Telecom Regulatory Authority of India

Consultation Paper

on

Review of network related Quality of Service standards for Cellular Mobile Telephone Service

Mahanagar Door Sanchar Bhawan,

J.L. Nehru Marg, (Old Minto Road)

New Delhi – 110 002, India

Stakeholders are requested to submit their comments, preferably in electronic form, to Shri U.K. Srivastava, Pr. Advisor (NSL) on the e-mail address pradvnsl@trai.gov.in by 26th August 2016 and counter comments by 2nd September 2016.

For any clarification/information, Shri U.K. Srivastava, Principal Advisor (NSL) may be contacted at Tel. No.+91-11-23232291, Fax: +91-11-23213036, e-mail: pradvnsl@trai.gov.in.

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INTRODUCTION

1.1 Sub-Clause (v) of clause (b) of sub-section (1) of section 11 of Telecom Regulatory Authority of India Act, 1997 (24 of 1997) mandates the Authority to "lay down the standards of quality of service to be provided by the service providers and ensure the quality of service and conduct the periodical survey of such service provided by the service providers so as to protect interest of the consumers of telecommunication services".

1.2 In exercise of its functions under the above provisions in the TRAI Act, the Authority had notified the "Regulation on Quality of Services (QoS) of Basic and Cellular Mobile Telephone Services, 2000" vide Notification dated 5th of July, 2000. The objectives of these regulations were to……..

(a) create conditions for customer satisfaction by making known the quality of service which the service provider is required to provide and the user has a right to expect;
(b) measure the Quality of Service provided by the Service Providers from time to time and to compare them with the benchmarks so as to assess the level of performance; and
(c) to generally protect the interests of consumers of telecommunication services.

1.3 The Quality of Service (QoS) standards in the above regulation were reviewed in 2005, and the revised QoS standards were issued by the Authority on 1st July, 2005. In these regulations the parameters for basic service (wireless) and Cellular Mobile Telephone Service were combined as the Quality of Service aspects associated with wireless medium is common for both the services.

1.4 In 2008, a need was felt for deletion of some of the parameters as they were no longer relevant in the era of competition and also a need was felt to define each parameter extensively and also to explain the measurement

methodology for each parameter so that uniform practice is adopted by all the service providers for measuring, recording and auditing of such parameters. Accordingly, the Authority notified the "The Standards of Quality of Service of Basic Telephone Service (Wireline) and Cellular Mobile Telephone Service Regulations, 2009." These regulations are still in force for basic service and cellular mobile telephone service.

1.5 The Quality of Service 2009 Regulations were first amended on 7th May 2012 to include QoS parameters for 3G services. TRAI had further in November, 2012 amended the regulations to provide for Financial Disincentives for delay in submission of Compliance Reports, non-compliance with the benchmarks for QoS Parameters and for wrong reporting of QoS performance.

1.6 Subsequently, TRAI reviewed the Quality of Service parameters for Basic Service (Wireline) keeping in view the practical difficulties expressed by the service providers in meeting the benchmarks, and issued "The Standards of Quality of Service of Basic Telephone Service (Wireline) and Cellular Mobile Telephone Service (Third Amendment) Regulations, 2014" after rationalizing the benchmark for some of the parameters. At the same time, TRAI tightened the benchmark for some of the parameters concerning call centres so as to ensure that the consumers are able to register their complaints etc. efficiently. To create further deterrent against consecutive non-compliance with the benchmarks, TRAI recently amended the regulations on 15th October 2015, providing for increased Financial Disincentives in cases of repetitive non-compliance.

1.7 The performance of service providers on the various QoS network parameters for Cellular Mobile Telephone Service (CMTS), as stipulated in the "The Standards of Quality of Service of Basic Telephone Service (Wireline) and Cellular Mobile Telephone Service Regulations, 2009" (as amended) are assessed for the service area as a whole, averaged over a month. But there could be many areas/ localities within the network where the performance on these QoS

parameters could be poor. Considering this and the growing concerns on various QoS parameters, TRAI has embarked upon a programme to undertake a series of drive tests of mobile networks in select cities, through independent agencies, apart from the regular country wide drive tests conducted alongwith the operators. The drive tests were repeated in these cities to assess improvements, if any. The results of these drive tests are published on TRAI website for information of stakeholders. Also several meetings are held with the service providers to discuss the findings of these drive tests and action by the TSPs for improving their performance.

