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Appendix A: Survey Responses

Survey Response 01

Resource Person : Technical Manager

Company : ZTE Lanka (Pvt) Ltd

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**
   Speed (Throughput), web page loading time, latency
2. **What are the target values you propose for the above mentioned parameters?**
   Speed : above 15Mbps, web page loading time < 5 secs, latency <50ms
3. **Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.**
   No but, it should strictly maintained in CBD and urban areas
4. **What are the parties you propose to measure those QoS parameters?**
   Corporate offices - Data should be collected in collective basis, Students
5. **How frequently should an audit be carried out by TRCSL?**
   Every 3 months, or else if an operator make major change then they needs to inform to TRSL and let them check the improvement
6. **Do you have any other suggestions or comments?**
   - Since back haul network plays a major role, government should invest to maintain a back haul network (country wide fiber network)
   - Operators should provide GBR

Survey Response 02

Resource Person : Manager - Core Network Planning

Company : Mobitel (Pvt) Ltd

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**

Avg. Download Speed, Avg. Upload Speed, Avg. Latency

2. **What are the target values you propose for the above mentioned parameters?**

Avg. Download Speed (3G→ 4 Mbps, 4G→10 Mbps), Avg. Upload Speed (3G→ 1 Mbps, 4G→4 Mbps), Avg. Latency (less than 200ms)

3. **Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons**.

Avg. Download Speed (Yes) → based on the geographical RAT, Avg. Upload Speed (Yes) → based on the geographical RAT, Avg. Latency (No)

4. **What are the parties you propose to measure those QoS parameters?**

NOC, Planning, SQ

5. **How frequently should an audit be carried out by TRCSL?**

Monthly

6. **Do you have any other suggestions or comments?**

Benchmark with international networks

Survey Response 03

Resource Person : Specialist - BSS

Company : Dialog Axiata PLC

1. What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?

User throughput, Service Availability (Downtime), Service Retainability (Service drop rate), Mobility (e.g. Handover success rate)

2. What are the target values you propose for the above mentioned parameters?

Based on the target Cx segment/Data package/Technologies used e.g. DCHSDPA

3. Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.

Not only the GEO, but the Cx segment wise since they expect different user experience

4. What are the parties you propose to measure those QoS parameters?

Not clear meant by parties

5. How frequently should an audit be carried out by TRCSL?

As frequently as they can without biasing any operator

6. Do you have any other suggestions or comments?

Personnel feeling is that the scope is too large, if we take one QOS parameter, User throughput only for an example can dig deep

Survey Response 04

Resource Person : Assistant Manager - BSS

Company : Dialog Axiata PLC

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**

Primary QoS parameters,

- HSDPA/HSUPA Data throughput (Per User)
- HSDPA/HAUPA/R99 RAB setup success rate (RAB – RAdio Bearer)
- HSDPA/HAUPA/R99 drop rate
- RRC connection setup success rate (RRC – Radio Resource Controller)
- RTWP of the serving cell (RTWP – Received Total Wideband Power)

Secondary QoS Parameters

- Power/CE/IuB/HS-Code Utilization

2. **What are the target values you propose for the above mentioned parameters?**

QoS Parameter	Value (For Daily Granularity)
HSDPA/HSUPA Data throughput (Per User)	Avg – 2.5 Mbps
HSDPA/HAUPA/R99 RAB setup success rate (RAB – RAdio Bearer)	99.90%
HSDPA/HAUPA/R99 drop rate	1.0%
RRC connection setup success rate (RRC –	99.90%

Radio Resource Controller)	
RTWP of the serving cell (RTWP – Received Total Wideband Power)	< -105 dBm
Power Utilization	< 60% of Max Power configured

3. **Do you think the target values should differ region wise? If yes, please identify such parameters and give your reasons.**

Yes,

HSDPA/HSUPA Data throughput (Per User) – Applications and customer orientation to use the connection vary region to region

4. **What are the parties you propose to measure those QoS parameters?**

- Network Planning Group
- Network Operation Group
- Network Quality Assurance Group
- Senior Management (Technical) – Higher level monitoring

5. **How frequently should an audit be carried out by TRCSL?**

By Quarterly

6. **Do you have any other suggestions or comments?**

No

Survey Response 05

Resource Person : Director – Network Performance Service

Company : Huawei Technologies Lanka Co., (Pvt) Ltd

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**

CS: There should be one index which can indicate the overall experience, the index need to be derived from call accessibility/retainability/voice quality

PS: There should be one index which can indicate the overall experience, the index need to be derived from data session setup success, retainability, & service specific metrics like page response delay, throughput & etc….

