3GPP TSG-RAN WG1 Meeting #105-e Tdoc R1- 2106047

E-meeting, May 10th – 27th, 2021

Agenda Item: 8.3.2

Source: Moderator (Ericsson)

Title: Summary#4 - Enhancements for IIOT/URLLC on Unlicensed Band

Document for: Discussion, Decision

# 1 Introduction

This document that is updated version of R1-2106046, summarizes the discussion during RAN1#105-e under the following email thread assigned by Mr. Chairman:

[105-e-NR-R17-IIoT-URLLC-03] Email discussion on enhancements for unlicensed band URLLC/IIoT – Sorour (Ericsson)

* 1st check point: 5/21
* 2nd check point: 5/25
* Final check: 5/27

During GTW on Tuesday, May 25th, the following agreements were made. Due to these agreements, the discussion topics of sections 2.1 and 2.2 are concluded for this meeting. During the last/third round of the discussion, the remaining issues in section 2.3 can be discussed for further progress.

Agreement:

* **Option 1 is taken in the following agreement:**

***Agreement:***

*Down-select one of the following options (target RAN1#104-e):*

* ***Option 1:*** *Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16.*
* ***Option 2-a:*** *“CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and cg-RetransmissionTimer-r16, respectively.*
  + *If cg-RetransmissionTimer-r16 is configured, “CG-UCI based procedures” should also be enabled by X.*
* *Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE.*
* *Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions*
* **Alt-a is taken in the following agreement:**

*Agreement:*

*In semi-static channel access mode when a UE can operate as UE-initiated COT,*

* *Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:*
  + ***Alt-a:*** *If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT*
  + ***Alt-b:*** *The UE assumes that the configured UL transmission corresponds to UE-initiated COT..*
* **Alt-a is taken in the following agreement:**

*Agreement:*

*In semi-static channel access mode when a UE can operate as initiating device,*

* *Select one of the following alternatives to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT:*
* *Alt-a: Determination based on the content in the scheduling DCI*
  + *FFS on whether the corresponding field(s) can be absent in DCI*
    - *If absent, determination based on the rules applied for configured UL transmissions is applied*
  + *FFS whether/how to handle the case when the gNB schedules an UL transmission in the next gNB’s FFP period*
  + *Alt-b: Determination based on the rules applied for a configured UL transmission*

# 2 Discussion topics

## 2.1 Harmonization w.r.t NR-U and URLLC CG

The topic of CG harmonization of NR-U and URLLC features developed in Rel-16 (excluding PUSCH repetition) has been discussed in previous meetings where the companies view in RAN1 have been categorized by 4 options as listed in the agreement in RAN1#103-e. Meanwhile RAN2 made some agreements on this topic with a disclaimer that the corresponding agreement is from RAN2 perspective.

The discussions in RAN1 in the last meeting concluded in down-selecting to two options, i.e. **Option 1 and Option 2a**.

|  |
| --- |
| **Agreements (RAN1#103-e):**  Down-select one of the following options (target RAN1#104-e):   * **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*. * **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively. * **Option 2-b:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and new parameter Y, respectively, where X and Y are different from *cg-RetransmissionTimer-r16.* * **Option 3:** CG-UCI based procedures are supported for unlicensed. CG-DFI based procedures are enabled or disabled for unlicensed using one RRC parameter *i.e. cg-RetransmissionTimer-r16* * Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE. * Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions.   **Agreement (RAN1#104bis-e):**   * Option 2-b and option 3 are not considered further for the agreement in RAN1#103-e regarding CG harmonization |

**Agreements (RAN2#112-e):**

**From RAN2 perspective**

1 It is assumed that LBT failures only happen infrequently in UCE (unlicensed controlled environment). A formal definition of UCE and its relationship to semi-static or dynamic access mode is not necessary in RAN2 specifications.

2 cg-RetransmissionTimer can be configured optionally for shared spectrum

3 When cg-RetransmissionTimer is configured, Rel-16 NR-U mechanism is used for HARQ process ID and RV selection.

4 When cg-RetransmissionTimer is not configured, Rel-16 URLLC mechanism may be used for HARQ process ID and RV selection.