1.8 While on one hand the service providers are mostly meeting the benchmark for most of the QoS parameters, because of averaging the performance for the entire service area, and on the other hand a large number of consumers have been complaining because of poor quality of experience (QoE). With a view to explore ways to devise a framework to protect the interests of the consumers, the Authority issued a Consultation Paper (CP) on 'Compensation to the Consumers in the Event of Dropped Calls' on the 4th September, 2015. Various models for either not charging the customer for dropped call or the appropriate methods for compensating the consumers upon call drop were discussed and comments were sought from stakeholders regarding the same. Keeping in view the comments and counter-comments received during consultation process, the Authority issued the "Telecom Consumers Protection (Ninth Amendment) Regulations, 2015 (9 of 2015)" on October 16th, 2015. Through these regulations, compensation of one Rupee was mandated for TSP for a dropped call to the calling consumers. Such credit in the account of the calling consumer was limited to three dropped calls in a day (00:00:00 hours to 23:59:59 hours). TRAI also issued a Technical Paper on Call Drop on 13.11.2015 explaining the factors contributing to call drop and various measures needed to be taken for addressing call drop issues etc.

1.9 These regulations were challenged by the service providers and their industry associations in the Hon'ble High Court of Delhi and vide the judgement in W.P.(C) No.11596/2015, the Hon'ble High Court upheld the

regulations. The decision of the High Court was challenged in the Supreme Court. The Hon'ble Supreme Court vide judgement in CIVIL APPEAL NO. 5018 OF 2016 (ARISING OUT OF S.L.P. (CIVIL) NO.6522 OF 2016), struck down the regulations.

1.10 One of the observations by the Hon'ble Supreme Court was:

> "It is always open to the Authority, with the vast powers given to it under the TRAI Act, to ensure, in a reasonable and non-arbitrary manner, that service providers provide the necessary funds for infrastructure development and deal with them so as to protect the interest of the consumer."

1.11 It may be mentioned that the intention of the regulations was to compensate consumers for the poor QoS on account of excessive call drop. In the situation of quashing of the regulations the moot question is how to ensure the QoS so that the customers may not face the kind of inconvenience which forced the Authority to take measures for compensating the consumers. One of the major issues highlighted by the Authority in the Consultation Paper on 'Compensation to the Consumers in the Event of Dropped Calls' issued on the 4th September, 2015 is that the service providers are not making adequate investments so that the QoS is maintained.

1.12 One of the options for ensuring QoS could be through increased investments for infrastructure development by redefining the parameters & benchmarks and measurement methodology to ensure that averaging over the entire service area does not affect the QoE of the consumer. Another option is through further tightening of the financial disincentive framework, providing for more stringent penal provisions for very poor performance and continuous non-performance (along with incentives for improvement).

1.13 In view of the above, a comprehensive consultation process on review of the QoS parameters is being initiated through this consultation paper.

Chapter 2 discusses the various options for improving Quality of Experience as perceived by the consumer, so as to identify the weak links in the network, and thereby ensuring Quality of Service. Chapter 3 focuses on reviewing the framework for financial disincentives for non-compliance with the Quality of Service benchmarks. Chapter 4 summarises the issues for consultation.

CHAPTER-2

IMPROVING QUALITY OF EXPERIENCE AS PERCEIVED BY THE CONSUMER

2.1 In the telecom sector, particularly in cellular mobile telephone service, there has been phenomenal growth. Technology changes have taken place with passage of time in providing mobile services. The Quality of Service is required to be reviewed periodically to update the Quality of Service parameters and benchmark. Customer satisfaction is the major determining factor in the emergence of new services, setting standards and designing of network. Therefore, the customer requirements and expectations are paramount consideration in reviewing Quality of service standards irrespective of the technology that has been deployed in the network.

2.2 Any review of quality of service regulations should also streamline the quality of service parameters monitoring, measurement and frameworks to the regulatory environment. There is also a case to consider new inputs from the service provider. Ensuring the quality of service is very important for customer satisfaction and protection of consumer interest. In selecting benchmark of quality of service, the parameter and benchmark should be meaningful to the consumer for enabling him to make an informed choice and also on the level of quality that they are getting, irrespective of the technology provided by the TSPs. The measures that are objective, measurable and verifiable are important to ascertain the quality of service being maintained by the service provider.

A. Redefining existing network related quality of service parameters for cellular mobile telephone service.

2.3 The Authority monitors the following Network related QoS parameters in a cellular mobile telephone service network as shown in table 2.1:

Table 2.1 Network Service Quality Parameters 2G & 3G Services

Serial Number	*Name of Parameter*	Benchmark	Averaged over a period
A	**Network Service Quality Parameters:**		
(i)	Network Availability		
	(a) BTSs Accumulated downtime (not available for service) (2G) Node-B's Accumulated downtime (not available for service) (%age) (3G)	≤ 2%	One Month
	(b) Worst affected BTSs due to downtime (2G) Worst affected Node-B's due to downtime (%age) (3G)	≤ 2%	One Month
(ii)	Connection Establishment (Accessibility)		
	(a) Call Set-up Success Rate (within licensee's own network) (2G) (3G)	≥ 95%	One Month
	(b) SDCCH/ Paging Channel Congestion (2G) SDCCH/Paging Channel and RRC Congestion (%age) (3G)	≤ 1%	One Month
	(c) TCH Congestion (2G) TCH and Circuit Switched RAB Congestion (%age) (3G)	≤ 2%	One Month
(iii)	Connection Maintenance (Retainability)		
	(a) Call Drop Rate (2G) Call Drop and Circuit Switched Voice Drop Rate: (%age) (3G)	≤ 2%	One Month
	(b) Worst affected cells having more than 3% TCH drop (call drop) rate (2G) Worst affected cells having more than 3% TCH drop (call drop) and Circuit Switched Voice Drop Rate:- CBBH (3G)	≤ 5% upto 31.03.2011 ≤ 3% From 01.04.2011	One Month
	(c) connections with good voice quality (2G) Connections with good voice quality and Circuit Switch Voice Quality (CSV quality) (3G)	≥ 95%	One Month

