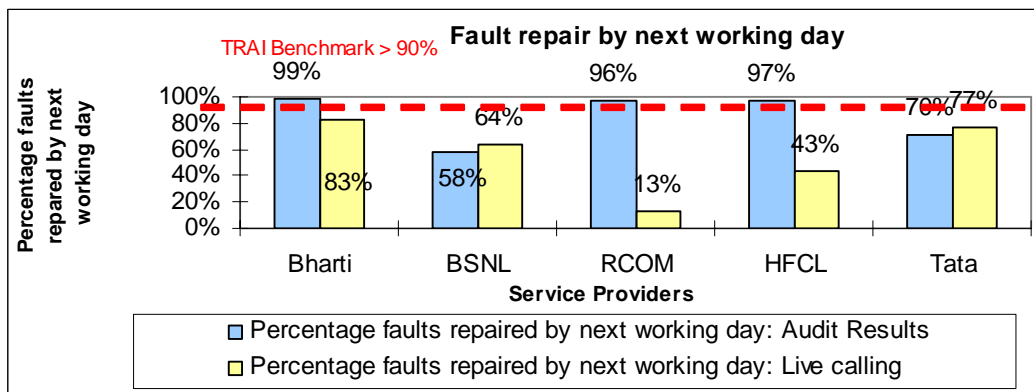


For fault repair by next working day BSNL and TATA falls short of the TRAI specified benchmark. For live calling scores only 13% of RCOM subscribers called claimed that the faults reported by them where cleared by next working day. Bharti score for live calling is observed to be highest with a score of 83%.
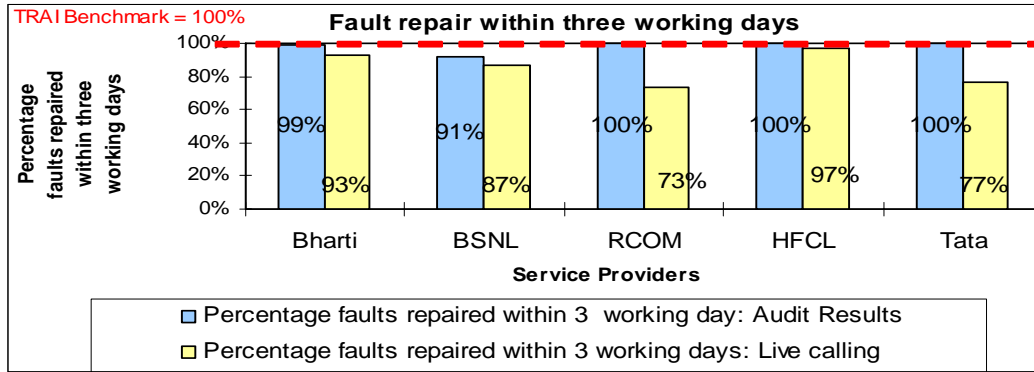
BSNL (by 9%) and Bharti (by 1%) fall short of TRAI specified benchmark for fault repair within 3 working days. Interestingly HFCL leads the way for live calling results with 97% of subscribers claiming that fault was repaired by three working days followed by Bharti at 93%

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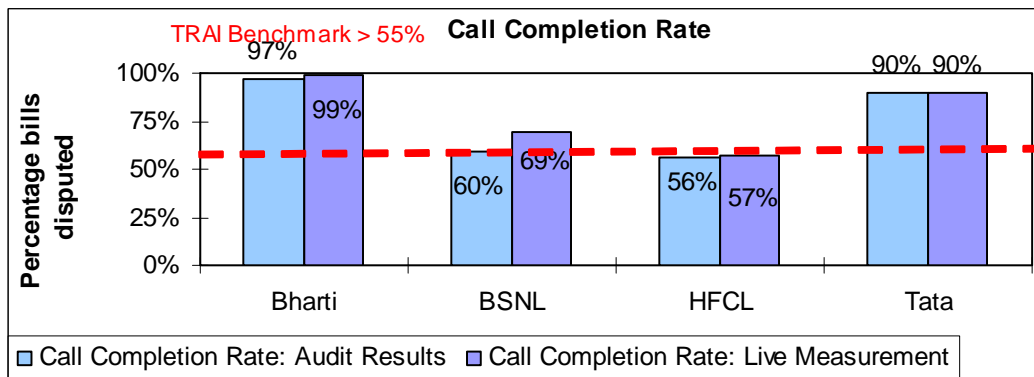


All the service providers were found to be meeting TRAI benchmark (55%) for Call Completion Rate both for live measurements and month in which the audit was carried out. However HFCL scores for live measurement were observed to be lowest in both the cases. As mentioned earlier Reliance does not have the technical capability to measure CCR and does not even report the same to TRAI.

## Percentage bills disputed
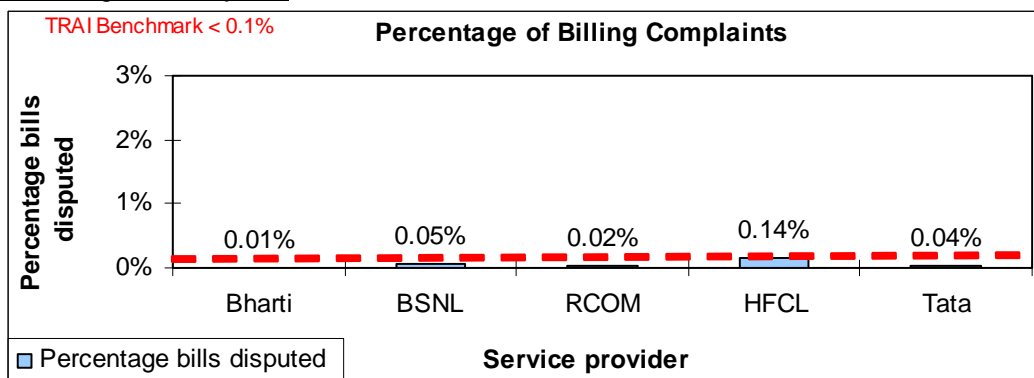


All the subscribers (except HFCL) meet the TRAI specified benchmark as percentage billing complaints remain <0.1% for all the operators

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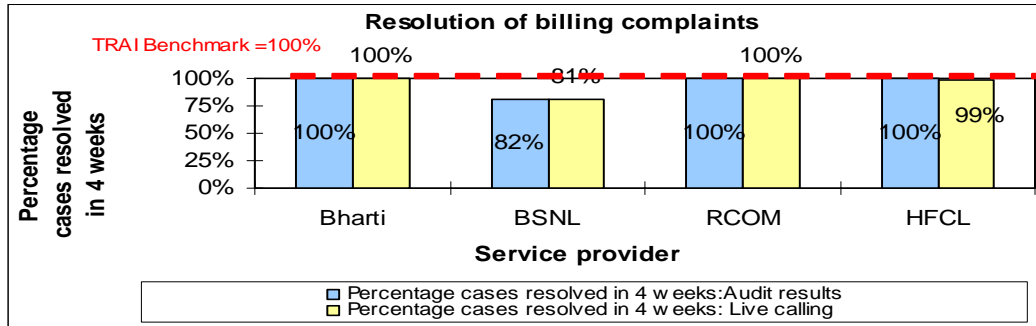


All the service providers (except BSNL at 82%) meet the TRAI specified benchmark for resolution of billing complaints within 4 weeks for the month of audit. For live calling results 81 % of BSNL subscribers and 100% of subscribers called for Bharti and RCOM claimed that their complain was resolved within 4 weeks. However sample calls made were low (<10) for RCOM owing to less billing complaints reported by customers. No cases of billing complaints were recorded for TATA

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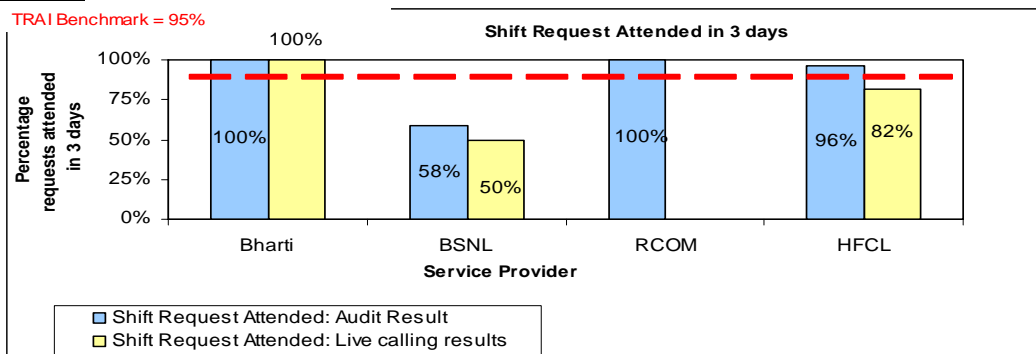


For shift requests attended within 3 days BSNL fall short of TRAI specified benchmark. For live calling Bharti leads with 100% subscribers claiming that request was attended in stipulated time followed by HFCL and BSNL at 82% and 50% respectively. Live calling could not carried out for Reliance because of non availability of data at the local office.

## Closure requests attended within 24 hours
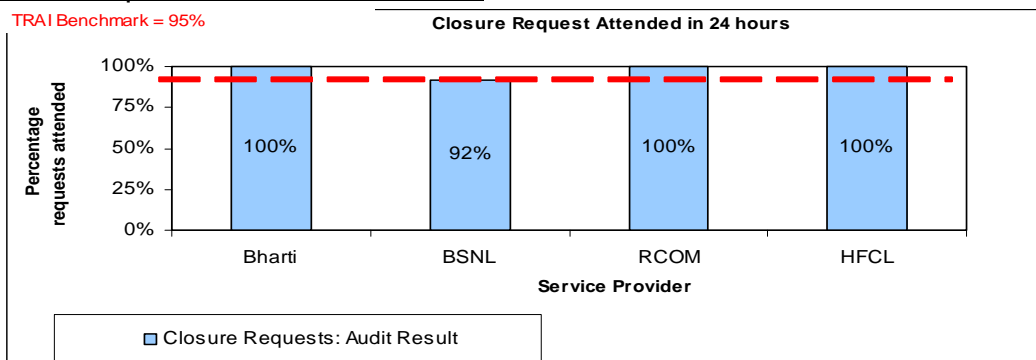


BSNL (at 92%), marginally falls short of the benchmark of 95% closure requests attended within 24 hours for the month of Audit

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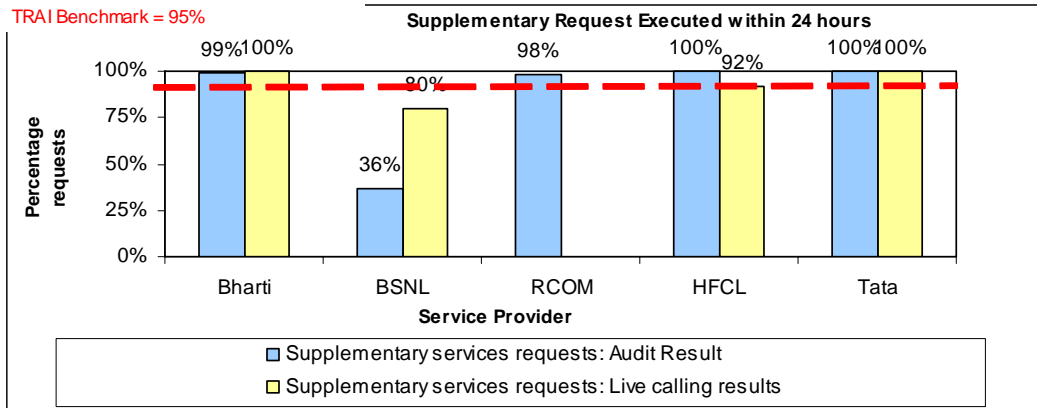


BSNL falls short of the TRAI specified benchmark of 95% "requests for additional services" to be attended within 24 hours for the month of Audit. For Live calling results as well BSNL score is observed to be the relatively (when compared to one month data) good with 80% of the total customers called claiming that the requests made by them were attended within 24 hours.

## Response time to customer for assistance - Calls answered electronically within 20 and 40 seconds (Comparison between one month audit live calling results)
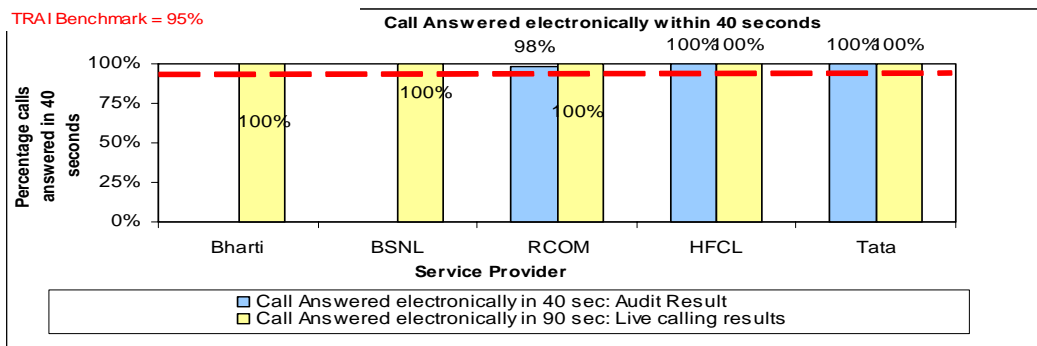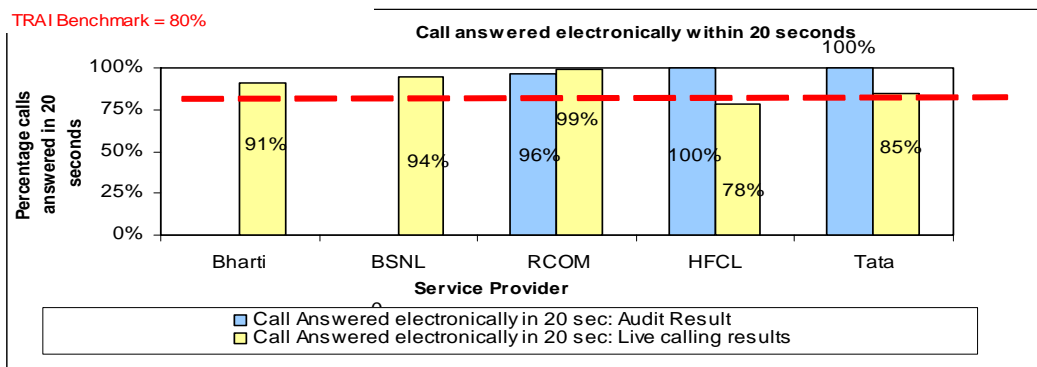




