3GPP TSG-RAN WG2 #109-e R2-200xxxx

**Electronic meeting, 24th February – 6th March, 2020**

Agenda Item: 6.7.2.2

Source: Ericsson

Title: Summary on [AT109e][033][IIOT] Scheduling Enhancements

Document for: Discussion, Decision

# 1 Introduction

In this document, we summarize the outcome of the following at-meeting email discussion.

* **[AT109e][033][IIOT] Scheduling Enhancements (Ericsson)**

 Scope: Treat summary on Scheduling Enhancements

 Intended outcome: Resolve issues, Describe Open Issues accurately.

 Deadline: Mar 3 1200 CET (conclusions on “easy agreements” by Feb 27 1200 CET)

This document is based on the pre-meeting summary paper R2-2002091 [32]. Compared to the summary paper R2-2002091, the main body remain unchanged. Companies are invited to provide feedbacks on the proposals that need further discussion in the e-meeting. In addition, companies can provide further comments (if any) on “easy agreements in R2-2002091” in Section 3 and identify other open issues in Section 4.

# 2 Discussion

## 2.1 LCP restriction enhancement

### 2.1.1 AllowedCGList for dynamic grant

RRC running CR R2-2001657 lists the following open issue for the LCH restriction enhancement *allowedCG-List:*

Editor’s note: In this implementation, it is assumed that the LCH configured with *allowedCG-List* is allowed to be mapped to dynamic grant. This requires a confirmation from RAN2.

Confirmation is proposed in [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2000706](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000706.zip), [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip), [R2-2001171](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001171.zip), [R2-2001290](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001290.zip), [R2-2001429](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001429.zip).

1. Confirm LCH configured with *allowedCG-List* is allowed to be mapped to dynamic grant

[R2-2001493](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001493.zip) discusses the need to consider beside configured grants also uplink grants addressed to CS-RNTI. For Type2 activation, the grant is stored as configured grant, so no further consideration is needed. For retransmission, since HARQ buffer data is retransmitted, no LCP is evaluated, so no consideration within LCH restriction is needed either. Thus, the proposal is not summarized here.

### 2.1.2 Applicability of PHY priority indication

The following FFS are noted in RRC running CR R2-2001657:

Editor’s note: In this implementation, it is assumed that the LCH configured with *allowedPHY-PriorityIndex* is allowed to be mapped to dynamic grant without any priority indication. FFS: The mapping restriction between a LCH configured with *allowedPHY-PriorityIndex* and a grant without any priority indication.

Editor’s note: FFS whether *allowedPHY-PriorityIndex* applies for configured grant.

These FFS are discussed in [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip), [R2-2000788](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000788.zip), [R2-2001461](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001461.zip), [R2-2001429](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001429.zip), [R2-2001171](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001171.zip), [R2-2001461](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001461.zip), [R2-2001493](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001493.zip), R2-2001033, R2-2000845, [R2-2001289](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001289.zip), [R2-2001029](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001029.zip), [R2-2000115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000115.zip)

In the TS 38.213 V16.0 clause 9.0, it is specified that “If a priority index is not provided for a PUSCH or a PUCCH, the priority index is 0”. Note that priority index 0 means low priority in PHY layer. If we allow high priority traffic to be mapped to a grant without priority indication, it may cause some issues since it would be subsequently treated as low priority in PHY layer. Therefore, we propose to align with the Ran1 spec:

1. LCH configured with allowedPHY-PriorityIndex is allowed to be mapped to dynamic grant without any priority indication only in case the configuration allows it to be mapped on low priority grant.

The above contributions consider diverging views regarding *allowedPHY-PriorityIndex* restrictions to CG.

1. *allowedPHY-PriorityIndex* does not apply for CG: [R2-2001171](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001171.zip), [R2-2001461](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001461.zip)**,** [R2-2001033](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001033.zip), [R2-2000845](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000845.zip), [R2-2001289](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001289.zip), [R2-2001029](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001029.zip)
2. *allowedPHY-PriorityIndex* applies for CG [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip), [R2-2000788](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000788.zip)

Some companies argue that, in light of *allowedCG-List,* it is not necessary to have *allowedPHY-PriorityIndex* for CG.

On the other hand, as mentioned in [R2-2000788](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000788.zip), this restrictive mapping between CG and LCH can also be used by the network to steer the traffic to the intended CG configuration (note that the traffic arrival at gNB might have jitter). It is useful to introduce *allowedPHY-PriorityIndex* for CG too. Furthermore, not applying such LCP restriction to CG will result in further complication in the specification, i.e. extra conditions would be required. Lastly, there seem to be no technical reasons against restricting the *allowedPHY-PriorityIndex* to dynamic grants.

There are diverging opinions, but this topic has been well discussed and understood. There is a majority support that “allowedPHY-PrioirtyIndex does not apply for configured grant”, and we propose

1. allowedPHY*-PriorityIndex* restriction applies only to dynamic grants.