(iv)	Point of Interconnection (POI) Congestion (on individual POI) (2G) Point of Interconnection (POI) Congestion (3G)	≤ 0.5%	One Month

2.4 As may be seen from the above Table, the performances of the service providers with reference to each of the the QoS benchmark is averaged for the entire service area for one month. Thereafter, the performance in all the three months of a Quarter is averaged and the performance in a Quarter is assessed. The performance so assessed gives only an overall performance of the service area. This performance, averaged for the entire service area may give a different picture about QoE that a customer experiences. There could be many areas/ localities within the service area where the QoS could be poor. For example, in case of call drop rate across the country, more than 12% of the individual BTSs are having call drop rate more than 2% and approximately 1% of the individual BTS are having call drop rate more than 10%, though the overall call drop rate in the country is around 0.7%. TRAI has issued a Direction on 29th July, 2015 to the TSPs to provide the call drop rate in 63 cities across the country. It is noted that again in most of the cities the TSPs are generally meeting the call drop rate of 2%. So the issue is whether the benchmarks for various parameters be mandated for sub-service area wise monitoring so that the problem areas could be identified, coordinated action could be taken to address the problem and effective measures can be taken to ensure QoS.

2.5 The options could be LDCA-wise or District Headquarter/ city/town-wise or BTS-wise. LDCA is a vast area and in many cases it covers more than one District. Considering this, monitoring of QoS at LDCA level may not reveal the problem areas and thereby effective monitoring and ensuring of QoS may be difficult. The other option is to have a district-wise monitoring of QoS parameters. This could give a more decentralised picture of QoS. The operator wise, districts with more than 2% call drop rate is shown in the Table 2.2 below.

Table 2.2 No of districts with > 2% call drop rate.

	JAN		FEB		MARCH		APRIL		MAY	
NAME OF TSP	No. of districts	Districts having CDR >2%	No. of districts	Districts having CDR >2%	No. of districts	Districts having CDR >2%	No. of districts	Districts having CDR >2%	No. of districts	Districts having CDR >2%
Aircel	508	45	507	31	509	52	493	87	511	62
Airtel	661	172	663	185	663	177	669	2	667	2
BSNL	527	149	542	134	558	137	562	110	510	68
Idea	620	1	633	10	637	4	638	2	637	1
MTNL	20	14	21	15	21	15	20	14	21	15
MTS	181	0	181	0	183	0	184	0	182	1
Quadrant	22	0	22	0	22	0	22	0	22	0
Reliance	550	0	540	1	539	1	538	2	442	0
Telenor	231	1	231	1	231	3	231	4	231	1
TTSL	515	2	514	23	469	0	502	3	485	57
Vodafone	653	91	655	91	657	92	662	15	661	2
Videocon	113	64	112	3	79	63				

BTS-wise monitoring of QoS could also give details of performance of each BTS so that QoS could be ensured effectively. Further, the customer could be aware of the QoS of his service provider in his locality. With the identification of poor performing BTS, the service provider could be compelled to improve the QoS.

Question 1: In case QoS is mandated at a sub-service area level, which option (LDCA-wise or District Headquarter/ city/ town-wise or BTS-wise) you would recommend? Please comment with justifications.

2.6 The existing benchmarks for various parameters have been prescribed considering monitoring of the QoS at service area level, by averaging the performance of the service area as a whole. With change in the level of measurement of QoS at sub-service area level, as explained above, there is a need to redefine the benchmark for the various parameters. The benchmark

should be so arrived at that it could be achievable and also it should force a service provider to invest in infrastructure and improve the service. Also the QoS parameters and benchmark should be technology agnostic (2G/ 3G/ 4G/ BWA) and could be measured and reported irrespective of the technology deployed. Keeping this in view, the various parameters and benchmarks are discussed below:

(a) BTSs[1] (BTS / Node Bs / eNode Bs) accumulated downtime (not available for service)