HFCL for live calling results marginally falls short of TRAI specfied benchmark of >80% calls answered by IVR within 20 seconds

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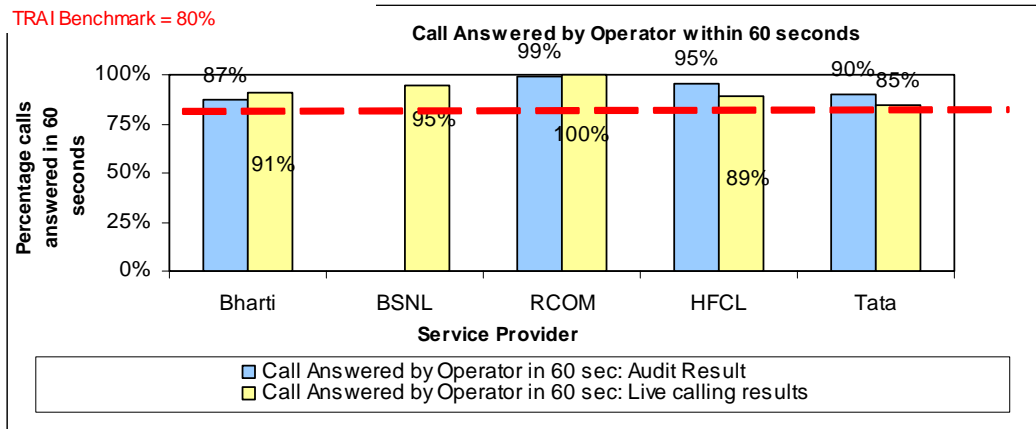


All the service providers comfortably meet the TRAI specified benchmark for calls answered by the operator within 60 seconds both for live calling and the month in which audit was carried out

## Response time to customer for assistance - Calls answered by the operator within 90 seconds (Comparison between one month audit results and live calling results)
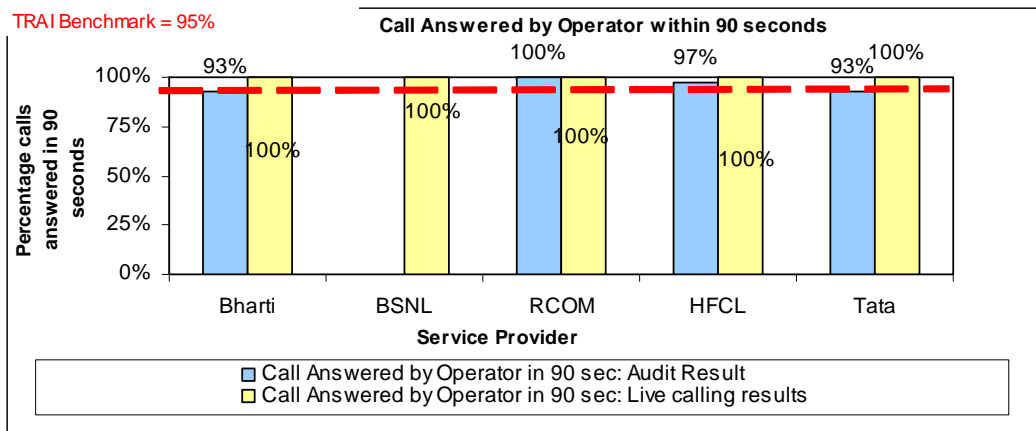


As per live calling results, the score on the parameter call answered by operator within 90 seconds for all the operators is observed to be 100%

## Time taken to refund of deposits after closure
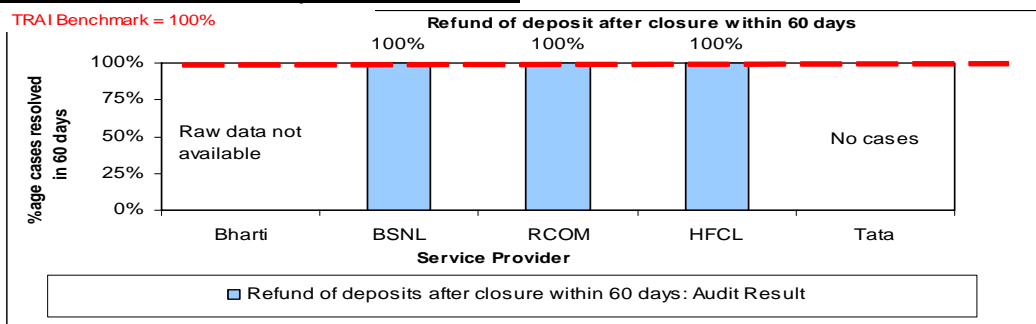


RCOM, BSNL and HFCL meet the TRAI specified benchmark for the month in which audit was carried out.

## 6.2 Graphical/Tabular Representations for Cellular Mobile Services

Accumulated Downtime
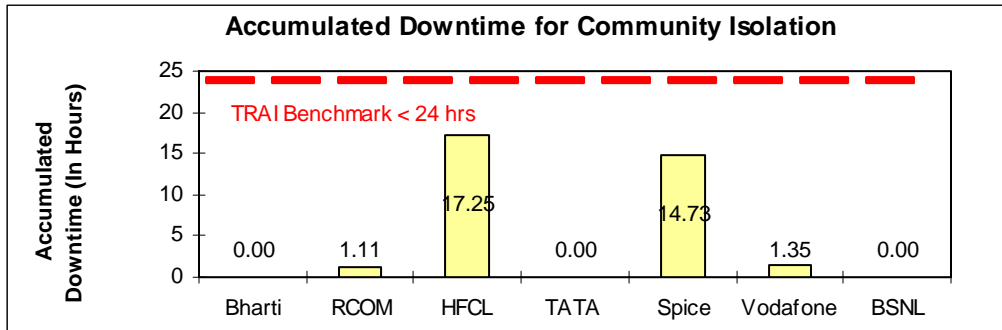


Only Bharti, BSNL & TATA did not experience a downtime in the Punjab circle in the month of audit. All other operators experienced a downtime in their network ranging from 1.11 hours for RCOM to 17.25 hours for HFCL.

Call Set-up Success Rate (CSSR)
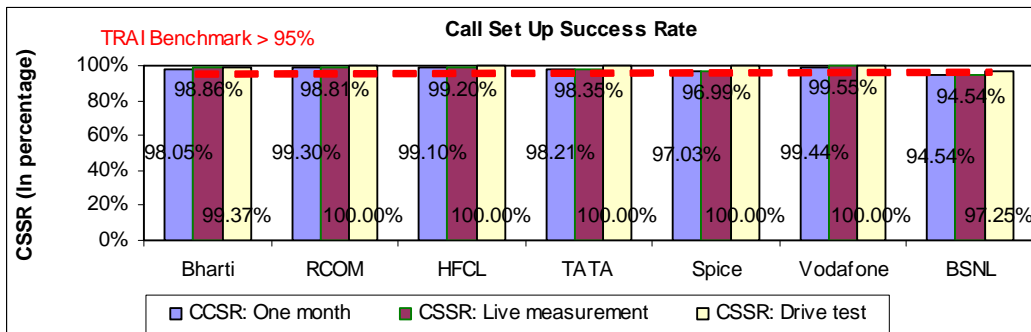


All the operators except, BSNL for the month of Audit and live measurement, are meeting the benchmark for the audit month, live measurement as well as the drive test.

Service Access Delay
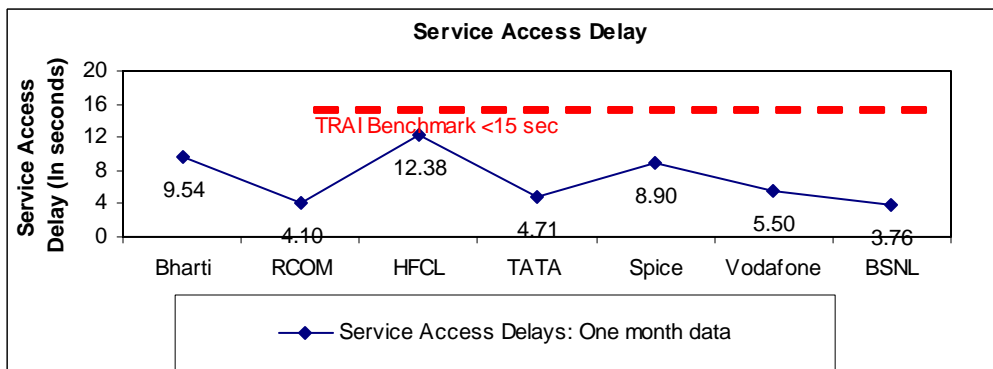


All the operators are meeting the benchmark. The auditors measured this parameter using a standard drive test tool kit. The highest service access delay was measured for HFCL at 12.38 seconds and the lowest was for BSNL at 3.76 seconds.

## SDCCH / Paging Channel Congestion
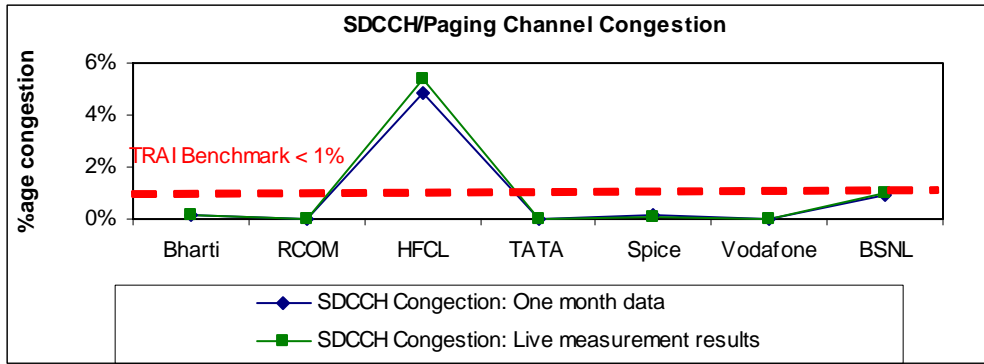


All the operators except HFCL meet the benchmark for the monthly audit period as well as three day live measurement. HFCL has around 5% congestion for both the monthly as well as three day live measurement.

## TCH Congestion
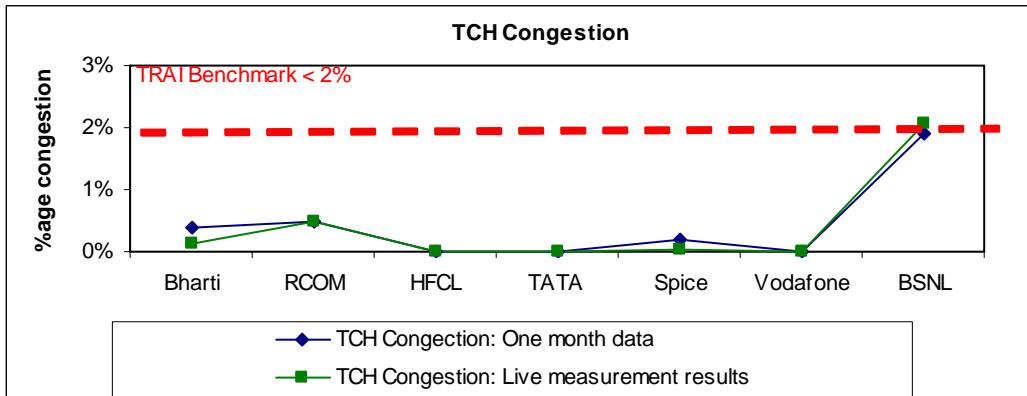


All the operators expect BSNL meet the TRAI benchmark for the three day live measurement. However, all the operators meet the TRAI specified benchmark for the monthly audit period.

## Call Drop Rate
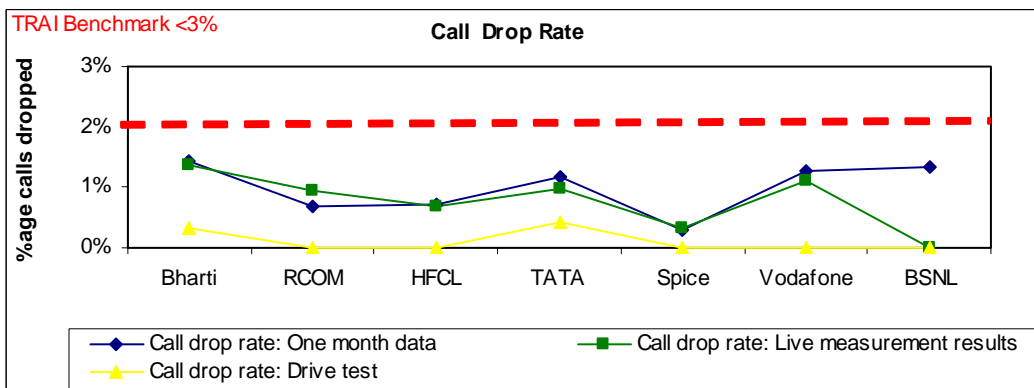


All the operators during the drive tests, three day live measurement and one month data verification meet the TRAI benchmark. The operator with the least call drop rates taking into consideration the figures for drive tests, live measurement and the month of audit is Spice.

## Voice quality
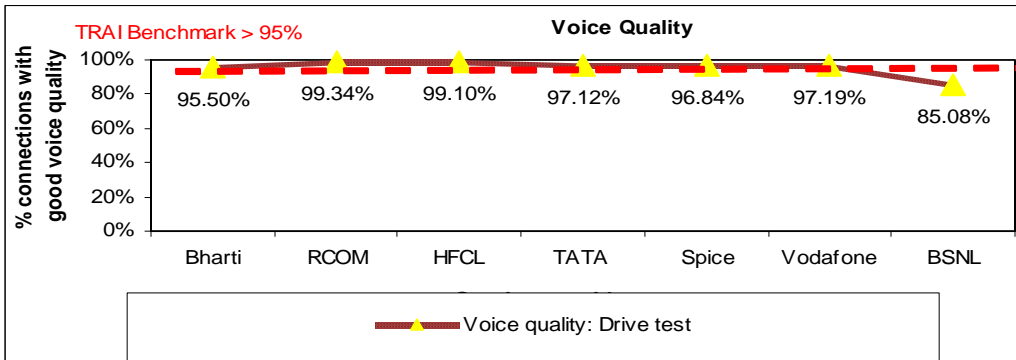


BSNL does not meet the TRAI benchmark as found out during the drive test. The lowest percentage of connections with good voice quality was observed across BSNL with 85.08% followed by Bharti at 95.50% and Spice at 96.84%. RCOM has the highest number of connections with good voice quality at 99.34%.

