



**EAST
ZONE**

TRAI AUDIT WIRELESS REPORT-NORTH EAST CIRCLE - OND QUARTER, 2014

Prepared By -



Prepared For-



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2 INTRODUCTION

2.1 ABOUT TRAI

TRAI's mission is to create and nurture conditions for growth of telecommunications in the country in a manner and at a pace that will enable India to play a leading role in the emerging global information society. One of the main objectives of TRAI is to provide a fair and transparent policy environment which promotes a level playing field and facilitates fair competition.

In pursuance of above objective, TRAI has been issuing regulations, order and directives to deal with the issues or complaints raised by the operators as well as the consumers. These regulations, order and directives have helped to nurture the growth of multi operator multi service - an open competitive market from a government owned monopoly. Also, the directions, orders and regulations issued cover a wide range of subjects including tariff, interconnection and quality of service as well as governance of the Authority.

TRAI initiated a regulation - The Standard of Quality of Service of Basic Telephone Service (Wireline) and Cellular Mobile Telephone Service regulations, 2009 (7 of 2009) dated March 20, 2009 and Quality of Service of Broadband Service Regulations, 2006 (11 of 2006) dated October 6, 2006 that provide the benchmarks for the parameters on customer perception of service to be achieved by service provider.

In order to assess the above regulations, TRAI has commissioned a third party agency to conduct the audit of the service providers and check the performance of the operators on the various benchmarks set by Telecom Regulatory Authority of India (TRAI).

2.2 OBJECTIVES

The primary objective of the Audit module is to-

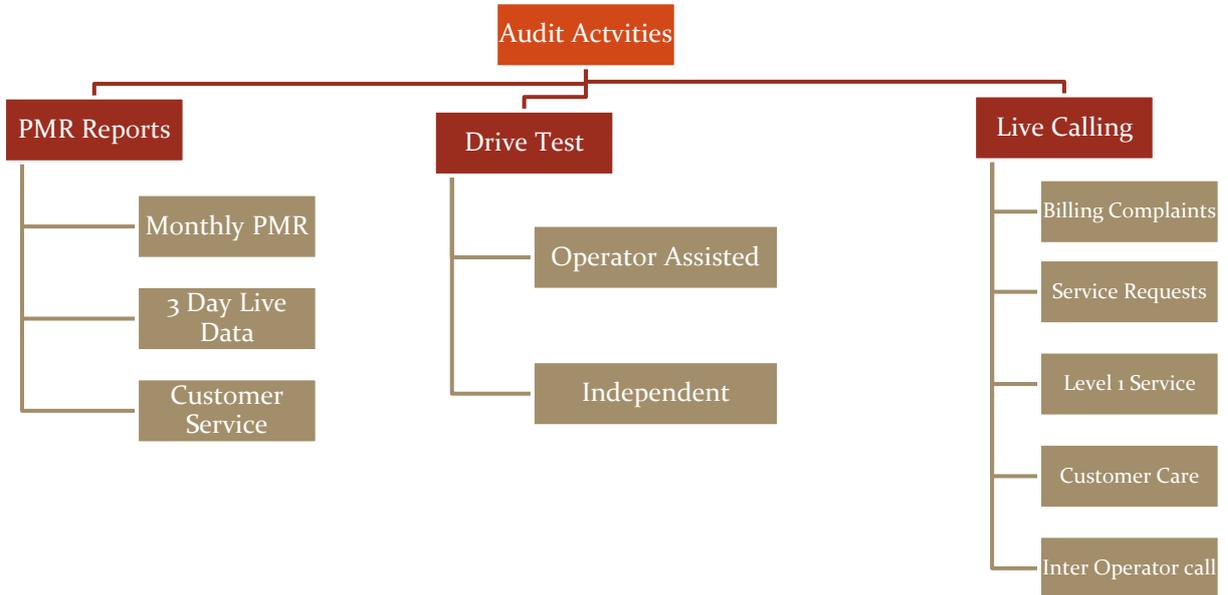
- Audit and Assess the Quality of Services being rendered by Basic (Wireline), Cellular Mobile (Wireless), and Broadband service against the parameters notified by TRAI. (The parameters of Quality of Services (QoS) have been specified by in the respective regulations published by TRAI).
- This report covers the audit results of the audit conducted for Cellular Mobile (Wireless) services in North East circle.

2.3 COVERAGE

The audit was conducted in North East circle (excluding Assam) covering all the SSAs (Secondary Switching Areas).



2.4 FRAMEWORK USED

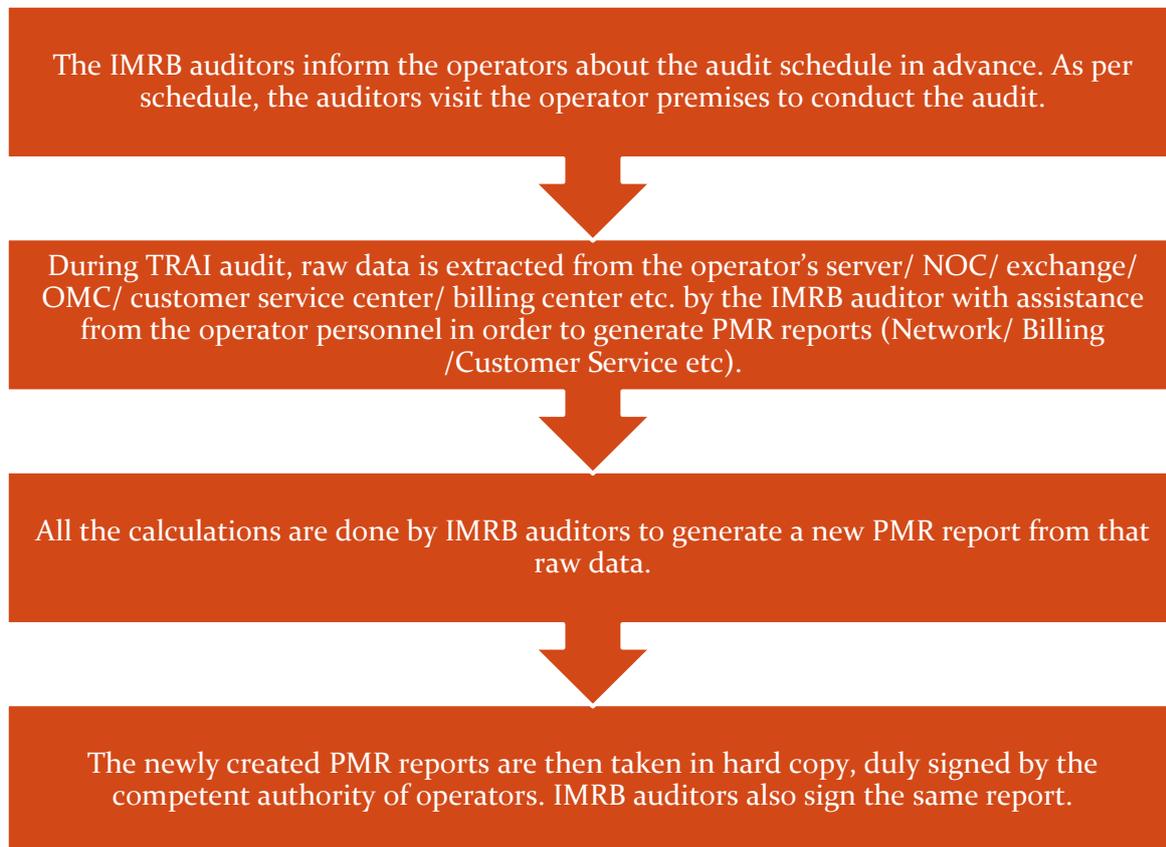


Let’s discuss each of the activity in detail and the methodology adopted for each of the module.

2.4.1 PMR REPORTS

2.4.1.1 SIGNIFICANCE AND METHODOLOGY

PMR or Performance Monitoring Reports are generated to assess the various Quality of Service parameters involved in the mobile telephony service, which indicate the overall health of service for an operator.



The PMR report for network parameters is taken for each month of the audit quarter and data is generally extracted and verified in the first week of the subsequent month of the audit month. For example, November 2014 audit data was collected in the month of December 2014.

The data to create PMR report for customer service parameters is extracted from Billing Center/ Customer Service Center and verified once every quarter in the subsequent month of the last month of the quarter. For example, data for quarter ending December 2014 (OND'14) was collected in the month of Jan 2014.

The raw data is extracted from operator's systems to create PMR in the following three formats.

- ↪ Monthly PMR (Network Parameters)
- ↪ 3 Day Live Measurement Data (Network Parameters)
- ↪ Customer Service Data

Let us understand these formats in detail.

2.4.1.2 MONTHLY PMR

This involved calculation of the various Quality of Service network parameters through monthly Performance Monitoring Reports (PMR). The PMR reports were generated from the data extracted from operator's systems in presence of IMRB representative at the operator's premises for the month of Oct, Nov and Dec 2014. The performance of operators on various parameters was assessed against the benchmarks. Parameters include-

Network Availability

- BTS accumulated downtime
- Worst affected BTS due to downtime

Connection Establishment (Accessibility)

- Call Set Up success Rate (CSSR)

Network Congestion Parameters

- SDCCH/Paging Channel Congestion
- TCH Congestion
- Point of Interconnection

Connection Maintenance

- Call Drop rate
- Worst affected cells having more than 3% TCH drop

Voice Quality

- % Connections with good voice quality

All the parameters have been described in detail along with key findings of the parameters in section 4 of the report. The benchmark values for each parameter have been given in the table below.

2.4.1.3 AUDIT PARAMETERS - NETWORK

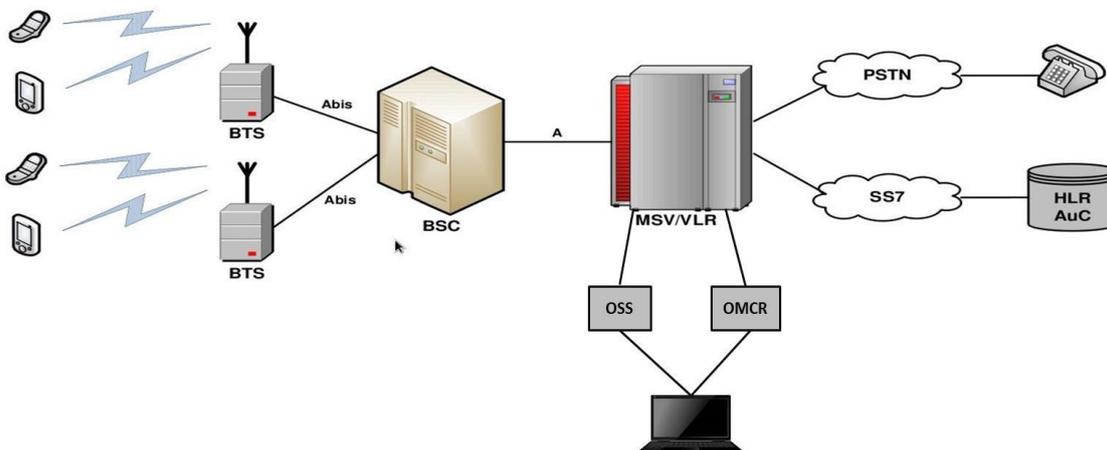
Let us now look at the various parameters involved in the audit reports.

Network Related

Network Availability	
BTSs Accumulated downtime (not available for service)	≤ 2%
Worst affected BTSs due to downtime	≤ 2%
Connection Establishment (Accessibility)	
Call Set-up Success Rate (within licensee's own network)	≥ 95%
SDCCH/ Paging Channel Congestion	≤ 1%
TCH Congestion	≤ 2%
Connection Maintenance (Retainability)	
Call Drop Rate	≤ 2%
Worst affected cells having more than 3% TCH drop (call drop) rate	≤ 3%
Connections with good voice quality	≥ 95%
Point of Interconnection	
(POI) Congestion (on individual POI)	≤ 0.5%

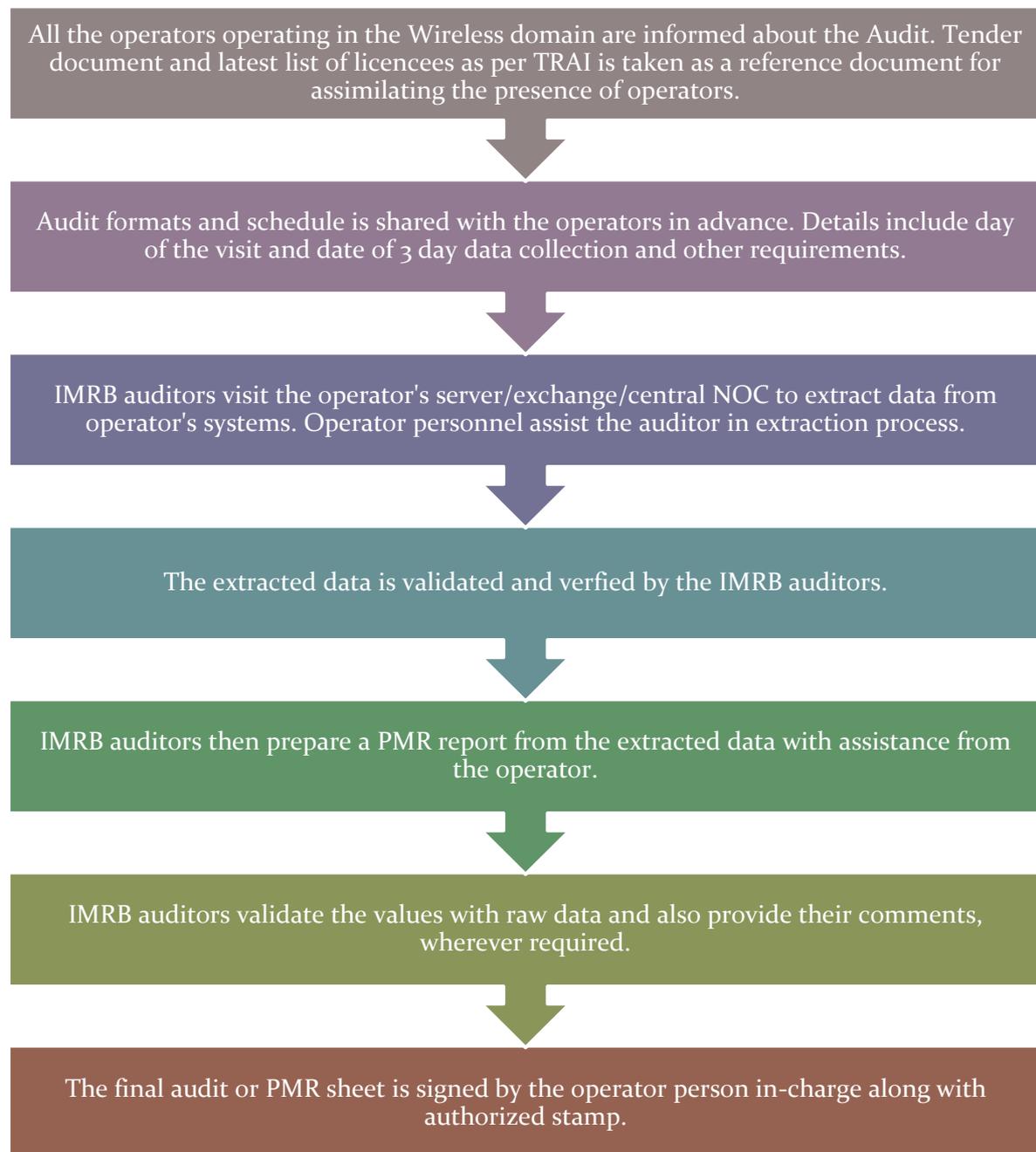
2.4.1.4 POINT OF DATA EXTRACTION

The data is extracted from a terminal/computer connected to OMCR & OSS on the operator network.



2.4.1.5 STEP BY STEP AUDIT PROCEDURE

The key steps followed for extraction of reports at the operator premises are given below.



Data has been extracted and calculated as per the counter details provided by the operators. The details of counters have been provided in section 8.15 of the report. The calculation methodology for each parameter has been stated in the table given below.

2.4.1.6 CALCULATION METHODOLOGY – NETWORK PARAMETERS

Parameter	Calculation Methodology
BTS Accumulated Downtime	Sum of downtime of BTSs in a month in hours i.e. total outage time of all BTSs in hours during a month / (24 x Number of days in a month x Number of BTSs in the network in licensed service area) x 100
Worst Affected BTS Due to Downtime	(Number of BTSs having accumulated downtime greater than 24 hours in a month / Number of BTS in Licensed Service Area) * 100
Call Setup Success Rate	(Calls Established / Total Call Attempts) * 100
SDCCH/ Paging Channel Congestion	$\text{SDCCH / TCH Congestion\%} = [(A_1 \times C_1) + (A_2 \times C_2) + \dots + (A_n \times C_n)] / (A_1 + A_2 + \dots + A_n)$ <p>Where:</p> <p>A₁ = Number of attempts to establish SDCCH / TCH made on day 1</p>
TCH Congestion	<p>C₁ = Average SDCCH / TCH Congestion % on day 1</p> <p>A₂ = Number of attempts to establish SDCCH / TCH made on day 2</p> <p>C₂ = Average SDCCH / TCH Congestion % on day 2</p> <p>A_n = Number of attempts to establish SDCCH / TCH made on day n</p> <p>C_n = Average SDCCH / TCH Congestion % on day n</p>
POI Congestion	$\text{POI Congestion\%} = [(A_1 \times C_1) + (A_2 \times C_2) + \dots + (A_n \times C_n)] / (A_1 + A_2 + \dots + A_n)$ <p>Where:</p> <p>A₁ = POI traffic offered on all POIs (no. of calls) on day 1</p> <p>C₁ = Average POI Congestion % on day 1</p> <p>A₂ = POI traffic offered on all POIs (no. of calls) on day 2</p> <p>C₂ = Average POI Congestion % on day 2</p> <p>A_n = POI traffic offered on all POIs (no. of calls) on day n</p> <p>C_n = Average POI Congestion % on day n</p>
Call Drop Rate	Total Calls Dropped / Total Calls Established x 100
Worst Affected Cells having more than 3% TCH drop	Total number of cells having more than 3% TCH drop during CBBH/ Total number of cells in the LSA x 100
Connections with good voice quality	No. of voice samples with good voice quality / Total number of samples x 100

2.4.1.7 3 DAY LIVE DATA

The main purpose of 3 day live measurement is to evaluate the network parameters on intraday basis. While the monthly PMR report provides an overall view of the performance of QoS parameters, the 3 day live data helps looking at intraday performance on the network parameters discussed earlier. All the calculations are done on the basis of that raw data of 3 days.

The 3 day live data provides a sample of 9 days in a quarter (3 days each month of a quarter) with hourly performance, which enables the auditor to identify and validate intraday issues for an operator on the QoS network parameters. For example, network congestion being faced by an operator during busy/peak hours.

Network related parameters were evaluated for a period of 3 days in each month. 3 day live audit was conducted for 3 consecutive weekdays for each month. The data was extracted from each operator's server/ NOC etc. at the end of the 3rd day. The extracted data is then used to create a report (similar to PMR report) to assess the various QoS parameters.

2.4.1.8 TCBH – SIGNIFICANCE AND SELECTION METHODOLOGY

As per QoS regulations 2009 (7 of 2009), Time Consistent Busy Hour” or “TCBH” means the one hour period starting at the same time each day for which the average traffic of the resource group concerned is greatest over the days under consideration and such Time Consistent Busy Hour shall be established on the basis of analysis of traffic data for a period of ninety days.

Step by step procedure to identify TCBH for an operator:

Day wise raw data is fetched from the operator's OMCR and kept in a readable format (preferably MS-Excel). Data for a period of 90 days is used to identify TCBH.

For each day, the hour in which average traffic of the resource group concerned is greatest for the day will be the 'Busy Hour' for the operator.

The modal frequency of the busy hour is calculated for 90 days period and the hour with highest modal frequency will be considered as TCBH for the operator

During audit, the auditors identified from the raw data that the TCBH for the operators in OND'14 was the time period as given below.

Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
19:00 - 20:00	20:00 - 21:00	18:00 - 19:00	19:00 - 20:00	19:00 - 20:00	20:00 - 21:00	19:00 - 20:00	19:00 - 20:00	18:00 - 19:00

2.4.1.9 CBBH – SIGNIFICANCE AND SELECTION METHODOLOGY

As per QoS regulations 2009 (7 of 2009), Cell Bouncing Busy Hour (CBBH) means the one hour period in a day during which a cell in cellular mobile telephone network experiences the maximum traffic.

Step by step procedure to identify CBBH for an operator:

Day wise raw data is fetched from the operator's OMCR and kept in a readable format (preferably MS-Excel). Data for a period of 90 days is used to identify CBBH.

For each day, the hour in which a cell in cellular mobile telephone network experiences maximum traffic for the day will be the 'Busy Hour' for the operator.

The modal frequency of the busy hour is calculated for 90 days period and the hour with highest modal frequency will be considered as CBBH for the operator

During audit, the auditors identified from the raw data that the CBBH for the operators in OND'14 was the time period as given below.

Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
20:00 - 21:00	20:00 - 21:00	19:00 - 20:00	19:00 - 20:00	19:00 - 20:00	20:00 - 21:00	20:00 - 21:00	19:00 - 20:00	18:00 - 19:00

2.4.1.10 CUSTOMER SERVICE PARAMETERS

The data to generate PMR report for customer service parameters is extracted at the operator premises and verified once every quarter in the subsequent month of the last month of the quarter. For example, data for quarter ending Dec 2014 (OND'14) was collected in the month of Jan 2014. To extract the data for customer service parameters for the purpose of audit, IMRB auditors primarily visit the following locations/ departments/ offices at the operator's end.

- Central Billing Center
- Central Customer Service Center

The operators are duly informed in advance about the audit schedule.

The Customer Service Quality Parameters include the following:

- Metering and billing credibility (postpaid and prepaid)
- Resolution of billing/charging complaints
- Period of applying credit/waiver/adjustment to customer's account
- Response time to the customer for assistance
- Termination/closure of service
- Time taken for refund of security deposit after closures.

Most of the customer service parameters were calculated by averaging over the quarter; however billing parameters were calculated by averaging over one billing cycle for a quarter.

All the parameters have been described in detail along with key findings of the parameter in section 5 of the report. The benchmark values for each parameter have been given in the table below.

2.4.1.11 AUDIT PARAMETERS – CUSTOMER SERVICE

Metering and Billing Credibility	Benchmark
No of billing complaints received - Post paid	≤ 0.1%
No. of billing complaints received- Prepaid	≤ 0.1%
Resolution of billing/ charging complaints within 4 weeks	98%
Resolution of billing/ charging complaints within 6 weeks	100%
Period of applying credit/ waiver within 1 week of resolution of complaint	100%
Response Time to the Customer form Assistance	
Accessibility of call centre/customer care	≥ 95%
Percentage of calls answered by the operators (voice to voice) within 90 seconds	≥ 95%
Termination/ closure of service	≤ 7 days
Time taken for refund of deposits after closures within 60 days	100%

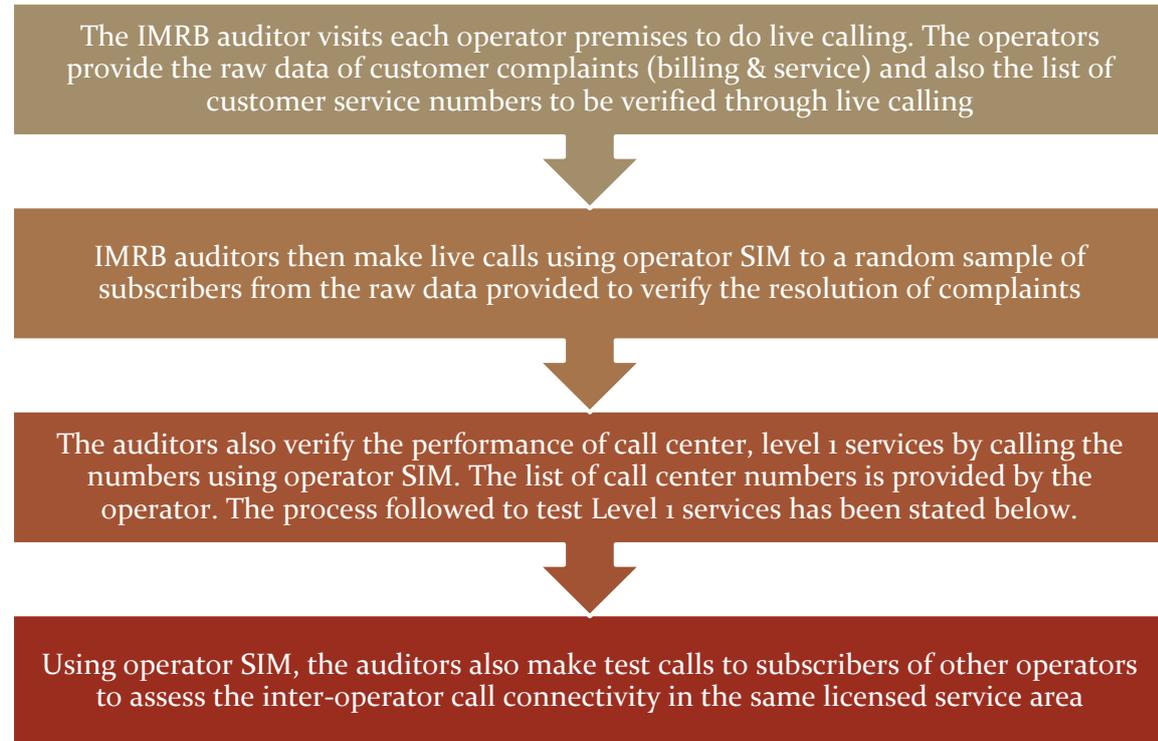
2.4.1.12 CALCULATION METHODOLOGY – CUSTOMER SERVICE PARAMETERS

Parameter	Calculation Methodology
Metering and billing credibility - Postpaid	Total billing complaints received during the relevant billing cycle / Total bills generated during the relevant billing cycle *100
Metering and billing credibility – Prepaid	Total charging complaints received during the quarter/ Total number of subscribers reported by the operator at the end of the quarter * 100
Resolution of billing/ charging complaints (Postpaid + Prepaid)	There are two benchmarks involved here: Billing or Charging Complaints resolved in 4 weeks from date of receipt / Total billing or charging complaints received during the quarter) x 100 Billing or Charging Complaints resolved in 6 weeks from date of receipt / Total billing or charging complaints received during the quarter) x 100
Period of applying credit waiver	Number of cases where credit waiver is applied within 7 days/ total number of cases eligible for credit waiver * 100
Call centre performance IVR (Calling getting connected and answered by IVR)	Number of calls connected and answered by IVR/ All calls attempted to IVR * 100
Call centre performance (Voice to Voice)	Call centre performance Voice to Voice = (Number of calls answered by operator within 90 seconds/ All calls attempted to connect to the operator) * 100 The calculation excludes the calls dropped before 90 seconds
Time taken for termination/ closure of service	Number of closures done within 7 days/ total number of closure requests * 100
Time taken for refund for deposit after closures	Number of cases of refund after closure done within 60 days/ total number of cases of refund after closure * 100

2.4.2 LIVE CALLING

2.4.2.1 SIGNIFICANCE AND METHODOLOGY

The main purpose of live calling is to verify the performance of various customer service parameters by doing test calls to the subscribers/ specific numbers. Below is a step wise procedure of live calling.



Live calling activity was carried out during the period of Dec 2014. The data considered for live calling was for the month prior to the month in which the live calling activity was being conducted. In this case, data of Nov 2014 was considered for live calling activity conducted in Dec 2014.

A detailed explanation of each parameter is explained below.

2.4.2.2 BILLING COMPLAINTS

Live calling is done to verify Resolution of billing complaints within stipulated time. The process for this parameter is stated below.

- ↳ Auditors request the operator provided the database of all the subscribers who reported billing complaints in one month prior to IMRB auditor visit. In case of BSNL, data for the complaints from the subscribers belonging to the sample exchanges is requested specifically
- ↳ A sample of 10% or 100 complainants, whichever is less, is selected randomly from the list provided by operator

Calls are made by auditors to the sample of subscribers to check and record whether the complaint was resolved within the timeframes as mentioned in the benchmark.

All the complaints related to billing as per clause 3.7.2 of QoS regulation of 20th March, 2009 were considered as population for selection of samples. A complete list of the same has been provided in Section 5.1.1.

TRAI benchmark-

Metering and billing credibility-Post Paid- Not more than 0.1% of bills issued should be disputed over a billing cycle

Metering and billing credibility -- Prepaid - Not more than 1 complaint per 1000 customers i.e. 0.1% complaints for metering, charging, credit, and validity

Resolution of billing/ charging complaints - 98% within 4 weeks, 100% within 6 weeks

2.4.2.3 SERVICE COMPLAINTS REQUESTS

“Service request” means a request made to a service provider by its consumer pertaining to his account, and includes.

- ↳ A request for change of tariff plan
- ↳ A request for activation or deactivation of a value added service or a supplementary service or a special pack
- ↳ A request for activation of any service available on the service provider’s network
- ↳ A request for shift or closure or termination of service or for billing details

All the complaints other than billing were covered. A total of 100 calls per service provider for each service in licensed service area were done by the IMRB auditors.

2.4.2.4 LEVEL 1 SERVICE

Level 1 is used for accessing special services like emergency services, supplementary services, inquiry and operator-assisted services.

Level 1 Services include services such as police, fire, ambulance (Emergency services). Test calls were made from operator SIMs. A total of 150 test calls were made per service provider in the quarter.

While most of the Level 1 services are toll free, it has been observed that some Level 1 services may not be toll free. In OND’14, IMRB has tried contacting the list of Level 1 services provided by TRAI as per the NNP (National Numbering Plan).

2.4.2.4.1 PROCESS TO TEST LEVEL 1 SERVICES

- On visiting the operator’s premises (Exchange/Central Server etc.), auditors ask the operator authorized personnel to provide a list of Level 1 services being active in their service. The list should contain a description of the numbers along with dialing code.

- Operators might provide a long list of L1 services. To identify emergency L1 service numbers, auditors check if there is any number that starts with code '10' in that list. If auditors find any emergency number in addition to the below list, that number is also tested during live calling.
- On receiving the list, auditors verify it if the below given list of numbers are active in the service provider's network.
- If there are any other additional numbers provided by the operator, auditors also do live calling on those numbers along with below list.
- If any of these numbers is not active, then we would write the same in our report, auditors write in the report.
- Post verifying the list, auditors do live calling by equally distributing the calls among the various numbers and update the results in the live calling sheet.

L1 Code	Description
100	Police
101	Fire
102	Ambulance
104	State Health Information Helpline
108	Emergency and Disaster Management Helpline
181	Chief Minister Helpline
1033	Road Accident Management Service
1056	Emergency Medical Service
1063	Public Grievance Cell of DOT
1064	Anti Corruption Helpline
1070	Relief Commissioner for Natural Calamities
1071	Air Accident Helpline
1072	Rail Accident Helpline
1073	Road Accident Information
1077	Control Room for District Collector
1091	Women Crisis Response Center
1098	Child Helpline
1099	Central Accident & Trauma Helpline
1909	National Do Not Call Registry
1916	Drinking Water Supply
1947	Unique Identification Authority of India
1950	Election Commission of India
15100	Free Legal Service Helpline
155214	Labour Helpline
106X	State of Art Hospitals (The actual code has to be confirmed from the operator as per presence of hospitals in the circle. We have to check for all hospitals as per availability of list with operator, For example 1066 is for Apollo)

2.4.2.5 CUSTOMER CARE

Live calling is done to verify response time for customer assistance is done to verify the performance of call center in terms of

- ↳ Calls getting connected and answered within 60 seconds by operator's IVR.
- ↳ % age of calls answered by operator / voice to voice) within 90 seconds: In 95% of the cases or more

The process for this parameter is stated below.

- ↪ Overall sample size is 100 calls per service provider per circle at different points of time, evenly distributed across the selected exchanges – 50 calls between 1000 HRS to 1300 HRS and 50 calls between 1500 HRS to 1700 HRS.
- ↪ Time to answer the call by the operator was assessed from the time interviewer pressed the requisite button for being assisted by the operator.
- ↪ All the supplementary services that have any kind of human intervention are to be covered here. It also includes the IVR assisted services.

2.4.2.6 INTER OPERATOR CALL ASSESEMENT

A total of 100 calls per service provider to all the other service providers in a licensed service area were done for the purpose of audit.

2.4.3 DRIVE TEST

2.4.3.1 SIGNIFICANCE AND METHODOLOGY

Drive test, as the name suggests, is conducted to measure the outdoor coverage in a moving vehicle in a specified network coverage area.

The main purpose of the drive test is to check the health of the mobile network of various operators in the area in terms of coverage (signal strength), voice quality, call drop rate, call set up success rate etc.

To assess the indoor coverage, the test is also conducted at two static indoor locations in each SSA, such as Malls, office buildings, shopping complexes, government buildings etc.

IMRB conducted two types of drive tests as mentioned below.

- ↪ Operator Assisted Drive Test
- ↪ Independent Drive Test

The main difference between the two is that in the operator assisted, operators participate in the drive test along with their hardware, software, phones etc. while in the independent drive test IMRB conducts the drive test on solitary basis and uses its own hardware. Operators generally do not have any knowledge of the drive test being conducted.

A detailed explanation of the two methodologies has been provided below.

2.4.3.2 OPERATOR ASSISTED DRIVE TEST

A total of 3 SSA were selected and audited in each quarter, 1 SSA in each month. The methodology adopted for the drive test-

- ↪ 3 consecutive days drive test in one SSA every month. SSA would be defined as per BSNL and month wise SSA list will be finalized by regional TRAI office.
- ↪ On an average, a minimum of 100 kilometers were covered each day
- ↪ Route map was designed in such a way that all the major roads, highways and all the important towns and villages were covered as part of audit.
- ↪ Special emphasis was given to those areas where the number of complaints received were on the higher side, if provided by TRAI.

- ↵ The route is defined in a way that we cover maximum area in the SSA and try to cover maximum villages and cities within the SSA. The route is designed such that there is no overlap of roads and we can start from the point from where we had left last day (if possible).
- ↵ The route was classified as-
 - With In city
 - Major Roads
 - Highways
 - Shopping complex/ Mall
 - Office Complex/ Government Building
- ↵ There were no fixed calls which we need to do for within city, major roads and highways, but a minimum of 30 calls in each route, i.e., within city, major roads and highways on each day. For indoors, 20 calls each for shopping and office complex each day preferably in relatively bigger city.
- ↵ The drive test covered selected cities and adjoining towns/rural areas where the service provider has commenced service, including congested areas and indoor sites.
- ↵ The drive test of each mobile network was conducted between 10 am and 8 pm on weekdays.
- ↵ The Vehicle used in the drive tests was equipped with the test tool that automatically generates calls on the mobile telephone networks.
- ↵ The speed of the vehicle was kept at around 30 km/hr.
- ↵ The holding period of each test call was 120 seconds.
- ↵ A test call was generated 10 seconds after the previous test call is completed.
- ↵ Height of the antenna was kept uniform in case of all service providers.