2. **What are the target values you propose for the above mentioned parameters?**

   a. This depends on operators' strategy and regulatory constraints. For an example a call drop below 0.2 will be good to have but if the ARPU is low it is not cost effective to invest heavily on such high target.

3. **Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.**

   a. Technically no reason to have different targets. But considering rural coverage it is accepted that even with low QoS it is required to provide service. So this can be considered as reason for having lower targets for rural coverage

4. **What are the parties you propose to measure those QoS parameters?**

   a. Should be measured by operator routinely and audits should be performed by regulator

   b. There should be third party benchmark also to measure current position comparatively

5. **How frequently should an audit be carried out by TRCSL?**

   a. Quarterly

6. Do you have any other suggestions or comments?

a. QoS need to be considered hand in hand with business economics. Otherwise it will not be practical

Survey Response 06

Resource Person : Engineer – Radio Network Optimization

Company : Etisalat Lanka (Pvt) Ltd

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**
    - DL/UL Throughput
    - Latency/Ping delay
    - FER
    - RSCP&Ec/Io
    - Browsing speed
    - Video buffering
2. **What are the target values you propose for the above mentioned parameters?**
    - DL/UL Throughput – 2-3 Mbps DL
    - Latency/Ping delay –
    - FER
    - RSCP&Ec/Io - -85/-8
    - Browsing speed-300kbps
    - Video buffering - Benchmarking

3. Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.

4. What are the parties you propose to measure those QoS parameters?

Operators/TRCSL

5. How frequently should an audit be carried out by TRCSL?

Once a month

6. Do you have any other suggestions or comments?

Survey Response 07

Resource Person : Technical Service Manager – Radio Network Planning

Company : Huawei Technologies Lanka Co., (Pvt) Ltd

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**

Suggest to have metrics that can measure QoS for combined services like CS+PS, Video Phone. Should consider accessibility and retain ability based on User behavior as smart phone usage as grown significantly. Considering Video Phone, most applications like skype have mobile applications so response time, delay and jitter metrics could be introduced to reflect actual user experience

2. **What are the target values you propose for the above mentioned parameters?**

This will have to be decided based on lab tests

3. **Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.**

Coverage and backhaul transmission may cause values to differ in different regions

4. **What are the parties you propose to measure those QoS parameters?**

Mainly Operator and Telecom Regulator. But consultancy firms who have field experience in South East Asia region would be able to give further insight for the benchmark

5. **How frequently should an audit be carried out by TRCSL?**

Based on Network growth and new technology implementation

6. **Do you have any other suggestions or comments?**

Latest and comprehensive tool setup is needed to capture the QoS in accurate and usable format

Survey Response 08

Resource Person : Assistant Manager - Radio Access Planning

Company : Mobitel (Pvt) Ltd

1. What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?

PS connection setup success rate/ PS connection drop rate/Average data throughput in a selected routes/latency for selected webservers / service availability

2. What are the target values you propose for the above mentioned parameters?

3. Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.

Average data throughput in a selected routes to be differ

4. What are the parties you propose to measure those QoS parameters?

Operator

5. How frequently should an audit be carried out by TRCSL?

Quarterly

6. Do you have any other suggestions or comments?

Survey Response 09

Resource Person : Assistant Manager - Broadband Access Planning

Company : Mobitel (Pvt) Ltd

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**
    a. Average file DL speed to a test server located locally and internationally (with single thread and multiple thread activation)
    b. Average file UL speed to a test server located locally and internationally
    c. Average web page loading time with a server located locally and internationally
    d. Average delay in loading video/ no. of buffering occurred in video streaming
2. **What are the target values you propose for the above mentioned parameters?**
    a. Single thread DL speed of 1Mbps
    b. UL speed of 400 kbps
    c. Page loading time depends on time. A standard simple page such as google loading within 2s and yahoo within 10s.
    d. Delay in playing video up to 5s and no buffering
3. **Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.**
    a. no
4. **What are the parties you propose to measure those QoS parameters?**
    a. Reporting by operators
    b. TRC
    c. Independent benchmark test party
5. **How frequently should an audit be carried out by TRCSL?**
    a. Every quarter of year

6. Do you have any other suggestions or comments?

ISP bandwidth, terminating location, link quality will have a significant impact on BB quality but would likely difficult to adjust easily.