## Billing Disputes
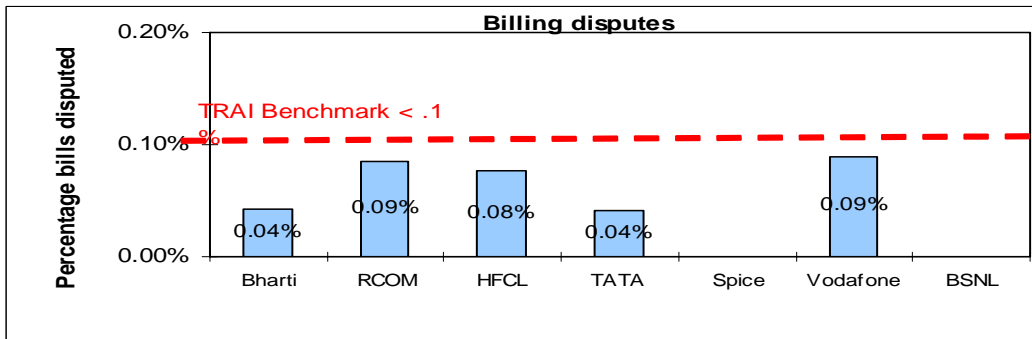


All the operators meet the TRAI benchmark on percentage billing disputes per 100 bills. Spice did not report the figures of the month of audit to the auditors while BSNL claimed that it did not receive any billing complaints during the month of audit.
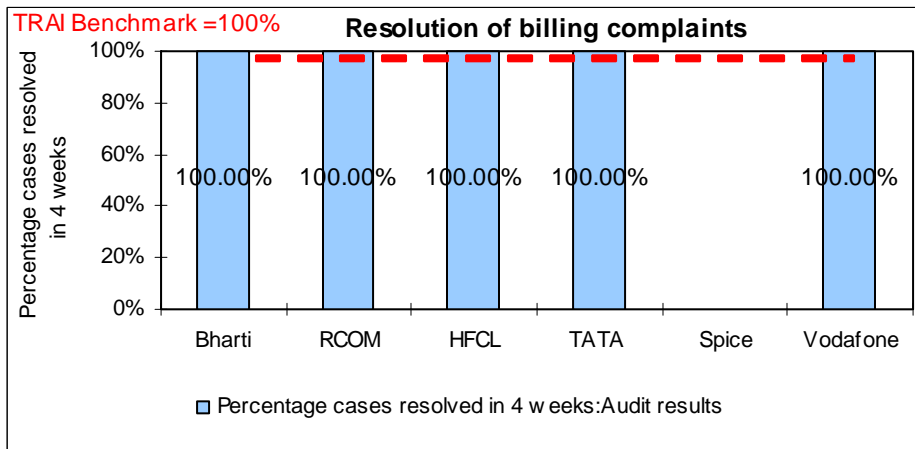


All the operators meet the TRAI benchmark of resolving 100% of the cases related to resolution of billing complaints for the month in which data was collected. However, the operators consider only

those as billing complaints where they have issued an internal ticket which essentially means that a refund is due to the customer. For billing details, Spice did not provide us any data while BSNL did not receive any complaints related to billing in the month of audit
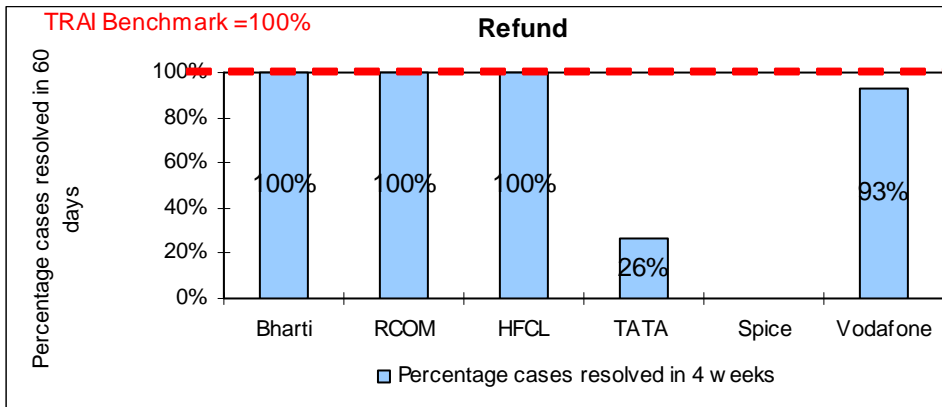


All the operators were found to giving the refunds to their subscribers within the stipulated time period except TATA and Vodafone. Only 26% of TATA subscribers who were due a refund claim to have been given the refund within the time stipulated by TRAI. For billing details, Spice did not provide us any data while BSNL did not receive any complaints related to billing in the month of audit.

## Live calling for billing Complaints

| Resolution of billing complaints | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total Number of calls made | 100 | 44 | 100 | 100 | DNP | 100 | 67 |
| Number of cases resolved in 4 weeks | 92 | 42 | 100 | 97 | DNP | 100 | 65 |
| Percentage cases resolved in four weeks | 92.00% | 95.45% | 100.00% | 97.00% | DNP | 100.00% | 97.01% |

Except for HFCL and Vodafone, none of the operators were able to meet the TRAI benchmark for the live calling aspect. Only 92% of Bharti subscribers say that their complaints were resolved within 4 weeks.

## Customer Care / Helpline:
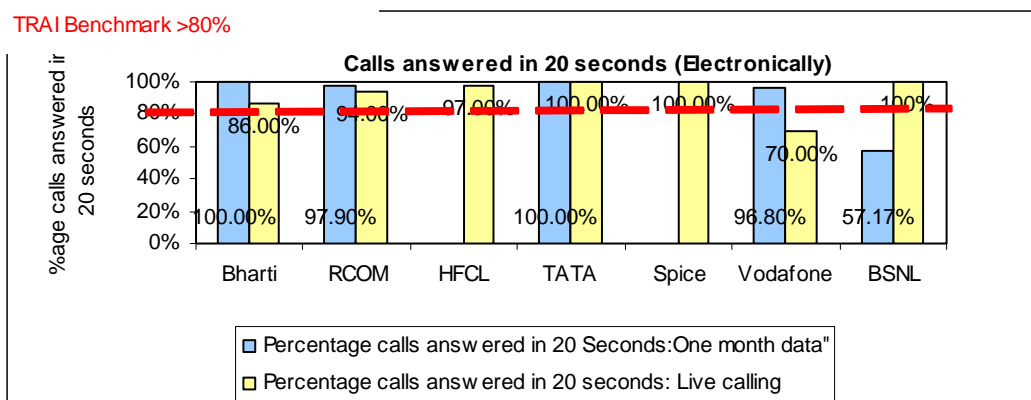
All the operators except Vodafone for live calling and BSNL for one month data verification meet the TRAI benchmark for IVR (Electronic) answering of customers' calls for the one month data as well as the live calling that was carried out during the audit. Spice did not provide the customer care details while HFCL does not measure IVR related parameters.
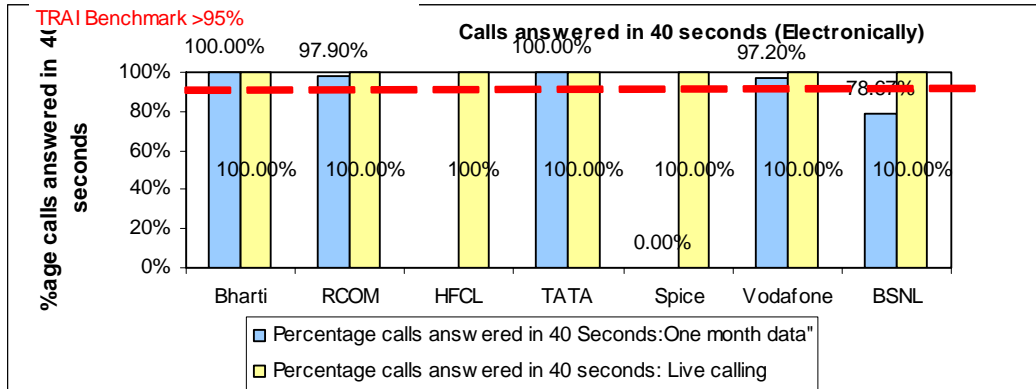


However, except for BSNL for the one month data verification, all other operators meet the TRAI benchmark for both the one month data as well as the live calling for voice to voice calls answered within 60 seconds.
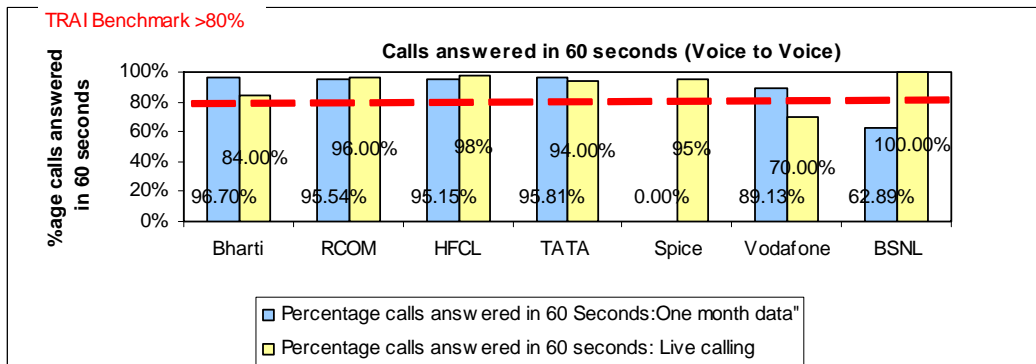


Except for Vodafone (70% calls answered by the operator in 60 seconds) for the live calling aspect and BSNL for the month period at 62.89%, all other operators meet the TRAI benchmark for both the one month data as well as the live calling for voice to voice calls answered within 60 seconds.
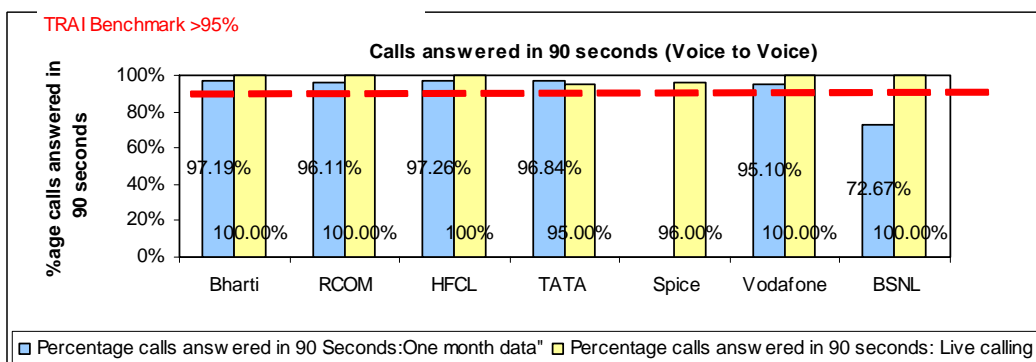
Except for BSNL for the month period at 72.67%, all other operators meet the TRAI benchmark for both the one month data as well as the live calling for voice to voice calls answered within 90 seconds.

Inter Operator Call Assessment

| Inter operator call Assessment (To/From) | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Bharti | NA | 94% | 100% | 100% | 100% | 98% | 89% |
| BSNL | 100% | 91% | 90% | 81% | 100% | 82% | NA |
| Vodafone | 100% | 95% | 100% | 100% | 100% | NA | 86% |
| TATA | 100% | 100% | 98% | NA | 100% | 94% | 100% |
| HFCL | 92% | 88% | NA | 100% | 100% | 100% | 84% |
| RCOM | 100% | NA | 96% | 96% | 100% | 96% | 97% |
| Spice | 100% | 100% | 100% | 100% | NA | 93% | 92% |

In the inter-operator call assessment, calls were made from the test sims of service provider whose audit was being conducted to all the other service providers. The calls from Bharti to all other service providers were established in the range of 92% to 100%. Similarly BSNL's connectivity with all the operators was found to be in the range of 84% to 100% of its calls to numbers of other operators got connected. It had maximum difficulty in connecting to an HFCL number. However, Vodafone has maximum difficulty in connecting to a BSNL number with only 82% of its calls getting connected. TATA had problems in connecting to BSNL with only 81 out of 100 of its calls getting established. Also, RCOM's connectivity to HFCL was not good with only 88 out of 100 calls getting connected. Spice did not have any problem in connecting to any of the operators with all 100% of its calls getting established.

