3GPP TSG-RAN WG2 Meeting #109bis-e R2-20xxxxx

Elbonia, 20 – 30 April 2020

**Agenda item: 6.20.2.1**

**Source: Nokia (Rapporteur)**

**Title: Offline 053 on LCP Mapping Restrictions**

**WID/SID: TEI - Release 16**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

LCP Mapping Restrictions

[R2-2002740](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002740.zip) LCP Mapping Restrictions Nokia, Deutsche Telekom, Ericsson, Fujitsu, Nokia Shanghai Bell, NTT DOCOMO INC., T-Mobile discussion Rel-16 TEI16 [R2-2000576](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2000576.zip)

[R2-2002741](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002741.zip) Dynamic LCP Mapping Restrictions Nokia, Deutsche Telekom, Fujitsu, Nokia Shanghai Bell, NTT DOCOMO INC., T-Mobile CR Rel-16 38.321 16.0.0 0689 1 B TEI16 [R2-2000577](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2000577.zip)

[R2-2002835](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002835.zip) Cell restriction for CA duplication OPPO discussion Rel-16 TEI16 [R2-2000406](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2000406.zip)

* [AT109bis-e][053][TEI16] LCP Mapping Restrictions (Nokia)

Scope: Treat papers above on LCP Mapping Restrictions.

Wanted Outcome: Agreed solution, if possible Agreed-in-principle CR(s)

Deadline: April 28 0700 UTC

# 2 Discussion

For several meetings, a number of contributions have suggested that LCP Mapping Restrictions need to be dynamically adjusted beyond what RRC already offers. Some possible scenarios include:

- TCP performance [[R2-2002740](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002740.zip)];

- Overload situation [[R2-2002740](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002740.zip)];

- Mobility Events on high frequencies [[R2-2002740](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002740.zip)];

- Duplication activation/deactivation [[R2-2002835](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002835.zip)].