5 As a baseline, HARQ processes sharing between multiple CGs are allowed when cg-RetransmissionTimer is configured as in Rel-16 NR-U.

6 HARQ processes sharing between multiple CGs are not allowed when cg-RetransmissionTimer is not configured.

7 FFS if LCH based prioritization can be configured with *cg-RetransmissionTimer*

8 The assumption for Rel-16 is that the network will not configure *autonomousTx and cg-RetransmissionTimer* simultaneously per cell. No optimizations will be pursued to allow the two features be configured together in Rel-16. No CR is needed for this for now.

9 If a configured grant is deprioritized and/or gNB didn’t get it (e.g. LBT failure and/or tx failure) then we should be able to autonomously re-transmit it. FFS how to achieve it (using existing mechanisms should be considered as baseline)

Table 1 shows the comparison between these two options with respect to the corresponding RRC parameters where Case#2 and Case#3 are the cases that the two options differ.

* Case#2:
  + Companies in favor of Option 1 argue that Case#2 is not well motivated and creates complications with respect to specifications and corresponding UE features. Companies in favor of Case#2 argue that CG-DFI is used to provide HARQ-ACK feedback and is thus more closely related to the CG retransmission timer. Therefore, CG-UCI and CG-DFI should be configured independently. On the other hand, CG-DFI and CG retransmission timer are complimentary and can be configured together.
    - Moderator observes that few proponents of Option 2a discard Case#2 and only consider Case#1,Case#3&Case#4 (Apple, Intel).
* Case#3:
  + Companies in favor of Option 1 argue that Case#3 is not well motivated and creates complications with respect to specifications and corresponding UE features. They also argue delay reduction claims in case of misalignment on traffic arrival and CG configurations, can be handled by e.g. multiple CG configuration toa LCH or adjusting periodicity. Also, the COT sharing information is not well motivated in controlled environments. Proponents of Option 2a, argue that Case#3 reduces mis-alignment delay and even LBT delay due to UE’s freedom of choosing HARQ-ID and RV, or sharing a gNB COT in a transmission opportunity without waiting for a later transmission opportunity, and hence being more efficient and less complex than other solutions such as multiple CG configurations. They also argue that in controlled environments LBT failures may not be often, but still present and important to be handled for URLLC application and in that regard, COT information in CG-UCI is useful.

Table 1: Combination of features based on configurations of corresponding RRC parameters in respective options. Note: 0 means the feature is disabled/not configured, 1 means enabled/configured)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Combination cases | Applicable options | CG-UCI | CG-DFI | New RRC parameter X | cg-RetransmissionTimer-r16 |
| Case#1 | Option 1 & Option 2a | 0 | 0 | 0 | 0 |
| Case#2 | Option 2a | 0 | 1 | 0 | 1 |
| Case#3 | Option 2a | 1 | 0 | 1 | 0 |
| Case#4 | Option 1 & Option 2a | 1 | 1 | 1 | 1 |

**Moderator observations:**

* Reviewing the contributions shows that the companies’ preferences with respect to Option 1 and 2a has remained similar to previous meeting, as well as the arguments.
* It seems each group has different perspectives on complexity and gain assessments. At least, the arguments to support or NOT to support Case#3 have not been changed.
* It seems from Option 1 proponents’ perspective, Case#2 is the most problematic case. Meanwhile some of Option 2a proponents discard Case#2 as well.

## 2.1.1 Discussion – 1st round

**Proposal and summary of views:**

**Proposal 1-1**

**Agreement:**

Down-select one of the following options (target RAN1#104-e):

* **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*.
* **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively.
* Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE.
* Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions

**Companies’ preferences on Proposal 1-1 are summarized below:**

* **Option 1:**
  + Nokia/NSB, vivo, HW/HiSi, Ericsson, DCM, NEC, LG, CATT, Sharp, ZTE, MTK, ETRI, Spreadtrum, OPPO
* **Option 2a:**
  + QC, Intel, Samsung, Apple, IDC, Panasonic, Sony

|  |  |
| --- | --- |
| **Questions:**   * Q1: Companies are kindly requested to provide any update/correction of their position with respect to the Option 1 and Option 2a. * Q2: Do the proponents of Option 2a prefer to add the sub-bullet below to exclude Case#2 in Table 1 from Option 2a? * Q3: Do the proponents of Option 1 support Option 2a if Case#2 in Table 1 is excluded by adding the sub-bullet below? * Q4: Please provide any other comments if needed.   **Proposal 1-1(updated)**  **Agreement:**  Down-select one of the following options (target RAN1#104-e):   * **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*. * **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively.   + [If cg-RetransmissionTimer-r16 is configured, “CG-UCI based procedures” should also be enabled by X.] * Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE. * Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions | |
| **Company** | **Comment** |
| Sony | Q1: Still support Option 2a.  Q2: The original proposal in Option 2a already described the new sub-bullet. The original proposal did say that ”CG-UCI procedures” and ”CG-DFI procedures” are independently enabled/disabled by X and cgRetransmissionTimer-r16 respectively. The new sub-bullet can be a note, but it does not offer any more information than the original proposal. |
| Intel | Q1: We still support Alt. 2a  Q2: The additional sub-bullet is fine for us if the intention is to preclude Case #2. This is inline with our understanding that when the cg-RetransmissionTimer-r16 is enabled disabling the CG-UCI procedure does not add any technical value |
| HW/HiSi | Q1: We still support Option 1  Q2: We cannot agree with introducing a new parameter X and impact all the current RAN1/2 spec depending on the CG-RetransmissionTimer just to allow one new combination out of 4, especially that the benefit of this new combination (CG-UCI without CG-DFI and CG ReTX) is not evident while the benefits of early termination and saving dynamic overhead of the rescheduling UL grants are lost. In that new combination,  - If only COT sharing indication is desired while the remaining HARQ ID/RV/NDI are still tied to the CG-RetransmissionTimer, it is not justified to incur the dynamic overhead of CG-UCI in every PUSCH to achieve COT sharing while operating an unlicensed controlled environment. - If HARQ ID/RV/NDI are made to be tied to the X parameter, then the only benefit seems to multiplexing of TBs in a period (without early termination and CG ReTx) which in our view can be matched by configuring shorter CG periodicity or using multiple CGs.  Q3: No, as explained in Q2, we do not see the motivation to enable this new combination given the drawbacks, spec impact and misalignment with RAN2 understanding |
| Nokia/NSB | Q1: We still support Option 1  Q3: No. The benefits of this combination are questionable and do not justify the added complexity |
| Apple | Q2: We support adding the sub-bullet for Option 2a. Case #2 should be excluded because CG retransmission does not work properly if CG-UCI is not enabled. This concern on case #2 has been raised by many companies against Option 2a. As one of proponents for Option 2a, we do not intend to support case #2. |
| IDC | Q2: We are fine with adding the sub bullet to preclude Case #2. |