## 6.3 Graphical/Tabular Representations for Broadband services

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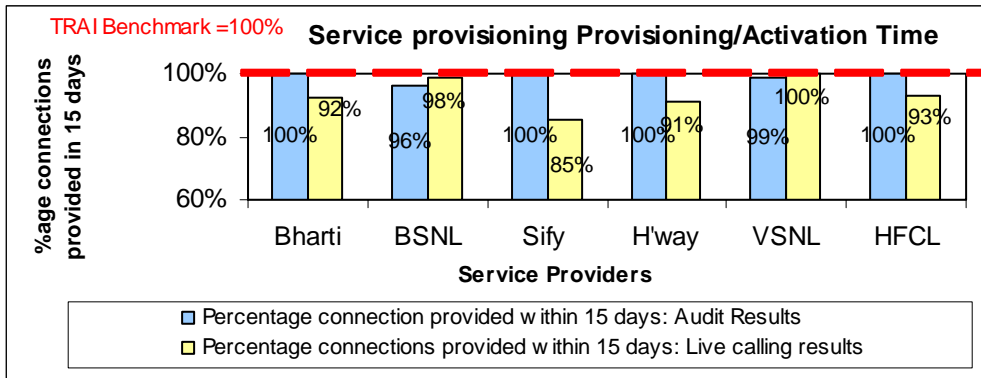


BSNL and VSNL marginally fall short of the benchmark for the month of Audit. Lowest live calling scores are observed for Sify at 85% and Highest is observed for VSNL at 100%

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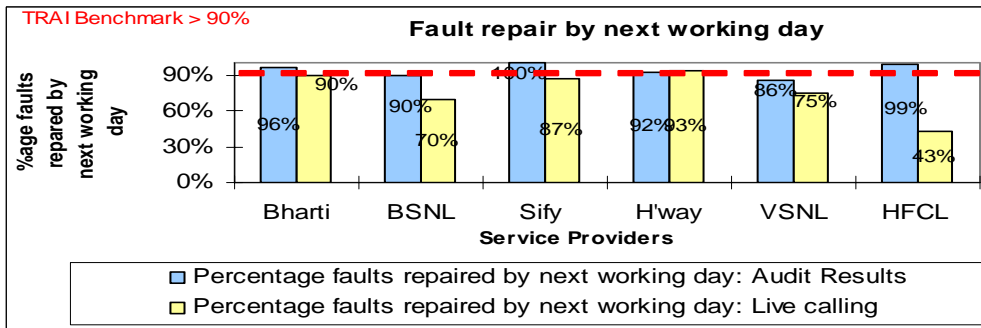


Highest scores on live calling are observed for Bharti at 90% followed Sify at 87%. Lowest score on live calling is observed for HFCL at 43%

It should be noted that VSNL (TATA communications) which does not meet the benchmark for one month data collection includes billing complaints while calculating percentage faults repaired within three working days.

Fault repair/Restoration time within three working days (Comparison between one month audit results and live calling results
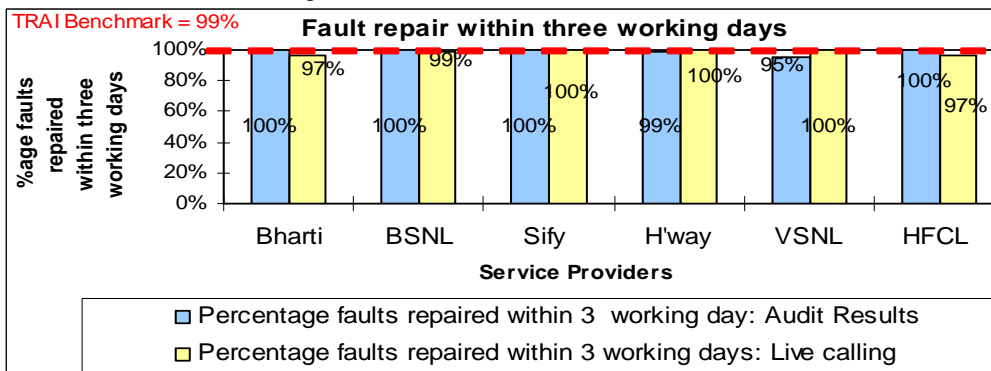
All the subscribers are meeting or close to meeting the benchmark both for live calling and one month data audit

## Percentage bills disputed
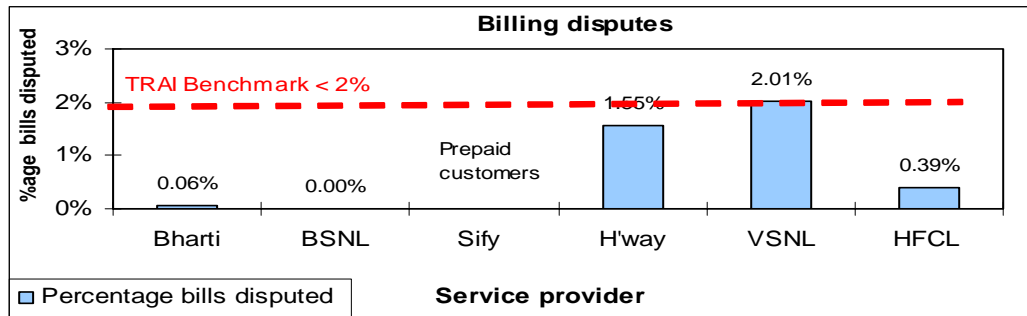


All the operators except (VSNL) meet the benchmark on percentage bills disputed, Sify claims that all its retail customers are prepaid customers and hence there are no billing complaints.

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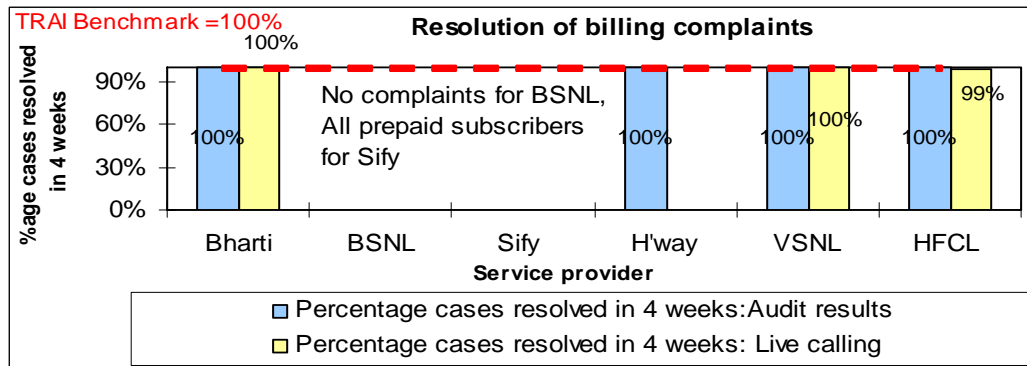


All the operators meet the TRAI specified benchmark for Percentage billing complaints resolved within four weeks during the month of Audit. Live calling could not be carried out for Hathaway owing to very few billing complaints reported in the month prior to visit of audit.

## Response time to customer for assistance - Calls answered by the operator within 60 seconds (Comparison between one month audit results and live calling results)
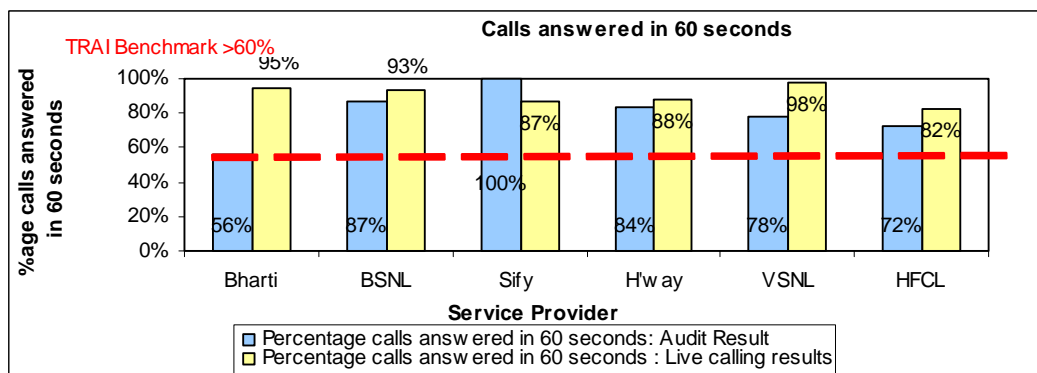
Bharti does not meet the TRAI specified benchmark for calls answered within 60 seconds by the operator for the month in which audit was carried out

**Response time to customer for assistance - Calls answered by the operator within 90 seconds (Comparison between one month audit results and live calling results)**
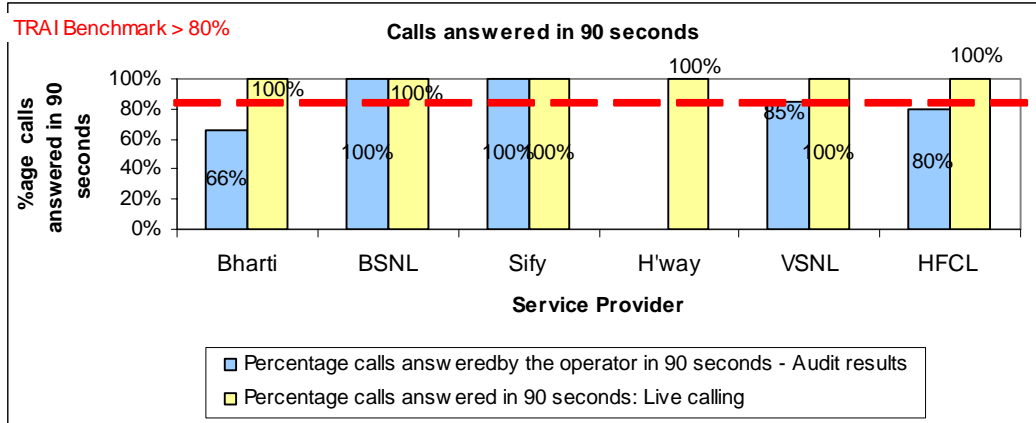


Bharti does not meet the TRAI specified benchmark for calls answered within 90 seconds by the operator for the month in which audit was carried out. Hathaway was unable to provide the details for calls answered within 90 seconds.

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

| Bandwidth Utilization | B'mark | Bharti | BSNL | Sify | H'way | VSNL | RCOM |
|---|---|---|---|---|---|---|---|
| One month Audit Results | | | | | | | |
| Total number of intra network links | | 144 | BRAS-23,T1-24,T2-610, DSLAMS-5456 | 400 | 3 | 16 | 5 |
| No of Intra network found to be above 90% | <80% | 0 | Uplink Traffic in Chennai BRAS is > 90% | 4 | 0 | 1 | 0 |
| Live measurement Results | | | | | | | |
| No of Intra network Links tested | | 15 | 20 | 37 | 3 | 10 | 0 |
| No of Intra network found to be above 90% | <80% | 0 | 0 | 0 | 0 | 0 | 0 |

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

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

However, the level from which the bandwidth utilization at Intra network links is being reported varied because of the difference in networks. For e.g. Bharti was found to be reporting Bandwidth from links running from each RSU (Collection of DSLAM's) to the main node in a circle. Whereas

VSNL considers the links between core distribution routers (lo9cated at 8 locations in India) and Routers being used for National long distance connectivity (Located at Chennai, Ernakkulam and Mumbai)

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

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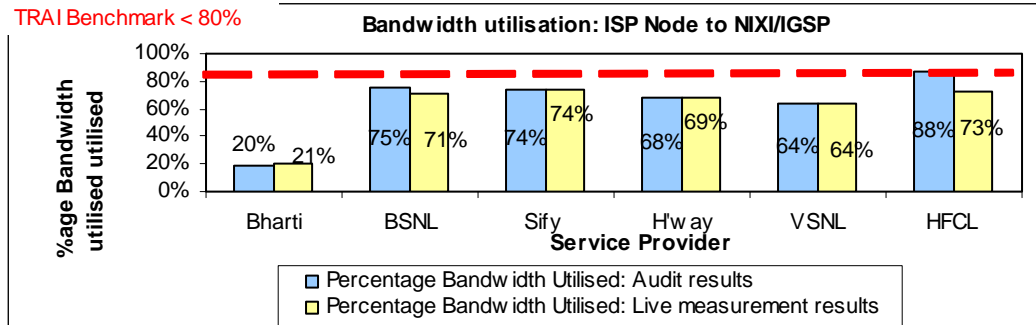


BSNL, Sify and VSNL (TATA Communications) meet the TRAI specified benchmark cumulatively for all gateways in India. For Bharti and Hathaway upstream links (to IGSP/NIXI) are physically located in Delhi.

## Broadband connection speed available to sample subscribers – Live calling results

| Download Speed | Benchmark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Percentage speed observed cumulatively for sample calls made | >80% | 59% | 90% | 75% | 75% | 74% | 84% |

All the service providers are 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 HFCL and BSNL comfortably meet the benchmark. Sify, VSNL and Hathaway (marginally by 5 to 6%) fall short the TRAI specified benchmark on download speed available to the customer. Bharti scores are observed to lowest at 59%.

Live calling scores are obtained cumulatively for sample calls made to customers across Punjab

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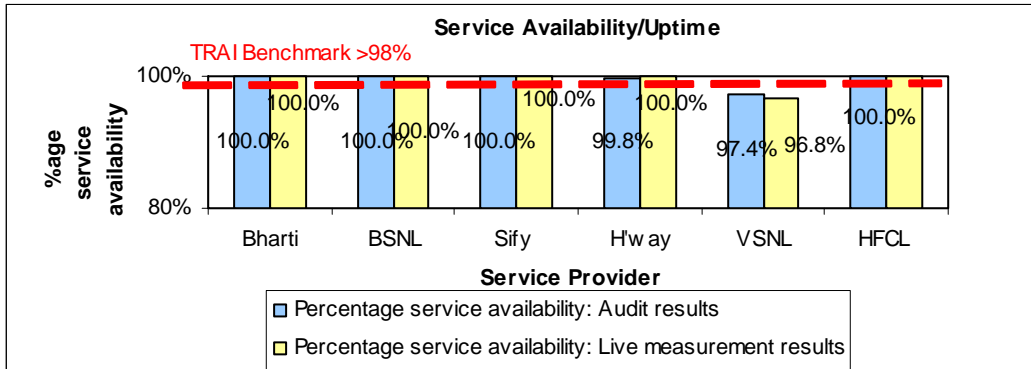


Most of the service providers meet the benchmark with uptime of more than 98% for the month of Audit. VSNL (TATA communications) marginally falls short of the benchmark during live measurements and month in which audit was carried out. However it should be considered that the service provider is taking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