2.4.3.3 INDEPENDENT DRIVE TEST

The number of independent drive tests to be conducted and their locations are decided basis TRAI recommendation.

- ↵ A minimum of 100 kilometers was traversed during the independent drive test in a SSA. The SSA would be defined as per BSNL and SSA list will be finalized by regional TRAI office.
- ↵ Route map was designed in such a way that all the major roads, highways and all the important towns and villages were covered as part of audit.
- ↵ Special emphasis was given to those areas where the number of complaints received were on the higher side, if provided by TRAI.
- ↵ The route is defined in a way that we cover maximum area in the SSA and try to cover maximum villages and cities within the SSA. The route is designed such that there is no overlap of roads (if possible).
- ↵ The route was classified as-
 - With In city
 - Major Roads
 - Highways
 - Shopping complex/ Mall
 - Office Complex/ Government Building
- ↵ There were no fixed calls which we need to do for within city, major roads and highways, but a minimum of 30 calls in each route, i.e., within city, major roads and highways on each day. For indoors, 20 calls each for shopping and office complex each day preferably in relatively bigger city.
- ↵ The drive test covered selected cities and adjoining towns/rural areas where the service provider has commenced service, including congested areas and indoor sites.
- ↵ The drive test of each mobile network was conducted between 10 am and 8 pm on weekdays.

- ↵ The Vehicle used in the drive tests was equipped with the test tool that automatically generates calls on the mobile telephone networks.
- ↵ The speed of the vehicle was kept at around 30 km/hr.
- ↵ The holding period of each test call was 120 seconds.
- ↵ A test call was generated 10 seconds after the previous test call is completed.
- ↵ Height of the antenna was kept uniform in case of all service providers.

2.4.3.4 PARAMETERS EVALUATED DURING DRIVE TEST

The parameters which were captured during the drive test include. Below are the parameters which are captured for the GSM and CDMA operators.

- ↵ Coverage-Signal strength (GSM)
 - ✓ Total calls made (A)
 - ✓ Number of calls with signal strength between 0 to -75 dBm
 - ✓ Number of calls with signal strength between 0 to -85 dBm
 - ✓ Number of calls with signal strength between 0 to -95 dBm
- ↵ Coverage-Signal strength (CDMA)
 - ✓ Total Ec/Io BINS (A)
 - ✓ Total Ec/Io BINS with less than -15 (B)
 - ✓ Low Interference = $[1 - (B/A)] \times 100$
- ↵ Voice quality (GSM)
 - ✓ Total RxQual Samples- A
 - ✓ RxQual samples with 0-5 value - B
 - ✓ %age samples with good voice quality = $B/A \times 100$
- ↵ Voice quality (CDMA)
 - ✓ Total FER BINS (forward FER) - A
 - ✓ FER BINS with 0-2 value (forward FER) - B
 - ✓ FER BINS with 0-4 value (forward FER) - C
 - ✓ %age samples with FER bins having 0-2 value (forward FER) = $B/A \times 100$
 - ✓ %age samples with FER bins having 0-4 value (forward FER) = $C/A \times 100$
 - ✓ No. of FER samples with value $> 4 = [A-C]$
- ↵ Call setup success rate
 - ✓ Total number of call attempts - A
 - ✓ Total Calls successfully established - B
 - ✓ Call success rate (%age) = $(B/A) \times 100$
- ↵ Blocked calls
 - ✓ 100% - Call Set up Rate
- ↵ Call drop rate
 - ✓ Total Calls successfully established - A
 - ✓ Total calls dropped after being established - B
 - ✓ Call Drop Rate (%age) = $(B/A) \times 100$

2.5 OPERATORS COVERED

Name of Operator	Number of Subscriber as per VLR
Aircel(DWL)	1837818
Airtel	3209565
BSNL NE 1 CDMA	6177
BSNL NE 2 CDMA	32370
BSNL NE 1 GSM	384505
BSNL NE 2 GSM	539630
Idea	359430
Reliance GSM	619228
Vodafone	1066597

Dec'14 VLR data was considered for the number of subscribers.

2.6 COLOUR CODES TO READ THE REPORT



Not Meeting the benchmark



Best Performing Operator

3 EXECUTIVE SUMMARY

The objective assessment of Quality of Service (QoS) carried out by IMRB gives an insight into the overall performance of various operators in the North East circle, with a parameter wise performance evaluation as compared to TRAI benchmark.

3.1 PMR DATA – 3 MONTHS CONSOLIDATED

Name of Service Provider	Network Availability		Connection Establishment (Accessibility)			Connection Maintenance (Retainability)		
	BTSs Accumulated downtime (not available for service)	Worst affected BTSs due to downtime	Call Set-up Success Rate (within licensee's own network)	SDCCH/ Paging Chl. Congestion	TCH Congestion	Call Drop Rate (%age)	Worst affected cells having more than 3% TCH drop	%age of connection with good voice quality
Benchmark	≤ 2%	≤ 2%	≥ 95%	≤ 1%	≤ 2%	≤ 2%	≤ 3%	≥ 95%
Aircel(DWL)	8.61%	43.59%	96.05%	2.49%	3.11%	2.22%	23.05%	92.88%
Airtel	0.32%	1.46%	97.74%	0.53%	0.45%	1.09%	0.87%	98.93%
BSNL NE 1 CDMA	4.76%	9.30%	97.05%	NA	0.00%	1.66%	No Data	98.00%
BSNL NE 2 CDMA	9.34%	14.66%	89.64%	NA	0.08%	1.11%	3.86%	100.00%
BSNL NE 1 GSM	1.96%	1.84%	97.22%	0.94%	1.93%	1.77%	2.93%	98.33%
BSNL NE 2 GSM	7.97%	29.45%	79.92%	0.57%	0.88%	6.49%	25.85%	87.49%
Idea	1.30%	0.77%	98.42%	0.30%	0.98%	1.75%	1.89%	95.45%
Reliance GSM	0.35%	1.54%	98.54%	0.02%	0.28%	0.66%	0.08%	98.23%
Vodafone	1.66%	1.94%	99.62%	0.14%	0.38%	0.68%	2.39%	97.91%

Note: Auditors were not able to get the data for worst affected cells having more than 3% TCH drop and Voice quality from BSNL NE 1 CDMA, as operator reported a technical problem in their systems.

NA: SDCCH/ Paging channel congestion not applicable for CDMA operators. Hence, it has been reported as NA for BSNL CDMA.

The above table represents the parameter wise observations for Wireless Operators for North East circle:

BTs Accumulated Downtime:

In North East, Aircel, BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark. Airtel performed the best among all operators by recording 0.32%.

Worst Affected BTs Due to Downtime:

Aircel, BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark. Idea had minimum worst affected BTs due to downtime at 0.77%.

Call Set-up Success Rate (CSSR):

BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark on CSSR. Best CSSR performance was observed for Vodafone with 99.62% of their calls getting completed.

All the operators were found to be calculating the parameter as per the norm specified by TRAI. CSSR was established as the ratio of total number of successful call attempts (establishment) to the total number of call attempts made.

Network Congestion parameters:

Aircel failed to meet the benchmark for both SDCCH Paging Channel Congestion and TCH Congestion parameters.

Reliance GSM performed the best on SDCCH Paging Channel Congestion and BSNL NE 1 CDMA performed the best on TCH congestion.

The calculation methodology of these parameters was found to be in complete accordance with TRAI specifications.

Call Drop Rate:

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

While Aircel and BSNL NE 2 GSM failed to meet the TRAI benchmark, Reliance GSM was the best performer by recording call drop rate of 0.66%.

Worst Affected Cells Having More than 3% TCH Drop:

Aircel, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark while Reliance GSM had minimum worst affected cells at 0.08%.

Voice Quality:

Aircel and BSNL NE 2 GSM did not meet the benchmark in terms of voice quality. BSNL NE 2 CDMA was the best performer by recording 100% voice quality.

3.2 3 DAY DATA – CONSOLIDATED

A three day live measurement was conducted to measure the QoS provided by the operators. It was seen from the live data collected, that the performance of the operators across all parameters more or less corroborated with the audit data collected.

Name of Service Provider	Network Availability		Connection Establishment (Accessibility)			Connection Maintenance (Retainability)		
	BTSs Accumulated downtime (not available for service)	Worst affected BTSs due to downtime	Call Set-up Success Rate (within licensee's own network)	SDCCH/ Paging Chl. Congestion (%)	TCH Congestion (%)	Call Drop Rate (%)	Worst affected cells having more than 3% TCH drop	%age of connection with good voice quality
Benchmark	≤ 2%	≤ 2%	≥ 95%	≤ 1%	≤ 2%	≤ 2%	≤ 3%	≥ 95%
Aircel(DWL)	8.60%	9.00%	96.01%	1.74%	3.46%	2.15%	22.23%	93.00%
Airtel	0.26%	0.00%	97.92%	0.42%	0.42%	1.12%	0.87%	98.93%
BSNL NE 1 CDMA	4.64%	2.07%	96.71%	NA	0.00%	1.69%	No Data	98.00%
BSNL NE 2 CDMA	9.49%	10.97%	90.08%	NA	0.11%	0.91%	3.80%	100.00%
BSNL NE 1 GSM	1.89%	1.90%	97.08%	0.93%	1.92%	1.73%	2.93%	97.61%
BSNL NE 2 GSM	4.69%	19.50%	80.26%	0.49%	0.85%	6.30%	17.05%	88.07%
Idea	1.18%	0.72%	99.11%	0.24%	0.46%	1.35%	1.76%	95.69%
Reliance GSM	1.35%	1.54%	98.72%	0.02%	0.23%	0.63%	0.08%	98.18%
Vodafone	1.66%	0.55%	99.79%	0.07%	0.21%	0.66%	2.41%	98.03%

Note: Auditors were not able to get the data for worst affected cells having more than 3% TCH drop and Voice quality from BSNL NE 1 CDMA, as operator reported a technical problem in their systems.

NA: SDCCH/ Paging channel congestion not applicable for CDMA operators. Hence, it has been reported as NA for BSNL CDMA.

The above table represents the parameter wise observations for Wireless Operators for North East circle:

BTSs Accumulated Downtime:

Aircel, BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark. Airtel performed the best among all operators by recording 0.26%.

Worst Affected BTSs Due to Downtime:

Aircel, BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark. Airtel had minimum worst affected BTSs due to downtime at 0.00%.

Call Set-up Success Rate (CSSR):

BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark on CSSR. Best CSSR performance was observed for Vodafone with 99.79% of their calls getting completed.

All the operators were found to be calculating the parameter as per the norm specified by TRAI. CSSR was established as the ratio of total number of successful call attempts (establishment) to the total number of call attempts made.

Network Congestion parameters:

Aircel failed to meet the benchmark for both SDCCH Paging Channel Congestion and TCH Congestion parameters.

Reliance GSM performed the best on SDCCH Paging Channel Congestion and BSNL NE 1 CDMA performed the best on TCH congestion.

The calculation methodology of these parameters was found to be in complete accordance with TRAI specifications.

Call Drop Rate:

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

While Aircel and BSNL NE 2 GSM failed to meet the TRAI benchmark, Reliance GSM was the best performer by recording call drop rate of 0.63%.

Worst Affected Cells Having More than 3% TCH Drop:

Aircel, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark while Reliance GSM had minimum worst affected cells at 0.08%.

Voice Quality:

Aircel and BSNL NE 2 GSM did not meet the benchmark in terms of voice quality. BSNL NE 2 CDMA was the best performer by recording 100% voice quality.

3.3 LIVE CALLING DATA – CONSOLIDATED

Name of Service Provider	Metering and Billing		Service Requests	Level 1 Service	Response time to customer for assistance	
	%age complaints resolved within 4 weeks	%age complaints resolved within 6 weeks	Complaint /Request attended to Satisfaction	Call answered in 60 seconds	Accessibility of call centre/ customer care	Percentage of calls answered by the operators (voice to voice) within 90 seconds
Benchmark	≥ 98%	≥ 100%		≥ 95%	≥ 95%	≥ 95%
Aircel(DWL)	71.00%	86.00%	80.00%	97.33%	100.00%	100.00%
Airtel	74.00%	88.00%	77.00%	98.67%	100.00%	100.00%
BSNL NE 1 CDMA	No Data	No Data	No Data	96.67%	100.00%	100.00%
BSNL NE 2 CDMA	No Data	No Data	No Data	98.00%	100.00%	100.00%
BSNL NE 1 GSM	67.00%	74.00%	76.00%	96.00%	100.00%	100.00%
BSNL NE 2 GSM	No Data	No Data	No Data	97.33%	100.00%	100.00%
Idea	62.00%	78.00%	81.00%	98.67%	100.00%	72.00%
Reliance GSM	74.00%	90.00%	61.00%	100.00%	100.00%	100.00%
Vodafone	79.00%	91.00%	82.00%	100.00%	100.00%	100.00%

Note: Auditors were not able to get billing complaints and service requests/complaints raw data from the central billing and complaints center of BSNL NE 1 CDMA, BSNL NE2 CDMA and BSNL NE 2 GSM as the operators were unable to provide the same.

Resolution of billing complaints

As per the live calling made to consumers, none of the operators met the benchmark.

Complaint/Request Attended to Satisfaction

Vodafone performed the best on customer satisfaction with service complaints/ requests.

Level 1 Service

All operators were able to meet the benchmark for level 1 service calls being answered within 60 seconds. Reliance GSM and Vodafone were the best performers with 100% calls getting answered within 60 seconds.

The details of live calling done for the level 1 service have been provided in the annexure for each operator.

Accessibility of Call Centre/Customer Care-IVR

For the IVR aspect, all the service providers met the TRAI benchmark with 100% accessibility of all call center/customer care center.

Customer Care / Helpline Assessment

Idea failed to meet the benchmark for the parameter while all other operators had 100% calls getting answered by the operator during live calling.

3.4 BILLING AND CUSTOMER CARE – CONSOLIDATED

Name of Service Provider	Metering and billing credibility		Resolution of billing complaints		Response time to customer for assistance	Customer care	
	Postpaid Subscribers	Prepaid Subscribers	% of complaints resolved in 4 weeks	% of complaints resolved in 6 weeks	% of cases where credit/wavier is received within one week	Percentage of calls answered by the operators IVR within 60 seconds	Percentage of calls answered by the operators (voice to voice) within 90 seconds
Benchmark	≤ 0.1%	≤ 0.1%	≥ 98%	≥ 100%	≥ 100%	≥ 95%	≥ 95%
Aircel(DWL)	0.06%	0.12%	100.00%	100.00%	100.00%	97.02%	97.27%
Airtel	0.05%	0.03%	100.00%	100.00%	100.00%	100.00%	96.92%
BSNL NE 1 CDMA	0.43%	0.36%	92.17%	100.00%	100.00%	100.00%	100.00%
BSNL NE 2 CDMA	0.00%	No Data	No Data	No Data	No Data	No Data	No Data
BSNL NE 1 GSM	0.07%	0.01%	76.64%	100.00%	100.00%	98.60%	91.00%
BSNL NE 2 GSM	0.00%	0.02%	84.11%	100.00%	100.00%	99.02%	100.00%
Idea	0.39%	0.23%	100.00%	100.00%	100.00%	99.87%	99.44%
Reliance GSM	0.04%	0.02%	100.00%	100.00%	100.00%	98.24%	86.63%
Vodafone	0.38%	0.15%	100.00%	100.00%	100.00%	100.00%	100.00%

Note: Auditors were not able to get prepaid billing complaints, resolution of billing complaints, credit/waiver and customer care data for the purpose of audit from BSNL NE 2 CDMA due to unavailability of data at the operator's central customer service centre and central billing centre.

Metering and billing credibility – Postpaid Subscribers

For the postpaid customers, BSNL NE 1 CDMA, Idea and Vodafone did not meet the benchmark. BSNL NE 2 CDMA was the best performer in the circle.

Metering and billing credibility – Prepaid Subscribers

For prepaid, Aircel, BSNL NE 1 CDMA, Idea and Vodafone did not meet the benchmark. BSNL NE 1 GSM was the best performer in the circle.

Resolution of Billing Complaints

BSNL NE1 CDMA, BSNL NE1 GSM and BSNL NE2 GSM did not meet the benchmark for resolving 98% complaints within 4 weeks. All the operators met the TRAI criteria of resolution of billing complaints within 6 weeks.

Response Time to customer for assistance - % of cases in which advance waiver is received within one week

All the operators met the TRAI benchmark of providing credit or waiver within one week in case of complaints received.

Customer Care Percentage of calls answered by the operators IVR within 60 seconds

All operators met the benchmark of 95% IVR call getting connected within 60 seconds. Airtel, BSNL NE 1 CDMA and Vodafone were the best performers.

Customer Care Percentage of calls answered by the operators (Voice to Voice) within 90 seconds

BSNL NE 1 GSM and Reliance GSM failed to meet the benchmark. BSNL NE 1 CDMA, BSNL NE 2 GSM and Vodafone had the highest percentage of calls being answered at 100 %.

3.5 INTER OPERATOR CALL ASSESSMENT – CONSOLIDATED

6. Inter Operator Call Assessment							
Inter operator call Assessment To↓ From→	Aircel(DWL)	Airtel	BSNL NE CDMA	BSNL NE GSM	Idea	Reliance GSM	Vodafone
Aircel(DWL)	NA	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Airtel	100.00%	NA	98.00%	99.00%	100.00%	100.00%	100.00%
BSNL NE 1 CDMA	88.00%	87.00%	NA	86.00%	91.00%	91.00%	90.00%
BSNL NE 2 CDMA	87.00%	91.00%	NA	87.00%	91.00%	88.00%	87.00%
BSNL NE 1 GSM	100.00%	100.00%	95.00%	NA	100.00%	100.00%	100.00%
BSNL NE 2 GSM	100.00%	100.00%	91.00%	NA	100.00%	100.00%	100.00%
Idea	100.00%	100.00%	100.00%	100.00%	NA	100.00%	100.00%
Reliance GSM	100.00%	100.00%	97.00%	100.00%	100.00%	NA	100.00%
Vodafone	100.00%	100.00%	94.00%	100.00%	100.00%	100.00%	NA



Maximum Problem faced by the calling operator to other operator. The orange colour denotes performance below circle average.

In the inter-operator call assessment, it was observed that BSNL NE 1 CDMA and BSNL NE 2 CDMA were the operators facing problems in connecting to and from other operators.

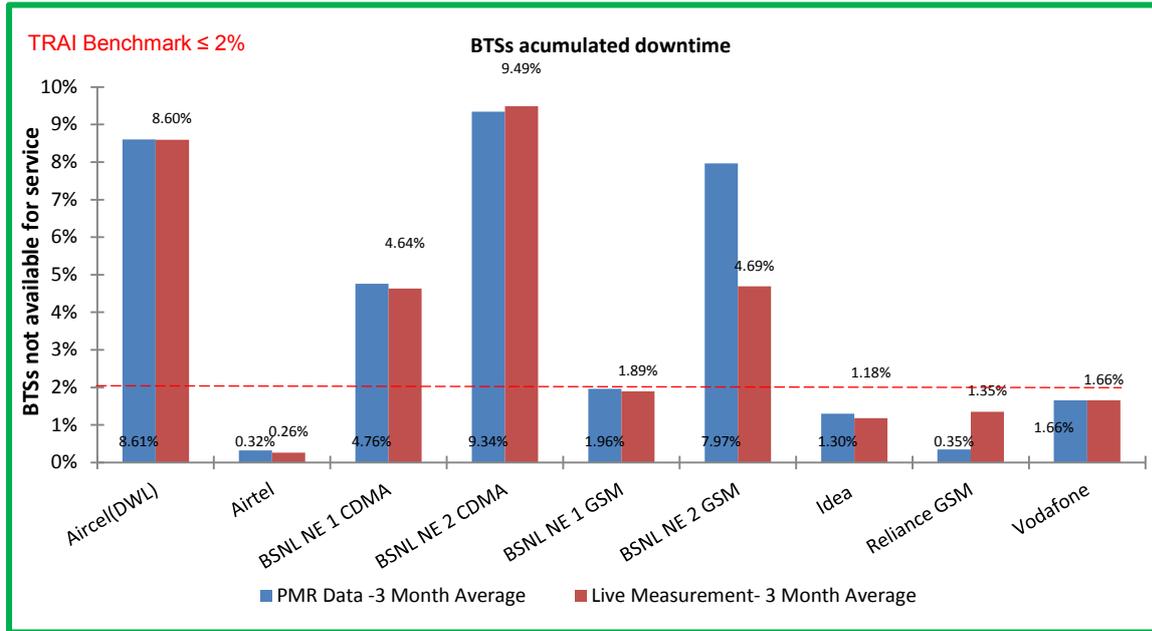
4 PARAMETER DESCRIPTION & DETAILED FINDINGS - COMPARISON BETWEEN PMR DATA, 3 DAY LIVE DATA AND LIVE CALLING DATA

4.1 BTS ACCUMULATED DOWNTIME

4.1.1 PARAMETER DESCRIPTION

- The parameter of network availability would be measured from following sub-parameters
 1. BTSs Accumulated downtime (not available for service)
 2. Worst affected BTSs due to downtime
- 1. **Definition - BTSs (Base Transceiver Station) accumulated downtime** (not available for service) shall basically measure the downtime of the BTSs, including its transmission links/circuits during the period of a month, but excludes all planned service downtime for any maintenance or software up gradation. For measuring the performance against the benchmark for this parameter the downtime of each BTS lasting more than 1 hour at a time in a day during the period of a month were considered.
- 2. **Computation Methodology -**
BTS accumulated downtime (not available for service) = Sum of downtime of BTSs in a month in hours i.e. total outage time of all BTSs in hours during a month / (24 x Number of days in a month x Number of BTSs in the network in licensed service area) x 100
- 3. **TRAI Benchmark -**
 - a. BTSs Accumulated downtime (not available for service) $\leq 2\%$
- 4. **Audit Procedure -**
 - The fault alarm details at the OMC (MSC) for the network outages (due to own network elements and infrastructure service provider end outages) was audited
 - All the BTS in service area were considered. Planned outages due to network up gradation, routine maintenance were not considered.
 - Any outage as a result of force majeure were not considered at the time of calculation
 - Data is extracted from system log of the server of the operator. This data is in raw format which is further processed to arrive at the cumulative values.
 - List of operating sites with cell details and ids are taken from the operator.
 - When there is any outage a performance report gets generated in line with that cell resulting and master base of the Accumulated downtime and worst affected BTS due to downtime.

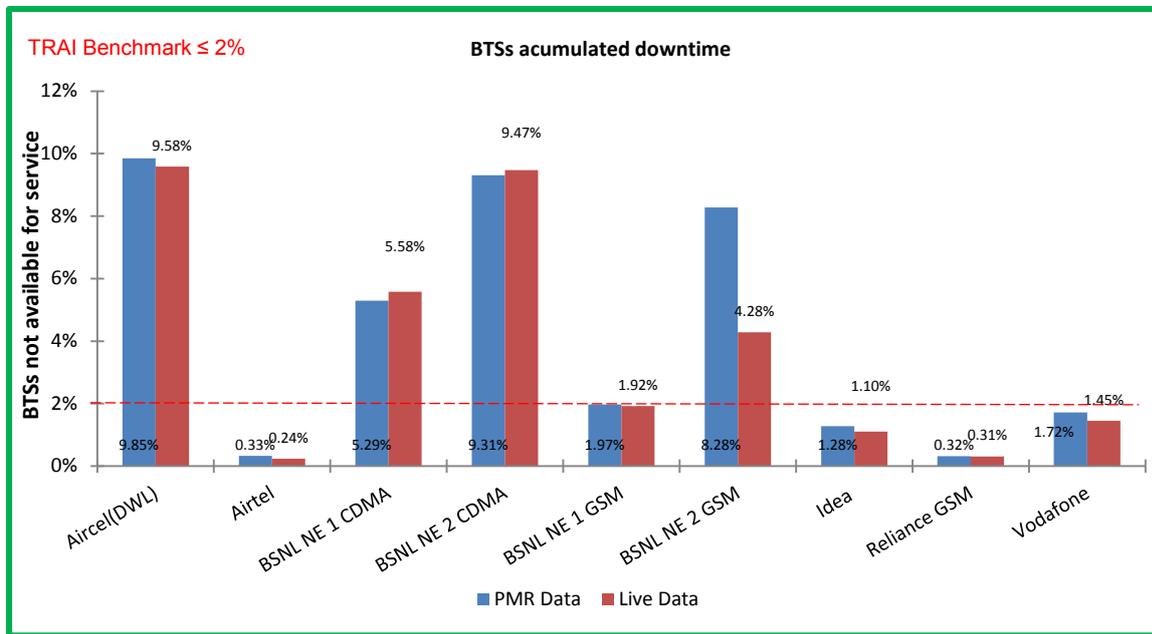
4.1.2 KEY FINDINGS – CONSOLIDATED



Data Source: Operations and Maintenance Center (OMC) of the operators

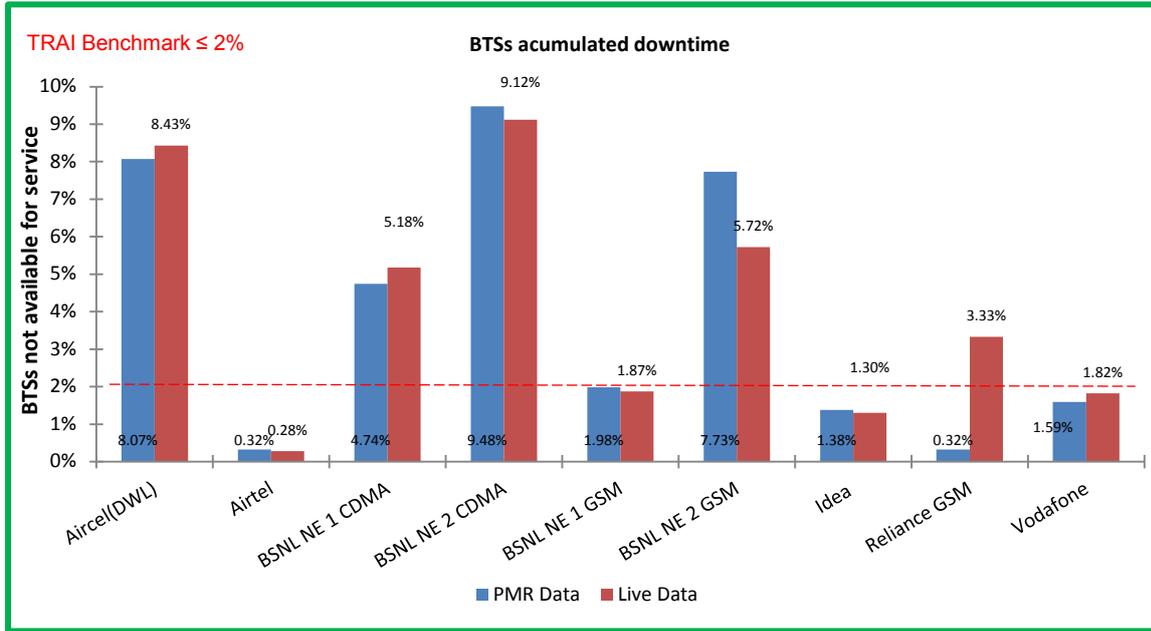
Aircel, BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark during audit.

4.1.2.1 KEY FINDINGS – MONTH 1



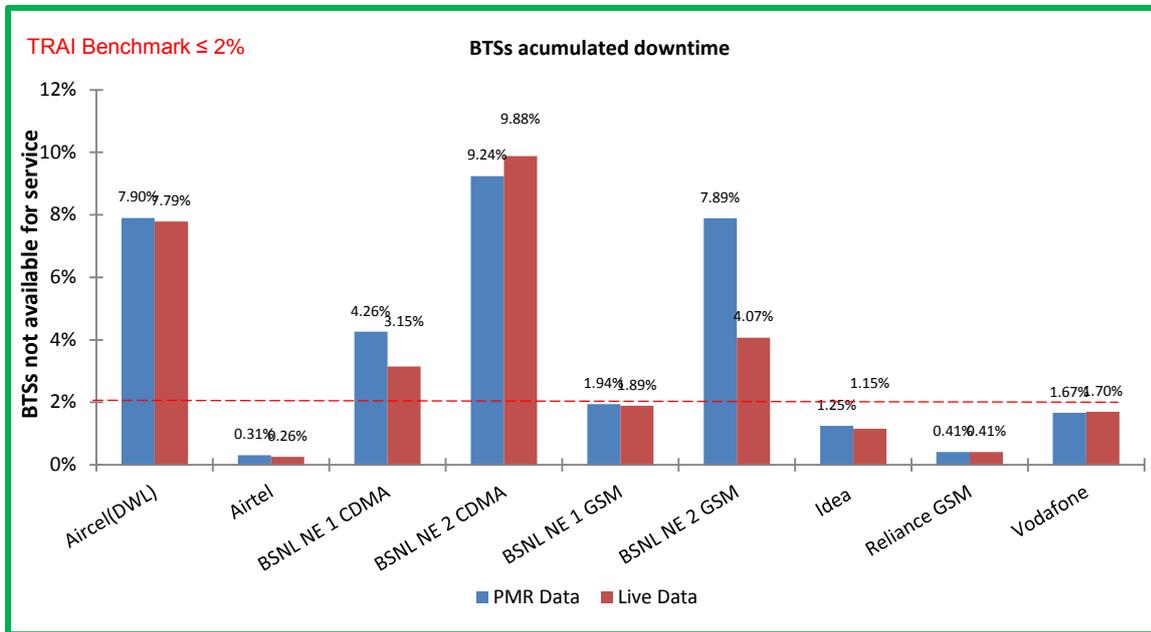
Data Source: Operations and Maintenance Center (OMC) of the operators

4.1.2.2 KEY FINDINGS - MONTH 2



Data Source: Operations and Maintenance Center (OMC) of the operators

4.1.2.3 KEY FINDINGS - MONTH 3



Data Source: Operations and Maintenance Center (OMC) of the operators

4.2 WORST AFFECTED BTS DUE TO DOWNTIME

4.2.1 PARAMETER DESCRIPTION

1. **Definition – Worst Affected BTS due to downtime** shall basically measure percentage of BTS having downtime greater than 24 hours in a month. Planned outages were not considered as part while computing.

For measuring the parameter “Percentage of worst affected BTSs due to downtime” the downtime of each BTS lasting for more than 1 hour at a time in a day during the period of a month was considered.

2. **Computation Methodology –**

Worst affected BTSs due to downtime = (Number of BTSs having accumulated downtime greater than 24 hours in a month / Number of BTS in Licensed Service Area) * 100

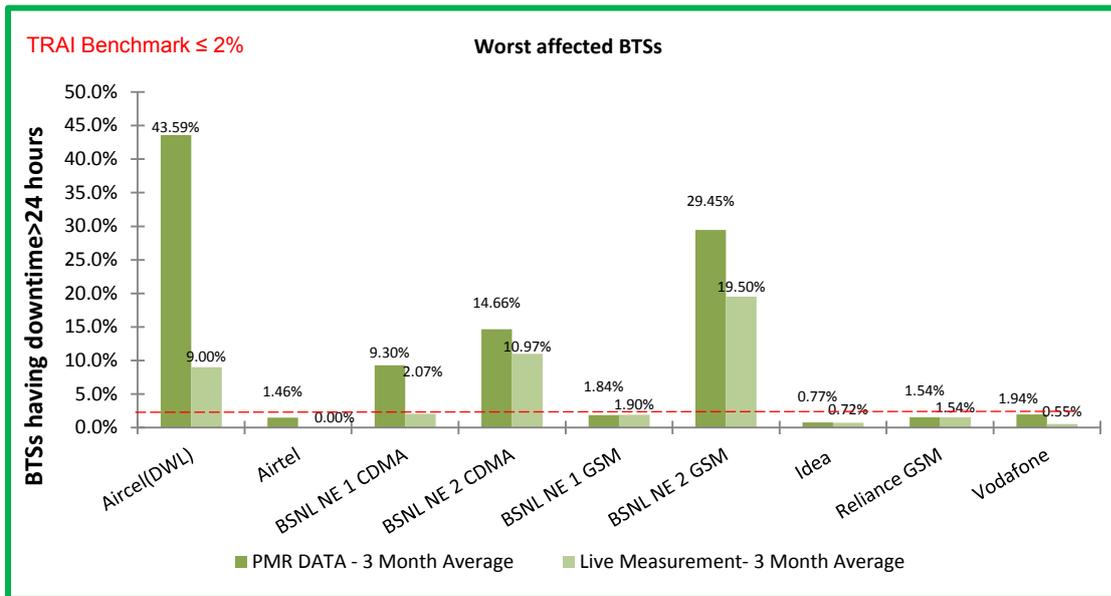
3. **TRAI Benchmark –**

- a. Worst affected BTSs due to downtime $\leq 2\%$

4. **Audit Procedure –**

- i. The fault alarm details at the OMC (MSC) for the network outages (due to own network elements and infrastructure service provider end outages) was audited
- ii. All the BTS in service area were considered. Planned outages due to network up gradation, routine maintenance were not considered.
- iii. Data is extracted from system log of the server of the operator. This data is in raw format which is further processed to arrive at the cumulative values.
- iv. Any outage as a result of force majeure was not considered at the time of calculation.
- v. List of operating sites with cell details and ids are taken from the operator.
- vi. All the BTS having down time greater than 24 hours is assessed and values of BTS accumulated downtime is computed in accordance.

