RJIL/TRAI/2017-18/903
28th March 2018

To,
Sh. Asit Kadayan
Advisor (QoS),
Telecom Regulatory Authority of India,
Mahanagar Doorsanchar Bhawan,
Jawahar Lal Nehru Marg, New Delhi 110002

Subject: Comments on Consultation Paper on 'Voice Services to LTE users (including VoLTE and CS Fallback)' dated 26.02.2018.

Dear Sir,

Please find enclosed herewith comments of Reliance Jio Infocomm Ltd. on the consultation paper on Voice Services to LTE users (including VoLTE and CS Fallback) dated 26.02.2018, for your kind consideration.

Thanking You,
For **Reliance Jio Infocomm Limited,**

Kapoor Singh Guliani
Authorised Signatory

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Enclosure: As above.

RELIANCE JIO INFOCOMM LTD'S COMMENTS ON TRAI'S CONSULTATION PAPER ON "VOICE SERVICES TO LTE USERS (INCLUDING VOLTE AND CS FALLBACK)" (Consultation Paper Dated 26th February, 2018)

General Comments:

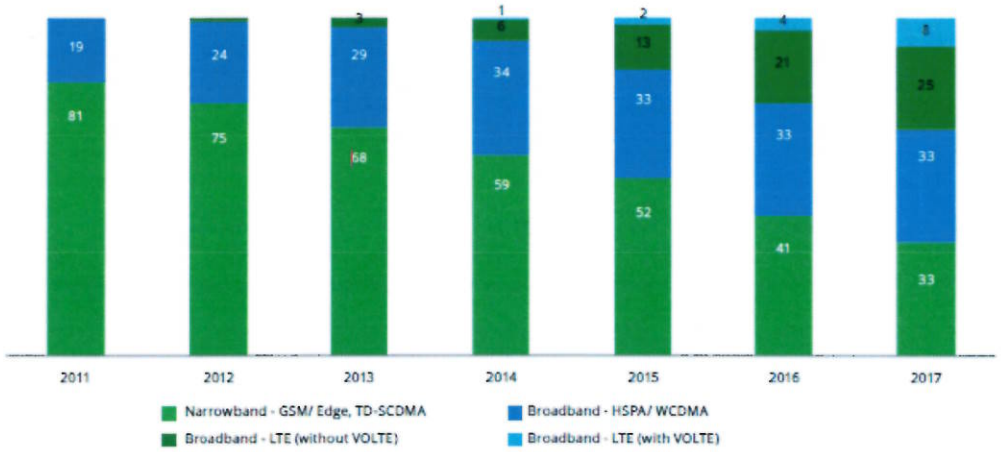
1. At the outset, we thank the Authority for issuing this consultation paper to discuss, review and finalize the issues to identify Quality of Service key performance indicators (KPIs) and measurement procedure principles in this dynamically evolving sector witnessing a trend towards ubiquitous Long Term Evolution (LTE) services.

2. We agree with the Authority that the ever-growing LTE penetration in India with practically all commercial networks offering LTE services will soon be covering the entire geography and population of the country. The Authority has rightly noted that the subscription of LTE services has exceeded 200 million subscribers in a short span despite many service providers yet to launch full-fledged VoLTE (Voice over LTE) services in India.

3. The growth of LTE and VoLTE services is an international trend with global analyst and experts like Deloitte predicting, in their Technology, Media and Telecommunications Predictions 2018-India edition, that VoLTE will be the most prevalent voice technology in the future with more than 60% of all broadband subscribers set to utilize VOLTE technology for voice services by 2023 surpassing 5 billion subscribers globally.

4. This report also indicates that globally over 8% of all mobile subscribers are already using Broadband-LTE (with VoLTE), and along with Broadband-LTE (without VoLTE) at 25%, the cumulative market share is already equal to 2G and 3G service. It also notes that a majority of these LTE/VOLTE subscribers come from Asia Pacific and India.

Figure 1: Global Mobile Subscriptions by Technology (%)



5. VoLTE services are an evolution over long standing core fundamental telecommunication voice service and builds on the advantages of IP networks to

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deliver the voice services of the future. VoLTE has inherent advantages of superior voice quality with faster connection times with integrated Rich communication services (RCS) and Video capability. It is no surprise that this feature rich service is being lapped up by users. Voice under VoLTE is no longer a vanilla service, but it is now a feature rich service redefining the way we communicate. In fact, voice with VoLTE is a fully integrated service that the mobile user will flexibly use like any other major mobile application.