# Compliance reports: Results of Verification of Records for October to December 2007
## 7.1 Basic (Wireline) services

| | | Bharti | | BSNL | | RCOM | | TATA | | HFCL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PMR | IMRB | PMR* | IMRB | PMR | IMRB | PMR | IMRB | PMR | IMRB |
| 1 | Provision of telephone after registration of demand | | | | | | | | | | |
| 1.1 | Percentage connections completed within 7 days | 100% | 100% | 89% | 89% | 91% | 91% | 100% | 100% | 98% | 98% |
| 2 | Fault incidence/clearance statistics | | | | | | | | | | |
| 2.1 | Fault incidence | <5 | 3.12 | 3.12 | 8.18 | 8.18 | Not reported | | | | 0.75 | 0.75 |
| 2.2 | Faults repaired within 24 hours | >90% | 95% | 95% | 75% | 75% | 100% | 98.8% | 75% | 75% | 99% | 99% |
| 2.3 | Mean time to repair | <8 hrs | 11.0 | 11.0 | 13.4 | 13.4 | 3.98 | 3.98 | 32.8 | 32.8 | 3.5 | 3.5 |
| 3 | Call Completion Rate (CCR) | >55% | 58% | 58% | 69% | 69% | Not measured by the operator | | 77% | 77% | 56% | 56% |
| 4 | Metering and billing credibility | | | | | | | | | | |
| 4.1 | Billing complaints per 100 bills issued | <0.1% | 0.00% | 0.00% | 0.02% | 0.02% | .005% | .005% | No cases | | 0.10% | 0.10% |
| 4.2 | %age of billing complaints resolved within 4 weeks | 100% | 0% | 0% | 89% | 89% | 100% | 100% | | | 99% | 99% |
| 5 | Customer care/helpline promptness | | | | | | | | | | |
| 5.1 | Shift requests (Total number received) | | | | | | | | | | |
| | Percentage shift requests attended within 3 days | 95% | 0.98 | 0.98 | 69% | 69% | 100% | 100% | No cases | | 98% | 98% |
| 5.2 | Closure request attended (Total number received) | | | | | | | | | | |
| | Closure within 24 hours | 95% | 77% | 77% | 96% | 96% | 99% | 99% | 100% | 100% | 100% | 100% |
| 5.3 | Supplementary (additional) service requests attended (Total number received) | | | | | | | | | | |
| | Additional facility provided within 24 hours | 95% | 98% | 98% | 73% | 73% | 99% | 99% | 100% | 98% | 100% | 100% |
| 6 | Response time to customer | | | | | | | | | | |
| 6.1 | % age call answered through IVR in 20 seconds | 80% | Not reported by the operator | | Details not available at the exchanges | | 98% | 98% | 100% | 100% | All calls answered in stipulated period of time | |
| | % age call answered through IVR in 40 seconds | 100% | | | | | 99% | 99% | 100% | 100% | | |
| 6.2 | % age calls answered by operator in 60 seconds | 80% | 97% | 97% | | | 97% | 97% | 85% | 85% | 94% | 94% |
| | % age calls answered by operator in 90 seconds | 95% | 98% | 98% | | | 99% | 99% | 86% | 86% | 97% | 97% |
| 7 | %age cases where refund received within 60 days | 100% | Details not available for verification | | 94% | 94% | 100% | 100% | No cases | | 100% | 100% |

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

| | | | |
|---|---|---|---|
| [yellow box] | Figures do not match with those reported in PMR | [blue box] Figures verified on all India basis | B'mark = TRAI Benchmark, DNA = Details not available, NA = Not Applicable |

**IMRB** international

## 7.2 Cellular Mobile services

| Parameter | SERVICE PROVIDER | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bharti | | RCOM | | HFCL | | TATA | | Spice | | Vodafone | | BSNL | |
| | PMR | IMRB | PMR | IMRB | PMR | IMRB | PMR | IMRB | PMR | IMRB | PMR | IMRB | PMR | IMRB |
| **Network Performance** | | | | | | | | | | | | | | |
| Accumulated Downtime | 13.28 hr | 13.28 hr | 0.17 hr | 0.17 hr | 4.30 hrs | 4.30 hrs | 0 | 0 | 4.61 | 4.61 | 2.31 hrs | 2.31 hrs | 1.03 hr | 1.03 hr |
| Call set up success rate | 99.29% | 99.29% | 99.40% | 99.40% | 97.10% | 97.10% | 98.34% | 98.34% | 98% | 98% | 99.44% | 99.44% | 98.40% | 98.40% |
| Service Access delay | 5.2 | 5.2 | 4.10 | 4.10 | 13.3 | 13.3 | 4.62 | 4.62 | 09.4 min | 09.4 min | < 10 sec | < 10 sec | 3.76 | 3.76 |
| Blocked call rate | | | | | | | | | | | | | | |
| *SDCCH Congestion* | 0.23% | 0.23% | 0% | 0% | 3.78% | 3.78% | 0.00% | 0.00% | 0.13% | 0.13% | 0.03% | 0.03% | 0% | 0% |
| *TCH Congestion* | 0.36% | 0.36% | 0% | 0% | 0.00% | 0.00% | 0.00% | 0.00% | 0.66% | 0.66% | 0.01% | 0.01% | 2% | 2% |
| Call drop rate | 1.30% | 1.30% | 0.60% | 0.60% | 0.64% | 0.64% | 0.94% | 0.94% | 0.80% | 0.80% | 1.35% | 1.35% | 2.80% | 2.80% |
| %age connections with good voice quality | 100.00% | 100.00% | 98.50% | 98.50% | 98.25% | 98.25% | 97.89% | 97.89% | 96.85% | 96.85% | 97.61% | 97.61% | 98.80% | 98.80% |
| Service coverage | Complied | | Complied | | Complied | | Complied | | Complied | | Complied | | Complied | |
| POI congestion | Complied | | Complied | | Complied | | Complied | | Complied | | Complied | | Complied | |
| **Customer Care** | | | | | | | | | | | | | | |
| Calls answered electronically | | | | | | | | | | | | | | |
| *Within 20 seconds* | 100.00% | 100.00% | 97.30% | 97.30% | Electronic segregation facility NA | | 100% | 100% | 100% | 100% | 97.56% | 97.56% | 100.00% | 100.00% |
| *Within 40 seconds* | 100.00% | 100.00% | 97.30% | 97.30% | | | 100% | 100% | 100% | 100% | 97.66% | 97.66% | 100.00% | 100.00% |
| Calls answered by the operator | | | | | | | | | | | | | | |
| *Within 60 seconds* | 98.20% | 98.20% | 82.00% | 82.00% | 94.30% | 94.30% | 84.80% | 84.80% | 96.00% | 96.00% | 96.90% | 96.90% | 93.00% | 93.00% |
| *Within 90 seconds* | 99.60% | 99.60% | 86.70% | 86.70% | 96.67% | 96.67% | 85.90% | 85.90% | 96.00% | 96.00% | 98.53% | 98.53% | 95.00% | 95.00% |
| **Billing complaints** | | | | | | | | | | | | | | |
| Billing complaints/100 bills | 0.01% | 0.01% | 0.09% | 0.09% | 0.07% | 0.07% | 0.07% | 0.07% | 0.06% | 0.06% | 0.03% | 0.03% | 0.07% | 0.07% |
| %age complaints resolved within 4 weeks | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |
| Period of refunds due to customers | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100.00% | 100.00% | 25% | 25% | < 4 weeks | < 4 weeks |

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

## 7.3 Broadband services

| Parameter | B'mark | Bharti | | BSNL | | Sify | | HFCL | |
|---|---|---|---|---|---|---|---|---|---|
| | | PMR | IMRB | PMR | IMRB | PMR | IMRB | PMR | IMRB |
| **Service provisioning** | | | | | | | | | |
| Percentage connections provided within 15 days | 100% | 100% | 100% | 100% | 99% | 100% | 100% | 100% | 100% |
| **Fault repair restoration time** | | | | | | | | | |
| Percentage faults repaired by next working days | > 90% | 96% | 96% | 94% | 92% | 91% | 91% | 100% | 100% |
| Percentage faults repaired within three working days | 99% | 99% | 99% | 100% | 100% | 99% | 99% | 100% | 100% |
| **Billing performance** | | | | | | | | | |
| Billing complaints per 100 bills issued | <2% | 0.02% | 0.00% | 0.06% | No cases found in sample PoPs | Prepaid | | 0.78% | 0.78% |
| %age of billing complaints resolved in 4 weeks | 100% | 100% | 100% | 100.00% | | | | 96% | 96% |
| %age cases in which refund of deposits after closure was made in 60 days | 100% | 95.00% | | | | | | 100% | 100% |
| **Customer care/helpline assessment (Voice to Voice)** | | | | | | | | | |
| Percentage calls answered within 60 seconds | > 60% | 91% | 91% | 81% | 89% | 88% | 88% | 83% | 82% |
| Percentage calls answered within 90 seconds | > 80% | 95% | 95% | 94% | 100% | 98% | 98% | 88% | 88% |
| **Bandwidth utilization/Throughput** | | | | | | | | | |
| *Intra network links (POP to ISP Node)* | | | | | | | | | |
| Total number of intra network links > 90% | | 0 | 0 | NR | 0 | 5 | 5 | 0 | 0 |
| *Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)* | | | | | | | | | |
| Percentage bandwidth utilized on upstream links | < 80% | 62% | 62% | NR | 78% | 85% | 85% | 56% | 56% |
| Broadband download speed | | No raw data available for verification | | | | | | | |
| **Service availability/uptime** | > 98% | 99.93% | 100% | NR | 100% | 100% | 100% | 100% | 100% |
| **Packet loss** | <2% | No raw data available for old ping test results | | NR | Complied* | No raw data available old ping test results | | | |
| **Network Latency** | | | | | | | | | |
| POP/ISP Node to NIXI | < 120 msec | | | NR | Complied* | | | | |
| ISP node to NAP port (Terresrtrial) | < 350 msec | | | NR | Complied* | | | | |

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

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

## Broadband services…..Ctd

| Parameter | Benchmark | VSNL | | Hathaway | |
|---|---|---|---|---|---|
| | | PMR | IMRB | PMR | IMRB |
| **Service provisioning time** | | | | | |
| Percentage connections provided within 15 days | 100% | 100% | 100%^^ | 100% | 100% |
| **Fault repair restoration time** | | | | | |
| Percentage faults repaired by next working days | > 90% | 88% | 88%^^ | 90% | 90% |
| Percentage faults repaired within three working days | 99% | 95% | 95%^^ | 99% | 99% |
| **Billing performance** | | | | | |
| Billing complaints per 100 bills issued | <2% | 1.22% | 1.22% | .01% | .01% |
| %age of billing complaints resolved in 4 weeks | 100% | 100.00% | 100.00% | 100% | 100% |
| %age cases in which refund of deposits after closure was made in 60 days | 100% | 100% | 100% | No cases | |
| **Customer care/helpline assessment (Voice to Voice)** | | | | | |
| Percentage calls answered within 60 seconds | > 60% | 86% | 86% | Details not available | |
| Percentage calls answered within 90 seconds | > 80% | 90% | 90% | | |
| **Bandwidth utilisation/Throughput** | | | | | |
| *Intra network links (POP to ISP Node)* | | | | Not reported by the operator | |
| Total number of intra network links > 90% | | 0 | 0 | | |
| *Upstream Bandwidth (ISP Node to NIXI/NAP/IGSP)* | | | | | |
| Percentage bandwidth utilised on upstream links | < 80% | 73% | 73% | Upstream links located in Delhi | |
| Broadband download speed | | >80% | No raw data available for verification | | |
| Service availability/uptime | > 98% | 97.82% | 97.82% | 99.26% | 99.26% |
| **Packet loss** | <2% | No raw data available for verification | | | |
| **Network Latency** | | | | | |
| POP/ISP Node to NIXI | < 120 msec | | | | |
| ISP node to NAP port (Terresrtrial) | < 350 msec | | | | |

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

## 7.4 Conclusions

### 7.4.1 Basic Wireline Services

1. For RCOM parameters related to customer care are reported on an all India level
2. During verification process carried out at exchanges it was observed that customer care data is not maintained at the exchanges as service provider has a centralized call centre.

### 7.4.2 Cellular Mobile services

1. All the figures reported in the PMR for all the service providers matched during the audit
2. TATA and RCOM do not meet the TRAI benchmark for customer care (voice to voice)
3. Vodafone does not meet the TRAI benchmark for period of refunds in the Punjab circle
4. RCOM reported the IVR figures on all India basis
5. HFCL does not report the figures for calls answered by IVR

### 7.4.3 Broadband services

1. Complete data for Sify was verified on an all India level
2. For BSNL there is slight variation observed in for some parameters when compared to the figures reported in PMR. But the reason is largely the fact that data was obtained for sample 5% of exchanges whereas reporting is done for 100% of exchanges.
3. 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. Most of the service providers (except BSNL) were also found to be unaware of TRAI specified guideline for carrying out ping tests of 1000 packets of 64 bytes each.
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 except BSNL
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 maintained only by BSNL

# 8. Annexure - I

## 8.1 Parameter wise performance reports for Basic Wireline services

One month data verification results for Service provisioning

| Service provisioning/Activation time | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Number of connections registered during the period | | 3422 | 973 | 3043 | 4637 | 58 |
| Total number of connections provided within 7 days | | 3422 | 646 | 2263 | 4603 | 56 |
| Percentage of connections provided within 7 days | 100% | 100% | 66% | 74% | 99% | 97% |

Live calling results for Service provisioning

| Service Provisioning/Activation Time | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of service registration calls made | | 100 | 984 | 100 | 100 | 31 |
| Number of cases in which connection was provided in 7 Days | | 89 | 816 | 78 | 92 | 30 |
| Percentage cases in which connection was provided in 7 days | 100% | 89% | 83% | 78% | 92% | 97% |

One month data verification results for Fault repair/Restoration time

| Fault Repair/Restoration time | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total number of faults registered during the period | | 1813 | 12225 | 5022 | 10996 | 27 |
| Total number of faults repaired by next working day | | 1795 | 7151 | 4842 | 10688 | 19 |
| Percentage of faults repaired by next working day | >90% | 99% | 58% | 96% | 97% | 70% |
| Total number of fault reparied within three working days | | 1795 | 11167 | 5022 | 10961 | 27 |
| Percentage faults repaired within three working days | 100% | 99% | 91% | 100% | 100% | 100% |

Live calling results for Fault repair/Restoration time

| Fault Repair | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of calls made | | 30 | 1409 | 30 | 30 | 26 |
| Number of cases where fauls were repaired by next working day | | 25 | 906 | 4 | 13 | 20 |
| Percentage cases where faults were repaired by next working day | >90% | 83% | 64% | 13% | 43% | 77% |
| Number of cases where faults were repaired within 3 days | | 28 | 1223 | 22 | 29 | 20 |
| Percentage cases where faults were repaired within 3 days | 100% | 93% | 87% | 73% | 97% | 77% |

### One month data verification results for CCR

| Traffic statistics - Call Completion Rate | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total local call attempts | | 39845280 | 31279 | DNA | 737722 | 264498 |
| Total number of successful local calls | | 38490372 | 18615 | DNA | 410862 | 238159 |
| Call Completion Rate (CCR) in the local network | >55% | 97% | 60% | DNA | 56% | 90% |