| CATT | Q1: We still support Option 1  Q3: No, the motivation of this combination need be clarified and for case 3, the benefit isn’t clear to us  One more comment for case 3, when CG-UCI based procedures are enabled but CG-DFI based procedures are disabled, NR-U autonomous ReTX does not apply since *cg-retransmissionTimer* is not configured. UE can’t be scheduled to retransmit the TB if decoding of CG-UCI is failure because gNB doesn’t know the HARQ process ID selected by the UE.  Anyway, both case 2 and case3 should be excluded in option2a so we should go with option 1. |
| vivo | Q1: We still support Option 1  Q3: No. The main usage of CG-UCI is to inform gNB about the NDI, HARQ ID and RV for autonomous retransmission. As seen in RAN2’s agreement, the CG-UCI is used when cg-RetransmissionTimer is configured.  RAN2 agreements  **3 When cg-RetransmissionTimer is configured, Rel-16 NR-U mechanism is used for HARQ process ID and RV selection.**  4 When cg-RetransmissionTimer is not configured, Rel-16 URLLC mechanism may be used for HARQ process ID and RV selection.  **5 As a baseline, HARQ processes sharing between multiple CGs are allowed when cg-RetransmissionTimer is configured as in Rel-16 NR-U.** |
| LG | Q1: We still support Option 1  Q3: No. We share the same view with other companies.  In case where CG-DFI and CG-ReTx-timer are disabled, we don’t think CG-UCI alone could work well, especially in terms of NDI signaling to differentiate initial TX and retransmission for a given HPN. |
| ZTE | Q1: We still support Option 1  Q3: Yes, we are also fine with the updated Option2a |
| ETRI | Q1: We still support Option 1  Q3: No. We share the view with other companies. |
| QC | Q1: Still support Option 2a.  Q2: We are fine with the sub-bullet adding to preclude Case #2. It is not helpful to disable the CG-UCI procedure when the cg-RetransmissionTimer-r16 is enabled. |
| Samsung | Q1: We still support Option 2a  Q2: OK to add the sub-bullet to exclude case #2. |
| Sharp | Q1: Support Option 1. |
| Asia Pacific | Q1: We support option 1.  Q3: No. Case 3 should also be excluded. |
| Panasonic | Q2: We support adding the sub-bullet for Option 2a. |
| DCM | Q3: We don’t agree with the updated Option 2a as it is. However, if the enabled CG-UCI includes COT sharing information only when cg-RetransmissionTimer is not configured, we support the proposal.  In this case, Rel-16 URLLC mechanism is used for HARQ process ID and RV selection, which is the same as Option 1. Indication of COT sharing information is useful irrespective of the configuration of cg-RetransmissionTimer. |
| Spreadtrum | Q3: NO. as same as other companies, we still think cg-retransmissionTimer enable CG-DFI but disable CGUCI cannot work well. |
| Moderator | **Companies’ preferences on Updated Proposal 1-1 are summarized below:**   * **Option 1:**   + Nokia/NSB, vivo, HW/HiSi, Ericsson, DCM, NEC, LG, CATT, Sharp, ZTE, MTK, ETRI, Spreadtrum, OPPO, Asia Pacific * **Option 2a:**   + QC, Intel, Samsung, Apple, IDC, Panasonic, Sony   **@DCM:** It seems to me that DCM is interested to have a case that only COT sharing information in CG-UCI is transmitted, under Option 1. It is not clear to me why the sub-bullet under Option 2a causes issue for the intended application. Please let me know if that I misunderstood.  **@All:** It seems companies’ positions have not changed. Proponents of Option 1 considers that Option 2a, even with excluding Case#2, is in conflict with RAN2 agreements, beside other arguments.  **@All: Considering the clarification above to DCM, let’s consider the updated Proposal 1-1 below and focus on concluding this proposal.**  **Proposal 1-1(updated)**  **Agreement:**  Down-select one of the following options (target RAN1#104-e):   * **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*. * **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively.   + If cg-RetransmissionTimer-r16 is configured, “CG-UCI based procedures” should also be enabled by X. * Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE. * Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions |

## 2.1.2 Discussion – 2nd round

**Companies’ preferences on Updated Proposal 1-1 are summarized below:**

* **Option 1:**
  + Nokia/NSB, vivo, HW/HiSi, Ericsson, DCM, NEC, LG, CATT, Sharp, ZTE, MTK, ETRI, Spreadtrum, OPPO, Asia Pacific
* **Option 2a:**
  + QC, Intel, Samsung, Apple, IDC, Panasonic, Sony

**Proposal 1-1(updated)**

**Agreement:**

Down-select one of the following options (target RAN1#104-e):

* **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*.
* **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively.
  + If cg-RetransmissionTimer-r16 is configured, “CG-UCI based procedures” should also be enabled by X.
* Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE.
* Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions

**Moderator observation/suggestion:**

* Companies’ position has not changed. Considering the observations/clarifications by Moderator in the previous section, let’s consider the updated Proposal 1-1 below and focus on concluding this proposal.

|  |  |
| --- | --- |
| **Questions:**   * Q1: Please provide any comments, including follow-up of discussion in previous if needed, or changes the status or suggestions to help to reach a consensus. | |
| **Company** | **Comment** |
| CATT | We are fine with updated proposal 1-1 |
| Sony | We are fine with updated Proposal 1-1. |
| HW/HiSi | As the moderator concluded, it is clear from the discussion and the views of the proponents of Option 2-a that Case 2 (disable CG-UCI procedures, enable CG-DFI and CG ReTx) is not beneficial and not intended. Therefore, we would like to further comment on Case 3 (enable CG-UCI procedures, disable CG-DFI and CG ReTx) based on the views provided so far.   * Besides that we disagree that COT sharing could be a strong motivation to introduce Case 3 given the WI’s objective of operation in unlicensed controlled environment, it should be understood that according to the definition of CG-UCI procedures in the agreement “*CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE,*” CG-UCI carrying only the COT sharing field should not be considered. The CG-UCI would at least carry the Rel-16 fields determined by the UE and this is applicable to all the options discussed/eliminated for that agreement. * It follows that, for Case 3 to be feasible, all the RAN1/2 spec related to UE determination of HARQ ID/RV/NDI based on the *cg-RetransmissionTimer*would would have to be switched to the new parameter X while the benefits of early termination, timely CWS adjustment, and CG ReTXs are disabled.   As such, Case 3 should offer a clear benefit in return of the spec effort and these lost benefits.  However, the only additional benefit seems to be multiplexing TBs in a CG period accompanied though with the problem of gNB not being able to reschedule the TB if the CG-UCI is not detected as pointed out by CATT. |
| Intel | We support the updated proposal 1-1. |
| Samsung | We support the updated proposal 1-1.  For URLLC, some URLLC traffic is very latency sensitive which more relies on the successful transmission of initial transmission. Therefore, we think reduced latency for initial transmission brought by CG-UCI is very important for better support of URLLC, even if when auto retransmission is disabled. Regarding HW’s comment for the lost benefit of timely CWS adjustment, it does not exist in FBE. |
| Panasonic | We support the updated proposal 1-1. |
| Moderator | **Companies’ preferences on Updated Proposal 1-1 are summarized below:**   * **Option 1:**   + Nokia/NSB, vivo, HW/HiSi, Ericsson, DCM, NEC, LG, CATT, Sharp, ZTE, MTK, ETRI, Spreadtrum, OPPO, Asia Pacific * **Option 2a:**   + QC, Intel, Samsung, Apple, IDC, Panasonic, Sony   **@All:** It appears from the discussion that for decision between Option 1 and Option 2a, to consider the updated Proposal 1-1. However, it seems companies are not convinced one way or another, to agree on one option. The proponents of Option 1 are not convinced of benefit of Case#3 for reduced latency specially in controlled environments, while proponent of Option 2a believe such a latency reduction, specially for initial transmission of CG-PUSCH is important. Companies RAN1/RAN2 spec impact with respect to Option 2a.  **@All:** Moderator status update/recommendation is as the following:   * Stable/no change /no consensus on Option 1 or Option 2a in update Proposal 1-1 * Moderator recommendation: Decision needed on Option 1 or Option 2a in update Proposal 1-1   **Proposal 1-1(updated)**  **Agreement:**  Down-select one of the following options (target RAN1#104-e):   * **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*. * **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively.   + If cg-RetransmissionTimer-r16 is configured, “CG-UCI based procedures” should also be enabled by X. * Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE. * Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions |
| Sharp | We support the updated proposal 1-1. |
| vivo | We support the updated proposal 1-1. For down-selection, we support option 1. |
| Apple | We support the updated proposal 1-1. |
| HW/HiSi | We support updated proposal 1-1. For down selection, we still support Option 1 for the reasons we mentioned earlier.  **In response to Samsung,** when we mentioned ’timely CWS adjustment’ among the benefits lost with Case 3 via Option 2-2 ”benefits of early termination, timely CWS adjustment, and CG ReTXs are disabled,” it is based on our understanding that the CG harmonization for operation in unlicensed controlled environment is for both LBE and FBE and not only for FBE. |
| ETRI | We are fine with the updated Proposal 1-1. For down-selection, we still support Option 1. |
| WILUS | We support the updated proposal 1-1. |
| Nokia/NSB | We are fine with the updated proposal 1-1, except that the meeting number should be 106-e, not 104-e.  For the alternatives, we still support Option 1. |
| IDC | We are fine with the updated proposal 1-1. |
| Moderator | **@Nokia:** Yes. Target has not been valid for multiple meetings. Perhaps we can leave it as it is and hopefully conclude this meeting. |
| Moderator | **@All:** Moderator status update/recommendation is as the following:   * Stable/no change /no consensus on Option 1 or Option 2a in update Proposal 1-1 * Moderator recommendation: Decision needed on Option 1 or Option 2a in update Proposal 1-1   **Companies’ preferences on Updated Proposal 1-1 are summarized below:**   * **Option 1:**   + Nokia/NSB, vivo, HW/HiSi, Ericsson, DCM, NEC, LG, CATT, Sharp, ZTE, MTK, ETRI, Spreadtrum, OPPO, Asia Pacific, WILUS? * **Option 2a:**   + QC, Intel, Samsung, Apple, IDC, Panasonic, Sony   **Proposal 1-1(updated)**  **Agreement:**  Down-select one of the following options (target RAN1#104-e):   * **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*. * **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively.   + If cg-RetransmissionTimer-r16 is configured, “CG-UCI based procedures” should also be enabled by X. * Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE. * Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions |
| Moderator | **The following agreement was made during GTW May 25th:**  Agreement:   * Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16. * Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE. * Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions   **The discussion in this section is concluded for this meeting.** |