**Question 1:** do you agree with the need to adjust LCP Mapping Restrictions beyond what RRC already allows.

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| Answers to Question 1 | | |
| Company | Yes/No | Technical comments to justify your answer (one may refer to the scenarios listed above to explain his/her views) |
| OPPO | Yes | In order to make the benefits of cell restriction equal to all DRBs (no matter whether CA duplication is configured or not), and also to make less network reconfiguration when cell restriction is still needed when CA duplication is deactivated, it’s better to indicate the UE whether to apply the cell restriction or not when the duplication is deactivated.  Network can configure whether the UE can lift the cell restriction configured for the LCH. For example, if the bearer is restricted from using certain serving cells, the network can configure the UE not lifting the cell restriction when the CA duplication is deactivated. Otherwise, the UE follows the legacy R15 behaviour. |
| Apple | No | Considering the number of new flows can be started in a smartphone in a very short order, it is not feasible for NW to track that as well as to assume that LCP restrictions can be modified at that dynamic pace. We sympathize with other scenarios such as mobility, however, given limited R16 time, we would want to leave up to RRC mechanisms in R16 specifications. |
| Lenovo | Yes | We also think that at least for the CA duplication case there should be more flexibility for controlling LCP restrictions, i.e. cell restrictions, without requiring at lot of RRC reconfigurations. |
| Ericsson | Yes |  |
| HW | Yes | We are ok to do this enhancement but focus on cell restriction for CA duplication. To us, CA could be the only realistic scenario, and we need to minimize the impacts of this enhancement at this late stage.  Other than that, we are not convinced about the benefit for other restrictions. Basically the restrictions for SCS, TTI are used to map URLLC traffic to suitable resource, but not to restrict eMBB with lower priority that can be allowed to use the remaining resource if any for maximum spectrum efficiency. Therefore, to deactivate the restrictions for URLLC means the QoS requirement cannot be ensured. And there is another risk of missing the (de-)activation command in such bad situation, so we tend to rely on other mechanisms to resolve the issue mentioned in R2-2002740. |
| Nokia | Yes | See R2-2002740.  In response to Apple: why do you assume the network cannot keep track of QoS flows? It is a requirement to guarantee proper QoS!  In response to Huawei: what other mechanisms do you have in mind to solve the scenarios described above? |
| Deutsche Telekom | Yes | Apart from the CA duplication deactivation case, we think that the frequent change of LCP mapping restrictions would improve the service performance and the system operation overall. We think the guaranteed QoS is important and considering that RRC signalling is slow and introduces overhead we think that the dynamic adjustment with MAC CE is a better choice. |
| Fujitsu | Yes | As a supporting company in R2-2002740. |
| Qualcomm | No | On R2-2002740:  We have sympathy for some of the issues identified in the observations, but we can’t agree that the proposed dynamic LCP mapping restriction is the right solution, for the following reasons:   * Issue described in Observation 1. Typically, a DRB contains multiple TCP flows which start at different times (e.g. due to dependence among http objects) and connect to different servers (e.g. due to CDN or cross links, even when user clicks on a single web page or an app). Therefore, a particular LCP mapping restriction may benefit some flows but at the same time would hurt others (for the same reason given in the paper). And dynamically adjusting the restrictions does not solve the problem. * Issue described in Observation 2. If the “high priority traffic” refers to URLLC, network can configure proper LCP restriction to ensure URLLC traffic does not get on “slow grant” and use admission control to prevent overloading. If it does not refer to URLLC, then we don’t see any issue, since high priority data is always sent first. * Issue in Observation 3. This is an issue that can and should be solved by beam management and/or beam failure recovery, not LCP restriction.   On R2-2002835:  This is an issue discussed several times during R15. We are not aware of any new use cases that justify a revisit. Therefore, we do not support discussing this topic again in R16. |
| LG | No | Reasons are as follows:  In NR, multiple flows are mapped to one DRB. This means that there are multiple TCP flows and each flows may be in different phase, e.g., some of them are in slow start and others are in congestion avoidance. Even though R2-2002740 argues “for TCP traffic, a shorter latency is mostly beneficial during the slow start phase.”, considering that slow start phase can be started anytime in TCP, i.e.at the beginning of the flow or after timeout, one logical channel may have packets for slow start phase intermittently and we doubt LCP mapping restriction is useful mechanism in this situation.  The second reason is that, in general, URLLC service have LCP restriction to satisfy their strict requirement, e.g., 0.5ms. In this condition, even though LCP mapping restriction is adjusted due to high load situation, if the URLLC traffic is transmitted on the slow grant, this may not satisfy URLLC requirement and may be meaningless data at the receiving side.  For the mobility with high frequency, we share QC’s view. This should be handled by beam management/recovery, not LCP restriction. |
| Futurewei | Yes | The awkward issue of LCP mapping restriction during duplication activation/deactivation should be addressed. |
| Samsung | No | We agree with Qualcomm and LG for the technical reasons.  We also consulted our network and chip implementation sides for the *real* necessity of this enhancements, but they do not think it is essential/required. |
| ZTE | Not sure. | If companies really want to do sth for LCH restriction. We tend to support to do some enhancements for allowedservingCell mapping restriction in the case that the CA duplication is deactivated.  For other factors, SCS, PUSCH duration, etc,we think it is too late in Rel-16, we need time to identify the issue, and then we can determine how to resolve it. For the solution proposed in R2-2002740,Can only the LCH restriction enable bit improve the concern mentioned in R2-2002740? |
| MediaTek | No | On R2-2002740:   * For observation 1: Several TCP flows may be mapped to the same DRB, and each TCP flow mapped to the same DRB, may be in different TCP status, e.g. some TCP flow are in slow start state and others are in congestion avoidance state. So, if NW really keeps track of QoS flows, detect that a QoS flow is created for TCP flow, and temporarily relax LCP restriction for the logical channel associated with the corresponding DRB, it may happen that other TCP flows mapped to the same DRB detect the increased bandwidth and hence aggressively push out their TCP segment. As a result, the newly created TCP flow cannot really gain from LCP restriction relaxation during the competition with other TCP flows mapped to the same DRB. In addition, LCP restriction relation for a logical channel, in our view, has the same impact to prioritize traffic from this logical channel, and therefore would have negative impact to other logical channels. * For observation 2: In a high load scenario, if we allow to high priority traffic to use a slower grant by LCP restriction relaxation, then latency requirement of the high priority traffic may not be satisfied. Instead of relaxing LCP restriction, in high load scenario NW should provide more UL resources for high-priority logical channels, e.g. NW should activate configured grants, which can only be used by high-priority traffic. * For observation 3: we share same view from QC that high frequency issue should be handled by beam management and/or beam failure recovery, not LCP restriction.   On R2-2002835:  We do not see strong motivation to revisit this issue. But we are willing to follow to majority view if recheck is needed. |
| Intel | No | On R2-2002740: we agree with the technical analysis from Qualcomm, LG, and MediaTek.  On R2-2002835: we are OK to follow majority view on whether to revisit the issue, e.g. whether to consider union of cells when CA duplication is deactivated. |
| DOCOMO | Yes | For observation 3: during the case that a high frequency gets blocked by an obstacle, the BFR RACH procedure with the frequency could get also blocked. So the LCH restriction solution may be efficient compared to the BFR. |