### Live measurement results for CCR

| Traffic statistics - Call Completion Rate | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total local call attempts | | 695472 | 56319 | DNA | 2228372 | 11440 |
| Total number of successful local calls | | 687392 | 39141 | DNA | 1265244 | 10241 |
| Call Completion Rate (CCR) in the local network | >55% | 99% | 69% | DNA | 57% | 90% |

### One month data verification results for Billing performance

| Billing Performance | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Billing disputes | | | | | | |
| Total bills generated during the period | | 21957 | 76255 | 76726 | 79269 | 2254 |
| Total number of bills disputed | | 2 | 38 | 13 | 114 | 1 |
| Percentage bills disputed | 0.10% | 0.01% | 0.05% | 0.02% | 0.14% | 0.04% |
| Resolution of billing complaints | | | | | | |
| Total complaints resolved in 4 weeks from date of receipt | | 2 | 31 | 13 | 114 | 0 |
| Percentage complaints resolved within 4 weeks of date of receipt | 100% | 100% | 82% | 100% | 100% | 0% |

### Live calling results for Billing performance

| Resolution of billing complaints | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of calls made | | 50 | 37 | 8 | 100 | 1 |
| Number of cases resolved in 4 weeks | | 50 | 30 | 8 | 99 | 1 |
| Percentage cases resolved in four weeks | 100% | 100% | 81% | 100% | 99% | 100% |

### One month data verification for Customer Care – Shifts

| Customer Care - Shift Requests | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of shift requests received | | 247 | 154 | 21 | 208 | 0 |
| Total number requests attended in 3 days | | 247 | 90 | 21 | 200 | 0 |
| Total number requests attended beyond 3 days | | 0 | 71 | 0 | 8 | 0 |
| Shifts not attended | | 0 | 1 | 0 | 0 | 0 |
| Percentage of requests attended in 3 days | 95% | 100% | 58% | 100% | 96% | NA |
| Percentage of requests attended beyond 3 days | | 0% | 46% | 0% | 4% | NA |
| Percentage of shifts not attended | | 0% | 1% | 0% | 0% | NA |

## Live calling results for Customer Care – Shifts

| Customer Care - Shift Requests | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total number of call to shift requests | | 50 | 188 | 0 | 50 | 0 |
| Total number of requests attended in 3 days | 95% | 50 | 94 | 0 | 41 | 0 |
| Total number of requests attended beyond 3 days | | 0 | 92 | 0 | 9 | 0 |
| Shifts not attended | | 0 | 2 | 0 | 0 | 0 |
| Percentage of requests attended in 3 days | | 100% | 50% | NA | 82% | NA |
| Percentage of requests attended beyond 3 days | | 0% | 49% | NA | 18% | NA |
| Percentage of shifts not attended | | 0% | 1% | NA | 0% | NA |

## One month data verification Audit results for Customer Care – Closures

| Customer Care - Closure Requests | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of closure requests received | | 1624 | 922 | 1833 | 1950 | 0 |
| Total closure attended within 24 hours | 95% | 1624 | 848 | 1827 | 1950 | 0 |
| Total number of requests attended beyond 24 hours | | 0 | 73 | 0 | 0 | 0 |
| Closure requests not attended | | 0 | 1 | 0 | 0 | 0 |
| Percentage of closure attended within 24 hours | | 100% | 92% | 100% | 100% | NA |
| Percentage of closure attended beyond 24 hours | | 0% | 8% | 0% | 0% | NA |
| Percentage of closures not attended | | 0% | 0% | 0% | 0% | NA |

## Live calling results for Customer Care – Supplementary requests

| Customer Care - Supplementary Requests | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of supplementary requests received | | 50 | 293 | 0 | 50 | 20 |
| Total number requests attended within 24 hours | 95% | 50 | 233 | 0 | 46 | 20 |
| Total number requests attended beyond 24 hours | | 0 | 50 | 0 | 4 | 0 |
| Supplementary requests not attended | | 0 | 0 | 0 | 0 | 0 |
| Percentage of requests attended within 24 hours | | 100% | 80% | NA | 92% | 100% |
| Percentage of requests attended beyond 24 hours | | 0% | 17% | NA | 8% | 0% |
| Percentage of supplementary requests not attended | | 0% | 0% | NA | 0% | 0% |

## Live calling results for calls answered electronically

| Customer Care Assessment | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of calls dialed on toll free number | | 100 | 3550 | 100 | 100 | 100 |
| Calls answered within 20 seconds | | | | | | |
| Total Number of calls answered by IVR in 20 seconds | 80% | 91 | 3354 | 99 | 78 | 85 |
| Percentage calls answered in 20 seconds | | 91% | 94% | 99% | 78% | 85% |
| Calls answered within 40 seconds | | | | | | |
| Total Number of calls answered by IVR in 40 seconds | 95% | 100 | 3550 | 100 | 100 | 100 |
| Percentage calls answered in 40 seconds | | 100% | 100% | 100% | 100% | 100% |

## Live calling results for calls answered by the operator

| Customer Care Assessment | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of calls dialed on toll free number | | 100 | 3550 | 100 | 100 | 100 |
| Calls answered within 60 seconds | | | | | | |
| Total Number of calls answered by operator in 60 seconds | 80% | 91 | 3358 | 100 | 89 | 85 |
| Percentage calls answered in 60 seconds | | 91% | 95% | 100% | 89% | 85% |
| Calls answered within 90 seconds | | | | | | |
| Total Number of calls answered by operator in 90 seconds | 95% | 100 | 3550 | 100 | 100 | 100 |
| Percentage calls answered in 90 seconds | | 100% | 100% | 100% | 100% | 100% |

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

| Resolution of billing complaints | Benchmark | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|---|
| Total Number of cases requiring refund | | DNA | 2553 | 0 | 90 | 0 |
| Number of cases where refund was made in < 60 days | | DNA | 2543 | 0 | 90 | 0 |
| Percentage cases where refund was made in < 60 days | 100% | DNA | 100% | 100% | 100% | NA |

## Level 1 Services

| Level 1 services | Bharti | BSNL | RCOM | HFCL | Tata |
|---|---|---|---|---|---|
| TOTAL Calls Made | 200 | 560 | 200 | 300 | 200 |
| Answered in 60 seconds | 200 | 492 | 196 | 285 | 196 |
| Percentage calls answered in 60 seconds | 100% | 88% | 98% | 95% | 98% |

## 8.2 Parameter wise performance reports for Cellular Mobile services

| Accumulated Downtime | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total Downtime (In hours) | 0.00 | 1.11 | 17.25 | 0.00 | 14.73 | 1.35 | 0.00 |

Audit Results for CSSR

| CSSR | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total number of call attempts | 5759810 | DNP | 369419 | 39536347 | 4667891 | 3103739 | 63284160 |
| Total number of successful calls | 5647650 | DNP | 366100 | 38828551 | 4529157 | 3086376 | 59827170 |
| CSSR | 98.05% | 99.30% | 99.10% | 98.21% | 97.03% | 99.44% | 94.54% |

Live measurement results for CSSR

| CSSR | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total number of call attempts | DNP | DNP | 1213197 | 3170221 | 4636209 | 1578404 | 2109472 |
| Total number of successful calls | DNP | DNP | 1203507 | 3118062 | 4496533 | 1571275 | 1994239 |
| CSSR | 98.86% | 98.81% | 99.20% | 98.35% | 96.99% | 99.55% | 94.54% |

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

| CSSR | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total number of call attempts | 315 | 452 | 468 | 483 | 219 | 202 | 218 |
| Total number of successful calls | 313 | 452 | 468 | 483 | 219 | 202 | 212 |
| CSSR | 99.37% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 97.25% |

DNP – the figure was obtained directly from the system.

| Service Access Delay | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| One month data collection | 9.54 | 4.10 | 12.38 | 4.71 | 8.90 | 5.50 | 3.76 |

Audit results for SDCCH and TCH Congestion

| Traffic Statistics | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| SDCCH Congestion | | | | | | | |
| Total number of SDCCH Attempts | 11937513 | DNP | 92661 | 380704 | 6585650 | 4318823.00 | 18285339 |
| Total Number of SDCCH Congestions | DNP | DNP | 4497 | 0 | DNP | DNP | 169054 |
| Percentage SDCCH Congestion | 0.13% | 0.00% | 4.85% | 0.00% | 0.12% | 0.02% | 0.92% |
| TCH Congestion | | | | | | | |
| Total number of TCH Attempts | 5759810 | DNP | 1465626 | 1317878 | 4667891 | 2515993.00 | 7622681 |
| Total Number of TCH Congestions | DNP | DNP | 70 | 0 | DNP | DNP | 144511 |
| Percentage TCH Congestion | 0.39% | 0.48% | 0.00% | 0.00% | 0.18% | 0.01% | 1.90% |

Live measurement results for SDCCH and TCH Congestion

| Traffic Statistics | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| SDCCH Congestion | | | | | | | |
| Total number of SDCCH Attempts | DNP | DNP | 287936 | 383170 | DNP | 2919400.00 | 173683896 |
| Total Number of SDCCH Congestions | DNP | DNP | 15542 | 0 | DNP | DNP | 1708102 |
| Percentage SDCCH Congestion | 0.12% | 0.00% | 5.40% | 0.00% | 0.04% | 0.01% | 0.98% |
| TCH Congestion | | | | | | | |
| Total number of TCH Attempts | DNP | DNP | 4632047 | 1132555 | DNP | 1296799.00 | 193223342 |
| Total Number of TCH Congestions | DNP | DNP | 8 | 0 | DNP | DNP | 3958253 |
| Percentage TCH Congestion | 0.14% | 0.47% | 0.00% | 0.00% | 0.04% | 0.00% | 2.05% |

DNP – the figure was obtained directly from the system.

## Audit Results for Call drop rate

| Call drop rate | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total number of calls established | 5647565 | DNP | 366100 | 31494965 | 4524157 | 2662907 | 7622681 |
| Total number of calls dropped | 81324 | DNP | 2603 | 372780 | 13855 | 33609 | 100947 |
| Call drop rate | 1.44% | 0.70% | 0.71% | 1.18% | 0.31% | 1.26% | 1.32% |

### Live measurement results for Call drop rate

| Call drop rate | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total number of calls established | DNP | DNP | 1203507 | 2992356 | 4496533 | 1296799.00 | DNP |
| Total number of calls dropped | DNP | DNP | 8099 | 29533 | 14928 | 14242.00 | DNP |
| Call drop rate | 1.36% | 0.94% | 0.67% | 0.99% | 0.33% | 1.10% | DNP |

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

| Call drop rate | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total number of calls established | 313 | 452 | 448 | 483 | 219 | 202.00 | 208 |
| Total number of calls dropped | 1 | 0 | 0 | 2 | 0 | 0.00 | 0 |
| Call drop rate | 0.32% | 0% | 0% | 0.41% | 0.00% | 0.00% | 0.00% |

DNP – the figure was obtained directly from the system.

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

| Voice quality | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total number of sample calls | 145098 | 14057 | 13499 | 15961 | 253209 | 225580 | 58730 |
| Total number of calls with good voice quality | 138573 | 13964 | 13378 | 15502 | 245205 | 219248 | 49966 |
| %age calls with good voice quality | 95.50% | 99.34% | 99.10% | 97.12% | 96.84% | 97.19% | 85.08% |

| Inter operator call Assessment (To/From) | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Bharti | NA | 94% | 100% | 100% | 100% | 98% | 89% |
| BSNL | 100% | 91% | 90% | 81% | 100% | 82% | NA |
| Vodafone | 100% | 95% | 100% | 100% | 100% | NA | 86% |
| TATA | 100% | 100% | 98% | NA | 100% | 94% | 100% |
| HFCL | 92% | NA | NA | 100% | 100% | 100% | 84% |
| RCOM | 100% | 88% | 96% | 96% | 100% | 96% | 97% |
| Spice | 100% | 100% | 100% | 100% | NA | 93% | 92% |

### Audit results for customer care (Electronically)

| Customer Care Assessment | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total Number of calls received by | 39123 | 40324997 | NA | 1585948 | DNP | 6875163.00 | 1225978 |
| Total Number of calls answered in 20 seconds | 39123 | 39476257 | Electronic segregation facility NA | 1585948 | DNP | 6655158.00 | 700950 |
| Percentage calls answered in 20 seconds | 100.00% | 97.90% | | 100.00% | DNP | 96.80% | 57.17% |
| Total Number of calls answered in 40 seconds | 39123 | 39476257 | Electronic segregation facility NA | 1585948 | DNP | 6682658.00 | 964529 |
| Percentage calls answered in 40 seconds | 100.00% | 97.90% | | 100.00% | DNP | 97.20% | 78.67% |

### Live calling results for customer care (Electronically)

| Customer Care Assessment | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total Number of calls received by the operator | 100 | 50 | 100 | 100 | 100 | 100.00 | 50 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Number of calls answered in 20 seconds | 86 | 47 | 97 | 100 | 100 | 70.00 | 50 |
| Percentage calls answered in 20 seconds | 86% | 94.00% | 97.00% | 100.00% | 100.00% | 70.00% | 100% |
| Total Number of calls answered in 40 seconds | 100 | 50 | 100 | 100 | DNP | 100.00 | 50 |
| Percentage calls answered in 40 seconds | 100% | 100.00% | 100% | 100.00% | 100.00% | 100% | 100.00% |

### Audit results for customer care (Voice to Voice)

| Customer Care Assessment | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total Number of calls received by the operator | 35673 | 441316 | 370208 | 506175 | DNP | 1496130.00 | 964529 |
| Total Number of calls answered in 60 seconds | 34496 | 421621 | 352263 | 484991 | DNP | 1333438.00 | 606637 |
| Percentage calls answered in 60 seconds | 96.70% | 95.54% | 95.15% | 95.81% | DNP | 89.13% | 62.89% |
| Total Number of calls answered in 90 seconds | 34670 | 424149 | 360080 | 490195 | DNP | 1422820.00 | 700950 |
| Percentage calls answered in 90 seconds | 97.19% | 96.11% | 97.26% | 96.84% | DNP | 95.10% | 72.67% |

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

| Customer Care Assessment | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total Number of calls made | 100 | 50 | 100 | 100 | 100 | 100.00 | 50 |
| Number calls answered within 60 seconds | 84 | 48 | 98 | 94 | 95 | 70.00 | 50 |
| Percentage calls answered in 60 seconds | 84.00% | 96.00% | 98% | 94.00% | 95% | 70.00% | 100.00% |
| Number calls answered within 90 seconds | 100 | 50 | 100 | 95 | 96 | 100.00 | 50 |
| Percentage calls answered in 90 seconds | 100.00% | 100.00% | 100% | 95.00% | 96.00% | 100.00% | 100.00% |

DNP – the figure was obtained directly from the system.