In addition, [R2-2001493](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001493.zip) proposes to exclude the UL grant scrambled with CS-RNTI, and considers UL grant scrambled with C-RNTI and MCS-RNTI. For Type2 activation, the grant is stored as configured grant, so no further consideration needed. For retransmission, since HARQ buffer data is retransmitted, no LCP is evaluated, so no consideration within LCH restriction needed either. Furthermore, it is also related with the editor’s note that “FFS whether an uplink grant addressed to CS-RNTI with NDI=1 (i.e. retransmission of a configured grant) is a configured grant or not. In this version of running CR, it is assumed that an uplink grant addressed to CS-RNTI with NDI=1 is considered as a dynamic grant”. We expect it to be resolved in the intra-UE prioritization agenda item. Thus, the proposal is not summarized here.

We have identified that proposal 3 needs further discussion and companies can provide feedback below.

|  |  |  |
| --- | --- | --- |
| Company | Support P3 (y/n) | Additional comments |
| LG | y |  |
| Qualcomm | y | allowedPHY*-PriorityIndex* is redundant given allowedCGs restriction has been introduced |
| OPPO | y | When we look back to the intention of introducing this IE, we can find both *allowedCG-List and* allowedPHY*-PriorityIndex* are used for reliability requirement. Considering *allowedCG-List* is agreed for CG, there is no need to apply allowedPHY*-PriorityIndex* to CG for the similar purpose. |
| Samsung | y |  |
| Docomo | yes |  |
| Spreadtrum | y | As *allowedCG-List* isintroduced for CG, allowedPHY*-PriorityIndex* is not needed. |
| CATT | y | Same view as Qualcomm |
| MediaTek | Y | Agree with Qualcomm |
| Huawei | yes | The intention of introducing allowedPHY-PriorityIndes is for DG. |
| Sequans | y |  |
| Nokia | No | We thought it is easier to apply this equally to both dynamic grants and configured grants. Also some UEs may not support allowedCG-List. However, if we’re the only ones with concerns, we’re OK to go with majority view. |
| Ericsson | No | It is useful to introduce *allowedPHY-PriorityIndex* for CG. This restrictive mapping between CG and LCH can also be used by the network to steer the traffic to the intended CG configuration (note that the traffic arrival at gNB might have jitter). Furthermore, not applying such LCP restriction to CG will result in further complication in the specification, i.e. extra conditions would be required. Lastly, there seem to be no technical reasons against restricting the *allowedPHY-PriorityIndex* to dynamic grants. Similar to Nokia, we are also fine to go with majority view. |

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| **Phase 1 summary: Although two companies do not agree, they are fine to go with the majority view. Thus, we propose that proposal 3 is “an easy agreement”.** |

## 2.2 Multiple SPS/CG enhancements

### 2.2.1 When multiple entry CG confirmation MAC CE can be generated

The following FFS are noted in MAC running CR R2-2001487:

|  |
| --- |
| Editor’s Note: When Multiple Entry Configured Grant Confirmation MAC CE is generated is FFS. |

It needs to be specified in which cases the multi entry CG MAC CE is used, in particular when there is only one configuration and also the legacy single-entry MAC CE could be used instead. The options are:

Option 1: Couple with configuredGrantConfigList-r16 configuration. [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2000789](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000789.zip)

Option 2a: When there are at least two CG indices configured [R2-2001290](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001290.zip)

Option 2b: When there are at least two CG pending for confirmation [R2-2001555](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001555.zip)

Option 3: Couple with Type 2 CG configured with ConfiguredGrantConfigIndexMAC [R2-2001489](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001489.zip)

Option 4: The multiple entry CG confirmation MAC CE shall be used in case the UL grant for new transmission can accommodate the MAC CE plus its subheader. [R2-2001461](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001461.zip)

It is our understanding [R2-2001489](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001489.zip) does not prefer option 2 above and its proposal option 3 is in principle closer to option 1. We propose to go forward with the simplest option with a majority view, i.e. option 1, that conditioned Rel-16 MAC CE usage with using the Rel-16 configuration for multiple configured grants.

1. If *configuredGrantConfigList-r16* is configured in the MAC entity, the multiple entry configured grant confirmation MAC CE is always used.

We have identified that proposal 4 needs further discussion and companies can provide feedback below

|  |  |  |
| --- | --- | --- |
| Company | Support P4 (y/n) | Additional comments |
| LG | y |  |
| Qualcomm | y |  |
| OPPO | y | Multiple CG confirmation MAC CE is introduced for the scenario that multiple CGs are configured. Thus, option1 may be the most straightforward way on choosing R15 or R16 MAC CE. |
| Samsung | y | We prefer option 3. But we are ok with option 1. |
| Docomo | yes | We prefer option2a, but fine with option1 |
| Spreadtrum | y | Option1 is a straightforward and clear way. |
| CATT | y | Safest and simplest approach |
| MediaTek | Y |  |
| Huawei | y |  |
| Sequans | y |  |
| Nokia | y |  |
| Ericsson | y |  |

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| **Phase 1 summary: All companies agree, and we propose that proposal 4 is “an easy agreement”.** |

Another open issue is when the multi CG MAC CE is generated. Related aspects are discussed in [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2001428](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001428.zip), [R2-2001461](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001461.zip), [R2-2001489](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001489.zip). In summary it is proposed:

1. As in legacy, the multiple entry configured grant confirmation MAC CE is generated if 1) the MAC entity has UL resources allocated for new transmission; 2) there is at least one triggered but not cancelled confirmation.