2.7 "BTSs 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 upgradation. For measuring the performance against the benchmark for this parameter, the down time of each BTS lasting for more than 1 hour at a time in a day during the period of a month is taken for computation. The total duration in hours of all such instances of downtime of BTSs is calculated. Thereafter, the performance against the benchmark is measured through the following formula:

$$\text{BTSs accumulated downtime (not available for service)} = \frac{\text{Sum of downtime of BTSs in a month in hours i.e. total outage time of all BTSs in hours during a month X 100)}}{\text{(24 X No. of days in the month X No. of BTSs in the network in the licensed service area)}}$$

2.8 The benchmark for this parameter is currently ≤2%. This means that, in a network having 1000 BTSs, in a month having 30 days, the total outage at the rate of 2% could be upto 1200 hours i.e. an outage of 1.2 hours per BTS in a month. In a service area having 5000 BTSs, the permissible

[1] With reference to this consultation paper, BTS means BTS/ Node Bs/ eNode Bs

outage at the rate of 2% in a month is upto 6000 hours i.e. an outage of 1.2 hours per BTS in a month. In case the QoS requirement is revised to District HQ/city/town level the denominator in the above formula need to be revised to No. of BTSs in the District HQ/city/town. In case the QoS benchmark is at BTS level the benchmark could be in hours or in percentage basis.

2.9 As per the Performance Monitoring Report (PMR) submitted by service providers for the quarter ending 31st March, 2016 (period between Jan to March 2016), in 2G networks, only in 3 cases service providers are not meeting this benchmark. Out of a total of 209 compliance reports submitted by the service providers, in 187 cases the performance is within the range of 0 to 1%. In 17 cases the performance levels are between 1 to 1.5% and in 12 other cases the performance was between 1.5 to 2%.

2.10 In 3G networks, as per the Performance Monitoring Report (PMR) submitted by service providers for the quarter ending 31st March, 2016 (period between Jan to March 2016), only 2 service providers are not meeting this benchmark. Out of a total of 106 compliance reports submitted by the service providers, in 85 cases the performance is within the range of 0 to 1%. In 7 cases the performance levels are between 1 to 1.5% and in 12 other cases the performance was between 1.5 to 2%.

(b) Worst affected BTSs due to downtime

2.11 For measuring the parameter "Percentage of worst affected BTSs due to downtime" the down time of each BTS lasting for more than 1 hour at a time in a day during the period of a month is recorded and wherever the accumulated downtime of a BTS during the period of a month exceeds 24 hours the said BTS is taken as worst affected BTS for computation. The total number of such worst affected BTSs in a month is determined. Thereafter, the performance against the benchmark is measured through the following formula:

Worst affected BTSs due to downtime =

No. of BTSs having accumulated downtime of >24 hours in a month X 100

Total No. of BTSs in the licensed service area

2.12 The benchmark for this parameter is currently ≤2%. It may be mentioned that while the permissible limit on an average per BTS for the parameter BTSs accumulated downtime (not available for service) in the above example works out to 1.2 hours per month, currently for calculating Worst affected BTSs due to downtime we are taking only BTSs having outage of more than 24 hours in a month. In this background it appears that the current benchmark needs to be further streamlined in accordance with the level at which QoS will be mandated –district or BTS or both levels.

2.13 As per the Performance Monitoring Report (PMR) submitted by service providers for the quarter ending 31st March, 2016, in 2G networks, only in 9 cases service providers are not meeting this benchmark. Out of a total of 217 cases, in 172 cases the performance was within the range of 0 to 1%. While In 16 cases the performance was between 1 to 1.5% and in 20 cases the performance was between 1.5 to 2%.

2.14 In 3G network, as per the Performance Monitoring Report (PMR) submitted by service providers for the quarter ending 31st March, 2016, only in 8 cases service providers are not meeting this benchmark. Out of a total of 106 cases, in 62 cases the performance was within the range of 0 to 1%. While In 13 cases the performance was between 1 to 1.5% and in 23 cases the performance was between 1.5 to 2%.

(c) Call Set-up Success Rate (CSSR)

2.15 Call Setup Success Rate is defined as the ratio of Established Calls to Call Attempts. This includes complete signalling in the call setup process

and does not aim to measure the performance of the called exchange or that of the Point of Interconnection (PoI).

2.16 Call Attempt is defined in the ITU –T E600 (03/93)/2.4 as "an attempt to achieve a connection to one or more devices attached to a telecommunication network". At a given point in the network a call attempt is manifested by a single unsuccessful bid, or a successful bid and all subsequent activity related to the establishment of the connection.

2.17 Currently the benchmark for this parameter is 95%. As per the Performance Monitoring Report (PMR) submitted by service providers for the quarter ending 31st March, 2016, in 2G networks, only in 4 cases service providers are not meeting this benchmark. Out of a total of 209 cases, in 146 cases the performance was above 98%. In 38 cases the performance was between 97 to 98%, while, in 13 cases the performance was between 96 to 97% and in 9 cases the performance was between 96 to 96%.