4.2.2 KEY FINDINGS – CONSOLIDATED

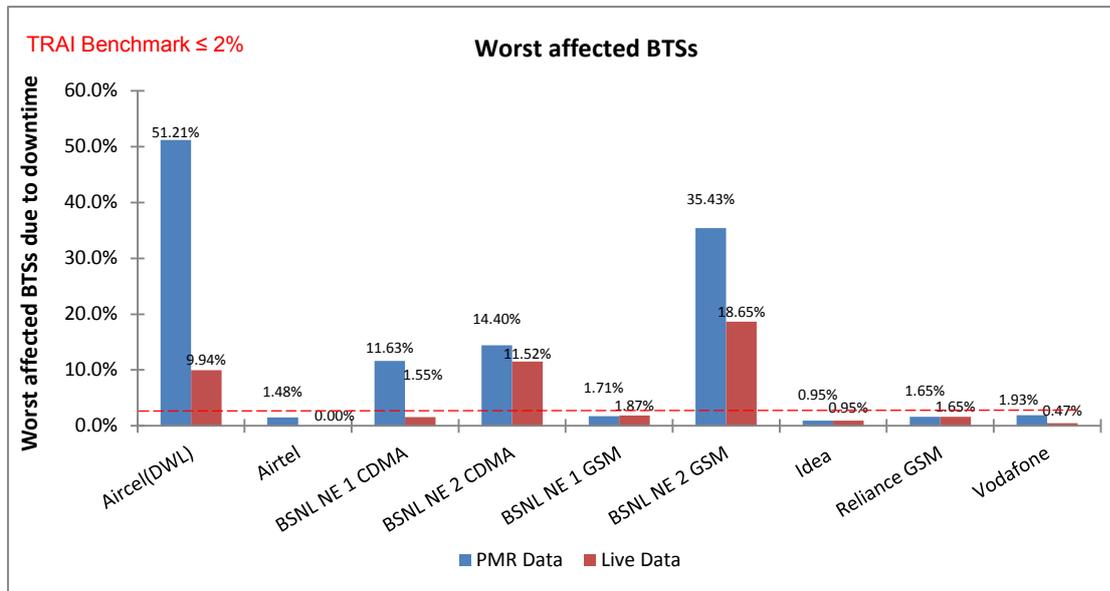


Data Source: Operations and Maintenance Center (OMC) of the operators

Aircel, BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM failed to meet the benchmark during audit.

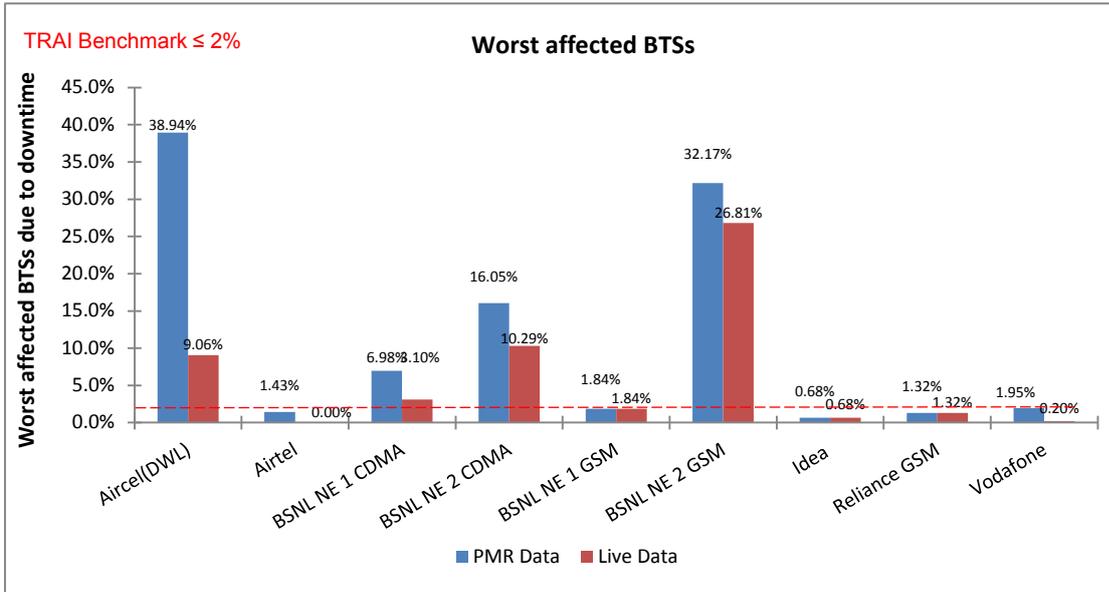
Significant difference was observed between PMR & live measurement data for Aircel, BSNL NE 1 CDMA and BSNL NE 2 GSM. The possible reason for the variation could be the difference in time frame of data as PMR data is for 30 days and live measurement data is for three days.

4.2.2.1 KEY FINDINGS – MONTH 1



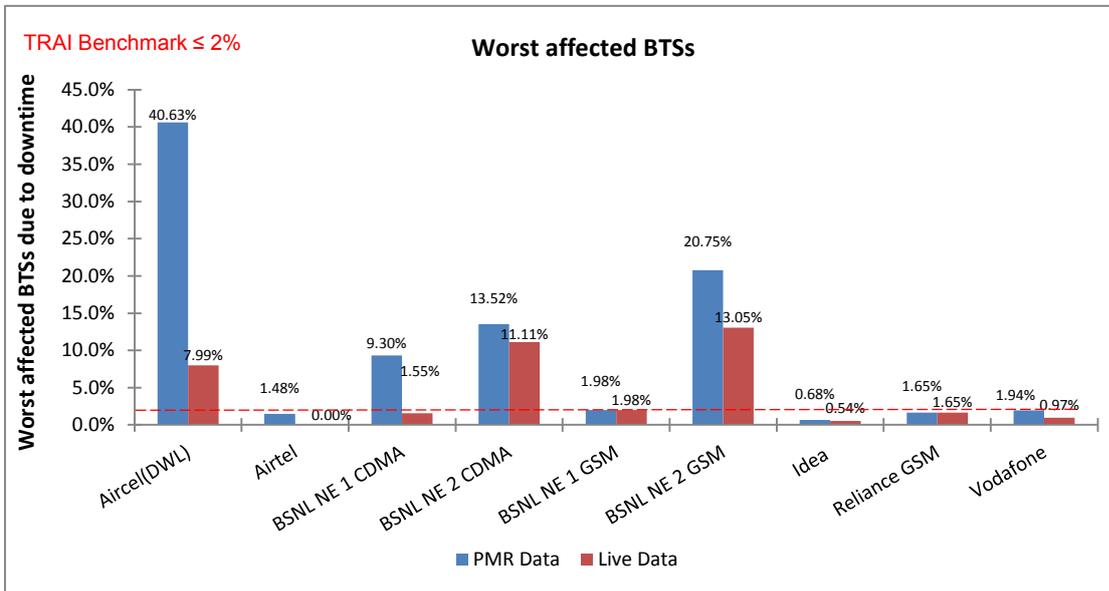
Data Source: Operations and Maintenance Center (OMC) of the operators

4.2.2.2 KEY FINDINGS - MONTH 2



Data Source: Operations and Maintenance Center (OMC) of the operators

4.2.2.3 KEY FINDINGS - MONTH 3



Data Source: Operations and Maintenance Center (OMC) of the operators

4.3 CALL SET UP SUCCESS RATE

4.3.1 PARAMETER DESCRIPTION

1. **Definition:** The ratio of successful calls established to total calls is known as Call Set-Up Success Rate (CSSR).

2. **Computation Methodology-**

$$(\text{Calls Established} / \text{Total Call Attempts}) * 100$$

Call Established means the following events have happened in call setup:-

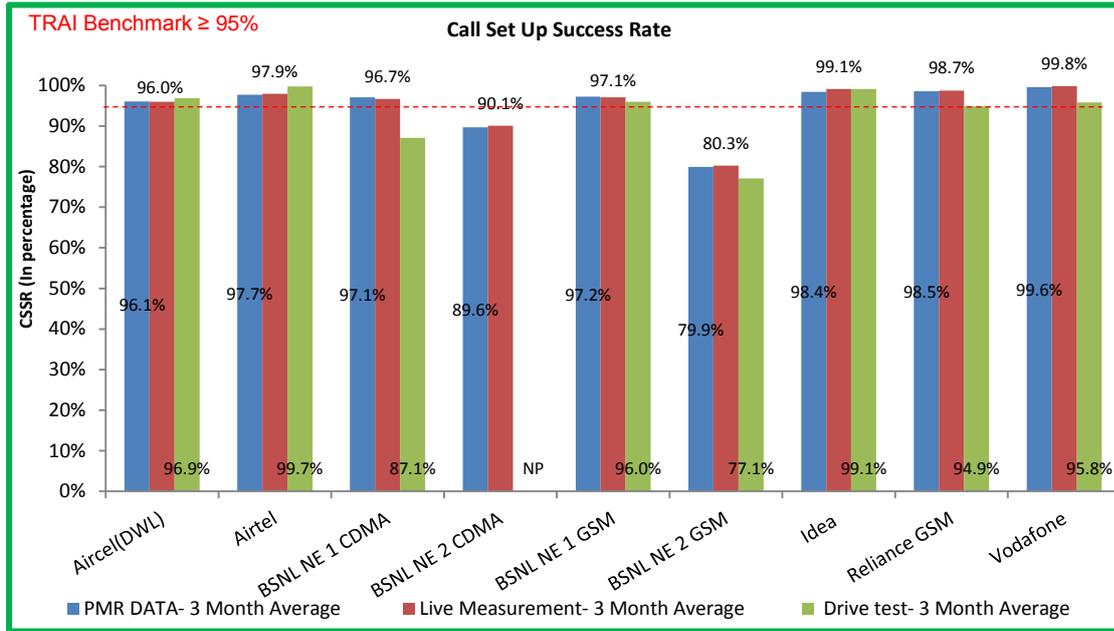
- ↳ call attempt is made
- ↳ the TCH is allocated
- ↳ the call is routed to the outward path of the concerned MSC

3. **TRAI Benchmark** $\geq 95\%$

4. **Audit Procedure -**

- ↳ The cell-wise data generated through counters/ MMC available in the switch for traffic measurements
- ↳ CSSR calculation should be measured using OMC generated data only
- ↳ Measurement should be only in Time Consistent Busy Hour (CBBH) period for all days of the week
- ↳ Counter data is extracted from the NOC of the operators.
- ↳ Total calls established include all calls established excluding Signaling blocking, TCH Drop and TCH blocking.
- ↳ The numerator and denominator values are derived from adding the counter values from the MSC.

4.3.2 KEY FINDINGS – CONSOLIDATED

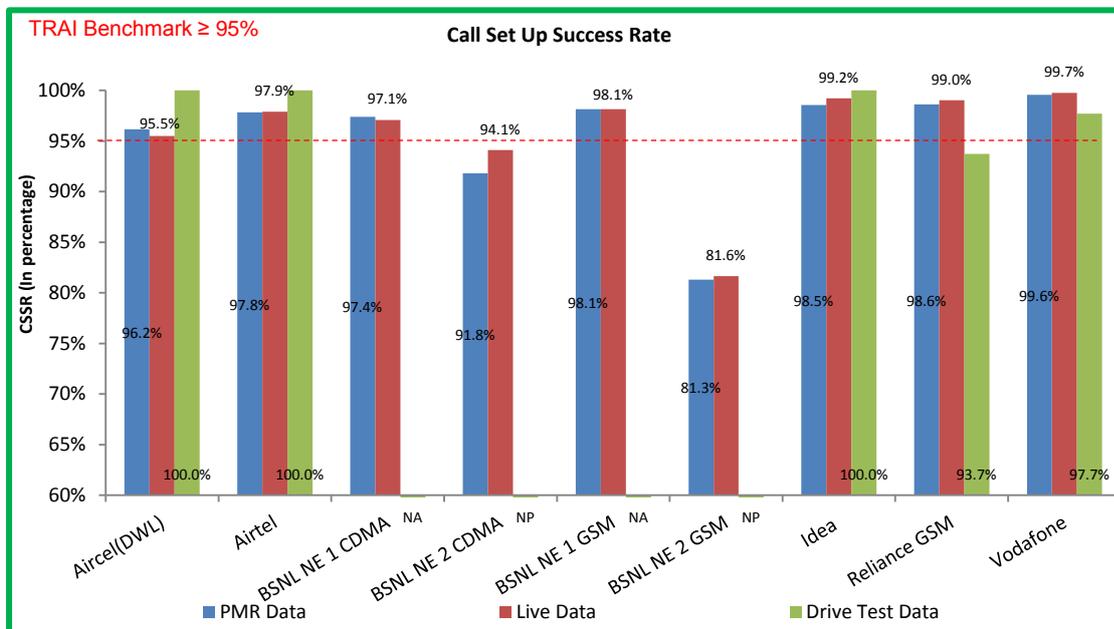


Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

NP: Operators BSNL NE 2 CDMA did not participate in the drive test.

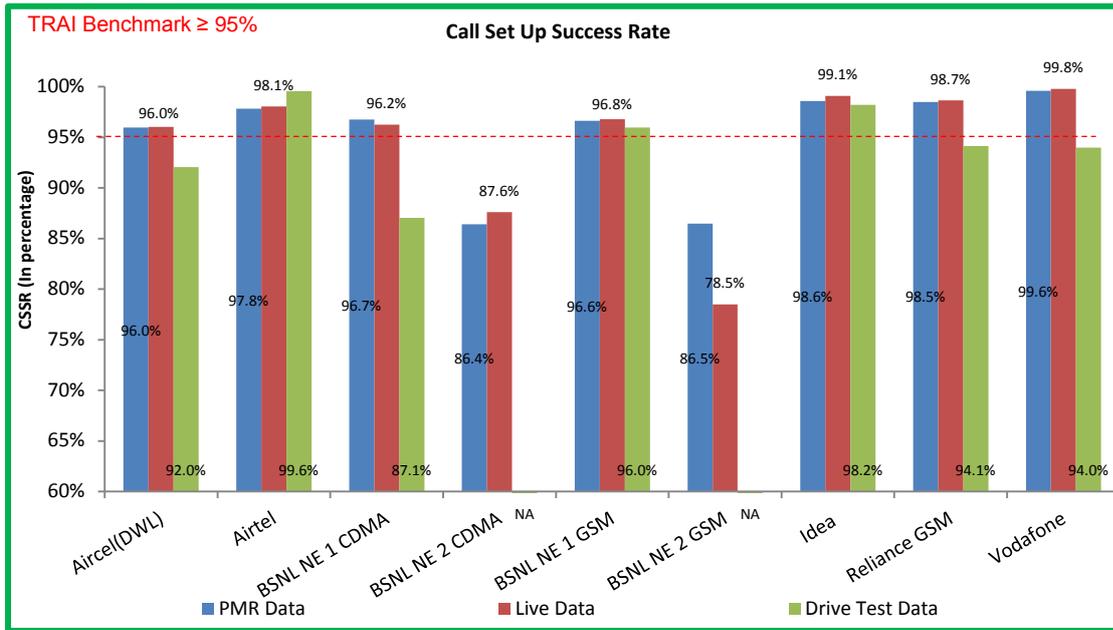
BSNL NE 2 CDMA and BSNL NE 2 GSM did not meet the benchmark for CSSR.

4.3.2.1 KEY FINDINGS – MONTH 1



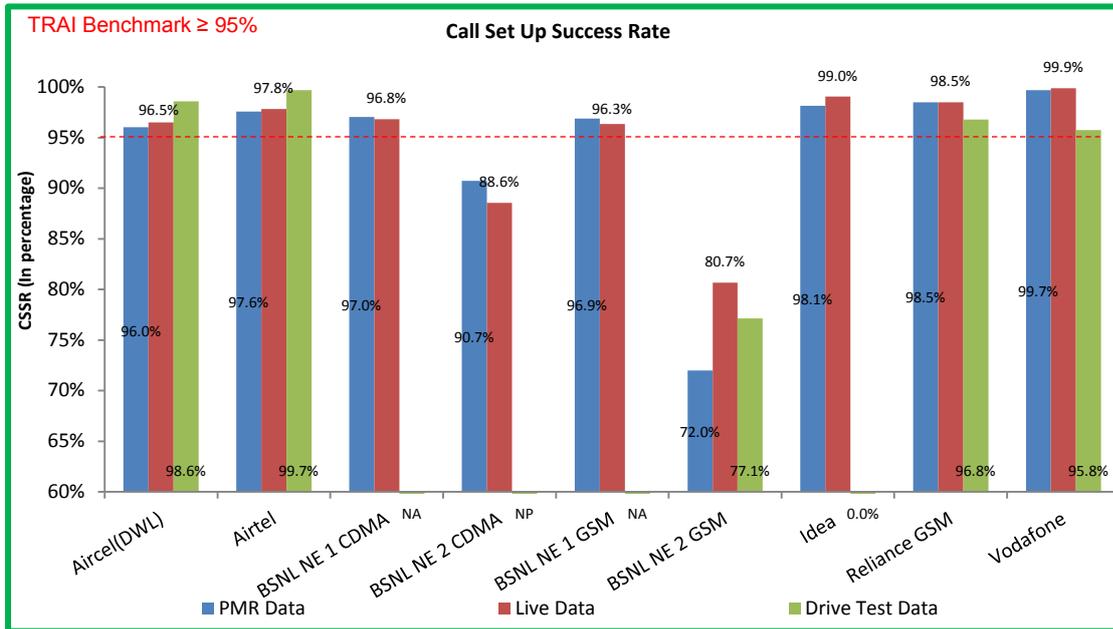
Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

4.3.2.2 KEY FINDINGS - MONTH 2



Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

4.3.2.3 KEY FINDINGS - MONTH 3



Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

4.4 NETWORK CHANNEL CONGESTION- PAGING CHANNEL /TCH CONGESTION/POI

4.4.1 PARAMETER DESCRIPTION

- 1. Definition:** It means a call is not connected because there is no free channel to serve the call attempt. This parameter represents congestion in the network. It happens at three levels:

- ↳ SDCCH Level: Stand-alone dedicated control channel
- ↳ TCH Level: Traffic Channel
- ↳ POI Level: Point of Interconnect

- 2. Computational Methodology:**

↳ **SDCCH / TCH Congestion%** = $[(A_1 \times C_1) + (A_2 \times C_2) + \dots + (A_n \times C_n)] / (A_1 + A_2 + \dots + A_n)$

- Where:- A_1 = Number of attempts to establish SDCCH / TCH made on day 1
- C_1 = Average SDCCH / TCH Congestion % on day 1
- A_2 = Number of attempts to establish SDCCH / TCH made on day 2
- C_2 = Average SDCCH / TCH Congestion % on day 2
- A_n = Number of attempts to establish SDCCH / TCH made on day n
- C_n = Average SDCCH / TCH Congestion % on day n

↳ **POI Congestion%** = $[(A_1 \times C_1) + (A_2 \times C_2) + \dots + (A_n \times C_n)] / (A_1 + A_2 + \dots + A_n)$

- Where:- A_1 = POI traffic offered on all POIs (no. of calls) on day 1
- C_1 = Average POI Congestion % on day 1
- A_2 = POI traffic offered on all POIs (no. of calls) on day 2
- C_2 = Average POI Congestion % on day 2
- A_n = POI traffic offered on all POIs (no. of calls) on day n
- C_n = Average POI Congestion % on day n

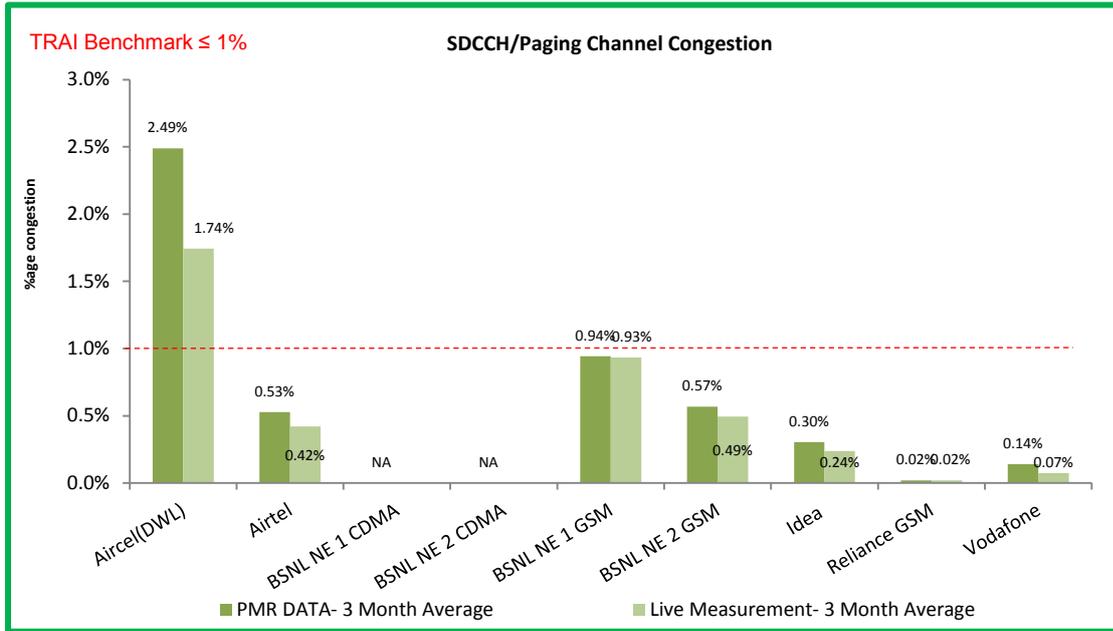
- 3. Benchmark:**

↳ SDCCH Congestion: $\leq 1\%$, TCH Congestion: $\leq 2\%$, POI Congestion: $\leq 0.5\%$

- 4. Audit Procedure –**

- ↳ Audit of the details of SDCCH and TCH congestion percentages computed by the operator (using OMC-Switch data only) would be conducted
- ↳ The operator should be measuring this parameter during Time consistent busy hour (TCBH) only SDCCH

4.4.2 KEY FINDINGS - SDCCH/PAGING CHANNEL CONGESTION

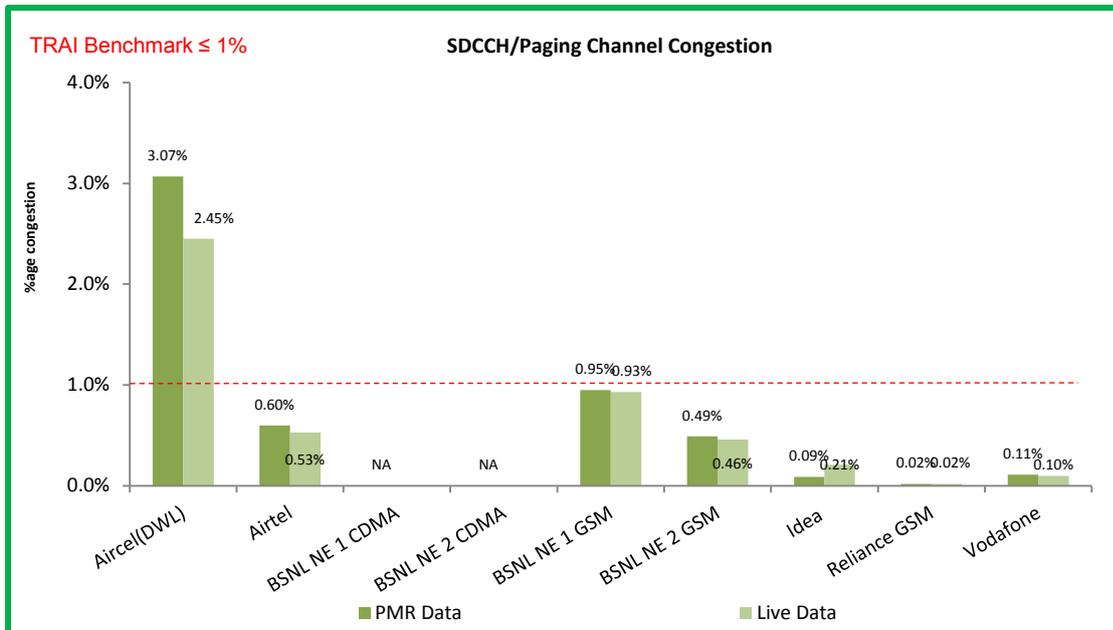


Data Source: Network Operations Center (NOC) of the operators

Aircel failed to meet the benchmark while all other operators met the TRAI benchmark of 1% as per PMR.

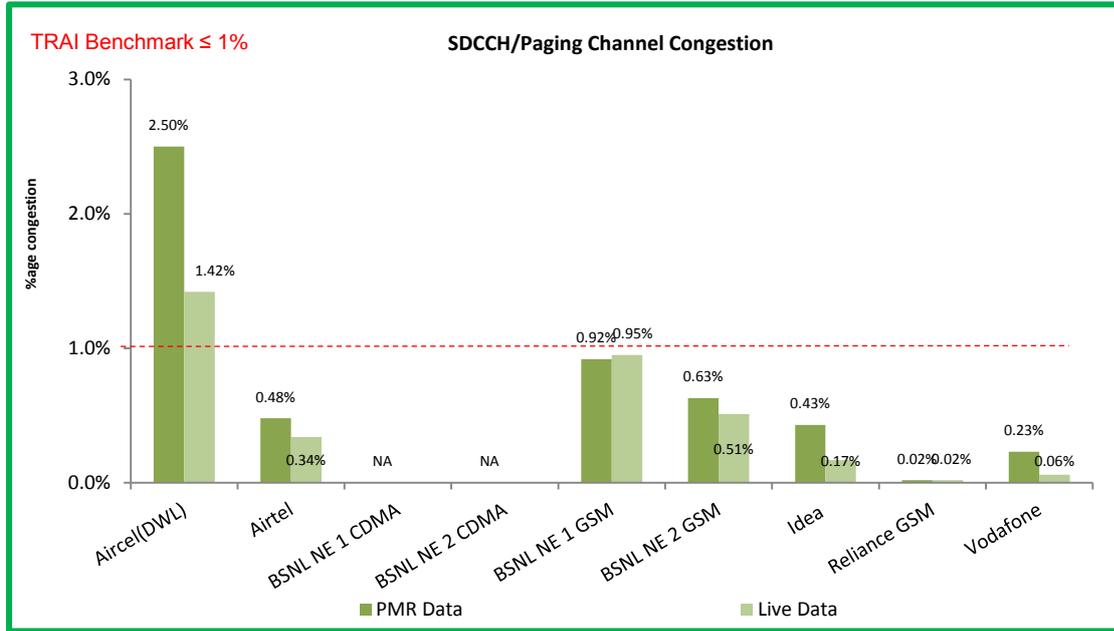
NA: SDCCH Congestion is a GSM parameter; hence it is not applicable for CDMA operators.

4.4.2.1 KEY FINDINGS - MONTH 1



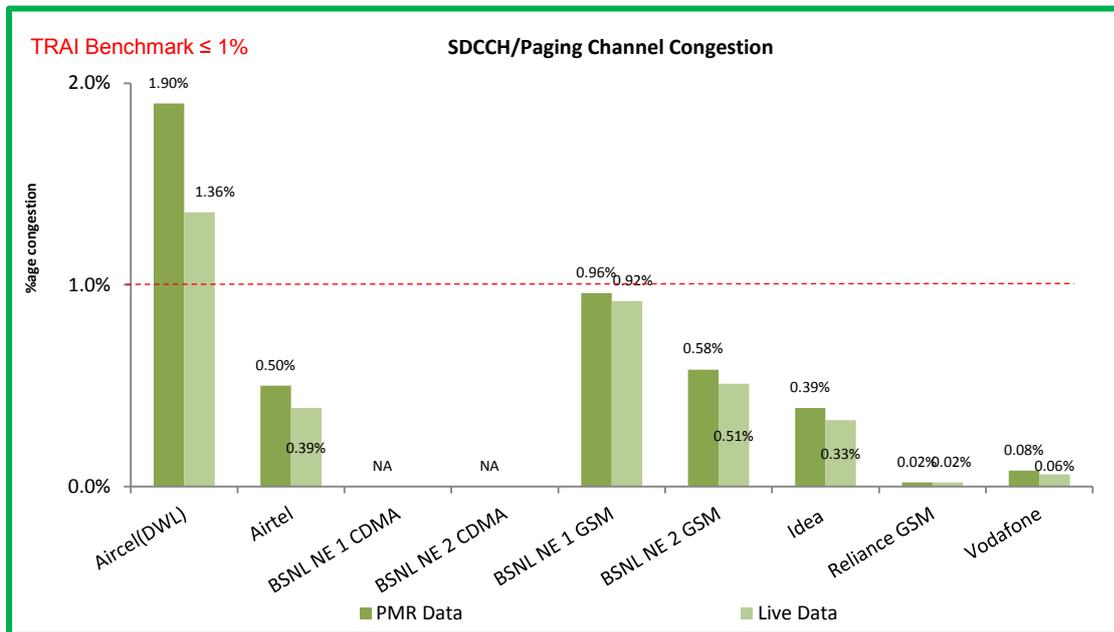
Data Source: Network Operations Center (NOC) of the operators

4.4.2.2 KEY FINDINGS - MONTH 2



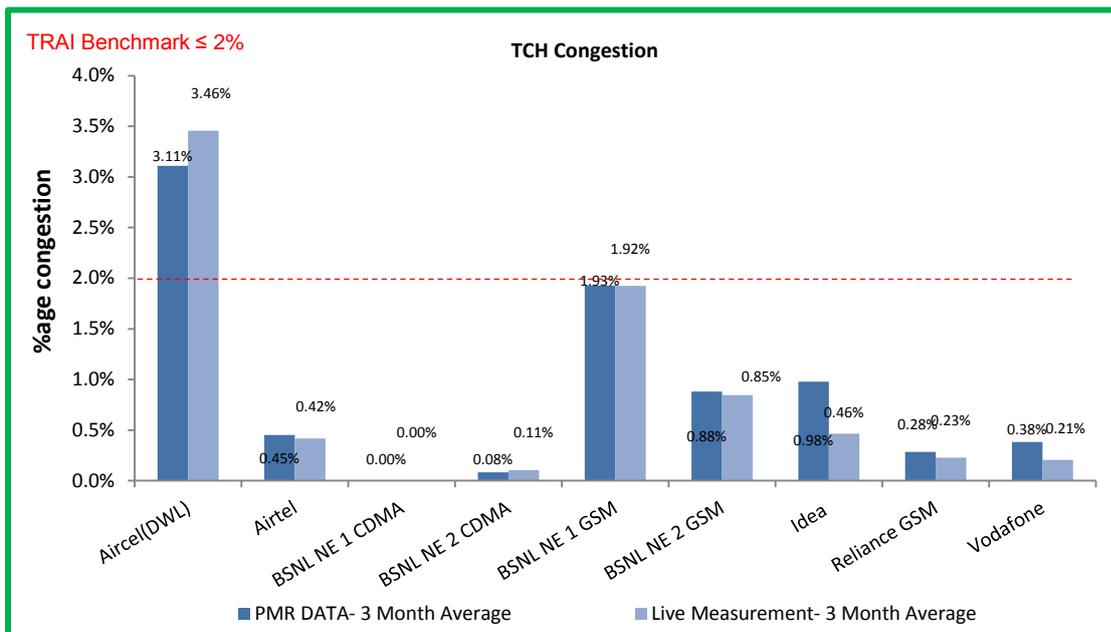
Data Source: Network Operations Center (NOC) of the operators

4.4.2.3 KEY FINDINGS - MONTH 3



Data Source: Network Operations Center (NOC) of the operators

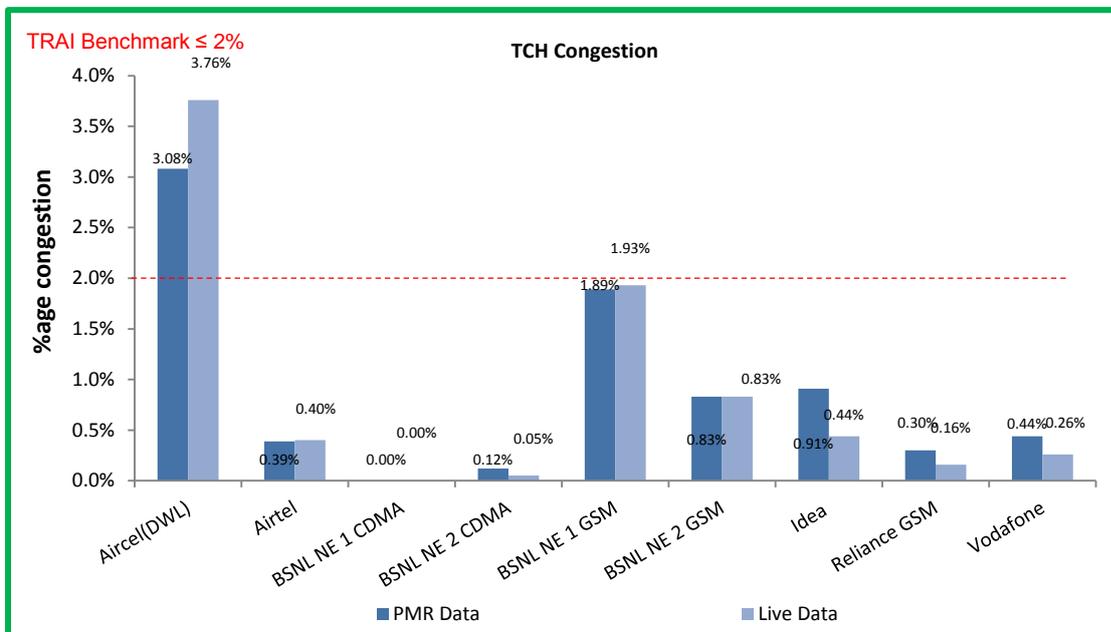
4.4.3 KEY FINDINGS – TCH CONGESTION



Data Source: Network Operations Center (NOC) of the operators

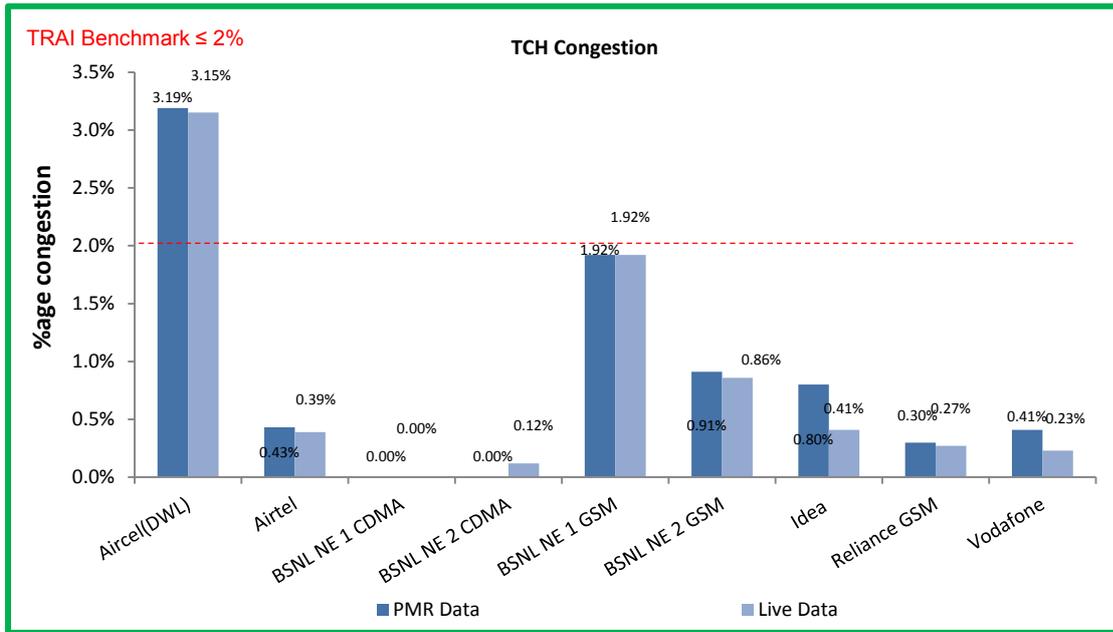
Aircel failed to meet the benchmark while all other operators met the TRAI benchmark of 2% during audit.