## 2.2 COT-initiator determination for configured UL transmissions

During the last meeting, determination of ownership of a COT for a configured UL transmission was extensively discussed. In case of configured UL transmission, the determination rule is already agreed for transmission opportunities within a UE-FFP that occur after the UE-FFP. However, the determination rule for the transmission opportunities aligned with UE-FFP boundaries are yet to be decided. The discussion in the previous meeting resulted in narrowing down the options to two Alt-a and Alt-b as described in the agreement below:

Agreement:

In semi-static channel access mode when a UE can operate as UE-initiated COT,

* Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:
  + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT
  + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT.

**On determination of COT initiator**

* Alt-a: Companies arguments in favour of Alt-a include at least the following:
  + More flexibility and efficiency
  + Possibility for no LBT as apposed to Alt-b (always 9us LBT)
  + Protecting gNB idle period
  + Similar procedures as Rel-16
  + …
* Alt-b: Companies arguments in favour of Alt-b include at least the following:
  + UE power saving
  + More robust to (DL) mis-detection
  + Less dependency on DL for UL transmissions
  + More suitable for CG PUSCH w.r.t. UE knowledge of traffic arrival
  + No LBT not possible (due to implementation?)
  + …
* Alt-a/Alt-b:
  + for large UE-FFP periodicities (e.g., {4, 5, 10} ms) adopt Alt-a, and for small UE-FFP periodicities (e.g., {1, 2, 2.5} ms) adopt Alt-b.
    - Len/MOT
  + RRC configure between Alt-a/Alt-b
    - ETRI

**Moderator observations:**

* Reviewing the contributions shows that the companies’ preferences with respect to Alt-a and Alt-b has remained similar to previous meeting, as well as the arguments.
* It seems each group has different perspectives on complexity and gain assessments.
* A company (MOT/Len) suggested compromised solution based on FFP duration configuration to choose between Alt-a and Alt-b.
* Irrespective of decision for Alt-a or Alt-b, a separate discussion is needed to clarify the following since moderator observes different interpretations among the companies:

**Does the gNB need to terminate its ownership of a COT that is initiated in gNB FFP when a UE initiated a COT within gNB FFP? Please note that is different from colliding DL/UL transmission**

* + **No:** Ericsson, DCM, ETRI, Samsung, vivo (support design restriction)
  + **Yes:** Speadtrum, Intel?, FW?

## 2.2.1 Discussion – 1st round

**Proposals and summary of views:**

**Proposal 2-1:**

Agreement:

In semi-static channel access mode when a UE can operate as UE-initiated COT,

* Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:
  + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT
  + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT.