2.18 In 3G networks, as per the Performance Monitoring Report (PMR) submitted by service providers for the quarter ending 31st March, 2016, only 3 service providers are not meeting this benchmark. Out of a total of 106 cases, in 68 cases the performance was above 98%. In 16 cases the performance was between 97 to 98%, while, in 18 cases the performance was between 96 to 97% and in 3 cases the performance was between 95 to 96%.

(d) Standalone Dedicated Control Channel (SDCCH) Congestion and Traffic Channel (TCH) Congestion

2.19 Congestion in the network leads to non-establishment of the call. The congestion can be in the signalling channel known as Standalone Dedicated Control Channel (SDCCH) (in respect of GSM network) /Paging Channel Congestion (in respect of CDMA network) or in the RRC (in respect of other packet based networks) or in the traffic channel (TCH) or in RAB.

2.20 Currently the benchmark for SDCCH congestion or Paging or Radio Resource control (RRC) Congestion is ≤1%. As per the Performance Monitoring Report (PMR) for 2G services submitted by service providers for the quarter ending March, 2016, only 5 service providers are not meeting this benchmark. Out of a total of 209 cases, in 165 cases the performance was below 0.5%. In 30 cases the performance was between 0.5 to 0.75% while in 12 cases the performance was between 0.75 to 1%.

2.21 In the case of SDCCH congestion, as per the Performance Monitoring Report (PMR) on 3G services for the quarter ending March, 2016, only in 4 cases service providers are not meeting this benchmark. Out of a total of 106 cases, in 70 cases the performance was below 0.5%. In 16 cases the performance was between 0.5 to 0.75% while in 16 cases the performance was between 0.75% to 1%.

2.22 In the case of TCH congestion, for 2G services for the quarter ending March, 2016, only in 7 cases service providers are not meeting this benchmark. Out of a total of 217 cases, in 163 cases the performance was within the range of 0 to 1%. In 33 cases the performance was between 1 to 1.5% while in 14 cases the performance was between 1.5 to 2%.

2.23 In the case of TCH congestion, for 3G services for the quarter ending March, 2016, only in 2 cases service providers are not meeting this benchmark. Out of a total of 106 cases, in 84 cases the performance was within the range of 0 to 1%. In 14 cases the performance was between 1 to 1.5% while in 6 cases the performance was between 1.5 to 2%.

(e) **Call Drop Rate**

2.24 The call drop represents the service provider's inability to maintain a call once it has been correctly established. The objective of this parameter is to provide the consumer with an expectation of how successful a mobile

network will be at retaining the receive signal throughout the whole duration of the call. This parameter include both incoming calls and outgoing calls which, once established, are dropped or interrupted prior to their normal completion by the user; the cause of the early termination being within the service provider's network.

2.25 The parameter gives a reliable measurement of the mobile network of the service provider for maintaining a call once it has been correctly established. Failures in coverage, problems with the quality of the signal, network congestion and network failures impact this parameter. This parameter is also affected by inadequate coverage, problems with the quality of the signal and voice including interference, radio access network congestion.

2.26 The measurement can be made via an automatic data collection system, based on various network counters which register the real traffic of the network. The counter is available on the switch or OMC and is recorded 24 hours a day, every day of the year. However, for reporting the performance the measurements are taken during Time Consistent Busy Hour (TCBH). The formula for calculating the percentage of dropped calls is:

$\frac{(A*100)}{B}$, where:

A = The total number of interrupted calls (dropped calls)

B = The total number of calls successfully established (where traffic channel is allotted)

This will be averaged over a month.

In some technologies where circuit switched voice does not exist, the Voice is provided over the network based on IP multimedia Subsystem or through Multimedia Telephony. In such networks in order to ensure proper voice communications, other fall back options may be defined like circuit switched

fall back option or Voice over Generic Access to ensure customer satisfaction.

2.27 Currently the benchmark for call drop rate is ≤2%. As per the PMR for 2G services for the quarter ending March, 2016, only in one case service provider is not meeting this benchmark. Out of a total of 211 cases reported, in 176 cases the performance was within the range of 0 to 1%. In 24 cases the performance was between 1 to 1.5% while in 10 cases it was between 1.5 to 2%. Considering the performance of service providers and also considering the public outcry in recent times it is felt that there is enough ground for further tightening of the benchmark for this parameter.

2.28 As per the PMR for 3G services submitted by service providers for the quarter ending March, 2016, only in 3 cases service providers are not meeting this benchmark. Out of a total of 106 cases reported, in 86 cases the performance was within the range of 0 to 1%. In 13 cases the performance was between 1 to 1.5% while in 7 cases it was between 1.5 to 2%.

2.29 There is always a concern whether all required counter values are included in calculation of call drops. Instead of calculating the call drop rate at the LSA level at TCBH, whether another alternative of calculating the Call drop rate at each BTS level calculated during the Cell Bouncing Busy Hour (CBBH) should be the benchmark?