4.4.3.1 KEY FINDINGS – MONTH 1



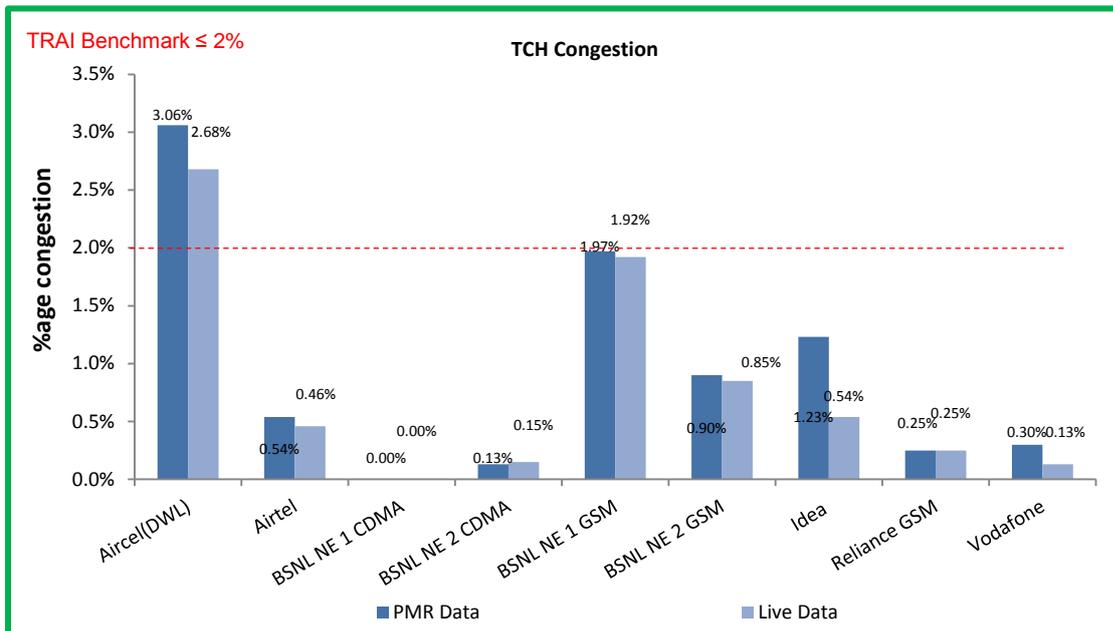
Data Source: Network Operations Center (NOC) of the operators

4.4.3.2 KEY FINDINGS - MONTH 2



Data Source: Network Operations Center (NOC) of the operators

4.4.3.3 KEY FINDINGS - MONTH 3



Data Source: Network Operations Center (NOC) of the operators

4.4.4 KEY FINDINGS – POI CONGESTION

Audit Results for POI Congestion-Consolidated										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Average number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
Average No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Average Capacity of all POIs (A) - in erlangs		40238	50858	No Data	No Data	27802	No Data	13758	8878	27325830
Average Traffic served for all POIs (B)- in erlangs		24325	19934	No Data	No Data	14312	No Data	8428	4579	6053012
Average POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%
Live Measurement Results for POI Congestion-Consolidated										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Average number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
Average No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Average Capacity of all POIs (A) - in erlangs		40238	50911	No Data	No Data	27802	No Data	13767	8883	891184
Average Traffic served for all POIs (B)- in erlangs		22526	20263	No Data	No Data	14197	No Data	8561	4653	198840
Average POI congestion	≤ 0.5%	12.33%	0.00%	No Data	No Data	0.33%	No Data	0.00%	0.00%	0.00%

Data Source: Network Operations Center (NOC) of the operators

All the operators met the benchmark of POI congestion as per PMR data. Auditors were not able to get the data from BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE2 GSM as the operator (BSNL) had technical issues.

4.4.4.1 KEY FINDINGS – MONTH 1

Audit Results for POI Congestion- PMR data-October										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40129	50565	No Data	No Data	27803	No Data	13526	8655	27512341
Traffic served for all POIs (B)- in erlangs		23284	19102	No Data	No Data	14326	No Data	7952	4452	5971100
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%

Live Measurement Results for POI Congestion- 3 Day data-October										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40129	50971	No Data	No Data	27803	No Data	13736	8669	887495
Traffic served for all POIs (B)- in erlangs		22398	19757	No Data	No Data	14020	No Data	8057	4676	195201
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.00%	No Data	0.00%	0.00%	0.00%

Data Source: Network Operations Center (NOC) of the operators

4.4.4.2 KEY FINDINGS – MONTH 2

Audit Results for POI Congestion- PMR data-November										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40128	50979	No Data	No Data	27802	No Data	13731	8632	26624846
Traffic served for all POIs (B)- in erlangs		23617	20152	No Data	No Data	14326	No Data	8584	4522	5892847
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%

Live Measurement Results for POI Congestion- 3 Day data-November										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40128	50639	No Data	No Data	27802	No Data	13736	8632	887494
Traffic served for all POIs (B)- in erlangs		22654	20454	No Data	No Data	14020	No Data	8746	4522	196430
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.50%	No Data	0.00%	0.00%	0.00%

Data Source: Network Operations Center (NOC) of the operators

4.4.4.3 KEY FINDINGS – MONTH 3

Audit Results for POI Congestion- PMR data-December										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		37	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40457	51030	No Data	No Data	27803	No Data	14016	9348	27840304
Traffic served for all POIs (B)- in erlangs		26073	20547	No Data	No Data	14284	No Data	8747	4762	6295090
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.49%	No Data	0.00%	0.00%	0.00%
Live Measurement Results for POI Congestion- 3 Day data-December										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		37	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40457	51122	No Data	No Data	27803	No Data	13830	9348	898562
Traffic served for all POIs (B)- in erlangs			20577	No Data	No Data	14550	No Data	8879	4762	204890
POI congestion	≤ 0.5%	37.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%

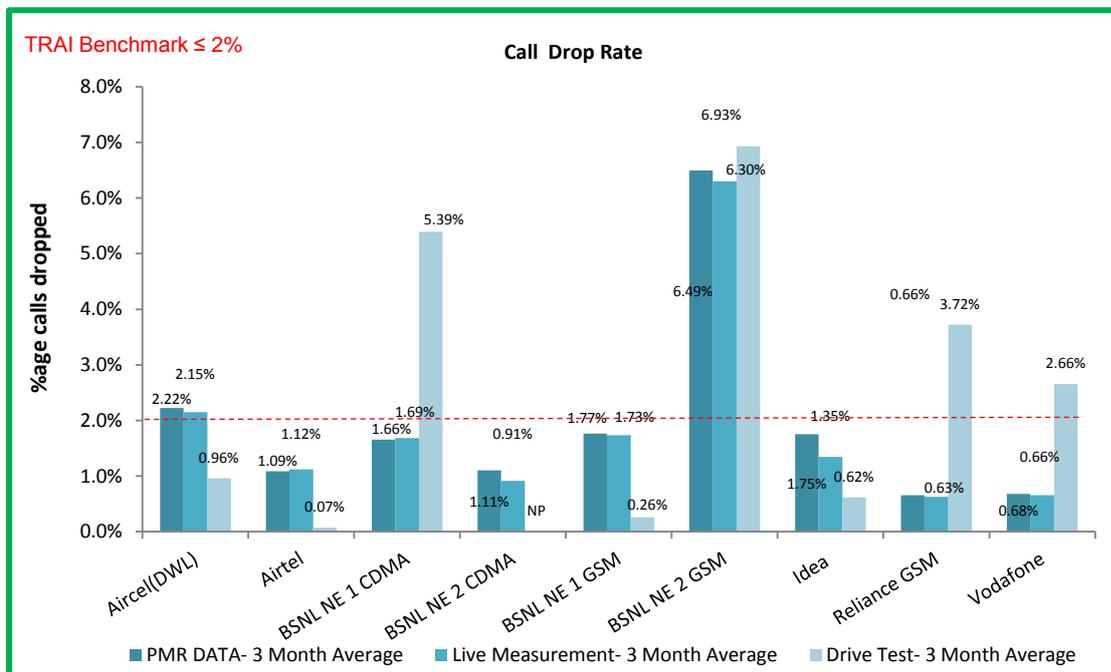
Data Source: Network Operations Center (NOC) of the operators

4.5 CALL DROP RATE

4.5.1 PARAMETER DESCRIPTION

1. **Definition** - The dropped call rate is the ratio of successfully originated calls that were found to drop to the total number of successfully originated calls that were correctly released.
 - ↳ **Total calls dropped** = All calls ceasing unnaturally i.e. due to handover or due to radio loss
 - ↳ **Total calls established** = All calls that have TCH allocation during busy hour
2. **Computational Methodology:** $(\text{Total Calls Dropped} / \text{Total Calls Established}) \times 100$
3. **TRAI Benchmark** -
 - ↳ Call drop rate $\leq 2\%$
4. **Audit Procedure** -
 - ↳ Audit of traffic data of the relevant quarter kept in OMC-R at MSCs and used for arriving at CDR was used
 - ↳ The operator should only be considering those calls which are dropped during Time consistent busy hour (TCBH) for all days of the relevant quarter.

4.5.2 KEY FINDINGS – CONSOLIDATED

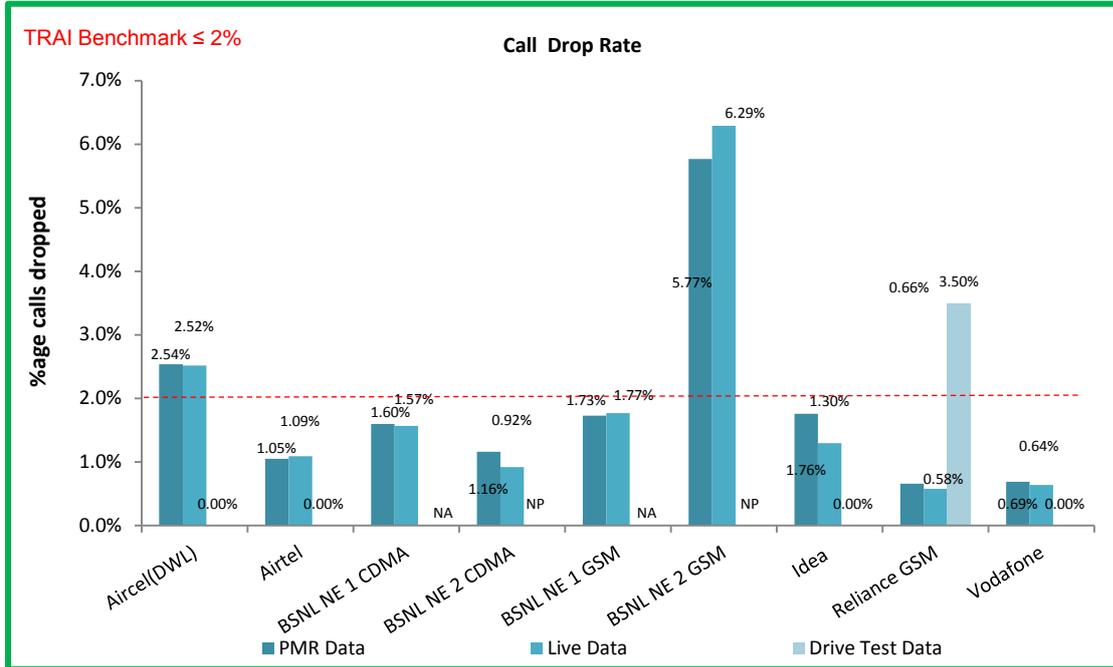


Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

NP: BSNL NE 2 CDMA did not participate in the drive test.

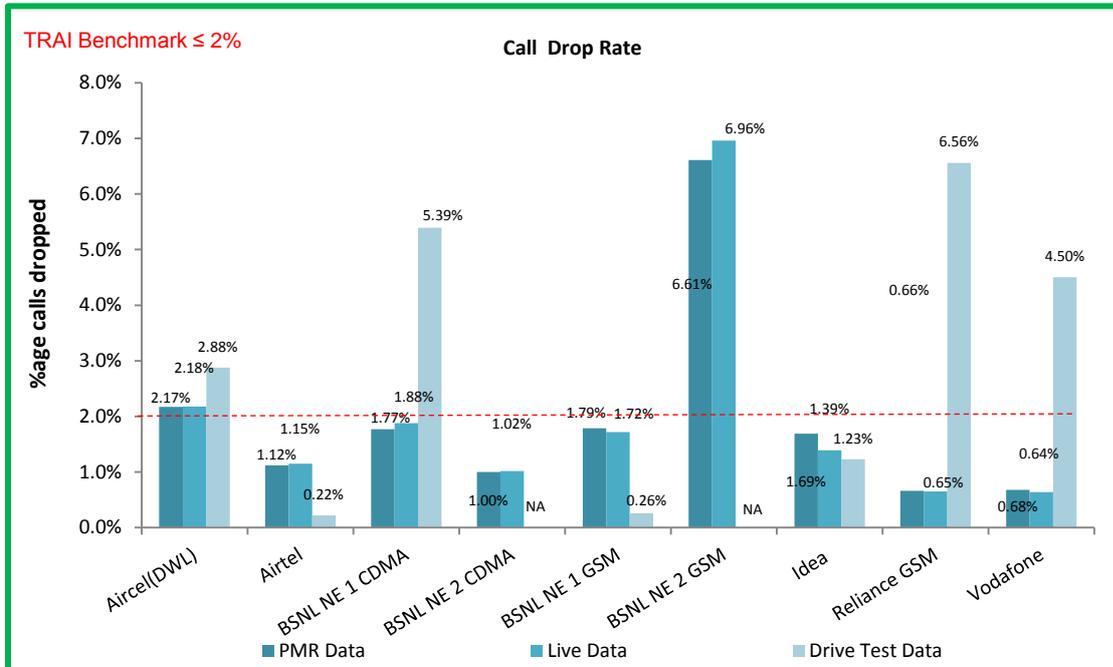
Aircel and BSNL NE 2 GSM failed to meet the TRAI specified benchmark.

4.5.2.1 KEY FINDINGS - MONTH 1



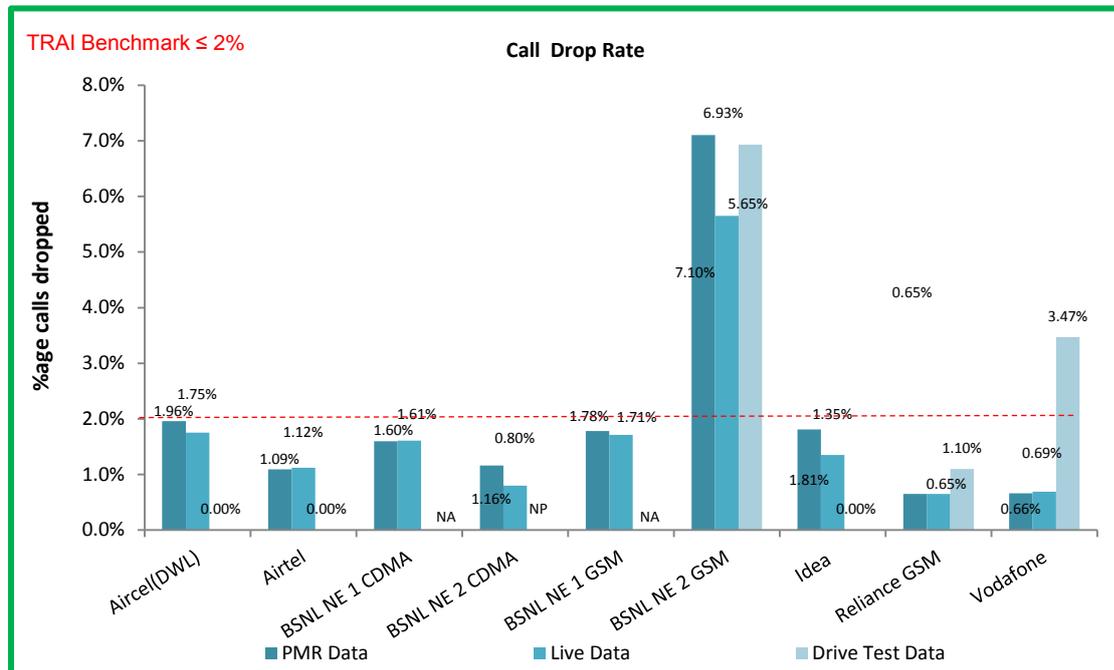
Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

4.5.2.2 KEY FINDINGS - MONTH 2



Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

4.5.2.3 KEY FINDINGS - MONTH 3



Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

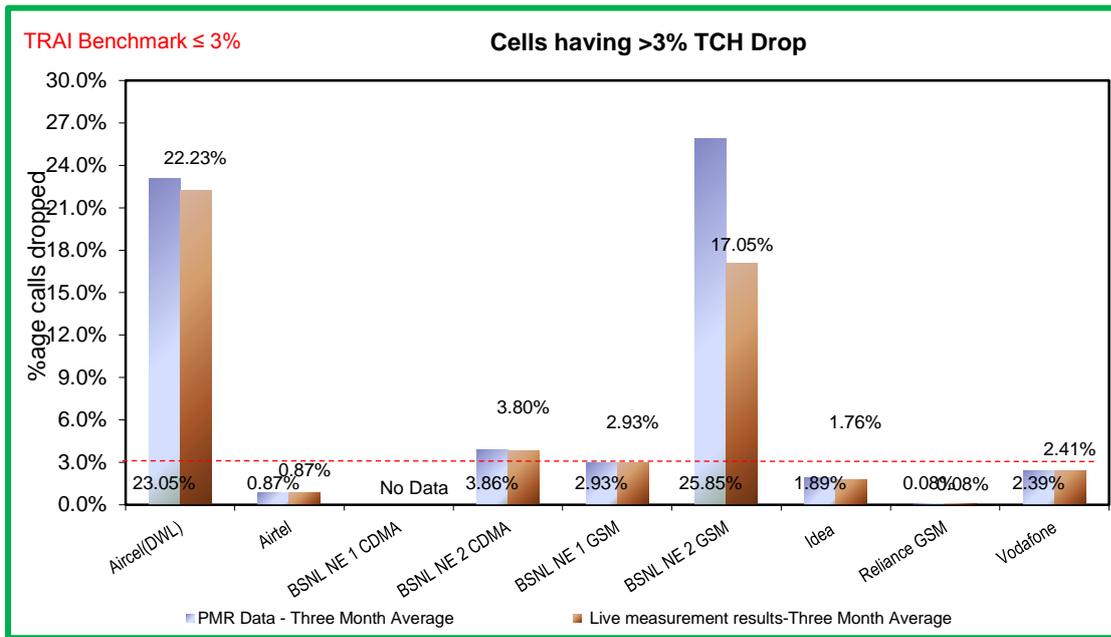
4.6 CELLS HAVING GREATER THAN 3% TCH DROP

4.6.1 PARAMETER DESCRIPTION

- Definition- Worst Affected Cells having more than 3% TCH drop** shall measure the ratio of total number of cells in the network to the ratio of cells having more than 3% TCH drop.
- Computational Methodology:** **(Total number of cells having more than 3% TCH drop during CBBH/ Total number of cells in the network) x 100**
- TRAI Benchmark -**
 - Worst affected cells having more than 3% TCH drop rate $\leq 3\%$
- Audit Procedure -**
 - Audit of traffic data of the relevant quarter kept in OMC-R at MSCs and used for arriving at CDR would be conducted.

The operator should only be considering those calls which are dropped during Cell Bouncing Busy hour (CBBH) for all days of the relevant quarter.

4.6.2 KEY FINDINGS – CONSOLIDATED

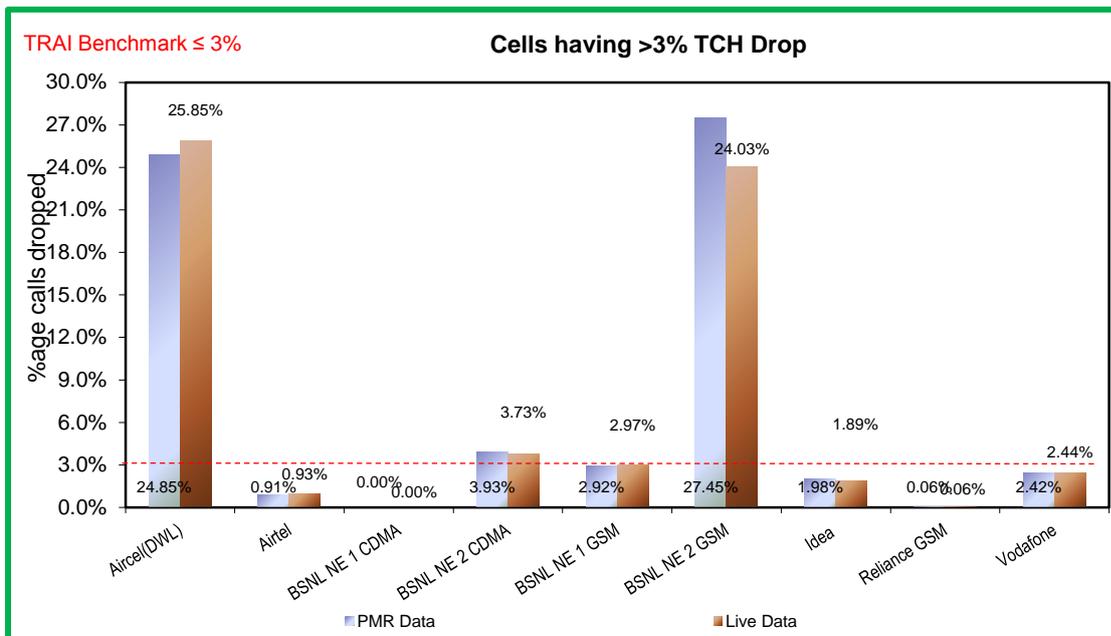


Data Source: Network Operations Center (NOC) of the operators

Aircel, BSNL NE 2 CDMA and BSNL NE 2 GSM did not meet the TRAI benchmark during audit.

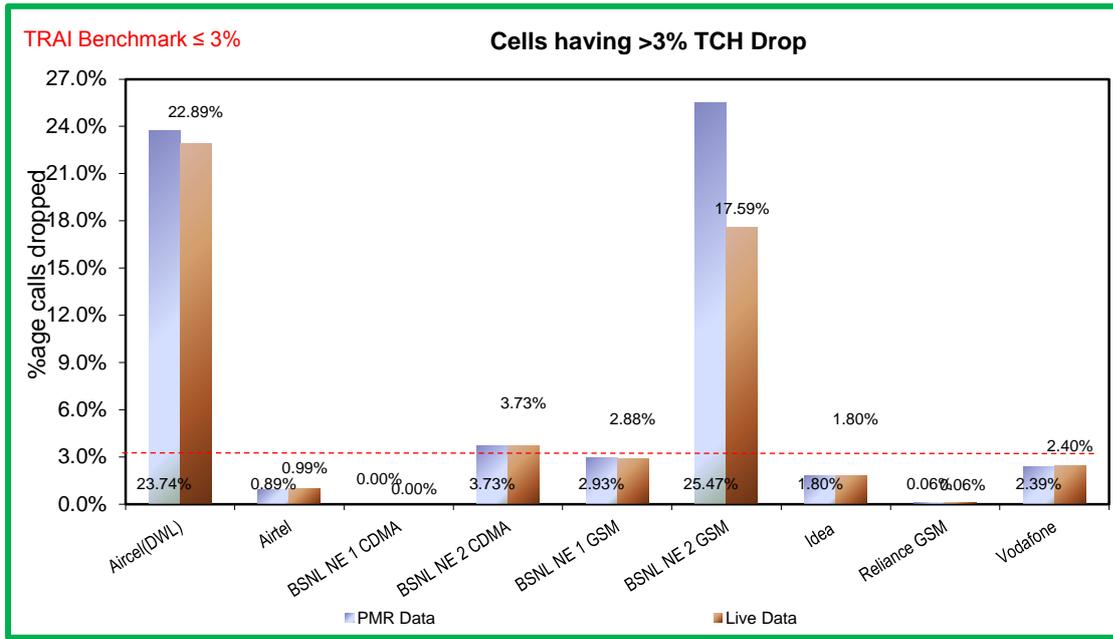
Auditors were not able to get the data for ‘worst affected cells having more than 3% TCH drop’ from BSNL NE 1 CDMA, as operator reported a technical problem in their systems.

4.6.2.1 KEY FINDINGS – MONTH 1



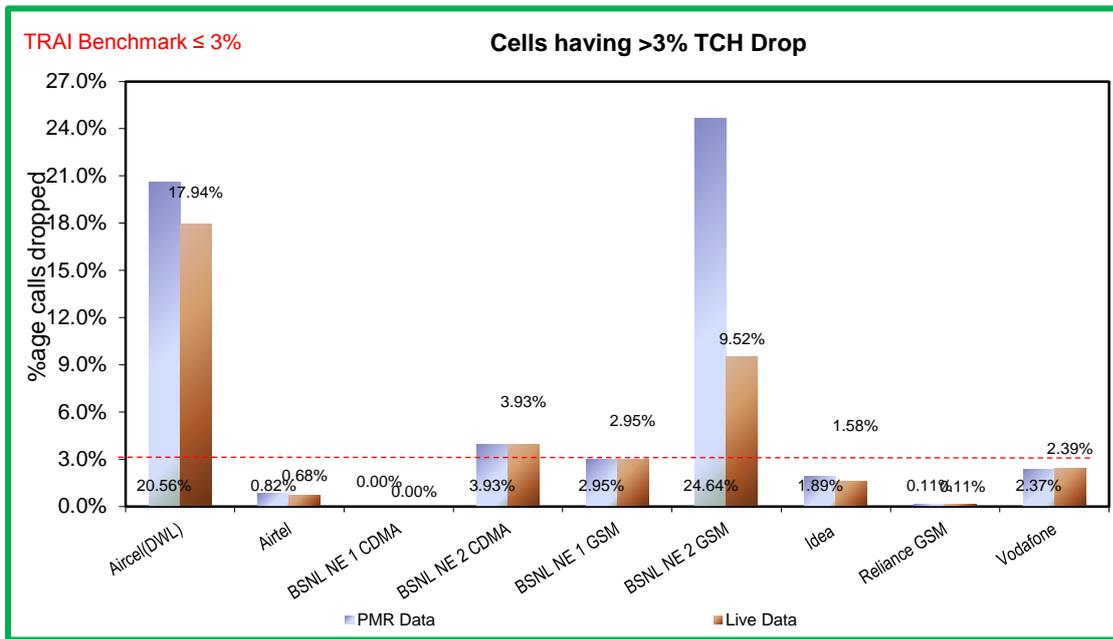
Data Source: Network Operations Center (NOC) of the operators

4.6.2.2 KEY FINDINGS - MONTH 2



Data Source: Network Operations Center (NOC) of the operators

4.6.2.3 KEY FINDINGS - MONTH 3



Data Source: Network Operations Center (NOC) of the operators

4.7 VOICE QUALITY

4.7.1 PARAMETER DESCRIPTION

1. Definition:

- ↳ for GSM service providers the calls having a value of 0 –5 are considered to be of good quality (on a seven point scale)
- ↳ For CDMA the measure of voice quality is Frame Error Rate (FER). FER is the probability that a transmitted frame will be received incorrectly. Good voice quality of a call is considered when its FER value lies between 0 – 4 %

2. Computational Methodology:

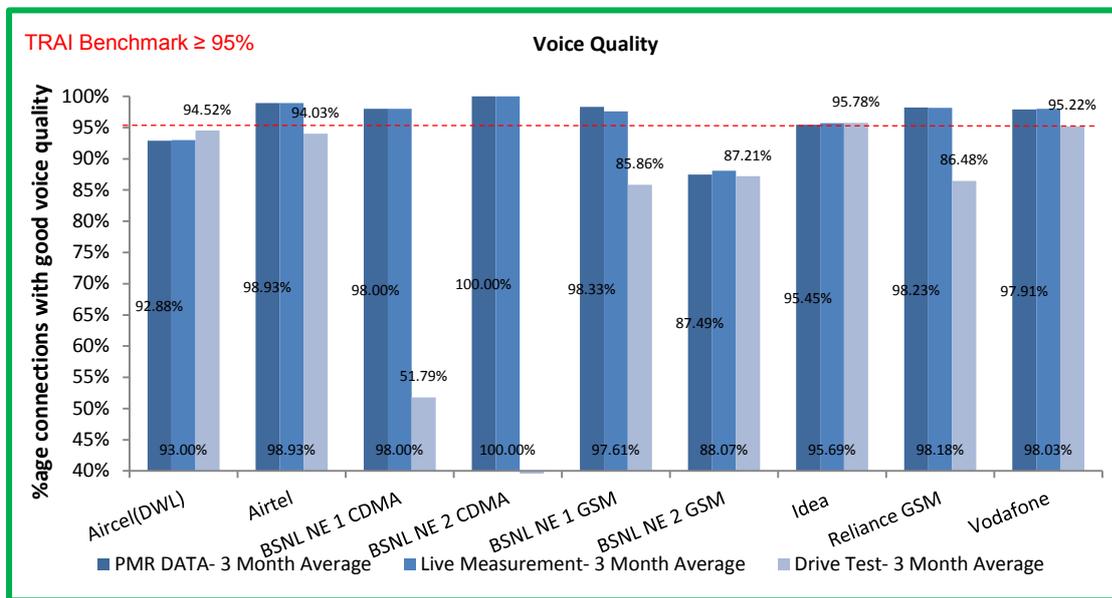
↳ **% Connections with good voice quality = (No. of voice samples with good voice quality / Total number of samples) x 100**

3. TRAI Benchmark: ≥ 95%

4. Audit Procedure –

- a. A sample of calls would be taken randomly from the total calls established.
- b. The operator should only be considering those calls which are meeting the desired benchmark of good voice quality.

4.7.2 KEY FINDINGS – CONSOLIDATED

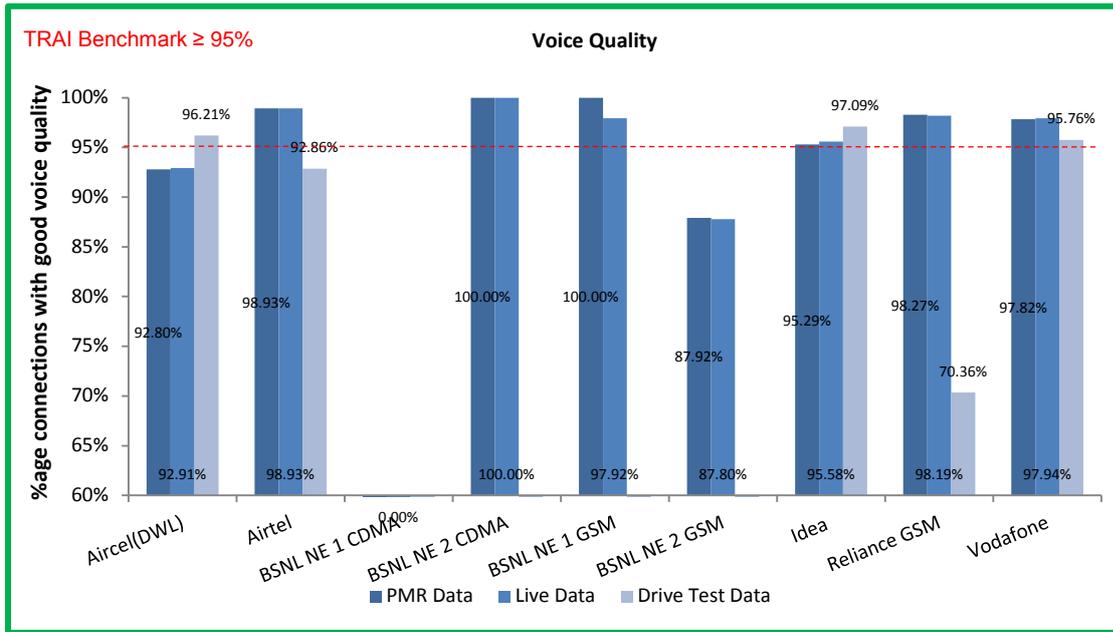


Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

Aircel and BSNL NE 2 GSM failed to meet the benchmark during audit.

BSNL NE 2 CDMA did not participate in the drive test.