### Audit Results for Billing performance

| Billing Performance | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total bills generated during the period | 287893 | 94658 | 83222 | 1058280 | DNP | 140518 | 40752 |
| Total number of bills disputed | 124 | 81 | 64 | 439 | DNP | 126.00 | 0 |
| Percentage bills disputed | 0.04% | 0.09% | 0.08% | 0.04% | DNP | 0.09% | 0.00% |
| Total complaints resolved in 4 weeks from date of receipt | 124 | 81 | 64 | 439 | DNP | 126.00 | NA |
| Percentage complaints resolved within 4 weeks of date of receipt | 100.00% | 100.00% | 100.00% | 100.00% | DNP | 100.00% | NA |
| Total number of cases requiring refund of deposits | 8 | 81 | 189 | 160 | DNP | 543 | NA |
| Total number of cases where refund was made within 60 days | 8 | 81 | 189 | 42 | DNP | 504 | NA |
| Percentage cases in which refund was receive within 60 days | 100% | 100% | 100% | 26% | DNP | 93% | NA |

### Live calling results for resolution of billing complaints

| Resolution of billing complaints | Bharti | RCOM | HFCL | TATA | Spice | Vodafone | BSNL |
|---|---|---|---|---|---|---|---|
| Total Number of calls made | 100 | 44 | 100 | 100 | NA | 100 | 67 |
| Number of cases resolved in 4 weeks | 92 | 42 | 100 | 97 | NA | 100 | 65 |
| Percentage cases resolved in four weeks | 92.00% | 95.45% | 100.00% | 97.00% | NA | 100.00% | 97.01% |

DNP – the figure was obtained directly from the system.

## 8.3 Parameter wise performance reports for Broadband services

One month data verification results for Service provisioning

| Service provisioning/Activation time | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| No of connections registered during the period | | 2125 | 707 | 3 | 259 | 1119 | 436 |
| Total number registered during 15 days | | 2125 | 681 | 3 | 259 | 1108 | 436 |
| Percentage of connections provided within 15 days | 100% | 100.0% | 96% | 100.0% | 100% | 99.0% | 100.0% |

Live calling results for Service provisioning

| Service Provisioning/Activation Time | B'mark | Bharti | BSNL | Sify | H'Way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Total Number of calls made | | 65 | 191 | 47 | 100 | 47 | 100 |
| Number of cases in which connection was provided in 15 Days | | 60 | 188 | 40 | 91 | 47 | 93 |
| Percentage cases in which connection was provided in 15 days | 100% | 92% | 98% | 85% | 91% | 100% | 93% |

One month data verification results for Fault repair

| Fault Repair/Restoration time | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Total number of faults registered during the period | | 1768 | 2505 | 3 | 1294 | 15122 | 835 |
| Total number of faults repaired by next working day | | 1697 | 2249 | 3 | 1190 | 13005 | 827 |
| Percentage of faults repaired by next working day | >90% | 96% | 90% | 100% | 92% | 86% | 99% |
| Total number of faults repaired within three working days | | 1768 | 2505 | 3 | 1281 | 14366 | 835 |
| Percentage of faults repaired within three working days | >99% | 100% | 100% | 100% | 99% | 95% | 100% |

Live calling results for fault repair

| Fault Repair | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Total Number of calls made | | 30 | 120 | 30 | 30 | 8 | 30 |
| Number of cases in which faults were repaired by next working day | | 27 | 84 | 26 | 28 | 6 | 13 |
| Percentage cases in which faults were repaired by next working day | >90% | 90% | 70% | 87% | 93% | 75% | 43% |
| Number of cases in which faults were repaired within three working days | | 29 | 119 | 30 | 30 | 8 | 29 |
| Percentage cases in which faults were repaired within three working days | >99% | 97% | 99% | 100% | 100% | 100% | 97% |

## One month data verification results for billing performance

| Billing Performance | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Billing disputes | | | | | | | |
| Total bills generated during the period | | 36650 | 48769 | Prepaid | 193 | 7643 | 18830 |
| Total number of bills disputed | | 21 | 0 | | 3 | 154 | 73 |
| Percentage bills disputed | <2% | 0.06% | 0.00% | | 1.55% | 2.01% | 0.39% |
| Resolution of billing complaints | | | | | | | |
| Total complaints resolved in 4 weeks from date of receipt | | 21 | 0 | Prepaid | 3 | 154 | 73 |
| Percentage complaints resolved within 4 weeks of date of receipt | 100% | 100% | NA | | 100% | 100% | 100% |
| Refund of deposits after closure | | | | | | | |
| Total number of cases requiring refund of deposits | | Details not provided by operator | 0 | Prepaid | Details not provided by operato | 430 | 3 |
| Total number of cases where refund was made within 60 days | | | 0 | | | 430 | 3 |
| Percentage cases in which refund was receive within 60 days | 100% | | N0 cases | | | 100% | 100% |

## Live calling results for billing complaints

| Resolution of billing complaints | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Total Number of calls made | | 100 | 0 | Prepaid customers | 0 | 8 | 69 |
| Number of cases resolved in 4 weeks | | 100 | 0 | | 0 | 8 | 68 |
| Percentage cases resolved in four weeks | 100% | 100% | NA | | NA | 100% | 99% |

## Live calling results for call centre

| Customer Care Assessment | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Total Number of calls made | | 100 | 400 | 100 | 100 | 100 | 100 |
| Calls answered within 60 seconds | | | | | | | |
| Number calls answered within 60 seconds | | 95 | 373 | 87 | 88 | 98 | 82 |
| Percentage calls answered in 60 seconds | >60% | 95% | 93% | 87% | 88% | 98% | 82% |
| Calls answered within 90 seconds | | | | | | | |
| Number calls answered within 90 seconds | | 100 | 400 | 100 | 100 | 100 | 100 |
| Percentage calls answered in 90 seconds | >80% | 100% | 100% | 100% | 100% | 100% | 100% |

## One month data verification results for Service Availability/Uptime

| Service Availability Uptime | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Total Operational Hours | | 26323464 | 53568 | 744 | 744 | 1073592 | 720 |
| Total Downtime | | 5869 | 2 | 0 | 1.5 | 28441 | 0.226 |
| Total time when the service was available | | 26317595 | 53566 | 744 | 742.5 | 1045151 | 719.77 |
| Service Availability Uptime in Percentage | >98% | 100.0% | 100.0% | 100.0% | 99.8% | 97.4% | 100.0% |

## Three day live measurement results for Service Availability/Uptime

| Service Availability Uptime | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Total Operational Hours | | 4909392 | 1728 | 72 | 72 | 63621 | 24 |
| Total Downtime | | 2026 | 0 | 0 | 0 | 2067 | 0.0052 |
| Total time when the service was available | | 4907366 | 1728 | 72 | 72 | 61554 | 23.99 |
| Service Availability Uptime in Percentage | >98% | 99.96% | 100.00% | 100.00% | 100.0% | 96.75% | 99.96% |

## One month data verification results for Bandwidth utilisation

| Bandwidth Utilization | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Intra-network links (POP to ISP Node) | | | | | | | |
| Total number of intra network links | | 144 | BRAS-23,T1-24,T2-610, DSLAM-5456 | 400 | 3 | 16 | 5 |
| No of Intra network found to be above 90% | | 0 | Uplink Traffic in Chennai BRAS is > 90% | 4 | 0 | 1 | 0 |
| International Bandwidth | | | | | | | |
| Total number of upstream links | | 2 | 97 | 28 | 3 | 28 | 1 |
| No of Intra network found to be above 90% | | 0 | 1 | 0 | 0 | 0 | 0 |
| Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs) | | 20000 | 17233 | 2830 | 99 | 29462 | 160 |
| Total International Bandwidth utilised during peak hours | | 3910 | 12877 | 2097 | 67 | 18720 | 140 |
| Percentage Bandwidth utilisation during peak hours (In mpbs) | >90% | 20% | 75% | 74% | 68% | 64% | 88% |

## Live measurement results for Bandwidth utilisation

| Bandwidth Utilisation | B'mark | Bharti | BSNL | Sify | H'way | VSNL | HFCL |
|---|---|---|---|---|---|---|---|
| Intra-network links | | | | | | | |
| Total number of intra network links | | 144 | BRAS-23,T1-24,T2-610, DSLAMS-5456 | 400 | 3 | 16 | 5 |
| No of Intra network Links tested | | 15 | 20 | 37 | 3 | 10 | 0 |
| No of Intra network found to be above 90% | | 0 | 0 | 0 | 0 | 0 | 0 |
| International Bandwidth | | | | | | | |
| Total number of upstream links | | 2 | 97 | 28 | 9 | 28 | 1 |
| No of Intra network found to be above 90% | | 0 | 10 t0 20 | 0 | 0 | 0 | NA |
| Total International Bandwidth available from ISP Node to IGSP/NIXI/NAP (In mpbs) | | 20000 | 18157 | 2830 | 99 | 29462 | 160 |
| Total International Bandwidth utilised during peak hours | | 4200 | 12909 | 2082 | 68 | 18720 | 116 |
| Percentage Bandwidth utilisation during peak hours (In mpbs) | >90% | 21% | 71% | 74% | 69% | 64% | 73% |

# 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<br>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:-<br>- Number of connections provided within 7 days<br>- Number of connections provided after 7 days<br>- Number of connections were request is still pending<br><br><u>Live calling : -</u><br>- Interviewers ensured that operator should provide list of all new numbers added in one month prior to IMRB staff visit.<br>- Live calling team called up at least 10% of the customers who applied for new connections during the month prior to Audit<br>- 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<br>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:-<br>Number of faults cleared within 24 hours<br>Number of cleared in more than 1 day but less than 3 days<br>Number of cleared in more than 3 days but less than 7 days<br>Number of cleared in more than 7 days but less than 15 days<br>Number of cleared in more than 15 days<br><u>Live calling : -</u><br>-Live calling to be done to verify 'Fault repair by next working day' parameter<br>-Interviewers ensured that operator provided a list of all the subscribers who reported   faults in one month prior to IMRB staff visit.<br>-Calls were made to up to 10% or 30 complainants for the concerned exchange, whichever is less<br>- Auditors checked and recorded whether the fault was corrected within the timeframes as mentioned in the benchmark. |

| 4. Metering and billing credibility – billing complaints | |
|---|---|
| Computational Methodology | Percentage incidence of billing complaints = (No. of billing complaints reported by the customer per month/ Total Number of Subscribers for that particular month)*100<br>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<br>Percentage resolution of billing complaints: 100% within a period of 4 weeks |
| Audit Procedure | IMRB Auditors to verify and collect data pertaining to<br>- Number of Billing complaints received at the service provider's level<br>- Last billing cycle stated should be such that due date for payment of bills must be beyond the date when this form is filled.<br>- Include all types of bills generated for customers. This could include online as well as other forms of bills presentation including printed bills<br>- 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.<br><u>Live calling : -</u><br>- IMRB Auditors collected the list of all the subscribers who have made billing complaints in the month prior to the Audit.<br> -100 such subscribers per service provider were called to check the time taken to resolve t he billing complaint. However, in some cases where number of billing complaints were less the sample size could not be achieved |

| 5. Customer care promptness (Shifts, Closures and Additional facility) | |
|---|---|
| Computational Methodology | Supplementary (Additional) services requests: A few of the supplementary services that are considered for the audit purpose:<br>Clip (caller line identification presentation) facility , STD, ISD, Call forwarding, Voice Mail etc. |
| Benchmark | Shifting of telephone line : Less than 3 days<br>Processing of closure request: Less than 24 hours<br>Supplementary (Additional) services requests: Less than 24 hours |
| Audit procedure | **IMRB Auditors collected and verified data pertaining to**<br>**Shifting Request: (Following key points were taken care of while verifying the data)**<br>- Date of filing form should be at least 3 working days after the date of month appraised.<br>- All the holidays are excluded and only working days are considered<br>- The number of shift requests per month does not include the pending connections of the previous months.<br>**Processing of closure request (Following key points were taken care of while verifying the data)**<br>- The operator includes all Requests for volunteer Permanent Closure and External (shifts to other exchanges) Shift requests received at their exchange.<br>- DNP (due to Non – payment) cases are excluded<br>- All holidays are excluded for calculating 24 hours.<br>- Closure requests attended in the previous months are excluded<br>- The period for closure starts from the time of submission of application by the subscriber.<br>**Supplementary (Additional) services requests**<br>- All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.<br>- Do not include holidays.<br>- Collect the list of all cases of all subscribers requested for additional facility in past 48 hours prior to IMRB staff visit.<br>- The period starts from the time of submission of application by the subscriber.<br>**Live calling was done in 10% of such cases to check the time taken to attend all such requests** |

| 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): <br> within 20 seconds = 80% of the calls over a period <br> within 40 seconds = 95% of the calls over a period <br> (ii) % age of calls answered by operator / voice to voice): <br> within 60 seconds = 80% of the calls over a period <br> 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. <br> - All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services. <br> - 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. <br> <u>Live calling: -</u> <br> - 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 <br> - Time to answer the call by the operator was assessed from the time interviewer pressed the requisite button for being assisted by the operator. <br> - 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 <br> - Cases requiring refund of deposits after closure are to be included <br> - 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 <br> <u>Live calling</u> : - <br> - Collect the details of all the cases for which the refund was provided by the operator prior to the month of Audit <br> - 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:- <br> Other exchange not working / lines blocked <br> Calling exchange is blocked <br> 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 <br> -Three days in which live measurement was carried out <br> - For the complete month in which audit was carried out |