**Summary 1**: TBD.

**Proposal 1**: TBD.

Assuming that LCP Mapping Restrictions need to be dynamically adjusted, we then need to discuss what mechanism needs to be introduced. Two approaches have been suggested:

- A generic mechanism based on MAC CE to enable/disable the LCP mapping restrictions [[R2-2002740](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002740.zip)];

- Link the LCP mapping restrictions to the activation/deactivation of duplication [[R2-2002835](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002835.zip)].;

**Question 2:** assuming that LCP Mapping Restrictions need to be dynamically adjusted, which mechanism addresses the scenarios you have in mind.

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| Answers to Question 2 | | |
| Company | Preferred Mechanism | Technical comments to justify your answer |
| OPPO | R2-2002835 | My understanding on the difference between 2740 and 2835 is that, 2740 uses a MAC CE to dynamically activate/deactivate the LCP restrictions configured for a logical channel. 2835 uses RRC signalling to enable/disable the cell restrictions.  It’s not clear to us why all the LCP restrictions should be adjusted using a dynamic way, e.g., allowedSCS-List, once it’s configured for a LCH, it means the data from this LCH may only fit to the allowed SCS configured.  We should stick to the original potential issue which seems to be that the LCHs associated with CA duplication can not apply cell restrictions any more once the duplication is deactivated, which may cause issue that the data from this LCH is not supposed to be transmitted on certain carriers while network has no means to prevent it except by using reconfiguration. |
| Lenovo | R2-2002835 | We consider CA duplication as the use case which benefits most from a more flexible LCP restrictions mechanism. Therefore, the solution proposed in R2-2002835 seems sufficient. However, we would be also OK for a MAC CE based solution as e.g. suggested in R2-2002740 if this is the majority view. |
| Ericsson | R2-2002740 | We think the actual solution can be discussed after having a principal agreement of supporting dynamic LCP restrictions. We note that the MAC CE has a better potential to control this dynamically. |
| HW | R2-2002835 | We think we should focus on some useful scenario and minimize the specification impacts especially at this late stage. To us, carrier aggregation is a common use case, so we are ok to support the enhancement for CA duplication provided in R2-2002835. |
| Nokia | R2-2002740 | We do not think we should limit the scope to CA activation/deactivation. The benefit of relying on separate MAC signalling is that all scenarios can be addressed: mobility can be improved, overload can be dealt with & TCP throughput can be enhanced. |
| Deutsche Telekom | R2-2002740 | The difference between the mechanisms is the dynamic way of changing the LCP mapping restrictions. The MAC mechanism in R2-2002740 has a better potential for more scenarios therefore we would prefer that. |
| Fujitsu | R2-2002740 | The outstanding benefit of using the separate MAC CE is that it makes the fast and dynamic control of LCP mapping restriction possible, compared to tying PDCP duplication activation and deactivation. |
| LG | None | As explained in Q1, we don’t think the mechanism in R2-2002740 is useful. However, if RAN2 decides to do something for LCP restriction, we prefer to resolve an issue on LCP restriction for CA duplication, i.e., R2-2002835. |
| Futurewei | R2-2002835 | In terms of addressing LCP mapping restriction issue during CA duplication activation/deactivation, approaches in both R2-2002740 and R2-2002835 would work. The one in R2-2002835 is simpler and have less impact to specs.  The approach in R2-2002740 has some potential of being more comprehensive/flexible in terms of controlling LCP mapping restriction, as it doesn’t restrict the use to duplication activation/deactivation. However, its current design (one bit to activate/deactivate the mapping restrictions) limit its usefulness. For example, when a cell mapping restriction is lifted for a logic channel carrying IIoT traffic after duplication deactivation, those on grant characteristics of SCS/duration/type would be also relieved, leading to loss of QoS control for URLLC data.  In addition, we also agree with Qualcomm’s and LG’s observation in their responses to Q1. |
| ZTE | Not for R2-2002740,  No strong point of view to R2-2002835 |  |
| DOCOMO | R2-2002740 | Same view as Nokia |
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**Summary 2**: TBD.

**Proposal 2**: TBD.

# 3 Conclusion

TBD.