6. VoLTE being a core IP based service provides added Quality of Service (QoS) advantage to the users and addresses the common challenges faced by customers using Circuit Switched Fallback (CSFB) services like:

   i. Failure to handover voice calls between LTE and 2G/ 3G leading to call drops.
   ii. VoLTE generally provides much lower call set up time as compared with CSFB the difference can be as much as 4-5 times.
   iii. VoLTE calls can be established without disturbing the ongoing data session, which is not the case with CSFB where data session is terminated on establishing a voice call. Further there are long delays in re-establishment of data sessions post completion of voice call.

7. VoLTE also delivers major advantages to service providers with better spectral efficiency, integrated IP based services with IP multimedia subsystem (IMS) functionality to grow differentiated services which delivers operational and cost advantage. Operators also get the flexibility advantage of converging all IP LTE services around IMS to help deliver higher QoS.

8. The VoLTE service, being the latest technological innovation, is not without challenges in deployment. The challenges start with complexity of a call set up with the relevant QoS to ensuring the radio network can deliver the necessary resources. The real time delivery of VoLTE requires assurance solutions with end-to-end visibility beginning with analytics at all stages, starting with handset data, Radio Access Network (RAN) and Core Network. The major consideration to assure the required QoS for VoLTE are RF considerations, Interoperability and scale management. Analysis and availability of corrective mechanisms at any stage is critical as the voice service quality is only as good as its weakest link. Thus analysis needs to be done from the user device right to the network core to optimize the VoLTE QoS for user.

9. At global level organisations like European Telecommunications Standards Institute (ETSI), Next Generation Mobile Networks (NGMN) and Small Cell Forum have been conducting several plugfests to emulate the environments of LTE and VoLTE deployments and test interoperability between elements. The complexity of the IMS environment with multiple nodes and variety of equipment by different Original equipment manufacturers (OEMs) implies that a clear testing and analysis methodology should be deployed for long durations for stable delivery of required QoS parameters.

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10. The Authority, has been ensuring the delivery of telecommunication services with optimum Quality of Service through its various interventions. The 5th amendment dated 18th August 2017, to Quality of Service of Basic Telephone Service (wireline) and Cellular Mobile Telephone Service Regulations, 2009, was one such step in ensuring the QoS for subscribers.

11. We understand and appreciate the Authority's approach to make the QoS parameters technology agnostic and to ensure that Drop Call Rates (DCR) are reduced across geographies. Evidently, a customer buys a service and not a technology, which is just a medium of delivery of service and all that matters to a customer is the quality of service received by him. The customer would be least concerned by the technology deployed as long as he received desired service quality. The Authority has always followed this logic to define same QoS parameters for all technologies and same principle needs to continue. Further, as the measures for a parameter may not be identical, these should be scientifically comparable. Thus RJIL firmly believes and recommends that the QoS parameters and benchmarks should be technology neutral with comparable measures.

12. Further, we submit that in interest of regulatory predictability and for stable delivery of required QoS, the recently amended QoS parameters for VoLTE services should be continued with for some time and a change should be contemplated only in case there is proven case of these parameters being found inadequate.

13. With regards to Silence/Call Muting phenomenon referred by the Authority, we submit that there are no proven measure for this issue. Also this is not a VoLTE only phenomenon but also a common experience shared by 2G/3G users as well. Muting is perceived by customer due to fragility of radio interface irrespective of technology deployed. As there are no proven scientific measures for muting, we recommend that the Authority should continue with existing Radio network QoS parameters without any change to observe this phenomenon as well.

14. We would also take this opportunity to point out that some of the measures and benchmarks used by Authority to measure voice quality parameters during the Independent Drive Tests (IDTs) are not suitable for VoLTE services. During IDT, the auditors are using SINR > 0 dB as a parameter for measuring voice quality for VoLTE with benchmark of 95%. We submit that non-negative SINR as a measure of quality for VoLTE have following shortcomings:

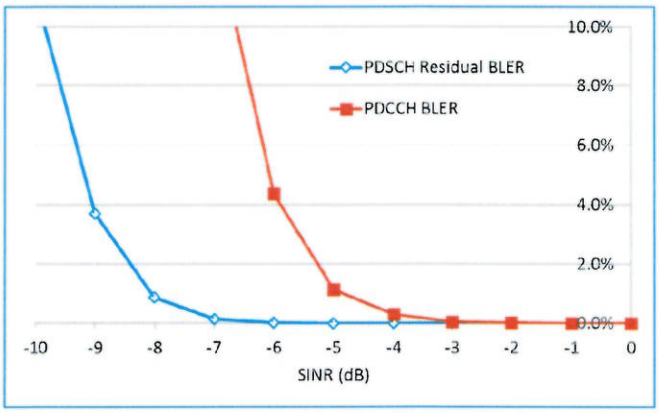
    i. SINR by definition is negative in the zone of overlap so > 0 dB as a benchmark value of voice quality practically not achievable. Globally all operators in any field test will not be able to conform to SINR > 0 dB.
    ii. SINR changes with Network loading. A cell with an average SINR of +12 dB in 20% loaded area degrades to less than -6 dB during Bouncing Busy Hour (BBH) when the loading is more than 90%.
    iii. The handover in LTE is triggered when one of the neighbouring cells is received with 3 dB higher power than the serving cell for a consistent duration of 100 ms (This parameter is called as Time To Trigger (TTT)). With a threshold of 3 dB

and an ideal case of single neighbour, the SINR in the handover region is generally – 3 dB. In a practical scenario there will be many locations where a UE will receive signal from other neighbours also. Even though other neighbours are weaker than the serving cell, their signal adds up as the interference and thus SINR at handover boundaries can be even lower than -3 dB. Since the device waits for time equal to TTT (100 ms) before sending a Measurement Report for handover, the negative SINRs can prevail for TTT duration. In some cases, the SINR can remain negative even after handover if there are multiple neighbours with similar signal strengths.

iv. In any network we have to keep 20-30% areas as overlap region between the sectors/sites for proper functioning of handovers and for good mobility results. So we may have a significant area in the network with SINR negative depending upon the clutter and site planned in the area. There may be cases where 5-20% of samples may be below SINR 0 dB because of overlap, loading, and actual poor SINR areas.

v. Thus in any LTE network, under various circumstances SINR could be less than 0 dB but voice quality or user experience does not get impacted.

vi. As per current established QOS norms of TRAI vis-à-vis CDMA performance of 4% FER as a measure of acceptable voice quality LAB simulations were performed to establish the required SINR. As per graph below PDSCH SINR of `-9dB and PDCCH SINR of -6dB can be considered as equivalent to 4% FER. Taking higher of the two, RJIL proposed -6dB as the benchmark for voice quality measurement.



15. Conclusion:

1.	**The Authority should persist with the QoS parameters provided under the 5th Amendment to QoS Regulations 2009.**
2.	**There is no need to prescribe technology specific QoS parameters.**
3.	**The Authority should wait for a proven standards and measures for silence/muting to be available before prescribing KPIs for the same.**
4.	**The Authority should change the measure of voice quality in IDTs**

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Issue wise response:

Question 1. Whether prescribed QoS parameters, as per existing QoS Regulations, are sufficient to effectively monitor QoS of VoLTE/CSFB calls? Please provide suggestions with justifications.
And
Question 2. If existing QoS parameters are not sufficient to monitor QoS of VoLTE/CSFB calls, then what new parameters can be introduced? Please provide details with justifications.

RJIL Response:

1. RJIL submits that the 5th amendment dated 18th August 2017, to Quality of Service of Basic Telephone Service (wireline) and Cellular Mobile Telephone Service Regulations, 2009, has been effected only as late as 1st October 2017. As mentioned by the Authority, the intent behind this amendment was to expand the scope of DCR measurements and to ensure that the QoS parameters are measured in a technology agnostic manner.

2. These amendments also crystallized the QoS parameters and measures for VoLTE services. As explained in general comments, RJIL endorses the Authority's policy of technology agnostic QoS parameters as the customers should be assured of same QoS parameters irrespective of the technology. Therefore we reiterate that there is no need to discuss technology specific parameters and same parameters and benchmarks should be applicable for all technologies with technology specific scientifically comparable measures.

3. Further, as the Authority is aware that VoLTE QoS parameters are being stabilized and implemented as per the 5th amendment dated 18th August 2017, therefore there is no case for changing these parameters and benchmarks after only 6 months of operation, unless there are proven shortcomings in the parameters. Additionally, as most of the service providers are still rolling out VoLTE services at pan-India level, it will be prudent to give sufficiently stable QoS parameters.

4. Furthermore, as submitted in General Comments, voice quality parameter SINR ≥ 0 dB for IDTs should be replaced with SINR >= -6dB

   Analysis of SINR as Parameter:

   i. All wireless networks need overlapping coverage between different cells to ensure seamless coverage experience for users. Handovers from one cell to another will happen in this overlap zone.