Question 2: How should the call drop rate calculated – either at the Licensed service area level calculated during TCBH, or calculated during the Cell Bouncing Busy Hour (CBBH) at BTS level should be the benchmark? Please give your views on each parameter, with justification.

(f) Worst affected cells having more than 3% TCH drops (call drop rate):

2.30 Worst affected cells are defined as cells in which the call drop rate exceeds 3% during Cell Bouncing Busy Hour (CBBH) or at any other hour of a day. The formula for calculating the Percentage of worst affected cells having more than 3% call drops is -

$$\text{Percentage of worst affected cells having more than3\% TCH drops (call drop rate)} = \frac{\text{No. of worst affected cells having call drop rate >3\% during CBBH in a month}}{\text{Total No. of cells in the licensed service area}} \times 100$$

Cell Bouncing Busy Hour (CBBH) means the one hour period in during which a cell in cellular mobile telephone network experiences the maximum traffic.

2.31 Currently the benchmark for this parameter is ≤3%. As per the PMR for 2G services for the quarter ending March, 2016, in 27 cases the service providers are not meeting this benchmark. Out of a total of 217 cases, in 60 cases the performance is within the range of 0 to 1%. In 24 cases the performance was between 1 to 1.5%, in 31 cases the performance was between 1.5 to 2% and in 75 cases the performance was between 2 to 3%. For calculation of the performance of service providers on this parameter only those BTSs which have more than 3% call drop is taken.

2.32 As per the PMR for 3G services for the quarter ending March, 2016, in 15 cases the service providers are not meeting this benchmark. Out of a total of 106 cases, in 9 cases the performance is within the range of 0 to 1%. In 20 cases the performance was between 1 to 1.5%, in 20 cases the performance was between 1.5 to 2% and the 42 cases the performance was between 2 to 3%. For calculation of the performance of service providers on

this parameter only those BTSs which have more than 3% call drop is taken.

(g) **Connections with good Voice Quality:**

2.33 The quality of voice in cellular mobile telecom services (GSM), is measured on a scale from 0 to 7. As the quality deteriorates, this value increases. The quality of the voice is considered to be good, if this value remains between 0 and 4. However, this value may be between 0 to 5 for the network where Frequency hopping phenomenon is used. In the case of CDMA, the fundamental performance measure for voice quality is the Frame Error Rate (FER). It is the probability that a transmitted frame will be received incorrectly. The frame includes signalling information and error detection bits as well as user voice/data. This metric includes the error detection/correction coding inherent in the system. Good voice quality is 0-4 % FER value. For FER of 4% for CDMA Enhance Variable Rate Codec (EVRC) System, the Speech Quality Rating is MOS score of 3.6. Further, for Bit Error Rate of Rx Qual 0 to 4 for GSM enhanced full rate (EFR) system, the Speech Quality Rating is MOS score of 3.4. In IP based technologies, Perceptual Objective Listening Quality Analysis (POLQA) offers an advanced level of benchmarking accuracy and adds significant new capabilities for wideband and super-wideband (HD) voice signals, along with support for most recent voice coding and VoIP/VoLTE transmission technologies. The voice quality depends heavily on the voice codec sampling rate and the resulting audio bandwidth.

2.34 The existing benchmark for this parameter is >95%. As per the PMR for 2G services for the quarter ending March, 2016, only in 5 cases the service providers are not meeting this benchmark. Out of a total of 209 cases reported, in 101 cases the performance is above 98%. In 50 cases the performance is between 97 to 98%, in 44 cases the performance is between 96 to 97% while in 11 cases the performance is between 95 to 96%.

2.35 As per the PMR for 3G services for the quarter ending March, 2016 all the service providers are meeting this benchmark. Out of a total of 106

cases reported, in 82 cases the performance is above 98%. In 12 cases the performance is between 97 to 98%, in 10 cases the performance is between 96 to 97% while in 3 cases the performance is between 95 to 96%.

(h) Point of Interconnection (POI) Congestion:

2.36 This parameter signifies the ease with which a customer of one network is able to communicate with a customer of another network. This parameter also reflects as to how effective is the interconnection between two networks. The benchmark notified by TRAI in the QoS Regulations for this parameter is <0.5%. This means out of 200 calls between two operators only one call should face congestion. The result of the monitoring reveals that degree of congestion between the operators is generally satisfactory in most of the areas. As per the PMR for 2G services for the quarter ending March, 2016, only in one case the service provider is not meeting this benchmark out of 209 cases.

2.37 As per the PMR for 3G services for the quarter ending March, 2016, all service providers are meeting this benchmark out of 106 cases.

Question 3: How should the benchmark for the network parameters be revised? Should it be licensed service area wise or district wise or BTS-wise or a combination? In such cases what should be the benchmarks? How should the benchmarks be measured? Please give your views on each parameter, with justification.