## 9.2 For Cellular Mobile services

| 1. Accumulated Downtime of the Network | |
|---|---|
| Computational Methodology as per QoS definition | The total time for which the network is down for a particular service provider resulting in a community isolation<br><br>**Computational Methodology: Accumulated downtime = Summation of Significant Downtime***<br>* 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:<br><br>• 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<br>• 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.<br>Call Established means the following events have happened in call setup:-<br>  ↳ call attempt is made<br>  ↳ the TCH is allocated<br>  ↳ the call is routed to the outward path of the concerned MSC<br>Computational Methodology: Calls Established / Total Call Attempts * 100 |
| Benchmark | > 95% |
| Audit Procedure | IMRB auditors collected and verified data pertaining to<br>  ↳ The cell-wise data generated through counters/ MMC available in the switch for traffic measurements was verified by the auditors<br>  ↳ CSSR calculation was measured using OMC generated data only<br>  ↳ Measurement was done only in Time Consistent Busy Hour (TCBH) period for all days of the week |

| 3. Service Access Delay | |
|---|---|
| Computational Methodology as per QoS definition | Service Access delay is a summation of following parts in the call flow:<br>↳ Time to connect calls<br>↳ Time to confirm instruction to connect<br>↳ Time to release calls<br>↳ Time to alert mobile set<br><br>**Computational Methodology:**<br>**Time to connect calls** = Time between "Origination" and "Service Connect" message from BTS to Mobile<br>**Time to confirm instruction to connect\*** = Time between "Origination" and "Base Station Acknowledgment"<br>Note: Time measured here is a sub-part of first measurement<br>**Time to release call** = Time between "Release on Reverse Link" and "Release on Forward Link"<br>**Time to alert a mobile** = This is measured as a mean of two measurements (i+ii/2):<br>● First paging attempt = Time between receiving a call request at PLMN and alerting the mobile<br>● Final paging attempt = Time between receiving a call request at PLMN and hearing start of "Not reachable" announcement |
| Benchmark | Between 9 to 20 seconds depending on number of paging attempts (Average of 100 calls < = 15 sec.) |
| Audit Procedure | **IMRB Auditors collected and verified records pertaining to**:<br>↳ 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<br>↳ 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)<br>↳ The component 'first paging attempt' was checked whether it was measured by the operator using a protocol analyser. |

| 4. Network Congestion Parameters | |
|---|---|
| Computational Methodology as per QoS definition | 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:<br>↳ SDCCH Level: Stand-alone dedicated control channel<br>↳ TCH Level: Traffic Channel<br>↳ POI Level: Point of Interconnect<br><br>Computational Methodology:<br>↳ **SDCCH / TCH Congestion% = [(A1 x C1) + (A2 x C2) +.......+ (An x Cn)] / (A1 + A2 +...+ An)**<br>    ● Where:-A1 = Number of attempts to establish SDCCH / TCH made on day 1<br>    ● C1 = Average SDCCH / TCH Congestion % on day 1<br>    ● A2 = Number of attempts to establish SDCCH / TCH made on day 2<br>    ● C2 = Average SDCCH / TCH Congestion % on day 2<br>    ● An = Number of attempts to establish SDCCH / TCH made on day n<br>    ● Cn = Average SDCCH / TCH Congestion % on day n<br>↳ **POI Congestion% = [(A1 x C1) + (A2 x C2) +.......+ (An x Cn)] / (A1 + A2 +...+ An)**<br>    ● Where:-A1 = POI traffic offered on all POIs (no. of calls) on day 1<br>    ● C1 = Average POI Congestion % on day 1<br>    ● A2 = POI traffic offered on all POIs (no. of calls) on day 2<br>    ● C2 = Average POI Congestion % on day 2<br>    ● An = POI traffic offered on all POIs (no. of calls) on day n<br>    ● Cn = Average POI Congestion % on day n |
| Benchmark | **SDCCH Congestion: < 1%**<br>**TCH Congestion: < 2%**<br>**POI Congestion: < 0.5%** |
| Audit Procedure | **IMRB Auditors collected and verified records pertaining to**:<br>↳ Audit of the details of SDCCH and TCH congestion percentages computed by the operator (using OMC–Switch data only) was conducted<br>↳ The operator should be measuring this parameter during Time consistent busy hour (TCBH) only SDCCH<br>↳ 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<br>↳ **Total calls dropped** = All calls ceasing unnaturally i.e. due to handover or due to radio loss<br>↳ **Total calls established** = All calls that have TCH allocation during busy hour<br><br>**Computational Methodology:**<br>Total Calls Dropped / Total Calls Established x 100 |
| Benchmark | < 3% |
| Audit Procedure | **IMRB Auditors collected and verified records pertaining to**:<br>↳ Audit of traffic data of the relevant quarter kept in OMC-R at MSCs and used for arriving at CDR was conducted.<br>↳ The operator should only be considering those calls which are dropped during Time consistent busy hour (TCBH) for all days of the relevant quarter |

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| 6. Percentage Connections with Good Voice Quality | |
|---|---|
| Computational Methodology as per QoS definition | Definition:<br>↳ for GSM service providers the calls having a value of 0 – 4 are considered to be of good quality (on a seven point scale)<br>↳ 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 %<br>**Computational Methodology:**<br>↳ **% 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**:<br>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.<br>Procedures that were to be followed by operator for obtaining relevant details for computing this parameter were audited<br>↳ Operator to conduct <u>at least one</u> drive test using standard drive test equipment every week during TCBH<br>↳ Each drive test should evenly cover the following 5 types of locations:<br>↳ **3 Outdoor** (Periphery of the city, Congested Area, Across the City), and **2 Indoor** (Office Complex and Shopping Complex)<br>↳ 2 minute long calls to be initiated and held throughout the drive test<br>↳ 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<br>↳ RxQual / FER samples generated during the drive test collected by the operator were verified<br>↳ *Measurements using Engineering handsets were not acceptable*<br>↳ All the operators were not maintaining this data at the switch level |

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| 7. Service Coverage | |
|---|---|
| Computational Methodology as per QoS definition | Definition:<br>↳ The level of signal available in a particular part of a city is known as signal strength.<br>**Computational Methodology:**<br>↳ Service Coverage for route type x = [(N1 x CSS1) + (N2 x CSS2) + …..+ (Nn x CSSn)] / (N1 + N2 +………..+Nn)<br>↳ Where:-N1 = Number of calls on type of route x made in drive test 1<br>↳ CSS1 = Average coverage signal strength on type of route x in drive test 1 (in dBm)<br>↳ N2 = Number of calls on type of route x made in drive test 2<br>↳ CSS2 = Average coverage signal strength on type of route x in drive test 2 (in dBm)<br>↳ Nn = Number of calls on type of route x made in drive test n<br>↳ CSSn = Average coverage signal strength on type of route x in drive test n (in dBm) |
| Benchmark | Indoor >= -75 dBm<br>In-vehicle >= -85 dBm<br>Outdoor – in city >= -95 dBm |
| Audit Procedure | **IMRB Auditors collected and verified call centre records pertaining to**:<br>↳ 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.<br>↳ Procedures were verified that were to be followed by operator for obtaining relevant details for computing this parameter:-<br>   ↳ Operator to conduct at least one drive test using standard drive test equipment* every week during Time consistent busy hour (TCBH).<br>   ↳ Each drive test should evenly cover the following 5 types of locations: –<br>     ↳ 3 Outdoor (Periphery of the city, Congested Area, Across the City), and<br>     ↳ 2 Indoor (Office Complex and Shopping Complex)<br>↳ *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<br><br>**To connect to operator:** The time taken to connect a person (as soon as he presses 9) to the customer care executive<br><br>**Computational Methodology:**<br>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):<br>   ↳ within 20 seconds = 80%<br>   ↳ within 40 seconds = 95%<br>(ii) %age of calls answered by operator (voice to voice):<br>   ↳ within 60 seconds = 80%<br>   ↳ within 90 seconds = 95% |

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| Audit Procedure | -IMRB auditors made test calls from the exchanges to the operator's customer care / helpline / toll free numbers. They will record the time taken to connect a customer's call both to the IVR as well as to a customer care executive.<br>- All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.<br>- 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.<br><u>Live calling: -</u><br>- 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<br>- Time to answer the call by the operator was assessed from the time interviewer pressed the requisite button for being assisted by the operator.<br>- 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:<br>• Local call charges billed as STD/ISD or vice-versa<br>• Toll free numbers charged<br>• Wrong roaming charges<br>• Call made/received disputed<br>• Wrongly charged extra for some service (SIM replacement charged twice, service not used but charged etc.)<br>• 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)<br>• Payment made but not reflected (may be wrongly adjusted to another customer etc.)<br>**Billing complaints per 100 bills issued** = Total billing complaints** received during the relevant quarter / Total bills generated* during the relevant quarter<br><br>* *All types of bills generated for customers i.e. printed bills, online bills and any other forms of bills generated are to be included*<br><br>** *Only dispute related issues (including those that may arise because of a lack of awareness at the subscribers' end) are to be included. It does not include any provisional issues (such as delayed dispatch of billing statements, etc.) in which the operator has opened a ticket internally.* |
| Benchmark | < 0.1% billing complaints per 100 bills |
| Audit Procedure | IMRB auditors collected and verified data pertaining to<br>- Number of bills generated<br>- Number of billing complaints received<br>- %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<br><br>*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.*<br><br>*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**<br>- Total number of billing complaints/bills disputed<br>- Number of complaints resolved in 4 weeks<br><br>**Live calling : -**<br>**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'**<br>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.**<br>**Operator to provide details of:-**<br>• **Dates of lodging** of all billing complaints resolved in favour of customer and resulting in requirement of a refund by the operator<br>• **Dates of refund** pertaining to all billing complaints received during the relevant quarter<br>**Also random live checks of all subscribers entitled for refund were conducted** |

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## 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<br><br>**Percentage connections provided within X working days** =<br>No of connections provided within X working days/ Total number of connections registered during the period  * 100<br><br>**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.<br><br>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<br>-Number of applications received at the service provider's level<br>-Number of connections provided within 15 days<br>-Number of connections provided after 15 days<br><br>**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<br><br>**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<br><br>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<br><br>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<br>-Number of applications received at the service provider's level<br>-Number of connections provided within 15 days<br>-Number of connections provided after 15 days<br><br>**Live calling** : Atleast 10% of the subscribers who had requested for new connections in month prior to Audit were called to check whether connection was provided in 15 days |

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| 3. Billing complaints per 100 bills issued | |
|---|---|
| **Computational Methodology as per QoS definition** | Billing complaints includes any of the following complaints related to billing from the point of view of customer:<br>• Wrongly charged extra for some service<br>• Cheque submitted on time but charged penalty for paying beyond due date<br>• Payment made but not reflected (may be wrongly adjusted to another customer etc.)<br><br>**Billing complaints per 100 bills issued** = Total billing complaints** received during the relevant quarter / Total bills generated* during the relevant quarter<br><br>* *All types of bills generated for customers i.e. printed bills, online bills and any other forms of bills generated are to be included*<br><br>** *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<br>- Number of bills generated<br>- Number of billing complaints received<br>- %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<br><br>*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.*<br><br>*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**<br>- Total number of billing complaints/bills disputed<br>- Number of complaints resolved in 4 weeks<br><br>**Live calling : -**<br>-**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 |

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| 3.2 Time taken to refund after closure | |
|---|---|
| Computational Methodology as per QoS definition | Time taken to refund = Date of refund – Date of closure<br><br>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**<br>-Number of cases requiring refund of deposits<br>-Number of cases where refund was made within 60 days<br>-%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<br><br><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 %<br>Calls answered within > 80% |
| Audit Procedure | **IMRB Auditors collected and verified call centre records pertaining to**<br>-Number of calls received by the operator<br>-Number and %age calls answered within **60 seconds**<br>-Number and percentage calls answered within **90 seconds**<br>**Live calling : -**<br>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<br><br>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).<br>-- 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**<br> **( I )POP to ISP gateway Node [Intra – network] Links**<br> -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<br> - Total Bandwidth available and Total bandwidth utilised during at the sample links TCBH for the complete month of audit<br>- Total number of intra network links having >90% bandwidth utilisation during the month of Audit<br>**(ii) ISP Gateway Node to IGSP / NIXI Node upstream Link's) for international connectivity**<br>-Total number of upstream links for International connectivity<br>-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<br>-Total Bandwidth available and Total bandwidth utilised at all the international links during TCBH for the complete month of audit (Also obtain details separately for the days) |

| Broadband download speed | |
|---|---|
| Computational Methodology as per QoS definition | This refers to the ratio of size of the file to be downloaded and total time required for error free transmission of the file |
| Benchmark | Subscribed broadband connection speed to be met    >80% from ISP Node to user |
| Audit Procedure | **Live calling : -**<br>-Details of live customers were obtained from the service providers<br>-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<br>-Details of total committed download speed and speed available to the users were recorded for each of the subscriber<br>- 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<br><br>Service availability/Uptime = (**Total operational hours – Total Downtime hrs)*100 / Total operational hours**<br><br>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<br><br>Planned outages for routine maintenance of the system are excluded from the calculation of service availability/uptime |
| Benchmark | - 90% for quarter ending June 2007<br>- 98% with effect from quarter ending September 2007 and onwards |
| Audit Procedure | **IMRB Auditors collected and verified call centre records pertaining to**<br>-Total operational hrs<br>-Total downtime hrs<br><br>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<br>Also, verification of old records(July to September 2007) was verified |

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| 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<br><br>The packet loss is measured by computing the percent packet loss of **1000 pings of 64 byte packet each**.<br><br>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<br><br>Minimum sample reference points for each service area shall be three in number or multiple reference points if required<br>**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**<br>   - Records maintained for ping tests conducted during the period of July to September 2007<br>   - Smoked ping test (wherever available) results for the period of July to September 2007<br>   - Results of live ping tests conducted during three day live measurement and month of Audit (During peak hours)<br>   - 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)<br><br>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<br><br>Minimum sample reference points for each service area shall be three in number or multiple reference points if required<br>**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<br>< 350 msec from User reference point at ISP Gateway Node to International nearest NAP port (Terrestrial)<br>< 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**<br>   - Records maintained for ping tests conducted during the period of July to September 2007<br>   - Smoked ping test (wherever available) results for the period of July to September 2007<br>   - Results of live ping tests conducted during three day live measurement and month of Audit (During peak hours)<br>   - Live ping tests were conducting by selecting a minimum of three user reference test points at POP/ISP Node in each circle |

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