**Companies’ preferences on Proposal 2-1 are summarized below:**

* **Alt-a:**
  + Nokia/NSB, Intel, HW/HiSi, DCM, Futurewei, IDC, LG, WILUS, Panasonic, Sony, ZTE, MTK, Spreadtrum, OPPO, Sharp(2nd), ETRI(2nd)
* **Alt-b:**
  + QC, vivo, Ericsson, Samsung, Apple, CATT, Sharp(1st), ETRI(1st)
* **Alt-a/Alt-b:**
  + Lenovo/MOT: For large UE FFP, Alt-a, otherwise Alt-b
  + ETRI: RRC configure between Alt-a/Alt-b

|  |  |
| --- | --- |
| **Questions:**   * Q1: Companies are kindly requested to provide any update/correction of their position with respect to Proposal 2-1. * Q2: What is your view on the following question?   **Does the gNB by regulation need to terminate its ownership of a COT that has initiated for a gNB FFP, when a UE initiates a COT within that gNB FFP?**   * + Please note that is different from colliding DL/UL transmissions.   + In order to establish a common understanding on regulation, please share your understanding assuming there is no collision between UL and DL transmission. Also, assume all signalling aspects are handled. * Q3: Please share any other comments if needed. | |
| **Company** | **Comment** |
| Intel | Q1: We support Alt. a  Q2: The regulatory requirements do not provide any restrictions on whether a device should terminate the ownership of a COT once this is acquired: in fact, as it was pointed out a device could potentially operate at anytime as an initiating device, a responding device, or both. However, for the specific case of CG operation, if the UE initiates a COT and shares it with the gNB (i.e., CG-UCI contains information that the UE intends to share its COT), in this case the gNB must terminate its ownership at least for the duration of the u-FFP. |
| HW/HiSi | Q1: We still support Alt-a.  Q2: No, by regulations, the two are different initiating devices that can continue transmitting until their respective idle periods and one device can transmit in the idle period of the other inline with the conclusion made in the previous meeting  Conclusion:  - In semi-static channel access mode, a UE as an initiating device, is allowed to transmit during the idle period of any FFP associated with the serving gNB if the UE transmission is based on UE initiated COT  ○ Note: the gNB may disallow UL transmission during symbols of the idle period by configuring them either as semi-static DL symbols, or indicating them as DL with SFI. |
| FW | Q1: We still support Alt-a, the arguments presented so far were not convincing that an UE needs to start its own COT rather than remain in the COT of gNB, together with all other UEs.  Q2: First I would like to thank the moderator for her efforts in creating the summary and the NWM document. Regarding the Question 2, we would like to understand the reasons for this question. There are few things confusing. By ”terminate its ownership” should we understand that gNB terminates the COT prior to UE initiating its own COT? Our understanding is that this question is related to Proposal 2-1, in this case the question is a little bit misleading because it assumes that Alt-b is already accepted and UE follows it. Maybe the question should be rephrased to include the situation when gNB initiates a COT, sends a grant to UE for sharing the COT, then UE sends its scheduled transmission in gNB COT, and then UE has a UL configured transmission 5 during the same gNB COT. Should UE start its own COT in the first place? As the group already decided that gNB is in control of scheduling and decisions, the gNB should have priority over UEs and UEs should defer their COT to gNB. We think that a more relevant question related to the Alt-b is the following: For Alt-b, please clarify how the gNB during its initiated COT acknowledges (HARQ) an UL transmission from UE in a possible UE initiated COT when gNB COT and UE COT overlaps in time. Or equivalently how two initiating COT devices can communicate back and forth with each other during their overlapping COTs? |
| Apple | Q2: No, the gNB can continue to use its own COT even if a UE initiates a COT within the gNB’s COT. From regulation perspective, gNB and UE are considered as two devices. They can each initiate its own COT, and the COT can overlap. The mechanism to ensure the coexistence (no collision) is that each device needs to do the LBT before performing another transmission after stopping the transmission for a while. So there is no issue for two initiating devices to communicate back and forth, to answer the question raised by Futurewei. Regarding Intel’ comment that the gNB must terminate its COT if the UE initiates a COT and shares it with the gNB, we don’t know why this has to be the case. In our view, the gNB can continue to use its own COT (i.e. not sharing the UE’s COT) if it prefers. |