Definition of SINR:
SINR [dB] = 10 log [S/(I+N)] Where, S : Signal Power of Serving Cell, I : Signal Power of Neighbour Cell (Interferer), and N : Noise Power

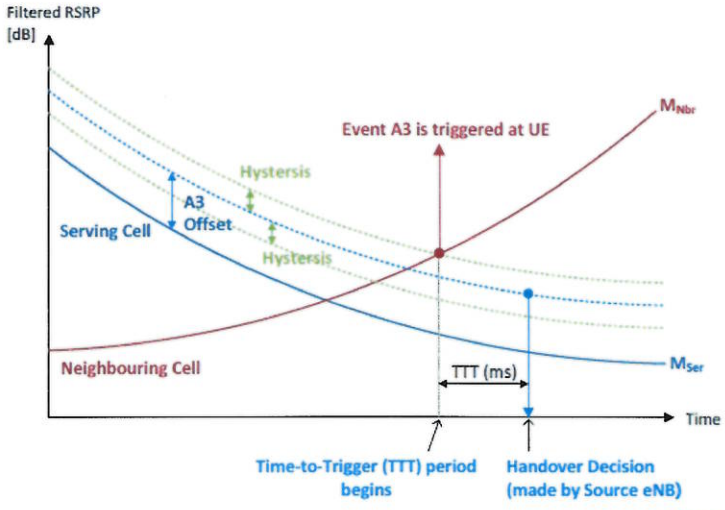
Thus for SINR ≥ 0 dB requires [S/(I+N)] ≥ 1,

ii. In cell edge area where serving cell power (S) equals neighbour cell power (I) then for SINR to be ≥ 0 dB, it requires S/(I+N) >= 1 which is theoretically and practically not achievable. Thus in any coverage overlap area (which is essentially required for seamless coverage) the SINR can be ≤ 0 dB. The coverage overlap is some areas would inevitably have two or more cells providing coverage in that zone.

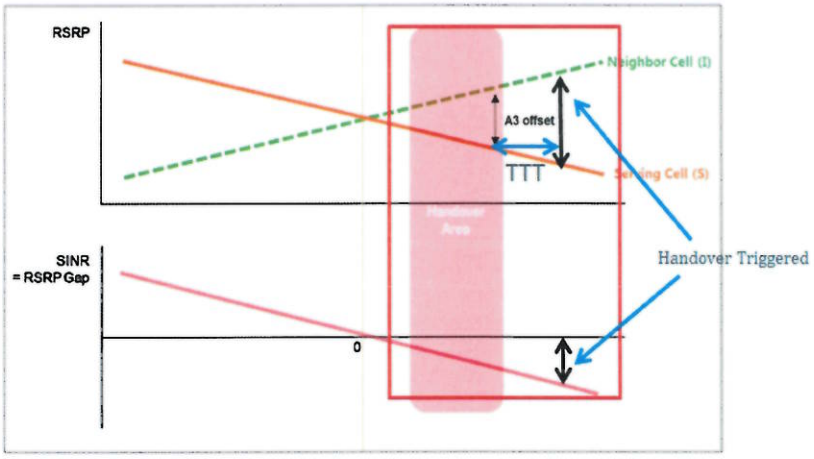
iii. Further, for handovers, 3GPP TS 36.331 has defined Reporting Criteria and Reporting Events based on RSRP Measurements (Reference Signal Received Power) which are globally used by all Operators. During intra band handovers, in order to reduce ping pong handovers, LTE uses A3 Offset as defined below.

iv. Event A3 is defined as "neighbour cell becomes better than the serving cell by an offset". The A3 offset is commonly defined as 3 dB. After A3 offset is met (i.e. the serving cell is 3 dB lower than the neighbouring cell), handover gets triggered after a pre-defined time as TTT (Time to Trigger) as shown in the figure below.

v. From the definition of SINR, we can see that here 10*Log[S/(I+N)] would be ≤ -3dB, which means negative SINR. Thus effectively all handovers happen at negative SINR.



vi. Apart from handovers, SINR can be lower in commercial network because of noise and overlapping coverage of two or more neighbour cells. As an example when serving cell RSRP is -105 dBm, first neighbour is at -103 dBm (stronger) and second neighbour is at -106 dBm (weaker), the SINR would be -3.76 dBm. This provides seamless user experience and no handover would be required in this case (As A3 offset is not met).