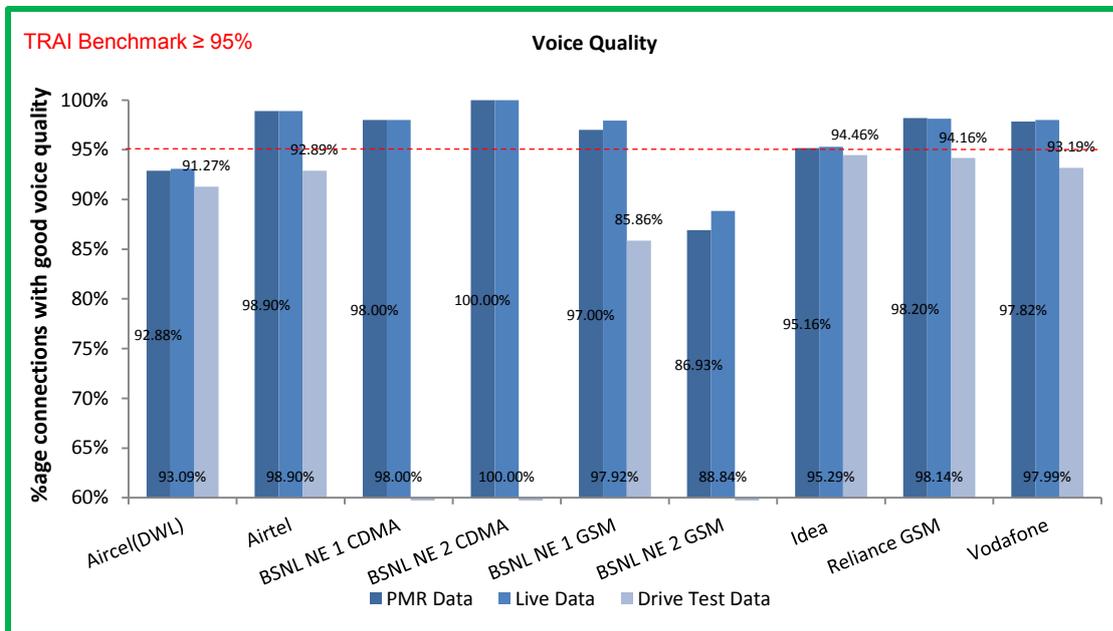
4.7.2.1 KEY FINDINGS – MONTH 1



Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

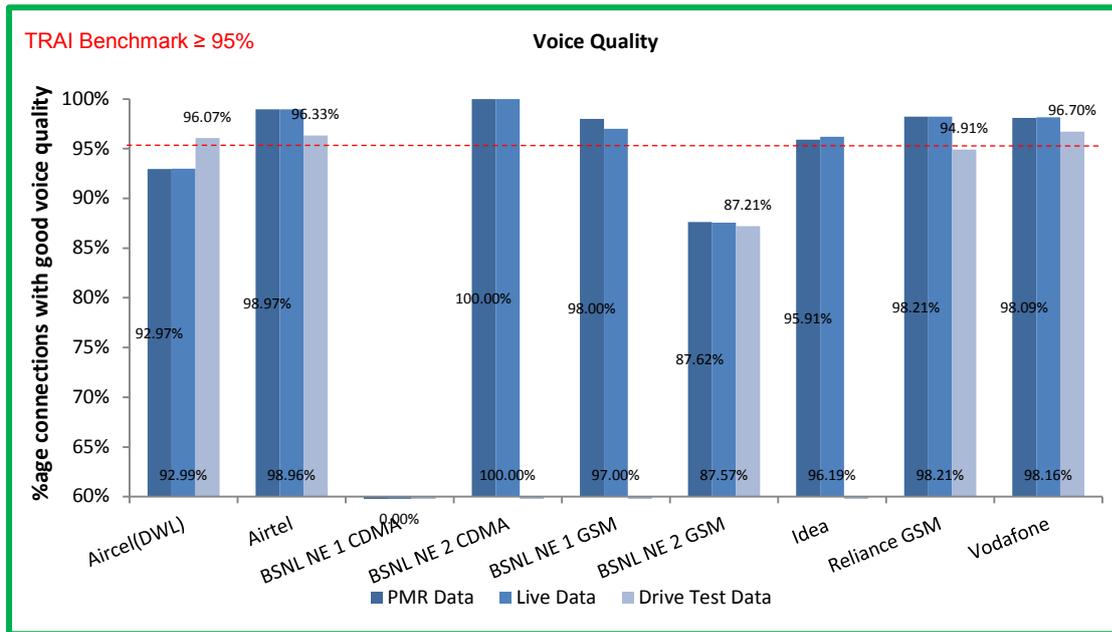
Auditors were not able to get the data from BSNL NE 1 CDMA as the operator reported a technical problem in their system.

4.7.2.2 KEY FINDINGS – MONTH 2



Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

4.7.2.3 KEY FINDINGS - MONTH 3



Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

Auditors were not able to get the data from BSNL NE 1 CDMA as the operator reported a technical problem in their system.

5 PARAMETER DESCRIPTION AND DETAILED FINDINGS – NON-NETWORK PARAMETERS

Note: Auditors were not able to get billing and customer service from the central billing and customer service centers respectively of BSNL NE 2 CDMA, as the operator was unable to provide the same.

5.1 METERING AND BILLING CREDIBILITY

The billing complaints for postpaid are calculated by averaging over one billing cycle in a quarter. For example, there are three billing cycles in a quarter, the data for each billing cycle is calculated separately and then averaged over.

The charging complaints for prepaid are calculated by taking all complaints in a quarter.

5.1.1 PARAMETER DESCRIPTION

All the complaints related to billing/ charging as per clause 3.7.2 of QoS regulation of 20th March, 2009 were covered. The types of billing complaints covered are listed below.

- ↪ Payments made and not credited to the subscriber account
- ↪ Payment made on time but late payment charge levied wrongly
- ↪ Wrong roaming charges
- ↪ Double charges
- ↪ Charging for toll free services
- ↪ Local calls charged/billed as STD/ISD or vice versa
- ↪ Calls or messages made disputed
- ↪ Validity related complaints
- ↪ Credit agreed to be given in resolution of complaint, but not accounted in the bill
- ↪ Charging for services provided without consent
- ↪ Charging not as per tariff plans or top up vouchers/ special packs etc.
- ↪ Overcharging or undercharging

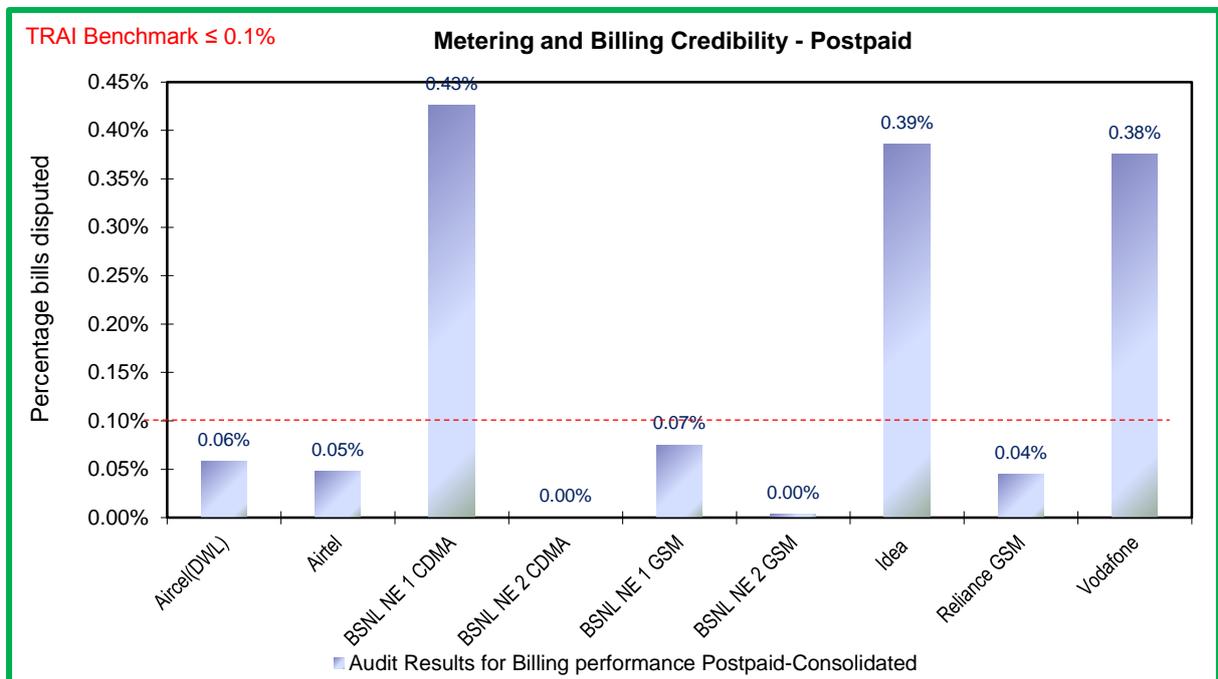
In addition to the above, any billing complaint which leads to billing error, waiver, refund, credit, or any adjustment is also considered as valid billing complaint for calculating the number of disputed bills.

➤ Computational Methodology:

- ↪ Metering and billing credibility (**Postpaid**) = (Total billing complaints** received during the relevant billing cycle / Total bills generated* during the relevant billing cycle)*100

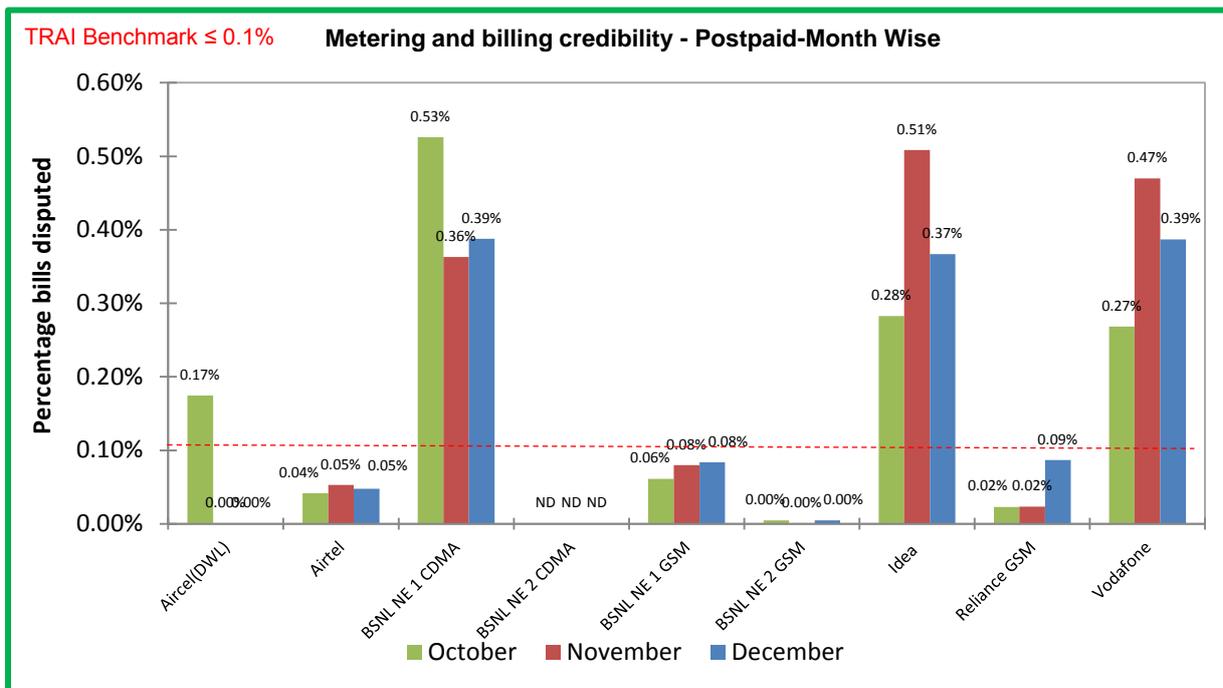
- ✎ *Operator to include all types of bills generated for customers. This would include printed bills, online bills and any other forms of bills generated
 - ✎ **Billing complaints here shall include only dispute related issues (including those that may arise because of a lack of awareness at the subscribers' end). It does not include any provisional issues (such as delayed dispatch of billing statements, etc.) in which the operator has opened a ticket internally.
 - ✎ Metering and billing credibility (**Prepaid**) = (Total charging complaints received during the quarter/ Total number of subscribers reported by the operator at the end of the quarter) * 100
- TRAI Benchmark: <= 0.1%
 - Audit Procedure:
 - ✎ Audit of billing complaint details for the complaints received during the quarter and used for arriving at the benchmark reported to TRAI would be conducted
 - For Postpaid, the total billing complaints would be audited by averaging over billing cycles in a quarter
 - ✎ For Prepaid, the data of total charging complaints in a quarter would be taken for the purpose of audit

5.1.2 KEY FINDINGS – METERING AND BILLING CREDIBILITY - POSTPAID



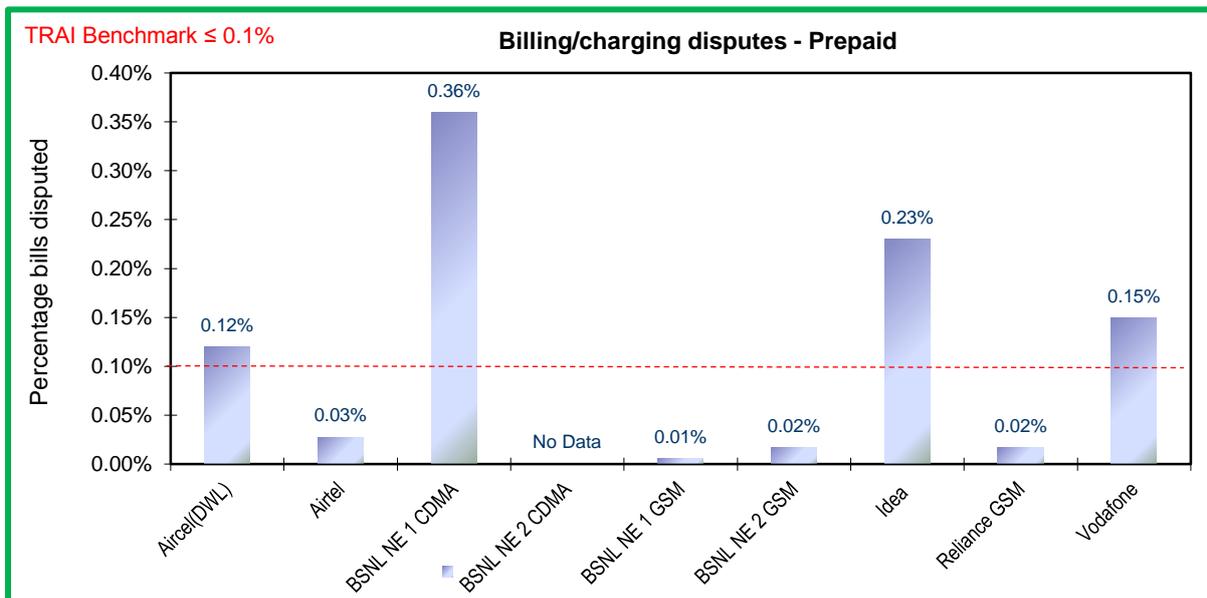
Data Source: Billing Center of the operators

For postpaid services, BSNL NE 1 CDMA, Idea and Vodafone failed to meet the benchmark.



Data Source: Billing Center of the operators

5.1.3 KEY FINDINGS - METERING AND BILLING CREDIBILITY - PREPAID



Data Source: Billing Center of the operators

For prepaid, Aircel, BSNL NE 1 CDMA, Idea and Vodafone did not meet the benchmark.

5.2 RESOLUTION OF BILLING COMPLAINTS

5.2.1 PARAMETER DESCRIPTION

Calculation of Percentage resolution of billing complaints

The calculation methodology (given below) as per QoS regulations 2009 (7 of 2009) was followed to - calculate resolution of billing complaints.

Resolution of billing complaints within 4 weeks:

%age of billing complaints (for post-paid customers)/ charging, credit & validity (for pre-paid customers) resolved within 4 weeks =

$$\frac{\text{number of billing complaints for post-paid customers/charging, credit/ validity complaints for pre-paid customers resolved within 4 weeks during the quarter}}{\text{number of billing/charging, credit / validity complaints received during the quarter}} \times 100$$

Resolution of billing complaints within 6 weeks:

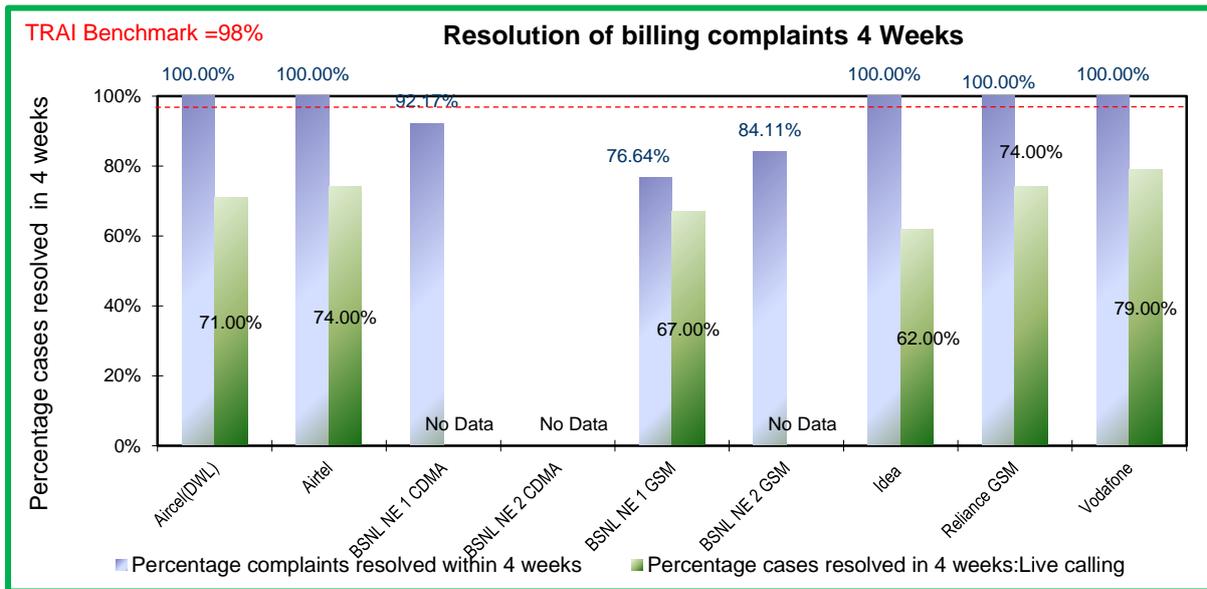
%age of billing complaints (for post-paid customers)/ charging, credit & validity (for pre-paid customers) resolved within 6 weeks =

$$\frac{\text{number of billing complaints for post-paid customers/charging, credit/ validity complaints for pre-paid customers resolved within 6 weeks during the quarter}}{\text{number of billing/charging, credit / validity complaints received during the quarter}} \times 100$$

- ↳ **Billing complaints here shall include only dispute related issues (including those that may arise because of a lack of awareness at the subscribers' end). It does not include any provisional issues (such as delayed dispatch of billing statements, etc.) in which the operator has opened a ticket internally. Complaints raised by the consumers to operator are only considered as part of the calculation.
- ⌚ *** 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.

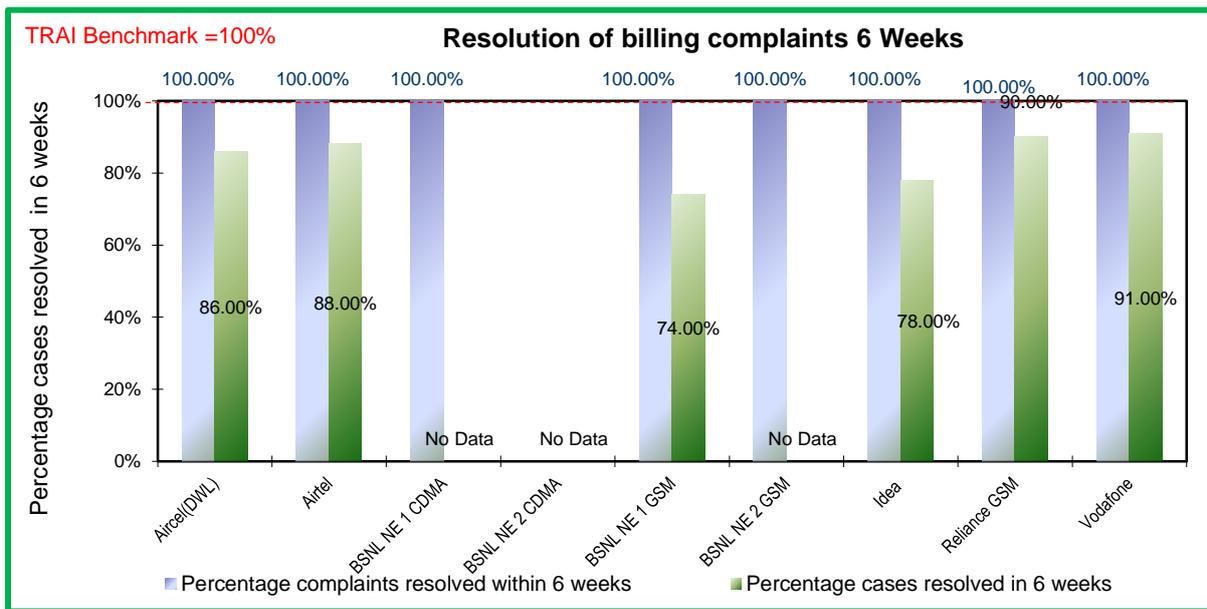
Benchmark: 98% complaints resolved within 4 weeks, 100% within 6 weeks.

5.2.2 KEY FINDINGS



Data Source: Billing Center of the operators

The audit results showed that BSNL NE 1 CDMA, BSNL NE 1 GSM and BSNL NE 2 GSM failed to meet the benchmark of 98% for resolution of complaints within 4 weeks. However, as per live calling done to customers, the performance of all operators was far inferior to the PMR data.



Data Source: Billing Center of the operators

The audit results showed that all the operators met the TRAI benchmark for resolution of complaints within 6 weeks. However, as per live calling done to customers, the performance of all operators was far inferior to the PMR data.

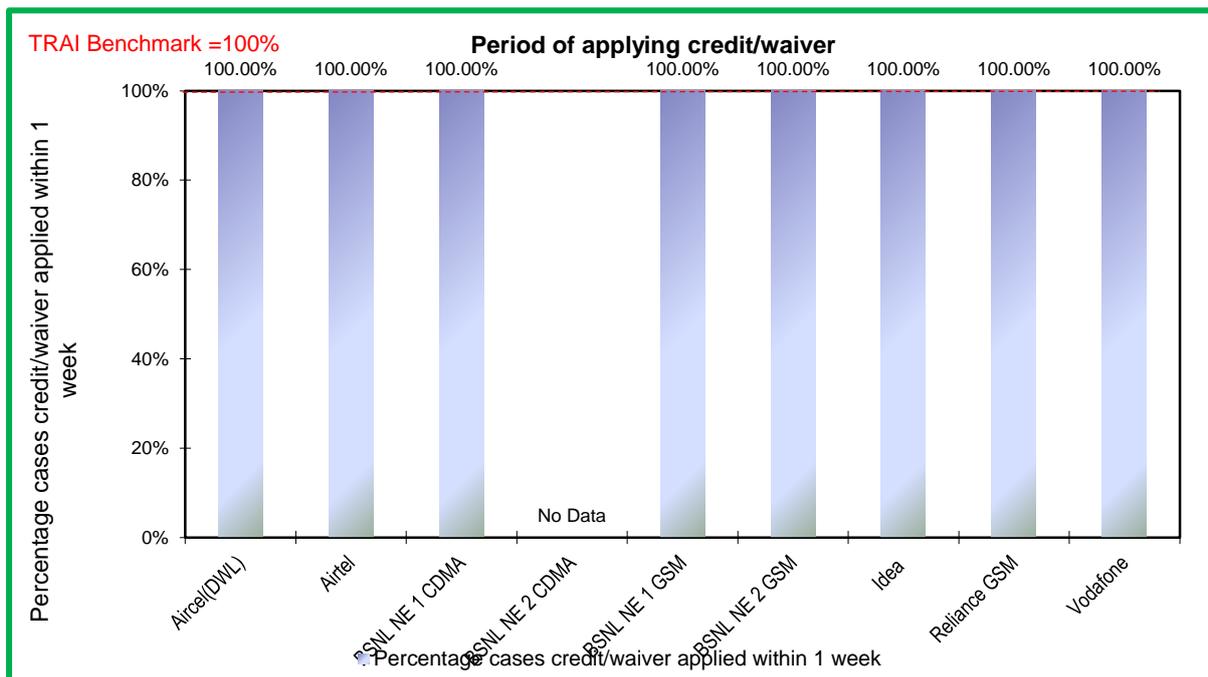
Note: Auditors were not able to get any raw data for the purpose of live calling from BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM as the operators were unable to provide the same. Data related to Resolution of billing complaints was also not available with BSNL NE 2 CDMA for the purpose of audit.

5.3 PERIOD OF APPLYING CREDIT/WAVIER

5.3.1 PARAMETER DESCRIPTION

- Computational Methodology:
 - ↳ **Period of applying credit waiver = (number of cases where credit waiver is applied within 7 days/ total number of cases eligible for credit waiver) * 100**
- TRAI Benchmark:
 - ↳ Period of applying credit waiver within 7 days: 100%
- Audit Procedure:
 - ↳ Operator to provide details of:-
 - List of all eligible cases along with
 - Date of applying credit waiver to all the eligible cases.
 - Date of resolution of complaint for all eligible cases

5.3.2 KEY FINDINGS



Data Source: Billing Center of the operators

All operators met the benchmark for the parameter.

5.4 CALL CENTRE PERFORMANCE-IVR

5.4.1 PARAMETER DESCRIPTION

➤ Computational Methodology:

↳ **Call centre performance IVR = (Number of calls connected and answered by IVR/ All calls attempted to IVR) * 100**

➤ TRAI Benchmark: >= 95%

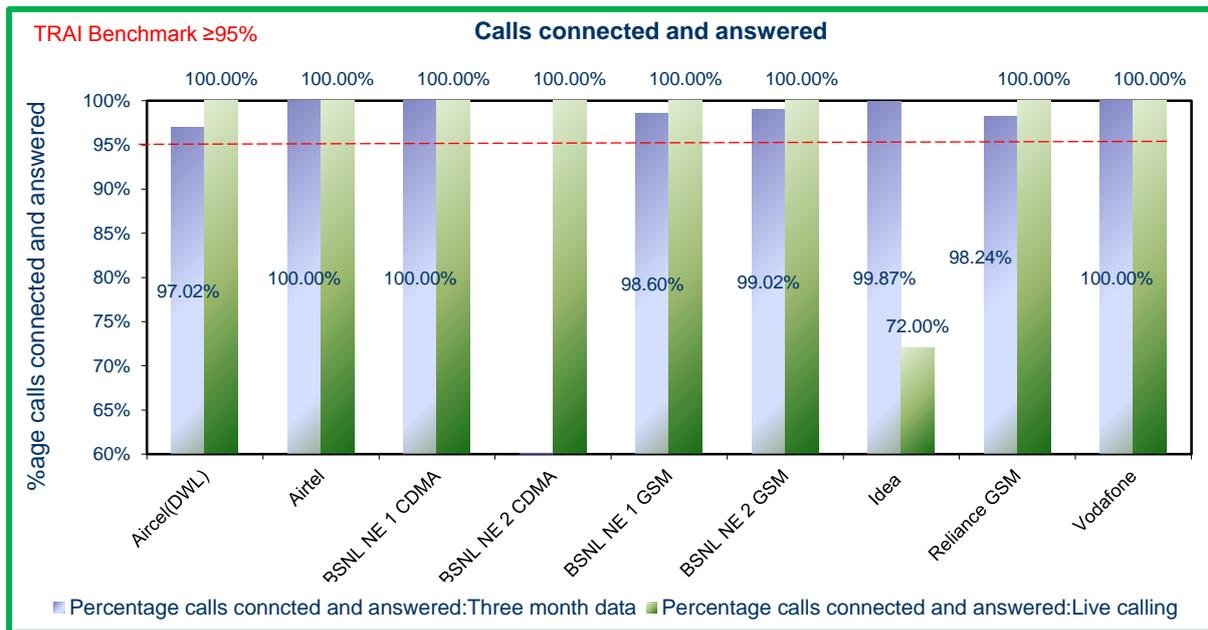
➤ Audit Procedure:

↳ Operators provide details of the following from their central call centre/ customer service database:

- Total calls connected and answered by IVR
- Total calls attempted to IVR

↳ Also live calling is done to test the calls connected and answered by IVR

5.4.2 KEY FINDINGS



Data Source: Customer Service Center of the operators

As per PMR data, all operators met the TRAI benchmark.

Note: Auditors were not able to get the raw data for the parameter from BSNL NE 2 CDMA to generate PMR as the operators were unable to provide the same.

5.5 CALL CENTRE PERFORMANCE-VOICE TO VOICE

5.5.1 PARAMETER DESCRIPTION

➤ Computational Methodology:

↳ Call centre performance Voice to Voice = (Number of calls answered by operator within 90 seconds/ All calls attempted to connect to the operator) * 100

➤ Audit Procedure:

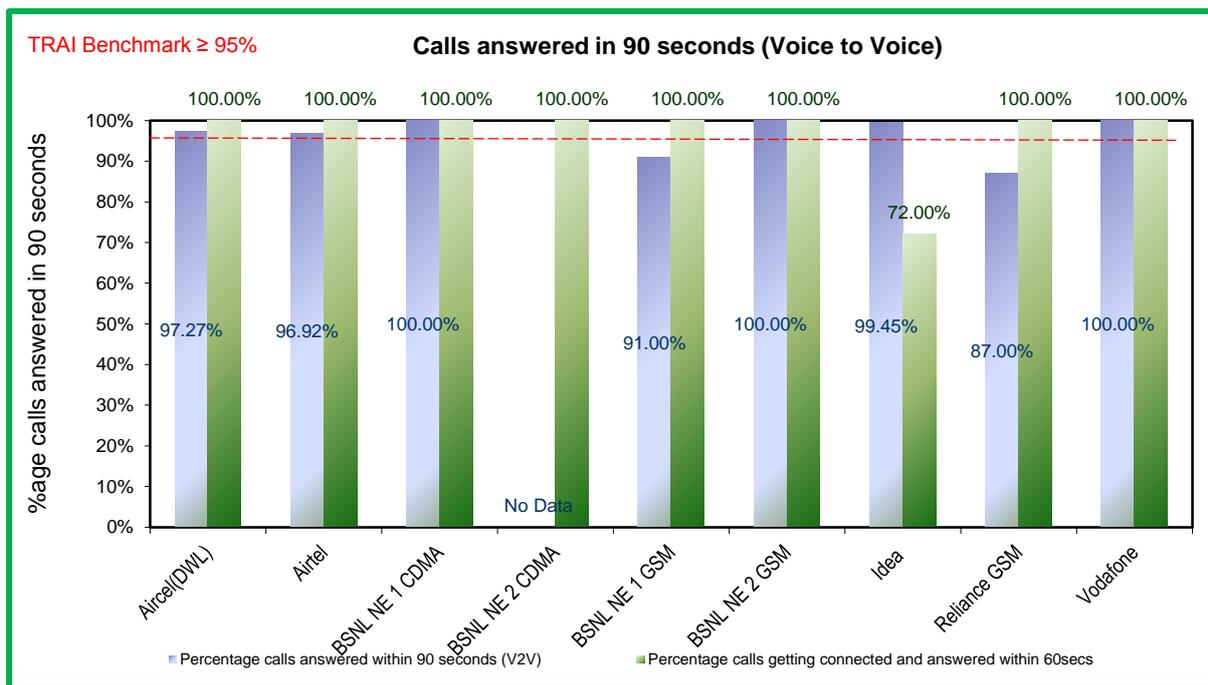
↳ Operators provide details of the following from their central call centre/ customer service database:

- Total calls connected and answered by operator within 90 seconds
- Total calls attempted to connect to the operator

↳ Also live calling was done to test the calls answered within 90 seconds by the operator

Benchmark: 95% calls to be answered within 90 seconds.

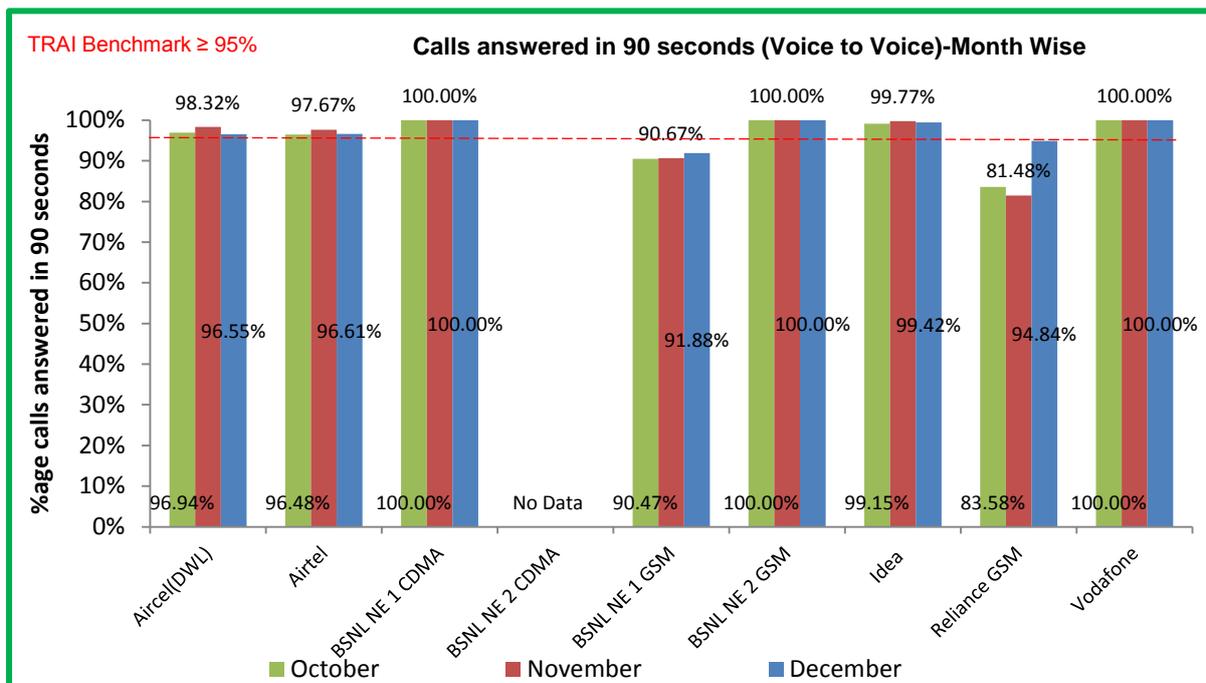
5.5.2 KEY FINDINGS



Data Source: Customer Service Center of the operators

Note: Auditors were not able to get the raw data for the parameter from BSNL NE 2 CDMA to generate PMR as the operators were unable to provide the same.

As per PMR data, BSNL NE 1 GSM and Reliance GSM failed to meet the benchmark.