### The priority of multiple entry CG confirmation MAC CE

The following FFS are noted in MAC running CR R2-2001487:

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| Editor’s Note: It is assumed that Multiple Entry Configured Grant Confirmation MAC CE has the same priority with Confirmation Grant Confirmation MAC CE in this version. The confirmation of this assumption may be needed. |

Since the multiple entry confirmation MAC CE will not be generated together with the single entry, it is okay to assume that they have the same priority. This is also discussed in [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2001290](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001290.zip), [R2-2001428](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001428.zip). [R2-2001489](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001489.zip), Thus, it is proposed:

1. Confirm that Multiple Entry Configured Grant Confirmation MAC CE has the same priority as Confirmation Grant Confirmation MAC CE.

### Detailed contents for multiple entry CG confirmation MAC CE

The following FFS are noted in MAC running CR R2-2001487:

|  |
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| Editor’s Note: In the current version of the running CR, fixed size MAC CE of four octets is assumed as an example. The format in detail should be discussed and updated later.Editor’s Note: It is an FFS whether this MAC CE has a fixed size or not.Editor’s Note: In the current version of the running CR, it is assumed that this MAC CE reports confirmation of type 2 configured grants. |

The following FFS are noted in RRC running CR R2-2001657:

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| Editor’s note: FFS the maximum length of the allowedList, i.e., the maximum number of configured grant configurations per MAC entity. |

When it comes to the maximum number of configured grant configurations per MAC entity, the following options are proposed:

Option 16 [R2-2001290](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001290.zip)

Option 32 [R2-2001428](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001428.zip)/[R2-2001429](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001429.zip), [R2-2001613](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001613.zip), [R2-2000789](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000789.zip), [R2-2001489](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001489.zip)

Option 48 [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip)

Option 64 [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2000430](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000430.zip)

Note, in one MAC entity there can be multiple cells with each up to four dedicated BWPs, each can have up to 12 CG configurations. For maximum flexibility in scheduling CGs among those BWPs and cells, in order to support a high number of TSC traffic flows, a large number is preferable. On the other side, the number is limited by UE implementation feasibility, and furthermore a smaller number would decrease the size of the MAC CE for CG confirmation. Given options above, it is proposed to go forward with the compromise of 32.

1. Maximum 32 CG configurations per MAC entity.

We have identified that proposal 7 needs further discussion and companies can provide feedback below

|  |  |  |
| --- | --- | --- |
| Company | Support P7 (y/n) | Additional comments |
| LG | y |  |
| Qualcomm | Prefer 16, can live with 32 | 16 is sufficient: Majority of use cases applicable for Rel-16 timeframe are expected to support one URLLC flow. Even for use cases such as motion control use cases discussed in clause A.2.2.1 of TS 22.104, they involve multiple URLLC flows traversing a UE with identical traffic pattern (e.g., set points are sent to multiple actuators in one shot). Hence, such use cases do not necessarily require multiple configured grants. |
| OPPO | y |  |
| Samsung | y |  |
| Docomo | yes |  |
| Spreadtrum | y |  |
| CATT | n | We prefer 64 for maximum flexibility, as mentioned by the rapporteur. We don’t think the MAC CE confirmation size is an issue if it is not fixed size. |
| MediaTek | Prefer 16 | We agree with QC that 16 CG configurations are sufficient.  |
| Huawei | No, prefer 64. | We prefer 64. The signaling overhead is not issue as the confirmation won’t happen often. On the other hand, We need large number of CGs to alleviate traffic and resource periodicity misalignment issue as now we don’t have other means.  |
| Nokia | y | We proposed to support more, but 32 is OK as well. We are not OK with less than 32. |
| Ericsson | y |  |

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| **Phase 1 summary: Compromises are needed.****Maximum 16 CG configuration per MAC entity – 2 companies indicate preference; 1 company indicate Not okay****Maximum 32 CG configuration per MAC entity – 8 companies indicate preference.****Maximum 64 CG configuration per MAC entity – 2 companies indicate preference.** |

The size of the MAC CE for multiple CG confirmation must include the maximum number of CG configurations per MAC entity. It can be of fixed size, i.e. always up to maximum number, or variable size, including e.g. only configured CG configurations. The options discussed are:

Variable size: [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip)

Fixed size: [R2-2000430](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000430.zip), [R2-2001290](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001290.zip), [R2-2001428](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001428.zip), [R2-2001489](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001489.zip), [R2-2000789](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000789.zip)

In summary, it is proposed to agree on the majority view and introduce a fixed size MAC CE of size 4 bytes to cover the 32 proposed configurations.