Handover Area

vii. Thus in any LTE Network, SINR could be less than 0 dB in overlap areas and SINR does not serve as direct correlation to Voice Quality as can be observed from the seamless voice quality experienced during handovers which actually happen with negative SINR as explained above.

viii. Moreover, corresponding to the negative SINRs, the eNodeB allocates a very robust Modulation and Coding Scheme (MCS) which uses the QPSK as the modulation and a very high redundancy Forward Error Correction (FEC) code. As a result the receiver (both UE in downlink and eNodeB in uplink) are able to demodulate the signal and recover the VoLTE bits faithfully at the output of decoder. Most modern receivers also use advanced techniques like Successive Interference Cancellation (SIC) which can recover signals faithfully even at considerably low SINRs.

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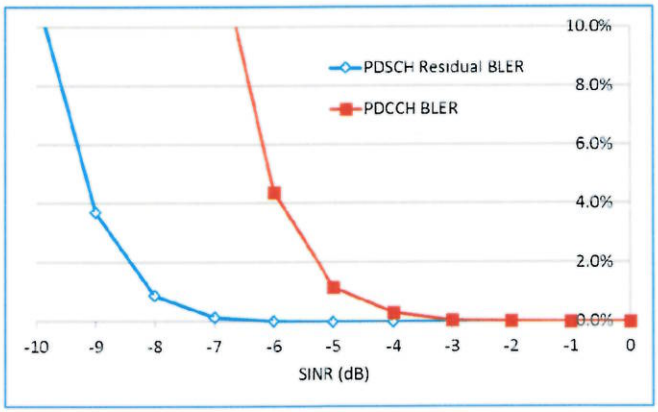
5. As per current established QOS norms of TRAI vis-à-vis CDMA performance of 4% FER as a measure of acceptable voice quality, LAB simulations were performed to establish the required SINR. As per graph below PDSCH SINR of `-9dB and PDCCH SINR of -6dB can be considered as equivalent to 4% FER. Taking higher of the two, RJIL proposed -6dB as the benchmark for voice quality measurement.



6. In view of the above analysis, we submit that instead of SINR > 0, the Authority should implement the parameter of SINR ≥ -6 dB as a measure for Voice Quality.

Question 3. How to define instance of silence/voice mute? How many such instances may be accepted during voice call? Whether existing parameters like packet loss, jitter, latency, end-to-end delay are sufficient to identify or measure silence/voice mute or some other parameters are also need to be factored to measure it? Please provide details with justifications.

And

Question 4. How to measure report and evaluate network or service from perspective of silence/voice mute problem? Which ITU measurement tools can be used to prepare framework for measurement of silence/voice mute problem? Please provide details with justifications.

RJIL Response:

We reiterate our submissions in General comments that muting is phenomenon observed by customers of all technologies be it 2G/3G or VoLTE and as of date there is no proven method or standard to measure muting. Clearly, in absence of a verifiable and scientifically proven test or measurement methodology, it would not be prudent to include such a parameter in the QoS Regulation.

Question 5. Whether certain range of timers and constants are required to be prescribed which may affect VoLTE call quality assessment? If yes, which may be those timers and constants and what may be the suggested ranges of timers and constants? Please provide details with justifications.

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RJIL Response:

1. RJIL submits that VoLTE services cannot be equated with TDM circuit based services like 2G services. The timers and constants like RLT are not applicable for VoLTE services. Therefore we submit that there are no suitable timers and constants that may affect VoLTE call quality assessment and the Authority should refrain from prescribing the same.

2. All the suggested timers and constants in the Consultation Paper are not reflective of impact on user experience but instead are used for engineering purpose and for network fine tuning to control the overlays and smooth mobility between the cells. Therefore these timers and constants have no relevance in measuring the QoS KPIs impact hence should not be considered.

Question 6. What parameters like Post Dialing Delay (PDD) may be introduced to measure performance of users being served voice via CSFB? What may be the threshold? How to measure report and evaluate? Please provide details with justifications.

RJIL Response:

We submit that RJIL does not offer CSFB services and therefore it will not be prudent on its part to make submission on this aspect. However, we submit that the Authority should keep in mind the CSFB specific issues while formulating the QoS parameters for this service.

Question 7. Any other issue which is relevant to this subject?

RJIL Response:

1. RJIL submits that in order to deliver optimum quality to the customers, the Authority should recommend speedy closure and implementation of spectrum frequency harmonization to mitigate possible interference issues especially for spectrum in 2300 MHz Band.

2. During the IDT, the areas where less than 100 calls were attempted should be excluded from measurement since it does not reflect true user experience.

3. We also submit that while all TSPs are launching VoLTE, however, in inter-operator calls, high quality voice cannot be experienced by customer due unavailability of IP to IP Interconnection. RJIL requested that IP to IP interconnection should be mandated so that complete benefits of 4G voice service can be made available to subscribers of all service providers. Further, this will also solve the issue of POIs.