Survey Response 10

Resource Person : Senior Engineer – Radio Network Planning & Optimization

Company : ZTE Lanka (Pvt) Ltd

1. **What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?**

Speed, web page loading time & should available in all the places

2. **What are the target values you propose for the above mentioned parameters?**

More than 10 Mbps always & less than 4 seconds

3. **Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.**

No

4. **What are the parties you propose to measure those QoS parameters?**

Customers who visited arcade, survery can be carried out after the customer service provided if they wish to answer & intitution/school/university students

5. **How frequently should an audit be carried out by TRCSL?**

By quarterly

6. **Do you have any other suggestions or comments?**

Guaranteed speed should be provided

Survey Response 11

Resource Person : Group Answer

Company : Alcatel-Lucent

1. What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?

It depends on the Mobile Technology and the services provided by each operator. Please find the attached doc with few KPI's for different technologies (GSM, WCDMA, and LTE).

2. What are the target values you propose for the above mentioned parameters?

Target values also Vendor and Operator specific. When any project starts mobile vendor should give there KPI's commitments and it will adjust by the operator according to their requirements, then at the end of the project vendor should achieve the KPI's targets to get the acceptance. This is for initial KPI's, but later on Operator will adjust the KPI's targets for periodic monitoring and Network maintainers.

WCDMA

Item	Service	KPI Target
Accessibility		
Call Setup Success Rate	Voice AMR 12.2	MOC: ≥ 97%
PDP Context Activation Success Rate	PS HSxPA	≥ 97%
Retainability		
CS Call Drop Rate	Voice AMR 12.2	≤ 0.5%
PS Call Drop Rate	PS HSxPA	≤ 0.5%
Mobility		
Soft handover Success Rate	Voice AMR 12.2	≥ 99%
Inter RAT handover Success Rate (3G/2G)	Voice AMR 12.2	≥ 98%
	PS HSxPA	≥ 98%

Integrity		
Call Setup Time	Voice AMR 12.2	MOC: 95% of successful calls ≤ 5 sec;
	PS HSxPA	PDP : 95% of successful calls ≤ 7secs;
Throughput		
Average FTP throughput UL	PS HSxPA	+ ≥ 300kbps
Average FTP throughput DL	PS HSxPA	+ ≥ 600bkps

LTE

KPI	KPI Target
(service) RRC setup success rate	>98%
ERAB Establishment success rate	>98%
(Service) dropped call rate	<3%
Ping round trip Delay – (32 bytes)	>50ms
Single user DL peak throughput at 30MHz (DL: UL=3:1)	120Mbps
Single user UL peak throughput at 30MHz (DL: UL=3:1)	6Mbps
Single user DL peak throughput at 20MHz (DL: UL=3:1)	80Mbps
Single user UL peak throughput at 20MHz (DL: UL=3:1)	6Mbps
Tracking Area update Success rate	>98%
E-UTRAN Mobility	>98%
E-UTRAN IP Latency	<30ms

3. Do you think the target values should differ regionwise? If yes, please identify such parameters and give your reasons.

Yes, Because If you take two regions like Dens and Rural, There is a huge difference in the carried traffic (Sites in dense carries high traffic and Rural area low traffic) and rate of Successful calls and the dropped calls. But when you come to KPI's you will see high call drop rate in Rural sites due to low number of generated calls. From The example you will see that for the Rural area, even for only one call drop you will get 20% of Call drop rate due to less number of calls. Therefore it's better to use regions wise KPI targets.

4. What are the parties you propose to measure those QoS parameters?

As I mentioned before for Initial KPI's commitment is from the Vendor and Operator negotiate it to get the best network from the Vendor, later on for network maintainers activities operator define new KPI's or they will maintain the initial KPI's from the Vendor.

5. How frequently should an audit be carried out by TRCSL?

As a Networks quality maintainer, TRC should perform frequent network Benchmarks among operators for different technologies and different services (Data Throughput). At least they should perform this kind of a activity for every six months time and acknowledge mobile operators and show their issues and ways to improve network.