1. MAC CE for CG configuration has fixed size of 4 bytes.

We have identified that proposal 8 needs further discussion and companies can provide feedback below

|  |  |  |
| --- | --- | --- |
| Company | Support P8 (y/n) | Additional comments |
| LG | y |  |
| Qualcomm | y  | Assuming P7 is agreed. |
| OPPO | y | It is a simplest and sufficient way. |
| Samsung | y |  |
| Docomo | yes |  |
| Spreadtrum | y | If maximum 32 CG configurations per MAC entity is agreed. |
| CATT | n | Considering the bits of type-1 CGs are unused, and not all CG IDs are used, there is lot of room for easily concatenating the bitmap based on the current CGs configuration and therefore reducing the MAC CE size, for example:CGi: This field indicates whether PDCCH indicating activation or deactivation of configured uplink grant I has been received where i is the ascending order of the type 2 configured grant configurations in *configuredGrantConfigList-r16* |
| MediaTek | Y | Agree that the MAC CE should be a fixed size. If P7 is agreed, 4 bytes is appropriate. |
| Huawei | N | We prefer fixed size of 8 bytes see our comments for P7.  |
| Nokia | Y | In case we support up to 32 CGs, fixed size is OK. |
| Ericsson | Y |  |

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| --- |
| **Phase 1 summary: Propose to discuss together with P7.** **11 companies provide views. One company prefers a variable size. One company prefers a fixed size of 8 bytes. Two companies agree, if P7 is agreed, All the remaining companies are fine with this.**  |

The question is whether CG confirmation MAC CE applies also for type 1 confirmation, or what entries in the MAC CE related to type 1 mean. This is discussed in [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2000789](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000789.zip), [R2-2001613](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001613.zip), [R2-2001489](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001489.zip), confirming:

1. Confirm that multiple entry configured confirmation MAC CE only confirms configured grant type 2 configurations and other entries can be ignored.

### SFN misalignment for CG type 1

This topic was summarized in the last meeting in R2-1916527, but was postponed. The majority of companies are fine with the option 2 in R2-1916527 and summarized in the following two proposals.

In [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip), [R2-2000431](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000431.zip), [R2-2000697](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000697.zip) the following is proposed:

1. For Type-1 CG, after receiving the configuration, UE should first identify the lowest N value corresponding to the nearest available CG occasion, then, N is incremented after each CG occasion starting from the N identified in the first step.

The same problem is discussed but with an alternative proposals in [R2-2001627](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001627.zip).

For the previous proposal, the following new field is proposed in [R2-2001627](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001627.zip), [R2-2001498](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001498.zip)(optional), [R2-2001428](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001428.zip), [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip), [R2-2000697](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000697.zip), [R2-2000431](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000431.zip).

1. Introduce *timeReferenceSFN* in RRC CG type 1 configuration.

The paper [R2-2000789](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000789.zip) proposes an alternative solution in which the *timeDomainOffset* is extended to 5120\*16-1 with three extra bits (compared to Proposal 11) to indicate the whole range of the HFN. This solution aligns the resource allocation of type 1 to type 2 CG and SPS, with no change on the MAC formula. A simlar principle is mentioned in the paper [R2-2001498](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001498.zip).

One company (that hasn’t submitted any contributions to this topic) indicates during the pre-meeting email discussion that the issue can be resolved by gNB implementation, as the option 1 in the summary R2-1916527.

The above two proposals are bundled together to solve the issue, and we propose to discuss them together. These two proposals need further discussion and companies can provide feedback below

|  |  |  |
| --- | --- | --- |
| Company | Support P10,11 (y/n) | Additional comments |
| LG | y |  |
| Qualcomm | y |  |
| OPPO | y | Introduce *timeReferenceSFN* in RRC CG type 1 configuration is a simpler and clearer option. |
| Samsung | y |  |
| Docomo | yes |  |
| Spreadtrum | y |  |
| CATT | y |  |
| MediaTek | Y |  |
| Huawei | y |  |
| Sequans | Y | Agree with P10, though for us same is achieved by just removing “Nth”.P11 is also preferred that *timeDomainOffset* keeps the existing meaning which is to indicate an offset within the periodicity (this is why it is defined up to 640ms which is the maximum periodicity). |
| Nokia | Y |  |
| Ericsson | N | We still think the alternative proposals in the paper [R2-2000789](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000789.zip) is better, since it results in a more straightforward MAC/RRC spec with a three-bit RRC signalling overhead in a not-very-often type 1 (re)-configurations. Nevertheless, we are also fine if majority companies support the other option.  |

|  |
| --- |
| **Phase 1 summary: Although one company does not agree, it is fine for them to go with the majority view. Thus, we propose that proposal 10,11 are “easy agreements”.** |

## 2.3 Open issues to complete the spec

### 2.3.1 Simultaneous configuration of type 1 on UL and SUL

Simultaneous configuration of type 1 CG for UL and SUL is discussed related to open issue noted in RRC-running CR R2-2001657

Editor’s note: FFS: WHETHER we follow the legacy restriction that the configured grant *type1* can only be configured for either or SUL, OR the configured grant *type1* can be configured for both UL and SUL.