5.6 TERMINATION/CLOSURE OF SERVICE

5.6.1 PARAMETER DESCRIPTION

➤ Computational Methodology:

✎ **Time taken for closure of service = (number of closures done within 7 days/ total number of closure requests) * 100**

➤ TRAI Benchmark:

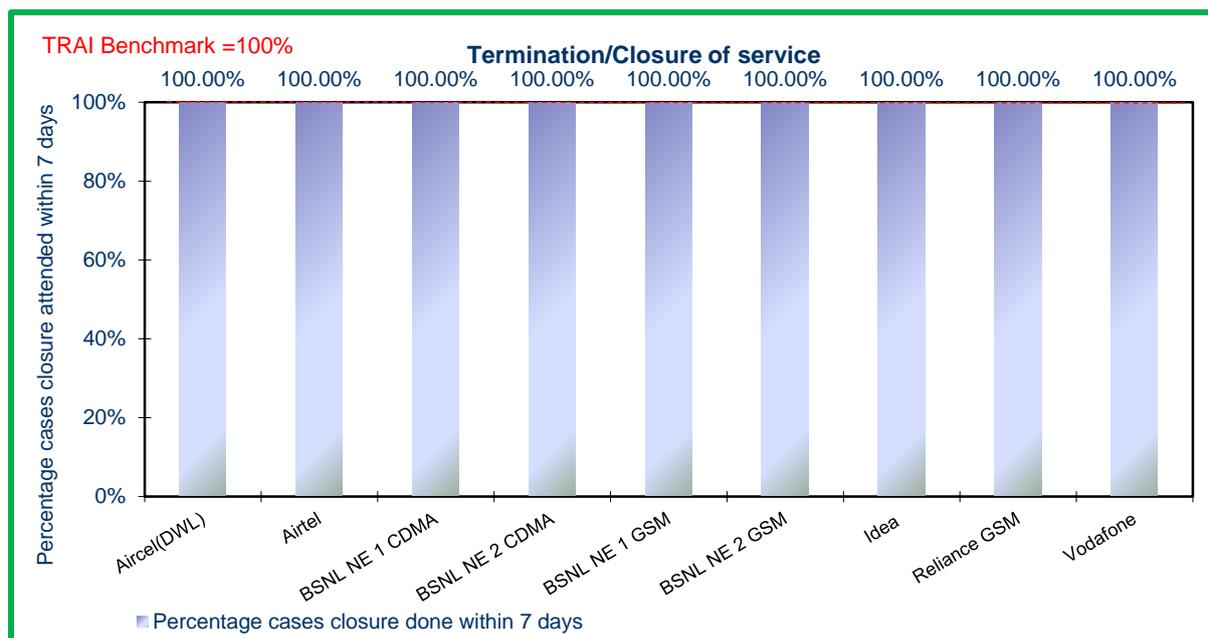
✎ Termination/Closure of Service: ≤ 7 days

➤ Audit Procedure:

✎ Operator provide details of the following from their central billing/CS database:

- Date of lodging the closure request (all requests in given period)
- Date of closure of service

5.6.2 KEY FINDINGS



Data Source: Customer Service Center of the operators

All the operators met the TRAI specified benchmark for the parameter.

5.7 REFUND OF DEPOSITS AFTER CLOSURE

5.7.1 PARAMETER DESCRIPTION

➤ Computational Methodology:

↳ **Time taken for refund for deposit after closures = (number of cases of refund after closure done within 60 days/ total number of cases of refund after closure) * 100**

↳ Any case where the operators need to return the amount back to consumers post closure of service in form of cheque/cash is considered to be refund.

➤ TRAI Benchmark:

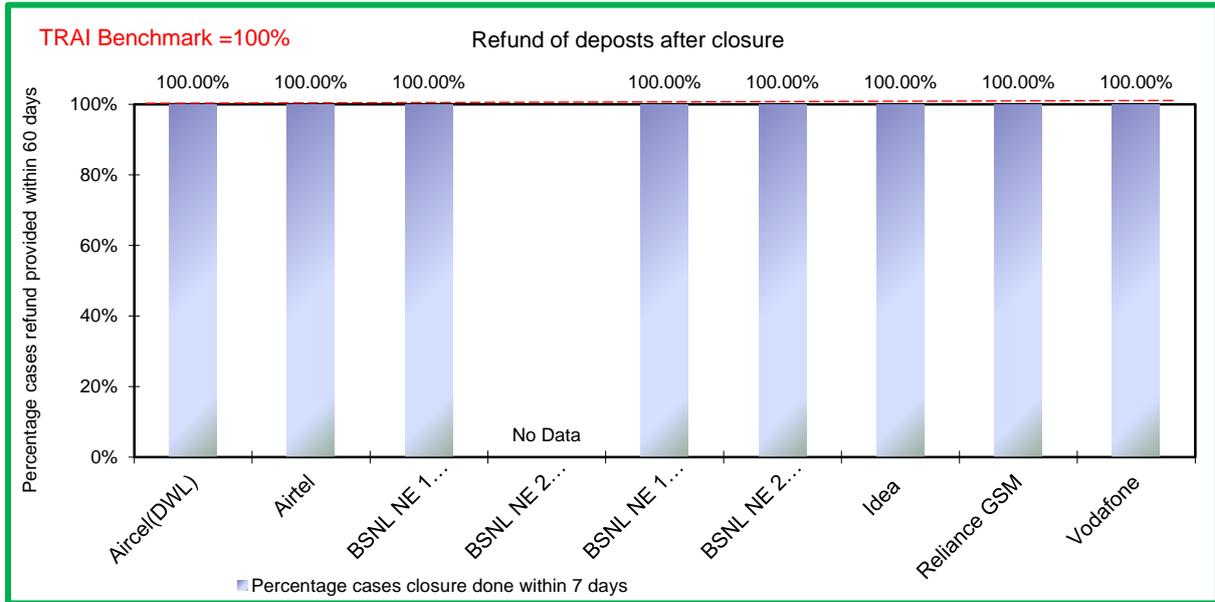
↳ Time taken for refund for deposit after closures: 100% within 60 days

➤ Audit Procedure:

↳ Operator provide details of the following from their central billing/refund database:

- Dates of completion of all 'closure requests' resulting in requirement of a refund by the operator.
- Dates of refund pertaining to all closure request received during the relevant quarter

5.7.2 KEY FINDINGS



Data Source: Customer Service Center of the operators

Auditors were not able to get the data for the parameter from BSNL NE 2 CDMA as the operator was unable to provide the same.

All the operators met the TRAI benchmark.

6 DETAILED FINDINGS - DRIVE TEST DATA

6.1 OPERATOR ASSISTED DRIVE TEST

The drive test was conducted simultaneously for all the operators present in the North East circle. As per the new directive given by TRAI headquarters, drive test for the month of October, November and December 2014 were conducted at a SSA level. Drive test was conducted for three days in each SSA and the selection of routes ensured that the maximum towns, villages, highways are covered as part of drive test. The routes were selected post discussion with TRAI advisors. IMRB auditors were present in vehicles of every operator. The holding period for all test calls was 120 seconds and gap between calls was 10 seconds.

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 > -75 dbm for indoor, -85 dbm for in-vehicle and > -95 dbm outdoor routes.

The schedule and operators involved in the operator assisted drive test for the North East circle are given below.

Month	Name of SSA Covered	Date of Drive Test	Name of Operator
October	Nagaland	29th to 31st October, 2014	Aircel(DWL)
November	Tripura	24th to 26th November 2014	Airtel
December	Arunachal Pradesh	15th to 16th December 2014	BSNL NE 1 CDMA
			BSNL NE 2 CDMA
			BSNL NE 1 GSM
			BSNL NE 2 GSM
			Idea
			Reliance GSM
			Vodafone

Note: - It is important to highlight that in case we are covering BSNL NE 1 GSM area then BSNL NE 2 GSM will be Not Applicable for that month hence values will be 'NA'.

BSNL NE 2 CDMA did not participate in any of the drive tests. Hence, it is reported as NP (Not Participated).

6.1.1 OCTOBER – NAGALAND

Month	Name of SSA Covered	Date of Drive Test
October	Nagaland	29th to 31st October, 2014

6.1.1.1 ROUTE DETAILS – NAGALAND SSA

Category	Type of location	North East-October		
		Nagaland		
		Day 1	Day 2	Day 3
Outdoor	Major Roads	Dimapur to Khuzama via Kohima Road Drive - 87.5 km and Dimapur Town Drive	Kohima to Wokha Road Drive – 75.3 km and kohima Town Drive	Wokha to Mekirang Road Drive – 63.2 km and Owkha Town Drive
	Highways			
	With in the City			
Indoor	Shopping complex			
	Office complex			

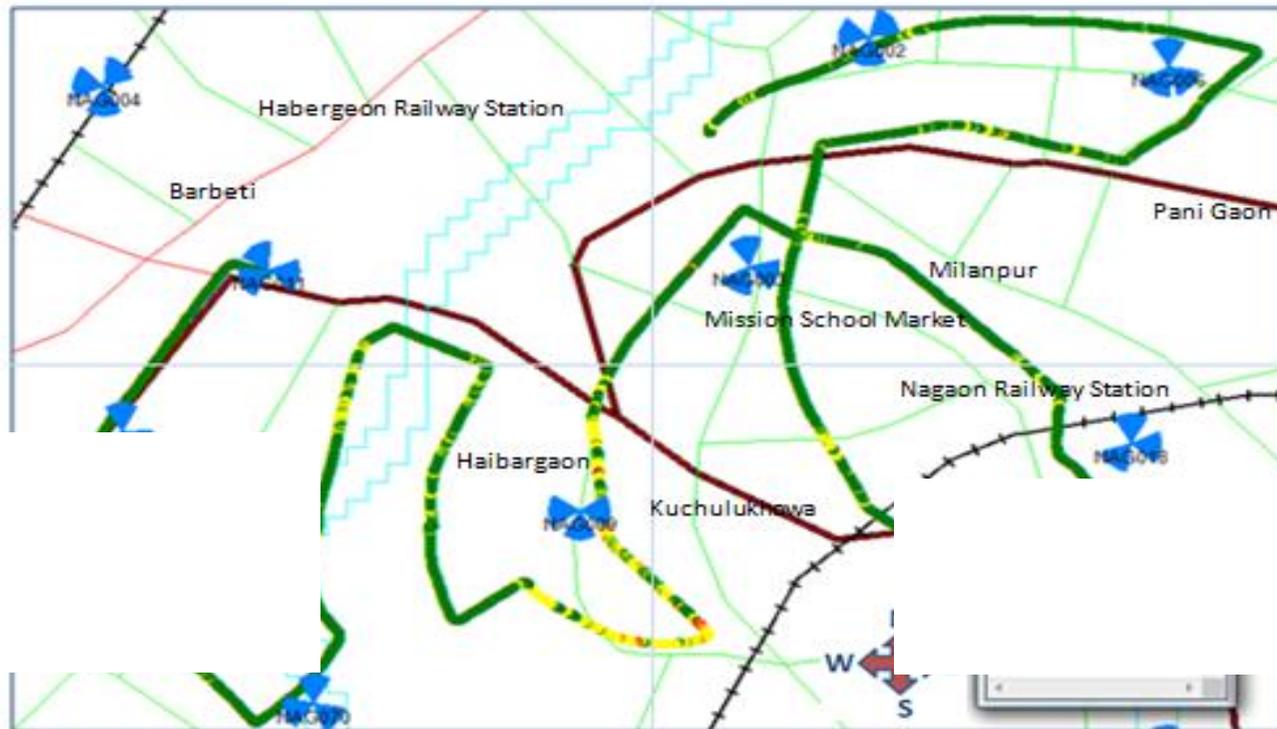
The route maps given in the report are provided for the purpose of identifying the routes traversed during the drive tests. We may observe three different colours (Red/Green/Yellow) of the lines, which signify signal strength; however these maps are for a single operator and have not been referred to any findings in this report. IMRB submits detailed operator wise Drive Test reports separately.

6.1.1.2 KILOMETERS TRAVELLED- NAGALAND SSA

Drive Test - Kilometers Travelled	Day 1	Day 2	Day 3	Total
Nagaland	119	91	99	309

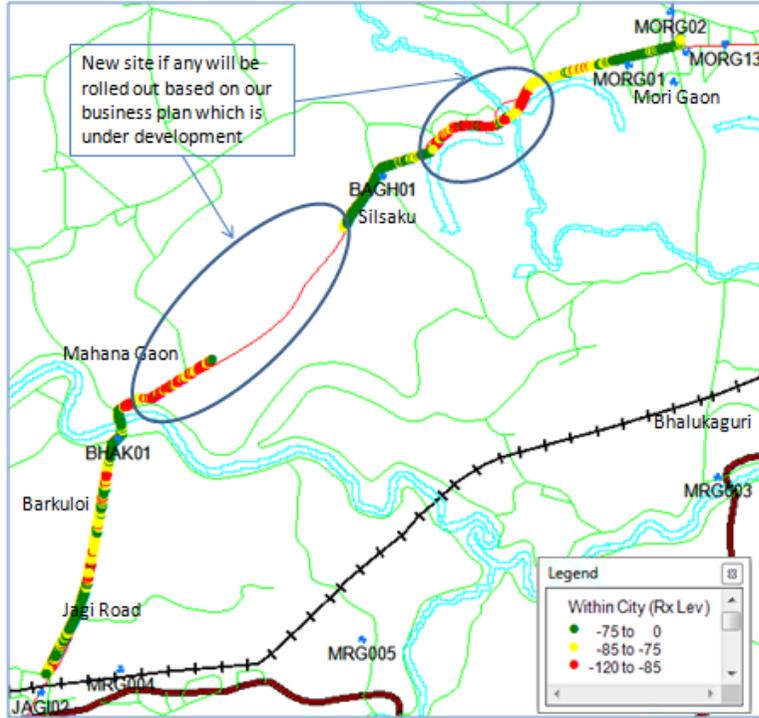
6.1.1.3 ROUTE MAP NAGALAND DAY 1

DAY 1 – NAGAON(WITHIN CITY) – (Rx Level Plot)



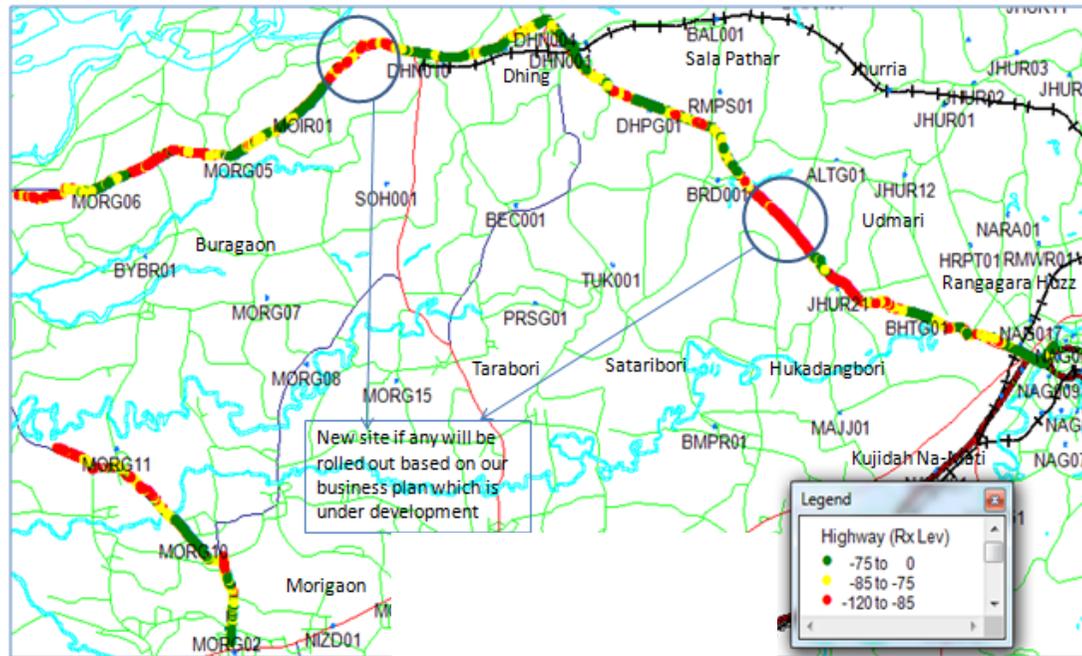
6.1.1.4 ROUTE MAP NAGALAND DAY 2

DAY 1 – MAJOR ROAD(HIGHWAY) – (Rx Level Plot)



6.1.1.5 ROUTE MAP NAGALAND DAY 3

DAY 1 – NAGAON(HIGHWAY) – (Rx Level Plot)



6.1.1.6 DRIVE TEST RESULTS – NAGALAND SSA

Executive Summary																			
Parameter's	B'mark	Aircel(DWL)		Airtel		BSNL CDMA NE 1		BSNL CDMA NE 2		BSNL GSM NE 1		BSNL GSM NE 2		Idea		Reliance GSM		Vodafone	
		In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
0 to -75 dBm		87.09%	51.31%	60.91%	68.48%	NA	NP	NA	NP	94.33%	9.17%	89.17%	45.84%	18.38%	30.34%				
0 to -85 dBm		99.65%	75.52%	96.58%	92.14%					100.00%	85.33%	99.78%	68.84%	90.16%	74.00%				
0 to -95 dBm		100.00%	100.00%	99.91%	99.34%					100.00%	96.83%	99.98%	84.44%	99.33%	93.86%				
Voice quality	≥ 95%	96.78%	95.76%	97.03%	91.46%					98.74%	95.67%	98.88%	73.69%	99.11%	94.45%				
CSSR	≥ 95%	100.00%	100.00%	100.00%	100.00%					100.00%	100.00%	100.00%	87.54%	100.00%	96.71%				
%age Blocked calls		0.00%	0.00%	0.00%	0.00%					0.00%	0.00%	0.00%	12.46%	0.00%	0.00%				
Call drop rate	≤ 2%	0.00%	0.00%	0.00%	0.00%					0.00%	0.00%	0.00%	2.53%	0.00%	0.00%				
Hands off success rate		100.00%	100.00%	100.00%	100.00%					100.00%	100.00%	100.00%	94.51%	100.00%	100.00%				

Data Source: Drive test reports submitted by operators to auditors

Note: Drive Test conducted in NE 2 region; hence BSNL NE 1 region is not applicable.

NP: BSNL NE 2 CDMA and BSNL NE 2 GSM did not participate in the drive test.

Voice quality:

Airtel, Reliance GSM and Vodafone did not meet the benchmark of 95% on voice quality in outdoor areas.

CSSR:

Reliance GSM did not meet the benchmark in outdoor areas.

Call drop rate:

Reliance GSM did not meet the benchmark for the criteria in outdoor locations.

6.1.2 NOVEMBER – TRIPURA

Month	Name of SSA Covered	Date of Drive Test
November	Tripura	24th to 26th November 2014

6.1.2.1 ROUTE DETAILS – TRIPURA SSA

Category	Type of location	North East-November		
		Tripura		
		Day 1	Day 2	Day 3
Outdoor	Major Roads	Surai Bari to Ambassa Road Drive - (102 km) and AMBASSA Town Drive	Ambassa to Udaipur Road Drive -(97 km) and AGARTALA Town Drive	Udaipur to Sabroom Road Drive - (96 km) and UDAIPUR Town Drive
	Highways			
	With in the City			
Indoor	Shopping complex			
	Office complex			

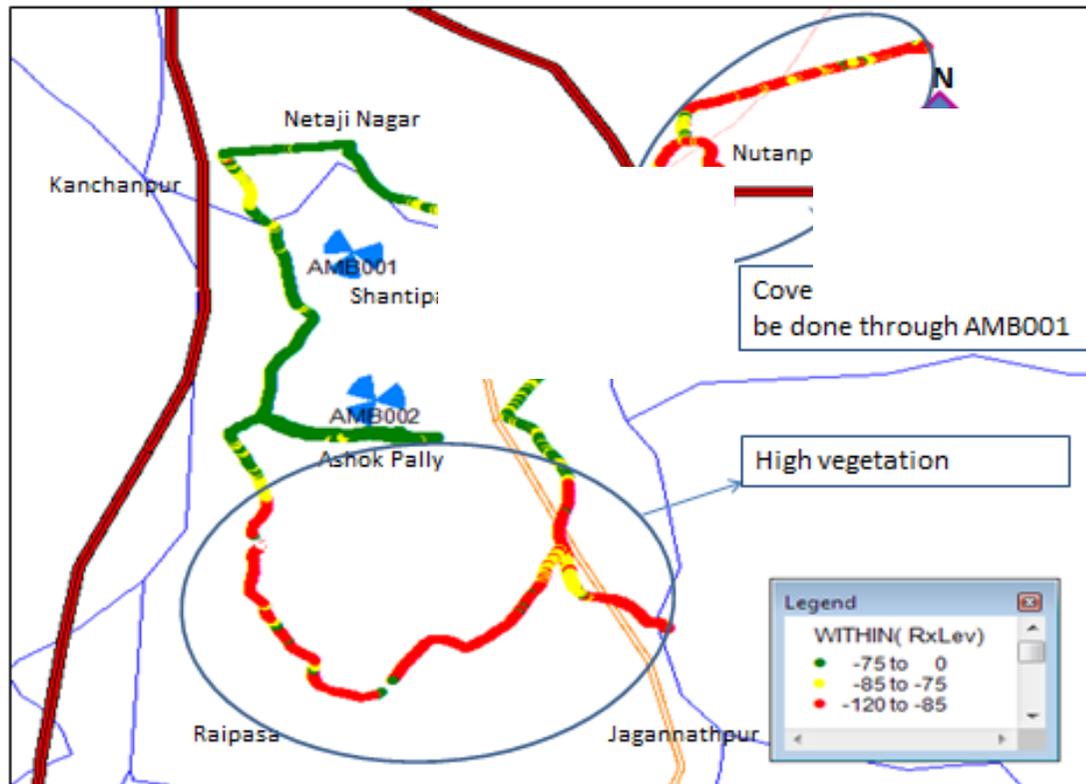
The route maps given in the report are provided for the purpose of identifying the routes traversed during the drive tests. We may observe three different colours (Red/Green/Yellow) of the lines, which signify signal strength; however these maps are for a single operator and have not been referred to any findings in this report. IMRB submits detailed operator wise Drive Test reports separately.

6.1.2.2 KILOMETERS TRAVELLED- TRIPURA SSA

Drive Test - Kilometers Travelled	Day 1	Day 2	Day 3	Total
Tripura	102	107	98	307

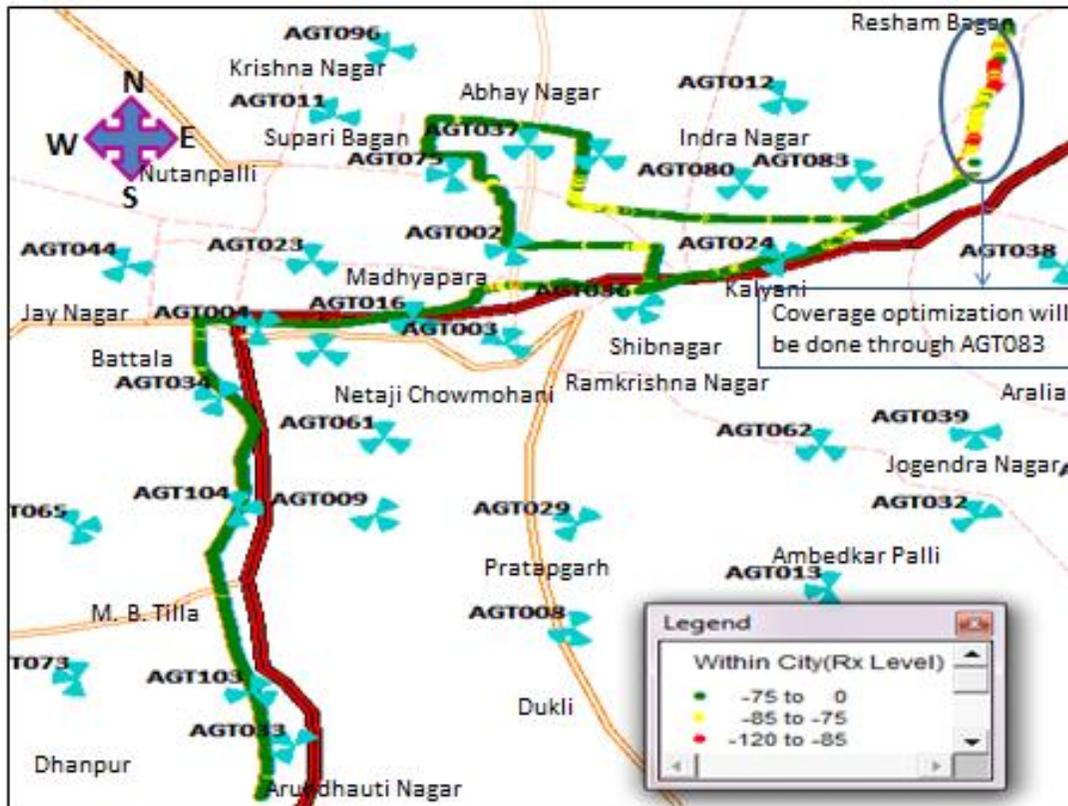
6.1.2.3 ROUTE MAP TRIPURA DAY 1

DAY 1 – AMBASA(WITHIN CITY) – (Rx Level Plot)

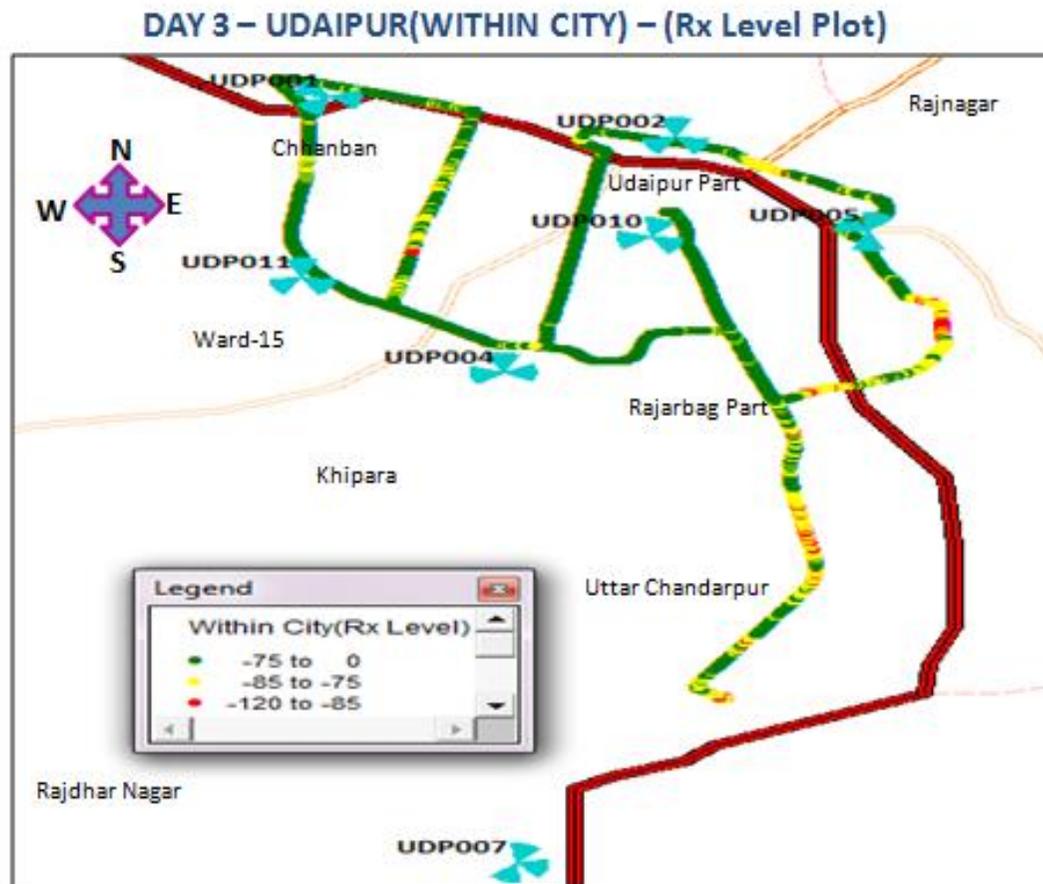


6.1.2.4 ROUTE MAP TRIPURA DAY 2

DAY 2 – AGARTALA (WITHIN CITY)– (Rx Level Plot)



6.1.2.5 ROUTE MAP TRIPURA DAY 3



6.1.2.6 DRIVE TEST RESULTS – TRIPURA SSA

Executive Summary																			
Parameter's	B'mark	Aircel(DWL)		Airtel		BSNL CDMA NE 1		BSNL CDMA NE 2		BSNL GSM NE 1		BSNL GSM NE 2		Idea		Reliance GSM		Vodafone	
		In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
0 to -75 dBm		72.77%	66.55%	41.78%	60.37%	23.36%	37.19%	NA		84.65%	75.33%	NA		50.33%	56.50%	0.92%	0.38%	20.20%	38.14%
0 to -85 dBm		99.01%	87.69%	94.30%	88.89%	38.22%	59.81%			98.88%	95.00%			99.67%	73.50%	1.28%	0.55%	92.24%	73.72%
0 to -95 dBm		100.00%	100.00%	99.98%	99.31%	38.39%	92.09%			99.97%	100.00%			100.00%	87.50%	1.56%	0.67%	99.24%	90.09%
Voice quality	≥ 95%	94.75%	90.81%	98.82%	92.64%	28.06%	62.42%			94.04%	85.17%			98.36%	94.31%	98.95%	93.56%	98.60%	93.50%
CSSR	≥ 95%	100.00%	95.23%	100.00%	99.69%	92.11%	88.50%			98.48%	96.79%			100.00%	98.07%	100.00%	93.79%	100.00%	95.37%
%age Blocked calls		0.00%	4.50%	0.00%	0.31%	5.26%	7.97%			1.52%	4.66%			0.00%	1.93%	0.00%	6.21%	0.00%	3.62%
Call drop rate	≤ 2%	0.00%	1.89%	0.00%	0.18%	3.03%	4.37%			1.08%	0.00%			0.00%	1.18%	0.00%	8.75%	0.00%	3.71%
Hands off success rate		100.00%	98.05%	100.00%	98.93%	97.34%	97.00%			100.00%	89.65%			100.00%	96.88%	100.00%	86.15%	100.00%	99.69%

Data Source: Drive test reports submitted by operators to auditors

Note: Drive Test conducted in NE 1 region; hence BSNL NE 2 region is not applicable.

Voice quality:

All operators failed to meet the voice quality benchmark of 95% in outdoor locations. Aircel, BSNL NE 1 CDMA and BSNL NE 1 GSM also missed the voice quality benchmark in indoor locations.

CSSR:

BSNL NE 1 CDMA failed to meet the benchmark in outdoor as well as indoor locations. Reliance GSM failed to meet the benchmark in outdoor locations.

Call drop rate:

BSNL NE 1 CDMA failed to meet the benchmark in outdoor as well as indoor locations. Reliance GSM and Vodafone failed to meet the benchmark in outdoor locations.

6.1.3 DECEMBER – ARUNACHAL PRADESH

Month	Name of SSA Covered	Date of Drive Test
December	Arunachal Pradesh	15th to 16th December 2014

6.1.3.1 ROUTE DETAILS – ARUNACHAL PRADESH SSA

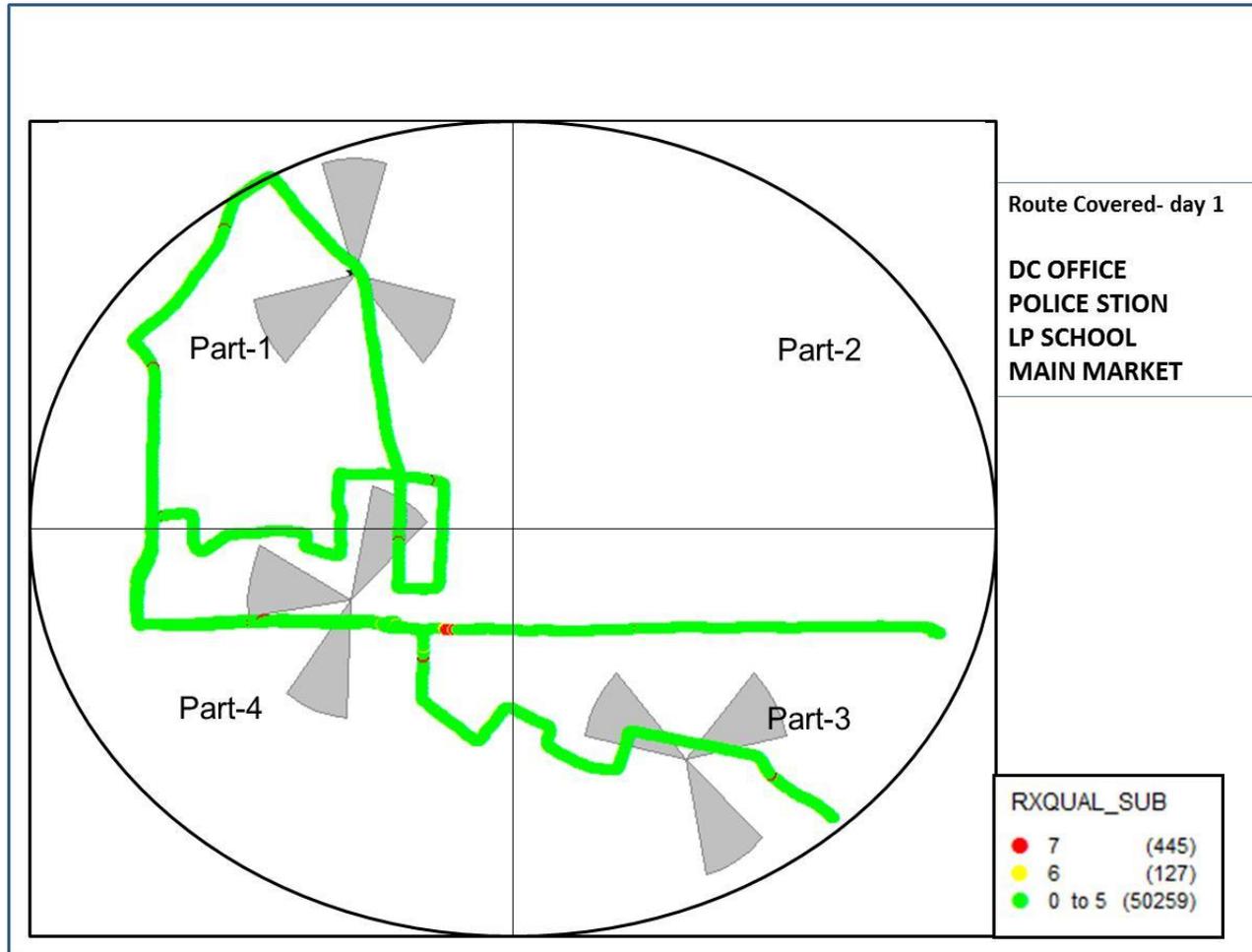
Category	Type of location	North East- December		
		Arunachal Pradesh		
		Day 1	Day 2	Day 3
Outdoor	Major Roads	Dirak Gate(Mahadevpur) to Wakro Via NAMSAI Road Drive(H. Way) (78 km) and NAMSAI Town Drive	Wakro to Tezu Road Drive (65 km) and TEZU Town Drive	Tezu to Santipur Via ROING Road Drive (95 km) and ROING Town Drive
	Highways			
	With in the City			
Indoor	Shopping complex			
	Office complex			

The route maps given in the report are provided for the purpose of identifying the routes traversed during the drive tests. We may observe three different colours (Red/Green/Yellow) of the lines, which signify signal strength; however these maps are for a single operator and have not been referred to any findings in this report. IMRB submits detailed operator wise Drive Test reports separately.