6. Do you have any other suggestions or comments?

Survey Response 12

Resource Person : Group Answer

Company : Ericsson Telecommunications Lanka (Pvt) Ltd

1. What are the QoS parameters you propose to measure, to ensure the customer satisfaction in mobile broadband?

a. If the idea is to ensure Customer Satisfaction (i.e. QoE : Quality of Experience), more forcus should give to end-user performance.

b. Eg . Data Throughput, Call Setup Success Rate, CQI average, PS Drop Rate, RTT : Round-trip-time, Latency & Jitter, BER, Re-Transmissions

2. What are the target values you propose for the above mentioned parameters?

a. Rough values are given for happy Customers

b. Data Throughput (> 2 Mbps), Call Setup Success Rate (99%), CQI average (>25) , PS Drop Rate (<5%), RTT : Round-trip-time (<100 ms), Latency & Jitter (lowest), BER (<10%)

3. What are the parties you propose to measure those QoS parameters?

a. Depends on the requirement :

4. How frequently should an audit be carried out by TRCSL?

a. Refer the earlier attachments

5. Do you have any other suggestions or comments?

a. QoS/QoE measurements are heavily subjective. Their accuracy depends on the way of collecting data, time of data collection, area of data collection, sample size, collection method (Drive Test Vs Network QoS) and often have to use statistical methods for analysis. Better to refer “QoS and QoE Management in UMTS Cellular Systems” book for more details.

Appendix B: Proposed Policy Framework

Quality of Service Parameters and Target Values for Broadband

Mobile Telephony

Definition	Measurement (Periods of measurement –one month and one quarter)	Proposed Target
QoS_1. Download Speed		
It is required to install download speed measurement software in the Server at ISP Node to facilitate to measure independently the download connection speed through a web link.	The regulator shall measure the download speed.	No target specified at this stage.
QoS_2. Latency		
This is the amount of time taken by a packet to reach the receiving endpoint after being transmitted from the sending point.	The regulator shall measure the latency using the test defined in QoS_1.	Less than 200ms
QoS_3. Average Throughput		
It is defined as the rate at which packets are transmitted in a network.	The regulator shall measure the average throughput using the test defined in QoS_1.	3G: 2Mbps LTE: 5Mbps

<table>
<tr><th colspan="3">QoS_4. PS Service Drop Rate/ E-RAB Drop Rate</th></tr>
<tr><td>It measures the inability of Network to maintain a connection and is defined as the percentage of abnormal disconnects with respect to all disconnects.</td><td>Computational Methodology:

In UMTS;

$$PS\ Call\ Drop\ Rate = \frac{Number\ of\ PS\ RAB\ Abnormal\ Releases}{Total\ Number\ of\ PS\ RAB\ Releases} * 100\%$$

In LTE;

$$E-RAB\ Drop\ Rate = \frac{Number\ of\ E-RAB\ Abnormal\ Releases}{(Number\ of\ E-RAB\ Abnormal\ Realeases + Number\ of\ E-RAB\ Normal\ Realeases)} * 100\%$$

Note: These values are measured from Access Network.</td><td>Less than 5%</td></tr>
<tr><th colspan="3">QoS_5. PS RAB Setup Success Rate/ E-RAB Setup Success Rate</th></tr>
<tr><td>It is defined as the percentage of PS RAB/E-RAB failures with respect to all PS RAB/E-RAB attempts.</td><td>Computational Methodology:

In UMTS;

$$PS\ RAB\ Setup\ Success\ Ratio = \frac{Number\ of\ PS\ RAB\ Setup\ Successes}{Number\ of\ PS\ RAB\ Setup\ Attempts} * 100\%$$

In LTE,

$$E-RAB\ Setup\ Success\ Rate = \frac{Number\ of\ E-RAB\ Suceessful\ Establishments}{Number\ of\ E-RAB\ Attempt\ Establishments} * 100\%$$

Note: These values are measured from Access Network.</td><td>Greater than 95%</td></tr>
<tr><th colspan="3">QoS_6. RRC Connection Setup Success Rate</th></tr>
</table>

It is defined as the percentage of RRC Connection Setup failures with respect to all RRC Connection Setup attempts.	Computational Methodology: In UMTS; $\text{RRC Setup Success Ratio} = \frac{\text{Number of RRC Setup Successes}}{\text{Number of RRC Connection Attempts}} * 100\%$ In LTE; $\text{RRC Connection Success Rate} = \frac{\text{Number of RRC Suceessful Connections}}{\text{Number of RRC Attempt Connections}} * 100\%$ **Note:** These values are measured from Access Network.	Greater than 95%
QoS_7. PDP Context Activation Success Rate		
It is defined as the percentage of PDP Context Activation failures with respect to all PDP Context Activation attempts.	Computational Methodology: $\text{PDP Context Activation Success Rate} = \frac{\text{Number of Successfully Completed PDP Co}}{\text{Number of Total Attempts of Context}} * 100\%$ **Note:** These values are measured from Core Network. It is required not to consider failures which are happened due to charging (Online Charging System – OCS related issues in prepaid customers and authentication failures due to credit issues in postpaid customers) as failures for this calculation.	Greater than 95%