The paper [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip) proposes that different configurations can be configured for UL and SUL. This is the assumption by the RRC rapportuer in the RRC running CR discussion and possibly also in the papers [R2-2000429](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000429.zip) and [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip). Thus, to make the discussion clear, we propose to confirm that

**Proposal 12a When multiple configured grant configurations per BWP is supported, different configured grant type 1 configurations can be configured in UL and SUL.**

The following options to solve this open issue are being discussed:

Option 1: UL and SUL can be configured simultanously.

 [R2-2000111](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000111.zip), [R2-2000429](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000429.zip)

Option 2: UL and SUL cannot be configured simultanously

 [R2-2001049](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001049.zip)

Some technical concerns are mentioned in the R2-20001049. Since this is a configuration option anyway, we propose to go with the majority view

**Proposal 12b When multiple configured grant configurations per BWP is supported, the same configured grant type 1 configuration can be configured for both UL and SUL.**

We have identified that proposal 12b needs further discussion and companies can provide feedback below

|  |  |  |
| --- | --- | --- |
| Company | Support P12b (y/n) | Additional comments |
| LG | y |  |
| Qualcomm | n | Update: we have updated our views on this.We share views expressed by MediaTek and Nokia below. |
| OPPO | n | It is unclear why we need to support the same configuration. |
| Samsung | y |  |
| Docomo | yes |  |
| Spreadtrum | y | We think it’s up to gNB implementation. |
| CATT | y |  |
| MediaTek | N | P12a is acceptable but not P12b. We do not see a reason to support the same configured grant configuration across NUL and SUL. CG configuration is defined for an UL, and should not be shared. Sharing the same CG ID across Uls will only lead to further confusion on the interpretation of the MAC CE, and impose the requirement to support twice as many CG configurations in a UE. |
| Huawei | y | We understand the same configuration as, more precisely, “overlapping CG 1 configurations on UL and SUL in time domain”. It could be handled e.g. by “intra-UE multiplexing” hence shall be allowed |
| Nokia | N | We need to at least disallow overlapping CG configurations on NUL and SUL. Since both UL and SUL are always active, then it would be unclear which uplink configuration and which CG configuration would be used by the UE at a time. |
| Ericsson | N | Agree with MediaTek and Nokia on complexities to support this feature.@Huawei. We are not sure if we have considered the dimension of NUL/SUL in the intra-UE discussion. |

|  |
| --- |
| **Phase 1 summary: 6 companies agree, while 5 companies do not agree. As some more arguments are provided by companies, we need further discussion.**  |

### 2.3.2 Naming of ”PHY-PriorityIndex”

[R2-2001429](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2001429.zip) propose to change the name of ”PHY-PriorityIndex” to ”Reliablity-PriorityIndex” to reflect its motivation. From RRC spec rapporterur point of view, we want techinques for a feature to be re-usable in other scenarios in later releases and prefer not to be restricted. One can refer MCS C-RNTI as an example. As there were no objections during the email discusison and this is proposed in the email discussion rapporterur summary [R2-2000785](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000785.zip) and paper R2-2000115**,** we propose to confirm that

**Proposal 13 Align the terminology and use name “phy-PriorityIndex” in TS 38.300, TS 38.321, TS 38.331 to indicate the priority of the grant/SR-source agreed by RAN1**

## 2.4 Other open issues

**Measurement gaps**

[R2-2000564](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000564.zip) proposes UE to transmit during the measurement gaps, since UE cannot transmit/receive during the measurement gap and it impacts the latency performance. However, there were other proposals before this meeting that even if allowing UE to send during measurement gap, it does not solve the issue for DL traffic and one simpler solution is to allow UE to be equipped with two radios. Therefore, we expect this topic to be contentious and unlikely to converge at e-Meeting.

**Confirmation MAC CE to indicate activation/deactivation status**

[R2-2000699](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000699.zip) proposes to change the confirmation from the reception of the DCI to activation/de-activation status. In addition, one company (that hasn’t submitted any contributions to this topic) indicates that they support the proposal in [R2-2000699](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000699.zip) and prefers further discussion. The proposal is motivated from the case that the network may send an activation DCI quickly followed by a deactivation DCI or vice versa. In this case, it is not clear the confirmation MAC CE is for the first or for the second DCI. We believe this can be avoided by network configurations that the network does not send two different DCIs closely in time, as it is not typical that network needs to activate and de-active one CG short in time. As a matter of fact, this was discussed in the MAC running CR and agreed among participant companies to go with the reception of the DCI.

Therefore, we expect this topic to be contentious and unlikely to converge at e-Meeting. One way-forward is to include this in an offline email discussion (if there is any) during the RAN2#109e.