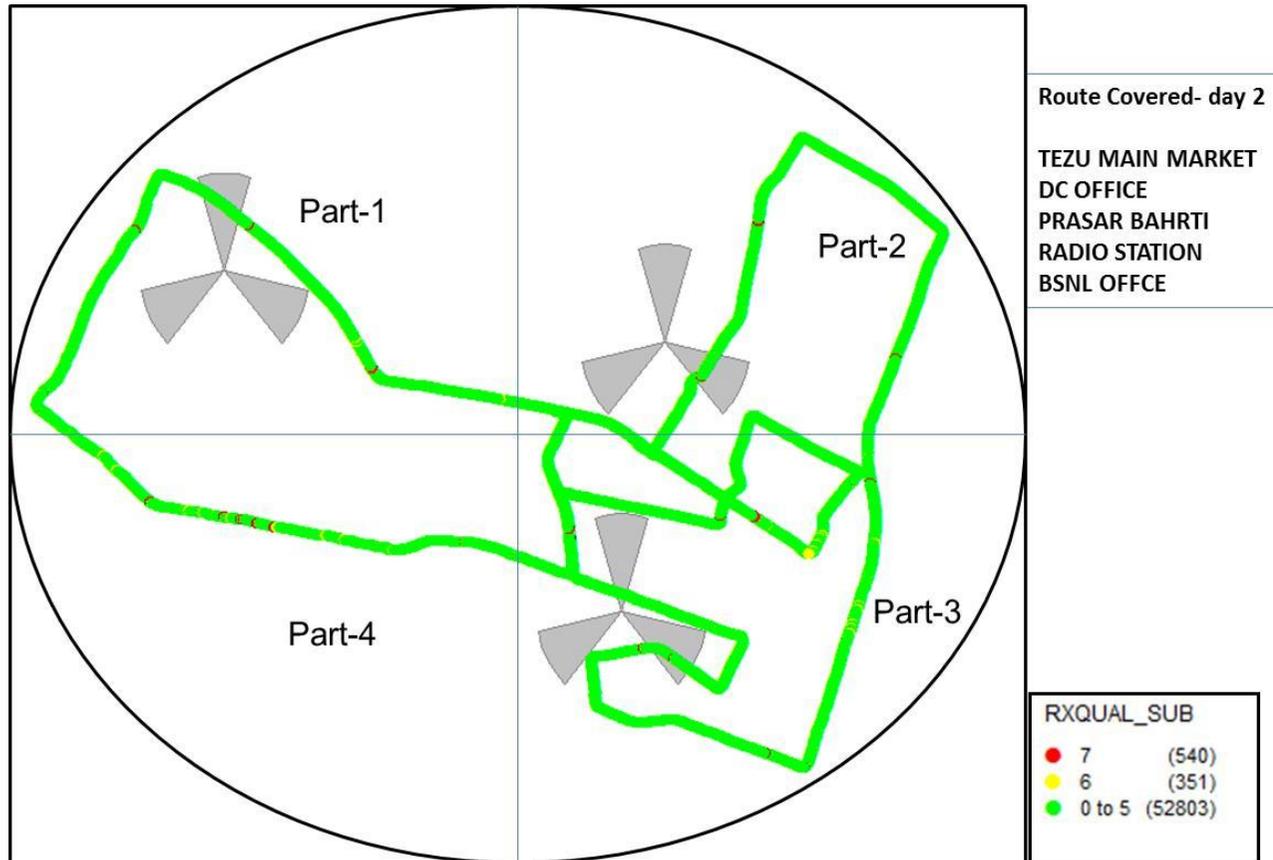
6.1.3.2 KILOMETERS TRAVELLED- ARUNACHAL PRADESH SSA

Drive Test - Kilometers Travelled	Day 1	Day 2	Day 3	Total
Arunachal Pradesh	108	105	95	308

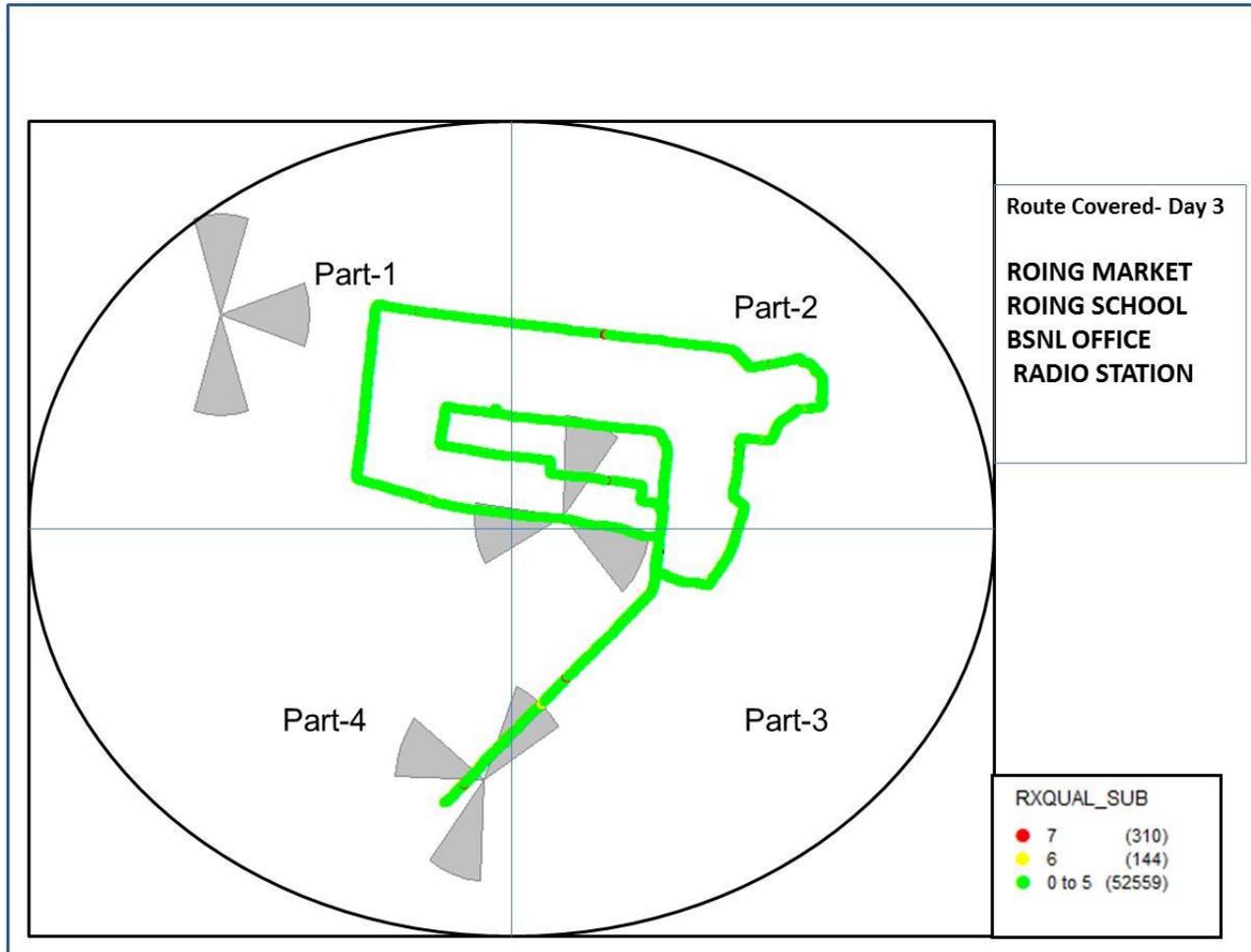
6.1.3.3 ROUTE MAP ARUNACHAL PRADESH DAY 1



6.1.3.4 ROUTE MAP ARUNACHAL PRADESH DAY 2



6.1.3.5 ROUTE MAP ARUNACHAL PRADESH DAY 3



6.1.3.6 DRIVE TEST RESULTS – ARUNACHAL PRADESH SSA

Executive Summary																			
Parameter's	B'mark	Aircel(DWL)		Airtel		BSNL CDMA NE 1		BSNL CDMA NE 2		BSNL GSM NE 1		BSNL GSM NE 2		Idea		Reliance GSM		Vodafone	
		In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor	In door	Outdoor
0 to -75 dBm		83.73%	62.92%	96.68%	56.87%	NA	Not Patcipated	NA	50.63%	25.68%	No Coverage	60.98%	36.85%	52.92%	37.58%				
0 to -85 dBm		99.95%	83.08%	99.79%	75.59%				91.77%	56.37%		97.93%	64.27%	97.73%	65.34%				
0 to -95 dBm		100.00%	100.00%	99.93%	93.99%				99.78%	85.95%		99.97%	85.38%	99.85%	84.75%				
Voice quality	≥ 95%	99.17%	94.63%	99.50%	95.83%				92.12%	88.08%		97.55%	94.24%	99.01%	95.72%				
CSSR	≥ 95%	100.00%	96.93%	100.00%	99.72%				98.41%	81.31%		100.00%	95.14%	100.00%	95.05%				
%age Blocked calls		0.00%	3.07%	0.00%	0.28%				2.74%	7.79%		0.00%	4.86%	0.00%	4.95%				
Call drop rate	≤ 2%	0.00%	0.00%	0.00%	0.00%				2.82%	5.45%		0.00%	1.90%	0.00%	4.05%				
Hands off success rate		100.00%	97.64%	100.00%	100.00%				70.37%	72.18%		100.00%	99.17%	100.00%	100.00%				

Data Source: Drive test reports submitted by operators to auditors

Note: Drive Test conducted in NE 2 region; hence BSNL NE 1 region is not applicable. BSNL NE 2 CDMA did not participate in the drive test. Idea does not have coverage in the region.

Voice quality:

BSNL NE 2 GSM failed to meet the benchmark of 95% for voice quality in outdoor as well as indoor locations. Aircel and Reliance GSM did not meet the benchmark in outdoor areas.

CSSR:

BSNL NE 2 GSM did not meet the benchmark for the criteria in outdoor locations.

Call drop rate:

BSNL NE 2 GSM did not meet the benchmark for the criteria in outdoor as well as indoor locations. Vodafone did not meet the benchmark for the criteria in outdoor locations.

7 CRITICAL FINDINGS

PMR Consolidated (Network Parameters)

Aircel failed to meet the benchmark for all network parameters, except CSSR. BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM also failed to meet the benchmark for majority network parameters.

3 Day Live Measurement (Network Parameters)

Aircel failed to meet the benchmark for all network parameters, except CSSR. BSNL NE 1 CDMA, BSNL NE 2 CDMA and BSNL NE 2 GSM also failed to meet the benchmark for majority network parameters.

Significant difference was observed between PMR & live measurement data for Aircel, BSNL NE 1 CDMA and BSNL NE 2 GSM. The possible reason for the variation could be the difference in time frame of data as PMR data is for 30 days and live measurement data is for three days.

Live Calling

None of the operators met the benchmark for complaints resolved within 4 weeks and within 6 weeks. For calls answered by operator (voice to voice), Idea failed to meet the benchmark.

As per live calling conducted for 'level 1' services, a number of Category-I (i.e. mandatory) services were not being operated by the operators.

Billing and Customer Care

BSNL NE 1 CDMA, Idea and Vodafone did not meet the benchmark for metering and billing credibility of postpaid subscribers.

Aircel, BSNL NE 1 CDMA, Idea and Vodafone did not meet the benchmark for metering and billing credibility of prepaid subscribers.

BSNL NE 1 CDMA, BSNL NE 1 GSM and BSNL NE 2 GSM did not meet the benchmark for resolving 98% complaints within 4 weeks.

BSNL NE 1 GSM and Reliance GSM did not meet the benchmark of answering 95% calls by the operator (voice to voice) within 90 seconds.

Inter-Operator Call Assessment

In the inter-operator call assessment, it was observed that BSNL NE 1 CDMA and BSNL NE 2 CDMA were the operators facing problems in connecting to and from other operators.

Drive Test (Operator Assisted)

In Tripura SSA, all operators failed to meet the voice quality benchmark of 95% in outdoor locations. Aircel, BSNL NE 1 CDMA and BSNL NE 1 GSM also missed the voice quality benchmark in indoor locations.

Reliance GSM in Nagaland SSA and BSNL NE 2 GSM in Arunachal Pradesh SSA failed to meet the benchmark for all parameters in outdoor locations.

8 ANNEXURE - CONSOLIDATED

8.1 NETWORK AVAILABILITY

Audit Results for Network Availability-Consolidated										
	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		5221	5876	387	730	1951	1287	2217	1815	4588
Sum of downtime of BTSs in a month (in hours)		334031	13963	13711	50740	28474	76288	21532	4721	56646
BTSs accumulated downtime (not available for service)	≤ 2%	8.61%	0.32%	4.76%	9.34%	1.96%	7.97%	1.30%	0.35%	1.66%
Number of BTSs having accumulated downtime >24 hours		2275	86	36	107	36	379	17	28	89
Worst affected BTSs due to downtime	≤ 2%	43.59%	1.46%	9.30%	14.66%	1.84%	29.45%	0.77%	1.54%	1.94%
Live Measurement- BTSs accumulated downtime-Consolidated										
	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		5215	5866	387	730	1951	1287	2217	1815	4588
Sum of downtime of BTSs in a month (in hours)		32269	1096	1292	5000	2658	4348	1884	3413	5487
(not available for service)	≤ 2%	8.60%	0.26%	4.64%	9.49%	1.89%	4.69%	1.18%	1.35%	1.66%
Number of BTSs having accumulated downtime >24 hours		469	0	8	80	37	251	16	28	25
Live Mesurement - Worst affected BTSs due to downtime	≤ 2%	9.00%	0.00%	2.07%	10.97%	1.90%	19.50%	0.72%	1.54%	0.55%

Data Source: Operations and Maintenance Center (OMC) of the operators

8.2 CONNECTION ESTABLISHMENT (ACCESSIBILITY)

Audit Results for CSSR, SDCCH and TCH congestion-Consolidated										
CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	96.05%	97.74%	97.05%	89.64%	97.22%	79.92%	98.42%	98.54%	99.62%
SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	2.49%	0.53%	NA	NA	0.94%	0.57%	0.30%	0.02%	0.14%
TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	3.11%	0.45%	0.00%	0.08%	1.93%	0.88%	0.98%	0.28%	0.38%

Data Source: Network Operations Center (NOC) of the operators

Live measurement results for CSSR, SDCCH and TCH congestion-Consolidated										
CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	96.01%	97.92%	96.71%	90.08%	97.08%	80.26%	99.11%	98.72%	99.79%
SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	1.74%	0.42%	NA	NA	0.93%	0.49%	0.24%	0.02%	0.07%
TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	3.20%	0.42%	0.00%	0.11%	1.92%	0.85%	0.46%	0.23%	0.21%
Drive test results for CSSR (Average of three drive tests) and blocked calls-Consolidated										
CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of call attempts		1137	1149	981	NP	398	459	559	987	1057
Total number of successful calls established		1095	1146	854	NP	382	354	553	935	1011
CSSR	≥ 95%	96.87%	99.74%	87.05%	NP	95.98%	77.12%	99.10%	94.88%	95.82%
Blocked calls	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
%age blocked calls		3.13%	0.26%	12.95%	NP	4.02%	22.88%	0.91%	5.12%	4.18%

Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

NP: Operator did not participate in the drive test.

8.3 CONNECTION MAINTENANCE (RETAINABILITY)

Audit Results for Call drop rate and for number of cells having more than 3% TCH-Consolidated										
Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls established		182995751	242142701	578111	19391836	250349277	238929497	31769652	49632888	3388224
Total number of calls dropped		4007646	2633327	9554	198536	4426864	14103501	557131	326176	22859
Call drop rate	≤ 2%	2.22%	1.09%	1.66%	1.11%	1.77%	6.49%	1.75%	0.66%	0.68%
Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		15034	17507	No Data	1527	5730	3961	6654	5458	13923
Total number of cells having more than 3% TCH		3464	153	No Data	59	168	1024	126	4	333
Worst affected cells having more than 3% TCH	≤ 3%	23.05%	0.87%	No Data	3.86%	2.93%	25.85%	1.89%	0.08%	2.39%

Data Source: Network Operations Center (NOC) of the operators

Live measurement results for Call drop rate and for number of cells having more than 3% TCH-Consolidated										
Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls established		17900180	23304976	55351	531268	25843348	56234836	43633832	39915984	1819324
Total number of calls dropped		377492	261790	928	4809	448356	3582040	586023	242283	11954
Call drop rate	≤ 2%	2.15%	1.12%	1.69%	0.91%	1.73%	6.30%	1.35%	0.63%	0.66%
Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		14911	17092	No Data	1527	5730	3961	6654	5458	13821
Total number of cells having more than 3% TCH		3309	148	No Data	58	168	675	117	4	333
Worst affected cells having more than 3% TCH	≤ 3%	22.23%	0.87%	No Data	3.80%	2.93%	17.05%	1.76%	0.08%	2.41%

Data Source: Network Operations Center (NOC) of the operators

Drive test results for Call drop rate (Average of three drive tests)-Consolidated										
Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls established		1095	1146	854	NP	382	433	553	935	1026
Total number of calls dropped		13	1	46	NP	1	30	4	36	28
Call drop rate	≤ 2%	0.96%	0.07%	5.39%	NP	0.26%	6.93%	0.62%	3.72%	2.66%

Data Source: Drive test reports submitted by operators to auditors

8.4 VOICE QUALITY

Audit Results for Voice quality -Consolidated										
Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		24888242494	35978051561	1052	210	298	238929497	5160177432	10225742359	529782931
Total number of calls with good voice quality		23117335571	35593588746	1031	210	293	209873474	4925172449	10044351095	518717558
%age calls with good voice quality	≥ 95%	92.88%	98.93%	98.00%	100.00%	98.33%	87.49%	95.45%	98.23%	97.91%

Live measurement results for Voice quality-Consolidated										
Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		2397008689	3631194878	1052	210	580	56234836	5483178186	7756656746	284847126
Total number of calls with good voice quality		2229235408	3592448173	1031	210	567	49558655	5247079067	7616608471	279235628
%age calls with good voice quality	≥ 95%	93.00%	98.93%	98.00%	100.00%	97.61%	88.07%	95.69%	98.18%	98.03%

Drive test results for Voice quality (Average of three drive tests)-Consolidated										
Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		1603060	1576226	104416	NP	614586	39438	971132	737865	1636607
Total number of calls with good voice quality		1505435	1480551	54073	NP	527653	34394	926174	652766	1552704
%age calls with good voice quality	≥ 95%	94.52%	94.03%	51.79%	NP	85.86%	87.21%	95.78%	86.48%	95.22%

Data Source: Network Operations Center (NOC) of the operators and Drive test reports submitted by operators to auditors

8.5 POI CONGESTION

Audit Results for POI Congestion-Consolidated										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Average number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
Average No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Average Capacity of all POIs (A) - in erlangs		40238	50858	No Data	No Data	27802	No Data	13758	8878	27325830
Average Traffic served for all POIs (B)- in erlangs		24325	19934	No Data	No Data	14312	No Data	8428	4579	6053012
Average POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%

Live Measurement Results for POI Congestion-Consolidated										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Average number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
Average No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Average Capacity of all POIs (A) - in erlangs		40238	50911	No Data	No Data	27802	No Data	13767	8883	891184
Average Traffic served for all POIs (B)- in erlangs		22526	20263	No Data	No Data	14197	No Data	8561	4653	198840
Average POI congestion	≤ 0.5%	12.33%	0.00%	No Data	No Data	0.33%	No Data	0.00%	0.00%	0.00%

Data Source: Network Operations Center (NOC) of the operators

8.6 TOTAL CALL MADE DURING THE DRIVE TEST-VOICE QUALITY

October									
Voice quality	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls	528880	453672	NA	NP	NA	NP	336927	190263	494820
November									
Voice quality	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls	736441	640751	104416	NA	614586	NA	634205	107822	718783
December									
Voice quality	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls	337739	481803	NA	NP	NA	39438	No Coverage	439780	423004

Data Source: Drive test reports submitted by operators to auditors

8.7 METERING AND BILLING CREDIBILITY

Audit Results for Billing performance Postpaid-Consolidated										
Billing Performance	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Metering and billing credibility - Postpaid-(Avg of 3 billing cycles)										
Total bills generated during the period		77529	107778	10082	4506	207289	62962	4156	38543	67717
Total number of bills disputed		44	51	43	0	155	2	16	17	254
Percentage bills disputed (Avg of 3 billing cycles)	≤ 0.1%	0.06%	0.05%	0.43%	0.00%	0.07%	0.00%	0.39%	0.04%	0.38%

Data Source: Billing Center of the operators

October										
Total bills generated during the first billing cycle		25218	36235	3424	1479	70123	21123	1416	12981	22376
Total number of bills disputed in first billing cycle		44	15	18	0	43	1	4	3	60
Percentage bills disputed (first billing cycle)	≤ 0.1%	0.17%	0.04%	0.53%	0.00%	0.06%	0.00%	0.28%	0.02%	0.27%
November										
Total bills generated during the second billing cycle		25889	35982	3307	1511	68955	21015	1377	12879	22342
Total number of bills disputed in second billing cycle		0	19	12	0	55	0	7	3	105
Percentage bills disputed (second billing cycle)	≤ 0.1%	0.00%	0.05%	0.36%	0.00%	0.08%	0.00%	0.51%	0.02%	0.47%
December										
Total bills generated during the third billing cycle		26422	35561	3351	1516	68211	20824	1363	12683	22999
Total number of bills disputed in third billing cycle		0	17	13	0	57	1	5	11	89
Percentage bills disputed (third billing cycle)	≤ 0.1%	0.00%	0.05%	0.39%	0.00%	0.08%	0.00%	0.37%	0.09%	0.39%

Data Source: Billing Center of the operators

Metering and billing credibility - Prepaid										
Performance prepaid	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of charging complaints		3243	874	163	No Data	31	122	945	276	1862
Total no of customers served		2716301	3196370	45350	No Data	547897	723894	410659	1640957	1245427
Percentage of charging complaints disputed	≤ 0.1%	0.12%	0.03%	0.36%	No Data	0.01%	0.02%	0.23%	0.02%	0.15%
Resolution of billing complaints (Postpaid+Prepaid)-Consolidated										
Billing Performance	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of billing/charging complaints		3287	925	206	0	186	124	961	293	2116
Total number of complaints resolved in favour of customer		11	282	115	0	107	107	644	259	1678
Total complaints considered invalid		3276	643	91	0	79	17	317	34	438
Number of complaints resolved in 4 weeks		11	282	106	0	82	90	644	259	1678
Percentage complaints resolved within 4 weeks	98.00%	100.00%	100.00%	92.17%	No Data	76.64%	84.11%	100.00%	100.00%	100.00%
Number of complaints resolved in 6 weeks		11	282	115	0	107	107	644	259	1678
Percentage complaints resolved within 6 weeks	100.00%	100.00%	100.00%	100.00%	No Data	100.00%	100.00%	100.00%	100.00%	100.00%
Period of applying credit / waiver										
Total number of complaints where credit/waiver is required		11	282	115	No Data	107	107	644	259	1678
Percentage cases in which credit/waiver was received within 1 week	100.00%	100.00%	100.00%	100.00%	No Data	100.00%	100.00%	100.00%	100.00%	100.00%

Data Source: Billing Center of the operators

Live calling results for resolution of billing complaints										
Resolution of billing complaints	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total Number of calls made		100	100	No Data	No Data	100	No Data	100	100	100
Number of cases resolved in 4 weeks		71	74	No Data	No Data	67	No Data	62	74	79
Percentage cases resolved in four weeks	≥ 98%	71.00%	74.00%	No Data	No Data	67.00%	No Data	62.00%	74.00%	79.00%
Number of cases resolved in 6 weeks		86	88	No Data	No Data	74	No Data	78	90	91
Percentage cases resolved in 6 weeks	100%	86.00%	88.00%	No Data	No Data	74.00%	No Data	78.00%	90.00%	91.00%

Data Source: Live calls made by auditors from operator's network

8.8 CUSTOMER CARE

Audit results for customer care (IVR) -Consolidated										
Customer Care Assessment	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of call attempts to customer care for assistance		4849150	0	159	No Data	494956	73180	1104284	2290860	2783139
Number of calls getting connected and answered (electronically)		4704869	0	159	No Data	488026	72460	1102808	2250652	2783104
Percentage calls getting connected and answered	≥ 95%	97.02%	100.00%	100.00%	No Data	98.60%	99.02%	99.87%	98.24%	100.00%

Data Source: Customer Service Center of the operators

Audit results for customer care (voice-to-Voice)- (Avg of 3 cycles)-Consolidated										
Customer Care Assessment	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total Number of calls received (3 cycles)		740687	1005772	11	No Data	143006	60	271471	454614	645200
Total Number of calls answered within 90 seconds (3 cycles)		669956	974766	11	No Data	130135	60	269967	395047	645200
Percentage calls answered within 90 seconds (Avg of 3 cycles)	≥ 95%	97.27%	96.92%	100.00%	No Data	91.00%	100.00%	99.44%	86.63%	100.00%
October										
Total calls received (Month 1)		266729	354073	5	No Data	48765	22	86766	109416	222720
Total calls answered within 90 seconds (Month 1)		243000	341609	5	No Data	44120	22	86028	91445	222720
% calls answered within 90 seconds (Month 1)	≥ 95%	96.94%	96.48%	100.00%	No Data	90.47%	100.00%	99.15%	83.58%	100.00%
November										
Total calls received (Month 2)		241021	335322	3	No Data	47667	19	89006	178094	216255
Total calls answered within 90 seconds (Month 2)		219627	327494	3	No Data	43221	19	88798	145115	216255
% calls answered within 90 seconds (Month 2)	≥ 95%	98.32%	97.67%	100.00%	No Data	90.67%	100.00%	99.77%	81.48%	100.00%
December										
Total calls received (Month 3)		232937	316377	3	No Data	46574	19	95699	167104	206225
Total calls answered within 90 seconds (Month 3)		207329	305663	3	No Data	42794	19	95141	158487	206225
% calls answered within 90 seconds (Month 3)	≥ 95%	96.55%	96.61%	100.00%	No Data	91.88%	100.00%	99.42%	94.84%	100.00%

Data Source: Customer Service Center of the operators

Live calling results for customer care (IVR)										
Customer Care Assessment	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of call attempts to customer care for assistance		100	100	100	100	100	100	100	100	100
Number of calls getting connected and answered (electronically)		100	100	100	100	100	100	100	100	100
Percentage calls getting connected and answered	≥ 95%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Live calling results for customer care (Voice to Voice)										
Customer Care Assessment	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total Number of calls received		100	100	100	100	100	100	100	100	100
Total Number of calls getting connected and answered		100	100	100	100	100	100	72	100	100
Percentage calls getting connected and answered within 60secs	≥ 95%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	72.00%	100.00%	100.00%

Data Source: Live calls made by auditors from operator's network

8.9 TERMINATION / CLOSURE OF SERVICE

Audit results for termination / closure of service-Consolidated										
Termination	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of closure request		168	404	97	15	113	19	46	116	422
Number of requests attended within 7 days		168	404	97	15	113	19	46	116	422
Percentage cases in which termination done within 7 days	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Data Source: Customer Service Center of the operators

8.10 TIME TAKEN FOR REFUND OF DEPOSITS AFTER CLOSURE

Audit results for refund of deposits-Consolidated										
Refund	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cases requiring refund of deposits		77	70	28	No Data	23	1	9	84	162
Total number of cases where refund was made within 60 days		77	70	28	No Data	23	1	9	84	162
Percentage cases in which refund was receive within 60 days	100.00%	100.00%	100.00%	100.00%	No Data	100.00%	100.00%	100.00%	100.00%	100.00%

Data Source: Customer Service Center of the operators

8.11 ADDITIONAL NETWORK RELATED PARAMETERS

Audit Results for Total Traffic Handled in Erlang									
Traffic in Erlang	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Equipped capacity of the network	104557	88628	27293	16875	112000	52000	20613	40000	41029
Total traffic handled in erlang during TCBH	52033	80067	97	1413	34693	10829	10899	15373	25583
Total no. of customers served (as per VLR)	1837818	3209565	6177	32370	384505	539630	359430	619228	1066597

Data Source: Network Operations Center (NOC) of the operators

8.12 LIVE CALLING RESULTS FOR RESOLUTION OF SERVICE REQUESTS

Live calling results for resolution of service requests									
Resolution of service requests	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total Number of calls made	100	100	No Data	No Data	100	No Data	100	100	100
Number of cases resolved to satisfaction	80	77	No Data	No Data	76	No Data	81	61	82
Percentage cases resolved in four weeks	80.00%	77.00%	No Data	No Data	76.00%	No Data	81.00%	61.00%	82.00%

Data Source: Live calls made by auditors from operator's network

8.13 LIVE CALLING RESULTS FOR LEVEL 1 SERVICES

Live calling for level 1 services										
Level 1 services	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total no. of calls made		150	150	150	150	150	150	150	150	150
Calls answered in 60 sec		146	148	145	147	144	146	148	150	150
% of calls connected in 60 seconds	≥ 95%	97.33%	98.67%	96.67%	98.00%	96.00%	97.33%	98.67%	100.00%	100.00%

Data Source: Live calls made by auditors from operator's network

8.14 LEVEL 1 SERVICES CALLS MADE

All the numbers given in mandatory list in Section 2.4.2.4.1 were tested. The following table provides the numbers that are activated for each operator. A tick (✓) for an operator signifies that the number was active for the operator.

Level 1 Service No	Category	Aircel	Airtel	BSNL CDMA 1	BSNL CDMA 2	BSNL GSM 1	BSNL GSM 2	Idea	Reliance GSM	Vodafone
100		✓	✓	✓	✓	✓	✓	✓	✓	✓
101			✓	✓	✓	✓	✓	✓	✓	✓
102								✓	✓	
104										
108								✓	✓	✓
181								✓		
1033								✓		
1056										
1063										
1064										
1066		✓	✓	✓	✓	✓	✓	✓	✓	✓
1068		✓	✓	✓	✓	✓	✓	✓	✓	✓
1070						✓	✓			
1071										✓
1072		✓	✓	✓	✓	✓	✓		✓	✓
1073		✓						✓		✓
1077		✓				✓	✓	✓		✓
1091			✓						✓	
1099										
1909		✓	✓			✓	✓	✓	✓	✓
1916									✓	
1947		✓	✓			✓	✓	✓	✓	✓
1950			✓					✓	✓	
15100		✓	✓				✓		✓	
155214										

Live calls were made to the active numbers to test the calls answered within 60 seconds. The details of the same have been given below for each operator.