Question 4: How could the network parameters be technology agnostic? What are the parameters and benchmarks that are required to be defined? Please give your views with justifications.

B. Additional parameters to measure network related quality of service parameters for cellular mobile telephone service:

(a) Radio link time out:

2.38 In a GSM system, a mobile station (MS) making a voice call tracks a radio link counter, which is used to ensure the quality of the radio link. The radio link counter is used to measure the quality on the Slow Associated Control Channel (SACCH) associated with a connection (which may be used to carry a voice call). At the start of a call, after handover, and after re-assignment, the radio link counter "S" is initialized to a network-defined Radio Link Timeout (RLT) value. After every bad SACCH block, S is decreased by 1. After every good SACCH block, S is increased by 2 (to a maximum value of RLT). If the radio channel conditions are bad, many radio blocks will be lost, and eventually the radio link counter will expire when the value of S equals the expiry value (zero). This event is termed Radio Link Failure (RLF), and at that point the device stops using the traffic channel.

2.39 The following are some commonly-seen problems leading to radio link failure:

a. Rapid radio channel degradation (e.g., due to sudden co-channel interference).
b. The network not sending a handover message in time to avoid RLF.
c. Uplink interference and/or limit-of-sensitivity (due to limited transmit power) issues.

2.40 For cells with obvious coverage holes or in areas where call drops occur during movement, a TSP can increase this parameter appropriately in order to increase the possibility to resume the conversation. This parameter is normally set depending upon the region – urban, semi-urban, rural areas. Though the RLT value is normally set up as per the network, setting up high values for the same could lead to customer dissatisfaction. Normally this is defined, for areas of light traffic and large coverage (rural areas) to be between 36 to 48; for areas of heavy traffic (urban areas) to be between 20 to

32 and for semi-urban areas and in areas with heavy traffic (with microcells) to be between 4 to 16.

Question 5: Do you think it is essential to mandate the TSPs to set the RLT parameter? If so what should be the criteria to set the value and the value that needs to be set. Please comment with justifications.

(b) Short Duration Calls

2.41 As explained earlier, in case of call drop rate though the TSPs are generally meeting the overall benchmark; another variant to analyse call drops could be an analysis of the Call Data Records (CDR) in the billing system. Though such short durations calls do not necessarily point to a call drop rate, it will give an indication of the normal trend of call drop as experienced by the consumer. The CDR analysis in Delhi was made for some service providers for the month of August 2015. It was noted that more than 30% of the CDR were of less than 30 seconds. This could imply either the calls were made for short duration or the calls were dropped within 30 seconds. It was also noticed that some of these calls were also repeat calls which might indicate multiple failures in getting connected to the same number.

2.42 Through data analytics of the CDR, it may be statistically possible to identify call drop rate. For example, every CDR captures at the end of call - cell id, the signal level, voice quality and various other parameters of the BTS at the end of the call. The CDRs with low signal level and poor voice quality and repeat of such calls within 30 seconds will give a clear indication of the call being dropped in the network. The TSPs could be mandated to identify such calls dropped in the network and calculate the call drop rate. TRAI could set a quality of service benchmark standards for the same.

Question 6: Do you think it will be appropriate to calculate call drop rate through CDR meta data analysis? If so, what should be the benchmarks for such call drop rates calculated? Please comment with justifications.

(c) QoS perceived by the customer

2.43 Yet another option of measuring the QoE of the consumer, would be to calculate the QoE as perceived by the consumer. Perceived QoS could be assessed by customer surveys and from service providers networks. Using the various Network Centric parameters like- Network Availability (BTS Accumulated downtime, Worst affected BTS due to downtime); Connection Establishment (CSSR, SDCCCH/paging channel congestion, TCH congestion); Connection Maintenance (Call drop rate, Worst affected cells having more than 3% TCH drop, Connection with good voice quality) and PoI Congestion; one can calculate the Network Service Quality Index (NSQI) . Similarly, the Customer Service Quality Index (CSQI) could be calculated by focusing on the Customer Centric parameters like- Metering and billing credibility – post paid and pre-paid; Resolution of billing/ charging complaints; Period of applying credit/ waiver/ adjustment to customer's account; Accessibility of call centre/ customer care; Percentage of calls answered by the operators (voice to voice) within 60 seconds; Termination/ closure of service; Time taken for refund of deposits after closure. And similarly the Customer Satisfaction Survey Quality Index (CSSQI)is calculated through consumer survey.

2.44 These different Indexes for cellular mobile telephone service: Network Service Quality Index (NSQI), Customer Service Quality Index(CSQI) and Customer Satisfaction Survey Quality Index (CSSQI) could then be used to evaluate the performance of the service providers on each parameter- based on a 10 point score by giving equal weightage to each parameter. (Whenever a benchmark is achieved, a score of 10 points will be assigned to that parameter. In case the performance of parameter is below benchmark, the score will be reduced depending on level of performance.) Accordingly, the total score for all parameters will be added. Using these the 'Customer Satisfaction Index' (CSI) could be calculated.