**Burst arrival time**

[R2-2000790](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2000790.zip) proposes a clarification of the burst arrival time defined in SA2 TS 23.501. gNB uses burst arrival time to determine when it has received all payload for inclusion in the next periodic allocated resources (such as DL SPS, UL CG and UL dynamic grant) in support of the corresponding TSN streams. At the moment, the burst arrival time is defined as the beginning of the burst, while it is more beneficial for RAN to obtain from TSCAI a burst arrival time that refers to the end of the burst. Note that, multiple packets from the single TSN stream or an aggregated TSN streams can arrive within the burst.

As this is the first time this issue is identified, we propose to treat this in the next meeting.

# 3. Companies’ inputs on easy agreements in R2-2002091

The following proposals have an overwhelming majority support and are identified by the rapporteur as easy agreements in R2-2002091.

**Proposal 1 Confirm LCH configured with allowedCG-List is allowed to be mapped to dynamic grant**

**Proposal 2 LCH configured with allowedPHY-PriorityIndex is allowed to be mapped to dynamic grant without any priority indication only in case the configuration allows it to be mapped on low priority grant.**

**Proposal 5 As in legacy, the multiple entry configured grant confirmation MAC CE is generated if 1) the MAC entity has UL resources allocated for new transmission; 2) there is at least one triggered but not cancelled confirmation.**

**Proposal 6 Confirm that Multiple Entry Configured Grant Confirmation MAC CE has the same priority as Confirmation Grant Confirmation MAC CE.**

**Proposal 9 Confirm that multiple entry configured confirmation MAC CE only confirms configured grant type 2 configurations and other entries can be ignored.**

**Proposal 12a When multiple configured grant configurations per BWP is supported, different configured grant type 1 configurations can be configured in UL and SUL.**

**Proposal 13 Align the terminology and use name “phy-PriorityIndex” in TS 38.300, TS 38.321, TS 38.331 to indicate the priority of the grant/SR-source agreed by RAN1**

Companies can provide comments below on which proposal is not acceptable and the reason.

|  |  |  |
| --- | --- | --- |
| Company | Proposal number | Why? |
| LG | Proposal 9 | Proposal 9 depends on what is indicated by the Multiple Entry CG Confirmation MAC CE. If the MAC CE indicates activation/deactivation status of each CG, there is no entry that can be ignored. |
| OPPO | Proposal 9 | We agree that confirmation MAC CE only confirms CG type2. But we would like to clarify: no additional specification is needed for the text of “**other entries can be ignored**”, right? |

|  |
| --- |
| **Phase 1 summary: There are only concerns for proposal 9 and companies are okay with all others. Thus, Proposal 1, 2, 5, 6, 12a, 13 are “easy agreements”.** **OPPO question is further clarified on the RAN2 email reflector and they are fine with proposal 9 (the answer is added here for completeness)***Further clarification may not be needed. If we do not specify how to do it for other entries, MAC entity’s behavior is not specified in the spec and UE will simply ignore it.* **On proposal 9, only one company is not okay.**  |

# 4. Other issues

Companies can identify further issues to be discussed at this email discussion:

|  |  |
| --- | --- |
| Issue number | Proposal company and description |
| 1 | [LG, OPPO] Confirmation MAC CE to indicate activation/deactivation status |
| 2 |  |

Companies can provide comments on the above indicated issue

|  |  |  |
| --- | --- | --- |
| Company | Issue number | Support or not, comments and etc. |
| LG | 1 | The Multiple Entry CG Confirmation MAC CE should contain the activation/deactivation status of each CG. Otherwise, if the MAC CE confirms reception status of DCI, there is no point of introducing multiple entries in confirmation MAC CE because the confirmation MAC CE would require only 1 entry in most cases. |
| OPPO | 1 | We support to reconsider the definition of CGi in confirmation MAC CE. As we mentioned in R2-2000699, there still is some ambiguity even though we rely on PDCCH reception, if supporting the delivery of multiple DCIs associated to the same CG before UE feedback. |

|  |
| --- |
| **Phase 1 summary: Two companies have indicated interests to further discuss confirmation MAC CE to indicate activation/deactivation status. This will be covered by the phase 2 discussion.** |

# 5 Phase 1 Conclusion

Easy agreements with no objection:

**Proposal 1 Confirm LCH configured with allowedCG-List is allowed to be mapped to dynamic grant**

**Proposal 2 LCH configured with allowedPHY-PriorityIndex is allowed to be mapped to dynamic grant without any priority indication only in case the configuration allows it to be mapped on low priority grant.**

**Proposal 3 allowedPHY-PriorityIndex restriction applies only to dynamic grants.**

**Proposal 4 If configuredGrantConfigList-r16 is configured in the MAC entity, the multiple entry configured grant confirmation MAC CE is always used.**

**Proposal 5 As in legacy, the multiple entry configured grant confirmation MAC CE is generated if 1) the MAC entity has UL resources allocated for new transmission; 2) there is at least one triggered but not cancelled confirmation.**