Aircel				Airtel				BSNL CDMA 1				BSNL CDMA 2			
Level 1 sevice No	Total calls made	Able to connect	Not able to connect	Level 1 sevice No	Total calls made	Able to connect	Not able to connect	Level 1 sevice No	Total calls made	Able to connect	Not able to connect	Level 1 sevice No	Total calls made	Able to connect	Not able to connect
100	19	19	0	100	17	17	0	100	50	50	0	100	50	50	0
1072	19	18	1	101	17	17	0	101	50	50	0	101	50	50	0
1073	19	19	0	1072	17	17	0	1072	50	45	5	1072	50	47	3
1077	19	19	0	1091	16	16	0								
1098	19	17	2	1098	16	15	1								
1909	19	18	1	1909	16	16	0								
1947	18	18	0	1947	17	17	0								
15100	18	18	0	1950	17	16	1								
				15100	17	17	0								

BSNL GSM 1				BSNL GSM 2				Idea				Reliance GSM				Vodafone			
Level 1 sevice No	Total calls made	Able to connect	Not able to connect	Level 1 sevice No	Total calls made	Able to connect	Not able to connect	Level 1 sevice No	Total calls made	Able to connect	Not able to connect	Level 1 sevice No	Total calls made	Able to connect	Not able to connect	Level 1 sevice No	Total calls made	Able to connect	Not able to connect
100	17	17	0	100	17	17	0	100	13	12	1	100	13	13	0	100	15	15	0
101	17	17	0	101	17	17	0	101	13	13	0	101	13	13	0	101	15	15	0
1070	17	15	2	1070	17	17	0	102	13	13	0	102	13	13	0	108	15	15	0
1072	16	16	0	1072	17	16	1	108	13	12	1	108	13	13	0	1071	15	15	0
1077	16	14	2	1077	17	17	0	181	13	13	0	1072	13	13	0	1072	15	15	0
1098	16	16	0	1098	17	16	1	1033	13	13	0	1091	13	13	0	1073	15	15	0
1909	17	17	0	1909	16	14	2	1073	12	12	0	1098	12	12	0	1077	15	15	0
1947	17	16	1	1947	16	16	0	1077	12	12	0	1909	12	12	0	1098	15	15	0
106	17	16	1	15100	16	16	0	1098	12	12	0	1916	12	12	0	1909	15	15	0
								1909	12	12	0	1947	12	12	0	1947	15	15	0
								1947	12	12	0	1950	12	12	0				
								1950	12	12	0	15100	12	12	0				

Data Source: Live calls made by auditors from operator's network

8.15 COUNTER DETAILS

SI No.	KPI	Formula with Counter Description
1	CSSR= (No of established Calls / No of Attempted Calls)%	<p>No of established Calls = ([Assignment Requests]-([Failed Assignments (Signaling Channel)]+[Failed Assignments during MOC on the A Interface (Including Directed Retry)]+[Failed Assignments during MTC on the A Interface (Including Directed Retry)]+[Failed Assignments during Emergency Call on the A Interface (Including Directed Retry)] +[Failed Assignments during Call Re-establishment on the A Interface (Including Directed Retry)]+[Failed Mode Modify Attempts (MOC) (TCHF)]+[Failed Mode Modify Attempts (MTC) (TCHF)]+[Failed Mode Modify Attempts (Emergency Call) (TCHF)]+[Failed Mode Modify Attempts (Call Re-establishment) (TCHF)]+[Failed Mode Modify Attempts (MOC) (TCHH)]+[Failed Mode Modify Attempts (MTC) (TCHH)]+[Failed Mode Modify Attempts (Call Re-establishment) (TCHH)])/No of Attempted Calls = ([Assignment Requests (Signaling Channel) (TCH)] + [Assignment Requests (Signaling Channel) (SDCCH)] + [Assignment Requests (TCHF Only)] + [Assignment Requests (TCHH Only)] + [Assignment Requests (TCHF Preferred, Channel Type Unchangeable)] + [Assignment Requests (TCHH Preferred, Channel Type Unchangeable)] + [Assignment Requests (TCHF or TCHH, Channel Type Unchangeable)] + [Assignment Requests (TCHF Preferred, Channel Type Changeable)] + [Assignment Requests (TCHH Preferred, Channel Type Changeable)] + [Assignment Requests (TCHF or TCHH, Channel Type Changeable)])</p>
2	SDCCH congestion= (SDCCH Failure/SDCCH attempts)%	<p>SDCCH Failure= ([Channel Assignment Failures (All Channels Busy or Channels Unconfigured) in Immediate Assignment Procedure (SDCCH)] + [Failed Internal Intra-Cell Handovers (No Channel Available) (SDCCH)] + [Number of Unsuccessful Incoming Internal Inter-Cell Handovers (No Channel Available) (SDCCH)] + [Failed Incoming External Inter-Cell Handovers (No Channel Available) (SDCCH)])/SDCCH attempts = ([Channel Assignment Requests in Immediate Assignment Procedure (SDCCH)] + [Internal Intra-Cell Handover Requests (SDCCH)] + [Number of Incoming Internal Inter-Cell Handover Requests (SDCCH) (900/850/810-900/850/810)] + [Number of Incoming Internal Inter-Cell Handover Requests (SDCCH) (1800/1900-1800/1900)] + [Number of Incoming Internal Inter-Cell Handover Requests (SDCCH) (900/850/810-1800/1900)] + [Number of Incoming Internal Inter-Cell Handover Requests (SDCCH) (1800/1900-900/850/810)] + [Incoming External Inter-Cell Handover Requests (SDCCH) (900/850/810-900/850/810)] + [Incoming External Inter-Cell Handover Requests (SDCCH) (1800/1900-1800/1900)] + [Incoming External Inter-Cell Handover Requests (SDCCH) (900/850/810-1800/1900)] + [Incoming External Inter-Cell Handover Requests (SDCCH) (1800/1900-900/850/810)])</p>
3	TCH congestion= (TCH Failures /TCH Attempts)%	<p>TCH Failures= ([Failed TCH Seizures due to Busy TCH (Signaling Channel)]+[Failed Assignments (First Assignment, No Channel Available in Assignment Procedure)]+[Failed Assignments (First Assignment, No Channel Available in Directed Retry Procedure)]+[Failed Assignments (Reconnection to Old Channels, No Channel Available in Assignment)]+[Failed Assignments (Reconnection to Old Channels, No Channel Available in Directed Retry)])/TCH Attempts = ([Assignment Requests (Signaling Channel) (TCH)] + [Assignment Requests (Signaling Channel) (SDCCH)] + [Assignment Requests (TCHF Only)] + [Assignment Requests (TCHH Only)] + [Assignment Requests (TCHF Preferred, Channel Type Unchangeable)] + [Assignment Requests (TCHH Preferred, Channel Type Unchangeable)] + [Assignment Requests (TCHF or TCHH, Channel Type Unchangeable)] + [Assignment Requests (TCHF Preferred, Channel Type Changeable)] + [Assignment Requests (TCHH Preferred, Channel Type Changeable)] + [Assignment Requests (TCHF or TCHH, Channel Type Changeable)])</p>

4	<p>Call Drop Rate= (The total no of dropped calls*100)/Total no of calls successfully established (where traffic channel is allotted)</p>	<p>The total no of dropped calls= ((Call Drops on Radio Interface in Stable State (Traffic Channel)) + [Call Drops on Radio Interface in Handover State (Traffic Channel)] + [Call Drops Due to No MR from MS for a Long Time (Traffic Channel)] + [Call Drops due to Abis Terrestrial Link Failure (Traffic Channel)] + [Call Drops due to Equipment Failure (Traffic Channel)] + [Call Drops due to Forced Handover (Traffic Channel)] + [Call Drops due to local switching Start Failure] + [Call Drops due to Failures to Return to Normal Call from local switching])/ Total no of calls successfully established (where traffic channel is allotted)= ((Assignment Requests)-([Failed Assignments (Signaling Channel)]+[Failed Assignments during MOC on the A Interface (Including Directed Retry)]+[Failed Assignments during MTC on the A Interface (Including Directed Retry)]+[Failed Assignments during Emergency Call on the A Interface (Including Directed Retry)] +[Failed Assignments during Call Re-establishment on the A Interface (Including Directed Retry)]+[Failed Mode Modify Attempts (MOC) (TCHF)]+[Failed Mode Modify Attempts (MTC) (TCHF)]+[Failed Mode Modify Attempts (Emergency Call) (TCHF)]+[Failed Mode Modify Attempts (Call Re-establishment) (TCHF)]+[Failed Mode Modify Attempts (MOC) (TCHH)]+[Failed Mode Modify Attempts (MTC) (TCHH)]+[Failed Mode Modify Attempts (Call Re-establishment) (TCHH))</p>
5	<p>Call Drop Rate= (No of cells having call drop rate >3% during CBBH in a month*100)/Total no of cells in the licensed service area</p>	<p>Above formula with counters being used in CBBH.</p>
6	<p>Connection with good quality voice= (Connection with good quality voice/Total voice samples)%</p>	<p>Connection with good quality voice = ((Number of MRs on Downlink TCHF (Receive Quality Rank 0)+Number of MRs on Downlink TCHF (Receive Quality Rank 1)+Number of MRs on Downlink TCHF (Receive Quality Rank 2)+Number of MRs on Downlink TCHF (Receive Quality Rank 3)+Number of MRs on Downlink TCHF (Receive Quality Rank 4)+Number of MRs on Downlink TCHF (Receive Quality Rank 5)+Number of MRs on Downlink TCHH (Receive Quality Rank 0)+Number of MRs on Downlink TCHH (Receive Quality Rank 1)+Number of MRs on Downlink TCHH (Receive Quality Rank 2)+Number of MRs on Downlink TCHH (Receive Quality Rank 3)+Number of MRs on Downlink TCHH (Receive Quality Rank 4)+Number of MRs on Downlink TCHH (Receive Quality Rank 5)) / Total voice samples= ((Number of MRs on Downlink TCHF (Receive Quality Rank 0)+Number of MRs on Downlink TCHF (Receive Quality Rank 1)+Number of MRs on Downlink TCHF (Receive Quality Rank 2)+Number of MRs on Downlink TCHF (Receive Quality Rank 3)+Number of MRs on Downlink TCHF (Receive Quality Rank 4)+Number of MRs on Downlink TCHF (Receive Quality Rank 5)+Number of MRs on Downlink TCHF (Receive Quality Rank 6)+Number of MRs on Downlink TCHF (Receive Quality Rank 7)+Number of MRs on Downlink TCHH (Receive Quality Rank 0)+:Number of MRs on Downlink TCHH (Receive Quality Rank 1)+Number of MRs on Downlink TCHH (Receive Quality Rank 2)+Number of MRs on Downlink TCHH (Receive Quality Rank 3)+Number of MRs on Downlink TCHH (Receive Quality Rank 4)+Number of MRs on Downlink TCHH (Receive Quality Rank 5)+Number of MRs on Downlink TCHH (Receive Quality Rank 6)+Number of MRs on Downlink TCHH (Receive Quality Rank 7))</p>

8.15.1 ERICSSON

Ericsson provides network support to Vodafone, Aircel, Idea, BSNL GSM and Reliance GSM in the circle.

SI No.	KPI	Ericsson
1	CSSR= (No of established Calls / No of Attempted Calls)%	CSSR (No of established Calls / No of Attempted Calls)=(TCASSALL/TASSALL)*100
2	SDCCH congestion= (SDCCH Failure/SDCCH attempts)%	SDCCH congestion (SDCCH Failure/SDCCH attempts)% = (CCONGS/CCALLS)*100
3	TCH congestion= (TCH Failures /TCH Attempts)%	TCH congestion (TCH Failures /TCH Attempts)%= (CNRELCONG+TNRELCONG)/TASSALL)*100
4	Call Drop Rate= (The total no of dropped calls*100)/Total no of calls successfully established (where traffic channel is allotted)	Call Drop Rate (Total no dropped calls/No of established calls)%= (TNDROP)/TCASSALL *100
5	Call Drop Rate= (No of cells having call drop rate >3% during CBBH in a month*100)/Total no of cells in the licensed service area	Above formula with counters being used in CBBH.
6	Connection with good quality voice= (Connection with good quality voice/Total voice samples)%	Connection with good quality voice (Connection with good quality voice samples 0-5 /Total voice samples)= 100 * (QUAL50DL + QUAL40DL + QUAL30DL + QUAL20DL + QUAL10DL + QUAL00DL) / (QUAL70DL + QUAL60DL + QUAL50DL + QUAL40DL + QUAL30DL + QUAL20DL + QUAL10DL + QUAL00DL)

Ericsson Counters

Counter	Counter Description
TCASSALL	Number of assignment complete messages on TCH for all MS classes
TASSALL	Number of first assignment attempts on TCH for all MS classes.
CNRELCONG	Number of released connections on SDCCH due to TCH or Transcoder (TRA) congestion.

TNRELCONG	Number of released TCH signalling connections due to transcoder resource congestion during immediate assignment on TCH
CCONGS	Congestion counter for SDCCH. Stepped per congested allocation attempt.
CCALLS	Channel allocation attempt counter on SDCCH.
TNDROP	The total number of dropped TCH Connections.
QUAL00DL	Number of quality 0 reported on downlink.
QUAL10DL	Number of quality 1 reported on downlink.
QUAL20DL	Number of quality 2 reported on downlink.
QUAL30DL	Number of quality 3 reported on downlink.
QUAL40DL	Number of quality 4 reported on downlink.
QUAL50DL	Number of quality 5 reported on downlink.
QUAL60DL	Number of quality 6 reported on downlink.
QUAL70DL	Number of quality 7 reported on downlink.

8.15.2 NSN (NOKIA SIEMENS NETWORKS)

NSN provides network support to Airtel in the circle.

Sl No.	KPI	NSN
1	CSSR= (No of established Calls / No of Attempted Calls)%	$CSSR = 100 - 100 * \frac{(SDCCH_BUSY_ATT) - (TCH_SEIZ_DUE_SDCCH_CON) + (SDCCH_RADIO_FAIL) + (SDCCH_RF_OLD_HO) + (SDCCH_USER_ACT) + (SDCCH_BCSU_RESET) + (SDCCH_NETW_ACT) + (SDCCH_BTS_FAIL) + (SDCCH_LAPD_FAIL) + (BLCK_8I_NOM)}{\{(CH_REQ_MSG_REC) + (PACKET_CH_REQ)\} - \{(GHOST_CCCH_RES) - (REJ_SEIZ_ATT_DUE_DIST)\}}$
2	SDCCH congestion= (SDCCH Failure/SDCCH attempts)%	$SDCCH \text{ congestion} = \frac{(sdccch_busy_att - .tch_seiz_due_sdccch_con)}{\{(CH_REQ_MSG_REC) + (PACKET_CH_REQ)\} - \{(GHOST_CCCH_RES) - (REJ_SEIZ_ATT_DUE_DIST)\}}$
3	TCH congestion= (TCH Failures /TCH Attempts)%	$TCH \text{ congestion} = \frac{BLCK_8I_NOM}{\{(TCH_NORM_SEIZ) + (MSC_I_SDCCH_TCH_AT) + (BSC_I_SDCCH_TCH_AT)\}}$

4	Call Drop Rate= (The total no of dropped calls*100)/Total no of calls successfully established (where traffic channel is allotted)	$\text{TCH Drop} = \frac{(\text{drop_after_tch_assign}) - (\text{tch_re_est_release})}{\{(\text{TCH_NORM_SEIZ}) + (\text{MSC_I_SDCCH_TCH_AT}) + (\text{BSC_I_SDCCH_TCH_AT})\}}$
5	Call Drop Rate= (No of cells having call drop rate >3% during CBBH in a month*100)/Total no of cells in the licensed service area	Above formula with counters being used in CBBH.
6	Connection with good quality voice= (Connection with good quality voice/Total voice samples)%	$\text{Connection with good quality voice} = \frac{(\text{FREQ_DL_QUAL0} + \text{FREQ_DL_QUAL1} + \text{FREQ_DL_QUAL2} + \text{FREQ_DL_QUAL3} + \text{FREQ_DL_QUAL4} + \text{FREQ_DL_QUAL5})}{(\text{FREQ_DL_QUAL0} + \text{FREQ_DL_QUAL1} + \text{FREQ_DL_QUAL2} + \text{FREQ_DL_QUAL3} + \text{FREQ_DL_QUAL4} + \text{FREQ_DL_QUAL5} + \text{FREQ_DL_QUAL6} + \text{FREQ_DL_QUAL7})}$

9 ANNEXURE – OCTOBER

PERFORMANCE REPORTS - PARAMETER WISE

1. Network Availability

Audit Results for Network Availability- PMR data-October

	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		1730	1959	129	243	642	429	739	605	1504
Sum of downtime of BTSs in a month (in hours)		126719	4764	5080	16830	9413	26434	7053	1442	19301
BTSs accumulated downtime (not available for service)	≤ 2%	9.85%	0.33%	5.29%	9.31%	1.97%	8.28%	1.28%	0.32%	1.72%
Number of BTSs having accumulated downtime >24 hours		886	29	15	35	11	152	7	10	29

Worst affected BTSs due to downtime	≤ 2%	51.21%	1.48%	11.63%	14.40%	1.71%	35.43%	0.95%	1.65%	1.93%
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Live Measurement Results for Network Availability- 3 Day live data-October

	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		1730	1954	129	243	642	429	739	605	1504
Sum of downtime of BTSs in a month (in hours)		11935	343	518	1656	887	1322	584	134	1574
BTSs accumulated downtime (not available for service)	≤ 2%	9.58%	0.24%	5.58%	9.47%	1.92%	4.28%	1.10%	0.31%	1.45%
Number of BTSs having accumulated downtime >24 hours		172	0	2	28	12	80	7	10	7
Worst affected BTSs due to downtime	≤ 2%	9.94%	0.00%	1.55%	11.52%	1.87%	18.65%	0.95%	1.65%	0.47%

2. Connection Establishment (Accessibility)

Audit Results for CSSR, SDCCH and TCH congestion- PMR data-October

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	96.15%	97.83%	97.39%	91.80%	98.13%	81.30%	98.54%	98.62%	99.56%

SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	3.07%	0.60%	NA	NA	0.95%	0.49%	0.09%	0.02%	0.11%

TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	3.08%	0.39%	0.00%	0.12%	1.89%	0.83%	0.91%	0.30%	0.44%

Live measurement results for CSSR, SDCCH and TCH congestion- 3 Day Data-October

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	95.50%	97.88%	97.07%	94.10%	98.13%	81.63%	99.20%	99.01%	99.74%

SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	2.45%	0.53%	NA	NA	0.93%	0.46%	0.21%	0.02%	0.10%

TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	3.76%	0.40%	0.00%	0.05%	1.93%	0.83%	0.44%	0.16%	0.26%

Drive test results for CSSR (Average of three drive tests) and blocked calls-October- Drive Test Data

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of call attempts		435	387	NA	NP	NA	NP	227	366	349
Total number of successful calls established		435	387	NA	NP	NA	NP	227	343	341
CSSR	≥ 95%	100.00%	100.00%	NA	NP	NA	NP	100.00%	93.72%	97.71%

Blocked calls	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
%age blocked calls		0.00%	0.00%	NA	NP	NA	NP	0.00%	6.28%	2.29%

3. Connection Maintenance (Retainability)

Audit Results for Call drop rate and for number of cells having more than 3% TCH-October-PMR data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of		49529010	83409205	210943	1450279	82977720	210111502	9381918	18447410	1132804

calls established										
Total number of calls dropped		1258436	873770	3366	16847	1439305	12133353	165274	121971	7851
Call drop rate	≤ 2%	2.54%	1.05%	1.60%	1.16%	1.73%	5.77%	1.76%	0.66%	0.69%

Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		4914	5836	No Data	509	1885	1319	2218	1815	4583
Total number of cells having more than 3% TCH		1221	53	No Data	20	55	362	44	1	111
Worst affected cells having more than 3% TCH	≤ 3%	24.85%	0.91%	No Data	3.93%	2.92%	27.45%	1.98%	0.06%	2.42%

Live measurement results for Call drop rate and for number of cells having more than 3% TCH-October- 3 Day data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls		4656556	7969097	20568	144999	8565721	20034562	14007991	23151575	610042

established										
Total number of calls dropped		117509	87054	323	1328	151789	1260214	181445	134029	3910
Call drop rate	≤ 2%	2.52%	1.09%	1.57%	0.92%	1.77%	6.29%	1.30%	0.58%	0.64%

Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		4820	5822	No Data	509	1885	1319	2218	1815	4583
Total number of cells having more than 3% TCH		1246	54	No Data	19	56	317	42	1	112
Worst affected cells having more than 3% TCH	≤ 3%	25.85%	0.93%	No Data	3.73%	2.97%	24.03%	1.89%	0.06%	2.44%

Drive test results for Call drop rate (Average of three drive tests)-October - Drive Test Data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls established		435	387	NA	NP	NA	NP	227	343	345

Total number of calls dropped		0	0	NA	NP	NA	NP	0	12	0
Call drop rate	≤ 2%	0.00%	0.00%	NA	NP	NA	NP	0.00%	3.50%	0.00%

4. Voice quality

Audit Results for Voice quality -PMR Data-October

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		7980625149	12051353912	No Data	70	98	210111502	1723923923	3601840271	171545443
Total number of calls with good voice quality		7406110787	11922162891	No Data	70	98	184730033	1642721154	3539418102	167810866
%age calls with good voice quality	≥ 95%	92.80%	98.93%	No Data	100.00%	100.00%	87.92%	95.29%	98.27%	97.82%

Live measurement results for Voice quality-3 Day data-October

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		784146061	1220746309	No Data	70	240	20034562	1738319534	4236627716	93754617
Total		728534112	1207735747	No Data	70	235	17590345	166152439	415978359	91823392

number of calls with good voice quality								6	0	
%age calls with good voice quality	≥ 95%	92.91%	98.93%	No Data	100.00%	97.92%	87.80%	95.58%	98.19%	97.94%

Drive test results for Voice quality (Average of three drive tests) - DT data-October

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		528880	453672	NA	NP	NA	NP	336927	190263	494820
Total number of calls with good voice quality		508845	421267	NA	NP	NA	NP	327131	133870	473823
%age calls with good voice quality	≥ 95%	96.21%	92.86%	NA	NP	NA	NP	97.09%	70.36%	95.76%

5. POI Congestion

Audit Results for POI Congestion- PMR data-October

POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31

No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40129	50565	No Data	No Data	27803	No Data	13526	8655	27512341
Traffic served for all POIs (B)- in erlangs		23284	19102	No Data	No Data	14326	No Data	7952	4452	5971100
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%
Live Measurement Results for POI Congestion- 3 Day data-October										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40129	50971	No Data	No Data	27803	No Data	13736	8669	887495
Traffic served for all POIs (B)- in erlangs		22398	19757	No Data	No Data	14020	No Data	8057	4676	195201
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.00%	No Data	0.00%	0.00%	0.00%

10 ANNEXURE – NOVEMBER

PERFORMANCE REPORTS - PARAMETER WISE

1. Network Availability

Audit Results for Network Availability- PMR data-November

	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		1736	1956	129	243	651	429	739	605	1536
Sum of downtime of BTSs in a month (in hours)		104213	4682	4546	17136	9574	24658	7584	1451	18136
BTSs accumulated downtime (not available for service)	≤ 2%	8.07%	0.32%	4.74%	9.48%	1.98%	7.73%	1.38%	0.32%	1.59%
Number of BTSs having accumulated downtime >24 hours		676	28	9	39	12	138	5	8	30

Worst affected BTSs due to downtime	≤ 2%	38.94%	1.43%	6.98%	16.05%	1.84%	32.17%	0.68%	1.32%	1.95%
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Live Measurement Results for Network Availability- 3 Day live data-November

	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		1733	1952	129	243	651	429	739	605	1536
Sum of downtime of BTSs in a month (in hours)		10513	392	481	1596	877	1768	690	1451	2016
BTSs accumulated downtime (not available for service)	≤ 2%	8.43%	0.28%	5.18%	9.12%	1.87%	5.72%	1.30%	3.33%	1.82%
Number of BTSs having accumulated downtime >24 hours		157	0	4	25	12	115	5	8	3
Worst affected BTSs due to downtime	≤ 2%	9.06%	0.00%	3.10%	10.29%	1.84%	26.81%	0.68%	1.32%	0.20%

2. Connection Establishment (Accessibility)

Audit Results for CSSR, SDCCH and TCH congestion- PMR data-November

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	95.98%	97.81%	96.74%	86.40%	96.63%	86.46%	98.57%	98.49%	99.59%
SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	2.50%	0.48%	NA	NA	0.92%	0.63%	0.43%	0.02%	0.23%
TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	3.19%	0.43%	No Data	0.00%	1.92%	0.91%	0.80%	0.30%	0.41%

Live measurement results for CSSR, SDCCH and TCH congestion- 3 Day Data-November

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	96.03%	98.06%	96.24%	87.60%	96.77%	78.48%	99.08%	98.66%	99.77%
SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	1.42%	0.34%	NA	NA	0.95%	0.51%	0.17%	0.02%	0.06%

TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	3.15%	0.39%	No Data	0.12%	1.92%	0.86%	0.41%	0.27%	0.23%

Drive test results for CSSR (Average of three drive tests) and blocked calls-November- Drive Test Data

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of call attempts		490	447	981	NA	398	NA	332	340	449
Total number of successful calls established		451	445	854	NA	382	NA	326	320	422
CSSR	≥ 95%	92.04%	99.55%	87.05%	NA	95.98%	NA	98.19%	94.12%	93.99%

Blocked calls	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
%age blocked calls		7.96%	0.45%	12.95%	NA	4.02%	NA	1.81%	5.88%	6.01%

3. Connection Maintenance (Retainability)

Audit Results for Call drop rate and for number of cells having more than 3% TCH-November-PMR data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls		64361074	74788451	183051	16533526	83448867	15490754	11086002	15966765	1121411

established										
Total number of calls dropped		1396866	841200	3234	165360	1493735	1023429	186808	106030	7577
Call drop rate	≤ 2%	2.17%	1.12%	1.77%	1.00%	1.79%	6.61%	1.69%	0.66%	0.68%

Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		5092	5828	No Data	509	1912	1319	2218	1815	4652
Total number of cells having more than 3% TCH		1209	52	No Data	19	56	336	40	1	111
Worst affected cells having more than 3% TCH	≤ 3%	23.74%	0.89%	No Data	3.73%	2.93%	25.47%	1.80%	0.06%	2.39%

Live measurement results for Call drop rate and for number of cells having more than 3% TCH-November- 3 Day data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls established		6442981	7482341	17171	176977	8614357	21081107	14450977	1545696	590881

Total number of calls dropped		140667	86397	322	1800	148443	1467700	200190	10079	3768
Call drop rate	≤ 2%	2.18%	1.15%	1.88%	1.02%	1.72%	6.96%	1.39%	0.65%	0.64%

Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		5103	5430	No Data	509	1912	1319	2218	1815	4550
Total number of cells having more than 3% TCH		1168	54	No Data	19	55	232	40	1	109
Worst affected cells having more than 3% TCH	≤ 3%	22.89%	0.99%	No Data	3.73%	2.88%	17.59%	1.80%	0.06%	2.40%

Drive test results for Call drop rate (Average of three drive tests)-November - Drive Test Data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls established		451	445	854	NA	382	NA	326	320	422
Total		13	1	46	NA	1	NA	4	21	19

number of calls dropped										
Call drop rate	≤ 2%	2.88%	0.22%	5.39%	NA	0.26%	NA	1.23%	6.56%	4.50%

4. Voice quality

Audit Results for Voice quality -PMR Data-November

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		8413049625	11664774895	1052	70	100	15490754	1757402363	3461008595	179127638
Total number of calls with good voice quality		7814242352	11536038501	1031	70	97	13466112	1672270960	3398600465	175221594
%age calls with good voice quality	≥ 95%	92.88%	98.90%	98.00%	100.00%	97.00%	86.93%	95.16%	98.20%	97.82%

Live measurement results for Voice quality-3 Day data-November

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		872983032	1198108607	1052	70	240	21081107	1855791265	357135537	94807862
Total number of		812667048	1184945054	1031	70	235	18728455	1768383071	350492353	92898824

calls with good voice quality										
%age calls with good voice quality	≥ 95%	93.09%	98.90%	98.00%	100.00%	97.92%	88.84%	95.29%	98.14%	97.99%

Drive test results for Voice quality (Average of three drive tests) - DT data-November

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		736441	640751	104416	NA	614586	NA	634205	107822	718783
Total number of calls with good voice quality		672128	595169	54073	NA	527653	NA	599043	101521	669841
%age calls with good voice quality	≥ 95%	91.27%	92.89%	51.79%	NA	85.86%	NA	94.46%	94.16%	93.19%

5. POI Congestion

Audit Results for POI Congestion- PMR data-November

POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
No. of POIs		0	0	No Data	No Data	0	No Data	0	0	0

not meeting benchmark										
Total Capacity of all POIs (A) - in erlangs		40128	50979	No Data	No Data	27802	No Data	13731	8632	26624846
Traffic served for all POIs (B)- in erlangs		23617	20152	No Data	No Data	14326	No Data	8584	4522	5892847
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%

Live Measurement Results for POI Congestion- 3 Day data-November

POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		36	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40128	50639	No Data	No Data	27802	No Data	13736	8632	887494
Traffic served for all POIs (B)- in erlangs		22654	20454	No Data	No Data	14020	No Data	8746	4522	196430
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.50%	No Data	0.00%	0.00%	0.00%

11 ANNEXURE – DECEMBER

PERFORMANCE REPORTS - PARAMETER WISE

1. Network Availability

Audit Results for Network Availability- PMR data-December

	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		1755	1961	129	244	658	429	739	605	1548
Sum of downtime of BTSs in a month (in hours)		103099	4517	4085	16774	9487	25196	6895	1828	19209
BTSs accumulated downtime (not available for service)	≤ 2%	7.90%	0.31%	4.26%	9.24%	1.94%	7.89%	1.25%	0.41%	1.67%
Number of BTSs having accumulated downtime >24 hours		713	29	12	33	13	89	5	10	30

Worst affected BTSs due to downtime	≤ 2%	40.63%	1.48%	9.30%	13.52%	1.98%	20.75%	0.68%	1.65%	1.94%
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Live Measurement Results for Network Availability- 3 Day live data-December

	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Number of BTSs in the licensed service area		1752	1960	129	244	658	429	739	605	1548
Sum of downtime of BTSs in a month (in hours)		9821	361	293	1748	894	1258	610	1828	1896
BTSs accumulated downtime (not available for service)	≤ 2%	7.79%	0.26%	3.15%	9.88%	1.89%	4.07%	1.15%	0.41%	1.70%
Number of BTSs having accumulated downtime >24 hours		140	0	2	27	13	56	4	10	15
Worst affected BTSs due to downtime	≤ 2%	7.99%	0.00%	1.55%	11.11%	1.98%	13.05%	0.54%	1.65%	0.97%

2. Connection Establishment (Accessibility)

Audit Results for CSSR, SDCCH and TCH congestion- PMR data-December

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	96.03%	97.57%	97.03%	90.72%	96.89%	71.99%	98.14%	98.50%	99.70%

SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	1.90%	0.50%	NA	NA	0.96%	0.58%	0.39%	0.02%	0.08%

TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	3.06%	0.54%	0.00%	0.13%	1.97%	0.90%	1.23%	0.25%	0.30%

Live measurement results for CSSR, SDCCH and TCH congestion- 3 Day Data-December

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
CSSR	≥ 95%	96.49%	97.82%	96.81%	88.55%	96.34%	80.67%	99.04%	98.50%	99.87%

SDCCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
SDCCH/Paging channel congestion	≤ 1%	1.36%	0.39%	NA	NA	0.92%	0.51%	0.33%	0.02%	0.06%

TCH congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
TCH congestion	≤ 2%	2.68%	0.46%	0.00%	0.15%	1.92%	0.85%	0.54%	0.25%	0.13%

Drive test results for CSSR (Average of three drive tests) and blocked calls-December- Drive Test Data

CSSR	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of call attempts		212	315	NA	NP	NA	459	No Coverage	281	259
Total number of successful calls established		209	314	NA	NP	NA	354	No Coverage	272	248
CSSR	≥ 95%	98.58%	99.68%	NA	NP	NA	77.12%	No Coverage	96.80%	95.75%

Blocked calls	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
%age blocked calls		1.42%	0.32%	NA	NP	NA	22.88%	No Coverage	3.20%	4.25%

3. Connection Maintenance (Retainability)

Audit Results for Call drop rate and for number of cells having more than 3% TCH-December-PMR data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of		69105667	83945045	184117	1408031	83922690	13327241	11301732	15218713	1134009

calls established										
Total number of calls dropped		1352344	918357	2954	16329	1493824	946719	205049	98175	7431
Call drop rate	≤ 2%	1.96%	1.09%	1.60%	1.16%	1.78%	7.10%	1.81%	0.65%	0.66%

Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		5028	5843	NA	509	1933	1323	2218	1828	4688
Total number of cells having more than 3% TCH		1034	48	NA	20	57	326	42	2	111
Worst affected cells having more than 3% TCH	≤ 3%	20.56%	0.82%	NA	3.93%	2.95%	24.64%	1.89%	0.11%	2.37%

Live measurement results for Call drop rate and for number of cells having more than 3% TCH-December- 3 Day data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls		6800643	7853538	17612	209292	8663270	15119167	15174864	15218713	618401

established										
Total number of calls dropped		119316	88339	283	1681	148124	854126	204388	98175	4276
Call drop rate	≤ 2%	1.75%	1.12%	1.61%	0.80%	1.71%	5.65%	1.35%	0.65%	0.69%

Cells having more than 3% TCH	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of cells in the network		4988	5840	NA	509	1933	1323	2218	1828	4688
Total number of cells having more than 3% TCH		895	40	NA	20	57	126	35	2	112
Worst affected cells having more than 3% TCH	≤ 3%	17.94%	0.68%	NA	3.93%	2.95%	9.52%	1.58%	0.11%	2.39%

Drive test results for Call drop rate (Average of three drive tests)-December - Drive Test Data

Call drop rate	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of calls established		209	314	NA	NP	NA	433	No Coverage	272	259

Total number of calls dropped		0	0	NA	NP	NA	30	No Coverage	3	9
Call drop rate	≤ 2%	0.00%	0.00%	NA	NP	NA	6.93%	No Coverage	1.10%	3.47%

4. Voice quality

Audit Results for Voice quality -PMR Data-December

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		8494567720	12261922754	No Data	70	100	13327241	1678851146	3162893493	179109850
Total number of calls with good voice quality		7896982432	12135387354	No Data	70	98	11677329	1610180335	3106332528	175685098
%age calls with good voice quality	≥ 95%	92.97%	98.97%	No Data	100.00%	98.00%	87.62%	95.91%	98.21%	98.09%

Live measurement results for Voice quality-3 Day data-December

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		739879596	1212339962	No Data	70	100	15119167	1889067387	3162893493	96284647
Total		688034248	1199767372	No Data	70	97	13239855	181717160	310633252	94513412

number of calls with good voice quality								0	8	
%age calls with good voice quality	≥ 95%	92.99%	98.96%	No Data	100.00%	97.00%	87.57%	96.19%	98.21%	98.16%

Drive test results for Voice quality (Average of three drive tests) - DT data-December

Voice quality	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of sample calls		337739	481803	NA	NP	NA	39438	No Coverage	439780	423004
Total number of calls with good voice quality		324462	464115	NA	NP	NA	34394	No Coverage	417375	409040
%age calls with good voice quality	≥ 95%	96.07%	96.33%	NA	NP	NA	87.21%	No Coverage	94.91%	96.70%

5. POI Congestion

Audit Results for POI Congestion- PMR data-December

POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		37	15	No Data	No Data	35	No Data	27	14	31

No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40457	51030	No Data	No Data	27803	No Data	14016	9348	27840304
Traffic served for all POIs (B)- in erlangs		26073	20547	No Data	No Data	14284	No Data	8747	4762	6295090
POI congestion	≤ 0.5%	0.00%	0.00%	No Data	No Data	0.49%	No Data	0.00%	0.00%	0.00%
Live Measurement Results for POI Congestion- 3 Day data-December										
POI congestion	Benchmark	Aircel(DWL)	Airtel	BSNL NE 1 CDMA	BSNL NE 2 CDMA	BSNL NE 1 GSM	BSNL NE 2 GSM	Idea	Reliance GSM	Vodafone
Total number of working POIs		37	15	No Data	No Data	35	No Data	27	14	31
No. of POIs not meeting benchmark		0	0	No Data	No Data	0	No Data	0	0	0
Total Capacity of all POIs (A) - in erlangs		40457	51122	No Data	No Data	27803	No Data	13830	9348	898562
Traffic served for all POIs (B)- in erlangs			20577	No Data	No Data	14550	No Data	8879	4762	204890
POI congestion	≤ 0.5%	37.00%	0.00%	No Data	No Data	0.48%	No Data	0.00%	0.00%	0.00%

12 ABBREVIATIONS

Following terms/abbreviations have been used in this report. This section provides meaning of the abbreviations used in the report.

1. TRAI – Telecom Regulatory Authority of India
2. QoS – Quality of Service
3. OND'14 – Refers to the quarter of October, November and December 2014
4. IMRB – Refers to IMRB International, the audit agency for this report
5. SSA – Secondary Switching Area
6. NOC – Network Operation Center
7. OMC – Operations and Maintenance Center
8. MSC – Mobile Switching Center
9. PMR – Performance Monitoring Reports
10. TCBH – Time Consistent Busy Hour
11. CBBH - Cell Bouncing Busy Hour
12. BTS – Base Transceiver Station
13. CSSR – Call Setup Success Rate
14. TCH – Traffic Channel
15. SDCCH – Standalone Dedicated Control Channel
16. CDR – Call Drop Rate
17. FER – Frame Error Rate
18. SIM – Subscriber Identity Module
19. GSM – Global System for Mobile
20. CDMA – Code Division Multiple Access
21. NA – Not Applicable
22. NC – Non Compliance
23. POI – Point of Interconnection
24. IVR – Interactive Voice Response
25. STD – Standard Trunk Dialing
26. ISD – International Subscriber Dialing



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