2.45 The CSI combines the user behavior and the actual performance of

the network, Technical Quality perception and Service Quality Perception are included to distinguish network technologies and service quality from customer's perspective. While Technical specifications are also added for evaluating the real performance of the network. To calculate this a number of latent variable needs to be defined - Customer Expectation ; Value perception; Technical quality perception; Customer Satisfaction; Service quality perception; Customer Loyalty; and Technical Specifications

Question 7: Do you think calculation of customer satisfaction index will help in QoE of the consumer? If so elaborate the methodology of the calculation of such indexes. What are the latent variable that need to be defined and how are they to be calculated? Please comment with justifications.

CHAPTER-3

REVIEW OF FRAMEWORK FOR FINANCIAL DISINCENTIVE FOR NON-COMPLIANCE WITH THE QUALITY OF SERVICE BENCHMARKS

3.1 In order to improve the QoS provided by the service providers, the Authority has prescribed financial disincentive through "Standards of Quality of Service of Basic Telephone Service (wireline) and Cellular Mobile Telephone Service (Second Amendment) Regulations, 2012 (24 Of 2012)" dated 8th November 2012.

3.2 TRAI has been monitoring compliance to these regulations through monthly/ quarterly performance reports submitted by service providers. Wherever non-compliance with the benchmark is observed the service provider is given an opportunity to explain the matter and after considering the reply submitted by the service provider, if found unsatisfactory, financial disincentives are imposed on the defaulting service providers. TRAI had analysed the compliance reports of cellular mobile telephone service providers for past several quarters and it was observed that in many cases, the amount of financial disincentives had not acted as a sufficient deterrent against non-compliance as there had been repeated cases of non-compliance with the benchmarks. This indicates lack of commitment or initiative on the part of TSPs to improve the quality of service. The Authority, therefore, had after undertaking public consultations to review the quantum of financial disincentives, had prescribed increasing financial disincentives for consecutive repeat non-compliance with the benchmark through the Standards of Quality of Service of Basic Telephone Service (wireline) and Cellular Mobile Telephone Service (Fourth Amendment) Regulations, 2015.

3.3 The details of revised quantum of financial disincentives are given below:

(i) Not exceeding Rupees one lakh per parameter for first non-compliance with the benchmark in a quarter,

(ii) Non-compliance with the benchmark of the same parameter consecutively in two or more subsequent quarters, not exceeding Rupees one and a half lakhs for second consecutive contravention and not exceeding Rupees two lakhs for each consecutive contravention thereof;

(iii) Non-compliance with the benchmark in any quarter, which is not a consecutive non-compliance, Rupees one lakh per parameter.

3.4 It may be seen that the above structure of financial disincentives is based on whether the QoS parameter is met or not and no consideration is given on the extant of how bad is the performance. The financial disincentive is same whether the benchmark is not met by 1% or 5%. One option towards streamlining the Quality of service parameters will be to explore the possibility of a scheme of graded financial disincentive so that in the case of very poor performance the financial disincentive could be very stringent. At the same time there could be reduced financial disincentive in case there is improvement in performance.

Question 8: What are your views on introducing a graded financial disincentives based on performance and what should be such quantum of financial disincentives for various parameters? Please comment with justifications.

CHAPTER-4

ISSUES FOR CONSULTATION

Question 1: In case QoS is mandated at a sub-service area level, which option (LDCA-wise or District Headquarter/ city/ town-wise or BTS-wise) you would recommend? Please comment with justifications.

Question 2: How should the call drop rate calculated – either at the Licensed service area level calculated during TCBH, or calculated during the Cell Bouncing Busy Hour (CBBH) at BTS level should be the benchmark? Please give your views on each parameter, with justification.

Question 3: How should the benchmark for the parameters be revised? Should it be licensed service area wise or district wise or BTS-wise or a combination? In such cases what should be the benchmarks? How should the benchmarks be measured? Please give your views on each parameter, with justification.

Question 4: How could the network parameters be technology agnostic? What are the parameters and benchmarks that are required to be defined? Please give your views with justifications.

Question 5: Do you think it is essential to mandate the TSPs to set the RLT parameter? If so what should be the criteria to set the value and the value that needs to be set. Please comment with justifications.

Question 6: Do you think it will be appropriate to calculate call drop rate through CDR meta data analysis? If so, what should be the benchmarks for such call drop rates calculated. Please comment with justifications.

Question 7: Do you think calculation of customer satisfaction index will help in QoE of the consumer? If so elaborate the methodology of the calculation of such indexes. What are the latent variable that need to be defined and how are they to be calculated? Please comment with justifications.

Question 8: What are your views on introducing a graded financial disincentives based on performance and what should be such quantum of financial disincentives for various parameters? Please comment with justifications.