**Proposal 6 Confirm that Multiple Entry Configured Grant Confirmation MAC CE has the same priority as Confirmation Grant Confirmation MAC CE.**

**Proposal 10 For Type-1 CG, after receiving the configuration, UE should first identify the lowest N value corresponding to the nearest available CG occasion, then, N is incremented after each CG occasion starting from the N identified in the first step.**

**Proposal 11 Introduce timeReferenceSFN in RRC CG type 1 configuration.**

**Proposal 13 Align the terminology and use name “phy-PriorityIndex” in TS 38.300, TS 38.321, TS 38.331 to indicate the priority of the grant/SR-source agreed by RAN1**

Potential easy agreements with overwhelming majority view (only one objection). There are further concerns on these two proposals and we propose to further discuss in Phase 2

**Proposal 9 Confirm that multiple entry configured confirmation MAC CE only confirms configured grant type 2 configurations and other entries can be ignored.**

**Proposal 12a When multiple configured grant configurations per BWP is supported, different configured grant type 1 configurations can be configured in UL and SUL.**

# 6 Phase 2 discussion

## 6.1 MAC CE

When it comes to the maximum number of configured grant configurations per MAC entity, the following views are collected:

|  |
| --- |
| Maximum 16 CG configuration per MAC entity – 2 companies indicate preference; 1 company indicate Not okayMaximum 32 CG configuration per MAC entity – 8 companies indicate preference.Maximum 64 CG configuration per MAC entity – 2 companies indicate preference. |

The size of the MAC CE for multiple CG confirmation must include the maximum number of CG configurations per MAC entity. It can be of fixed size, i.e. always up to the maximum number, or variable size, including e.g. only configured CG configurations. The following views are collected on the proposal of a fixed size of 4 bytes:

|  |
| --- |
| 11 companies provide views. One company prefers a variable size. One company prefers a fixed size of 8 bytes. Two companies agree, if P7 is agreed. All the remaining companies are fine with this. |

From the Rapporteur’s point of view, for the maximum number of CG configurations per MAC entity, a compromise is needed. After collecting views during at-meeting, it seems to us that 32 configurations with a fixed MAC CE size is the only compromise to conclude the topic.

**Proposal 7 Maximum 32 CG configurations per MAC entity.**

**Proposal 8 MAC CE for CG configuration has a fixed size of 4 bytes.**

We would like to give another try and companies can provide comments below on which proposal is not acceptable and the reason. If you do, please also propose a way forward that would be acceptable for all (considering also the views collected in phase 1).

**Question 1: Which proposal is not acceptable?**

|  |  |  |
| --- | --- | --- |
| Company | P7/P8? | Rationale and way forward  |
|  |  |  |
|  |  |  |

There is only one objection to proposal 9 below

**Proposal 9 Confirm that multiple entry configured confirmation MAC CE only confirms configured grant type 2 configurations and other entries can be ignored.**

The concern is related with the issue raised in Section 4. We propose to resolve that first.

In the MAC running CR, the confirmation MAC CE confirms the reception status of the DCI. This was not explicitly agreed in the online meeting but discussed and agreed during MAC running CR discussion.

The rationale to support **confirmation MAC CE to indicate DCI reception** **status** is that

* Suppose network sends a re-activation command for an already activated CG configuration, to change the resource allocation, for example, TBS, MCS and etc. If MAC CE indicates CG activation/deactivation status, there is no way for the network to know whether this change of resource allocation is received since the CG is already activated.
* Multiple-entry confirmation MAC CE is also specified for LTE AUL confirmation MAC CE, in which if the bit is set to one, it means that the DCI is received.

There is another option that **confirmation MAC CE to indicate activation/deactivation status.** The rationale to support the alternative option is that

* The Multiple Entry CG Confirmation MAC CE should contain the activation/deactivation status of each CG. Otherwise, if the MAC CE confirms reception status of DCI, there is no point of introducing multiple entries in confirmation MAC CE because the confirmation MAC CE would require only 1 entry in most cases.
* As mentioned in R2-2000699, there still is some ambiguity even though we rely on PDCCH reception, if supporting the delivery of multiple DCIs associated to the same CG before UE feedback.

Since this was discussed in the MAC running CR, we believe majority of the companies are fine with the current running CR. Thus, we would like to ask if companies want to support the alternative option.

**Question 2: Do companies support the alternative option?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No ? | Additional comments |
|  |  |  |
|  |  |  |

## 6.2 Simultaneous configuration of type 1 on UL and SUL

The two candidate proposals are as below:

**Proposal 12a When multiple configured grant configurations per BWP is supported, different configured grant type 1 configurations can be configured in UL and SUL.**

**Proposal 12b When multiple configured grant configurations per BWP is supported, the same configured grant type 1 configuration can be configured for both UL and SUL.**

Suppose we have two configurations, denoted by index-a and index-b. In proposal 12a, it is meant to configure index-a in UL and index-b in SUL. In Proposal 12b, it is meant to configure index-a in both UL and SUL. Note that here we mean the MAC-entity level index *configuredGrantConfigIndexMAC* in RRC running CR.

As a reminder, here is an overview of SUL operation from TS 38.300.

In case of Supplementary Uplink (SUL, see TS 38.101-1 [18]), the UE is configured with 2 ULs for one DL of the same cell, and uplink transmissions on those two ULs are controlled by the network to avoid overlapping PUSCH/PUCCH transmissions in time. Overlapping transmissions on PUSCH are avoided through scheduling while overlapping transmissions on PUCCH are avoided through configuration (PUCCH can only be configured for only one of the 2 ULs of the cell). In addition, initial access is supported in each of the uplink (see clause 9.2.6). An example of SUL is given in Annex B.

During the phase 1 discussion, all companies support two different configurations. But proposal 12a itself is not confirmed due to a concern that if two CG Type 1 configurations on UL and SUL overlap in time-domain, UE can transmit on both PUSCH resources and so unclear which uplink configuration the UE would use. Note that, it is required that overlapping transmission on PUSCH are avoided through network scheduling per Stage 2 spec above.

We think the similar time-overlapping issue applies to CG type 2, e.g., one CG type 2 in UL and one CG type 2 in SUL, or one CG type 1 in UL and one CG type 2 in SUL. Thus, we have also included CG type 2 below

From the discussion papers, there are two candidate proposals to address this:

1. **Two CGs, one activated in UL and another activated in SUL, are not time-overlapping by network implementation.**
2. **Two CGs, one activated in UL and another activated in SUL, can be time-overlapping and handled by ”intra-UE prioritzation/multiplexing”**

Comments on the two options (if not clear) are welcome. As this is a field description in RRC, companies are also invited to provide views on how to capture.

**Question 3: Which option do companies support to address issue of time-overlapping resources in the proposal 12a?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/2 | Additional comments |
|  |  |  |

**Rapporteur proposal on proposal 12b**

Proposal 12b is controversial. We suggest understanding the issue better to resolve 12a first and do not treat the proposal 12b further at this meeting.

# 7 References

1. R2-2000111 Remaining issues for multiple CG configurations CATT
2. R2-2000429 Configured grant configurations for SUL serving cell Huawei, HiSilicon
3. R2-2000430 Discussion on the new CG type 2 confirmation MAC CE Huawei, HiSilicon
4. R2-2000431 Method to avoid confusion between UE and network for CG type 1 Huawei, HiSilicon
5. R2-2000564 Consideration on collision of measurement gap and TSN traffic Spreadtrum Communications
6. R2-2000697 SFN misalignment issue on periodicities of non-divisor of 10240ms OPPO
7. R2-2000699 Left issue on multiple entry confirmation MAC CE OPPO
8. R2-2000706 Support mapping LCHs configured with allowedCG-list to dynamic grant OPPO
9. R2-2000788 LCP restriction enhancement based on PHY priority indcation Ericsson
10. R2-2000789 SPS and CG remaining MAC aspects Ericsson
11. R2-2000790 TSC AI clarifications: meaning of arrival time Ericsson
12. R2-2000791 Draft LS: TSC AI clarifications for arrival time Ericsson
13. R2-2001049 Remaining issues on TSC scheduling Nokia, Nokia Shanghai Bell
14. R2-2001171 LCP restrictions in IIoT Intel Corporation
15. R2-2001290 Open issues in Scheduling Enhancements Qualcomm Incorporated
16. R2-2001428 Remaining Issues for Multiple SPS-CG enhancements CMCC
17. R2-2001429 Remaining Issues for LCP restrictions CMCC
18. R2-2001461 The considerations on scheduling enhancement ZTE Corporation, Sanechips
19. R2-2001476 TP on IIoT Running RRC for Scheduling Enhancements CMCC
20. R2-2001489 Remaining Issues on CG Confirmation MAC CE Samsung
21. R2-2001493 LCP Restriction for allowedCG-List and allowedPHY-PriorityIndex Samsung
22. R2-2001498 Type 1 Configured Grant with Integer Periodicity Samsung
23. R2-2001555 Consideration on multiple entry CG confirmation MAC CE LG Electronics Inc.
24. R2-2001613 Multiple Entry Configured Grant Confirmation MAC CE Intel Corporation
25. R2-2001627 Impact of CG/SPS with periodicities non dividing HF length Sequans Communications
26. R2-2000785 Remaining minor issues in [108#32][IIoT] Running CR 38.331 Ericsson
27. R2-2001033 Remaining issues on Configured Grant, Huawei
28. R2-2000845 On UL intra-UE prioritisation, MediaTek Inc.
29. R2-2001289 Open issues in Intra-UE prioritization, Qualcomm
30. R2-2001029 L1-priority applies for CG Lenovo, Motorola Mobility
31. R2-2000115 Remaining issues for intra-UE multiplexing and prioritization CATT
32. R2-2002091, Summary on Scheduling Enhancement for IIoT (6.7.2.2), Ericsson