| Len/Mot | Q2: No. We think the COT association is per transmission, and we think the question is related to both configured grant and scheduled UL transmissions. BTW, not clear to us what “assume all signalling aspects are handled” means. |
| Nokia/NSB | Q1: We still support Alt-a  Q2: No. The regulations wrt COT are written from a single device perspective, and nothing forbids gNB and UE from initiating overlapping COTs. |
| CATT | Q1: We support Alt.b and we are also fine with supporting both Alt.a and Alt.b which can address different scenarios and is configurable  Q2: Yes, because it isn’t clear whether gNB transmission belongs to gNB initiated COT or sharing UE-initiated COT from UE perspective and from gNB perspective, it isn’t clear that UE transmission belongs to UE initiated COT or sharing gNB-initiated COT. |
| LG | Q1: We still support Alt-a  Q2: Before providing the opinion, I’d like to clarify the same question is also being asked for the opposite case, i.e., the UE by regulation need to terminate its ownership of a COT that has initiated for a UE FFP, when the gNB initiates a COT within that UE FFP.  Our view is that, even though there is no such restriction in the regulations, we could design in such way so that one of UE and gNB becomes COT initiator while the other becomes COT responder at a same timing as have designed so far, to avoid potential complication. |
| ETRI | Q1: We prefer Alt-b, or RRC configuration between Alt-a/Alt-b. We are also okay with Alt-a.  Q2: No, COT overlapping between two nodes is not forbidden based on ETSI regulation. |
| QC | Q1: Still support Alt-b. |
| Samsung | Q1: We still support Alt-b  Q2: No.  We share the similar view with Intel that the regulation supports device could potentially operate at any time as an initiating device, a responding device, or both, which means it can change per transmission. A COT initiated by UE can be overlapped with another COT initiated by gNB.  We don’t agree with Intel that gNB must terminate its COT if the UE initiates a COT and shares it with the gNB. gNB has freedom to use UE’s COT or use gNB’s COT, similar as LBE. |
| ZTE | Q1: We still support Alt-a  Q2: NO. There is no regulation forbidding gNB and UE to initiate overlapping COTs. |
| Asia Pacific | Q1: We support Alt-a.  Q2: No. Regulation does not require gNB to terminate its own COT. |
| OPPO | Q1: we support Alt-a |
| DCM | Q2: No, a node is allowed to use the initiated COT until the idle period of the FFP |
| Panasonic | Q2: No. In our view, in this case, both gNB and UE would be ”initiating device” (”initiating device” is the device that initiates COT in the definition of the regulation). According to the regulation (ETSI EN 301 893 section 4.2.7.3.1), there seems to be no description that a COT of initiating device is terminated by other devices. Then, we think that gNB does not need to terminate its ownership of a COT. |
| vivo | Q2: No, by regulations, there is no restrictions to terminate gNB’s ownership of a COT when a UE initiates a COT within that gNB FFP.  Q3: We would like to propose one compromised solution. Hope companies can consider it for progress. Since the main motivation for the objective of supporting UE initiated COT is for CG transmission, as the UE should more knowledge about the buffer status. So we would like to at least give the UE a chance to decide whether to share gNB’s COT or initiate its own COT.  **Compromised solution: Alta + Altb**   * **When a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, if CG-UCI is configured, UE can decide and inform gNB whether the CG transmission uses gNB initiated COT or UE initiated COT;** * **else if CG-UCI is not configured, Alt-a should be used.** |
| Sony | Q1: Still support Alt-a.  Q2: Yes. Otherwise, if both UE & gNB are COT initiator, it isn’t clear whether the UE can transmit in gNB’s FFP Idle Period and vice-versa.  Q3: On vivo’s compromise solution, does this mean the UE still needs to detect whether gNB has initiated a COT? If gNB did not initiate a COT, is there a need for UE to send this CG-UCI indication? |
| Sharp | Q2: No. I think this issue has been addressed in RAN1 104b-e meeting.  Q3: We can support the compromised solution proposed by vivo.  If CG-UCI is configured, via CG-UCI reporting the understandings on COT association between gNB and UE can be aligned. The potential misaligned understandings are considered as a drawback of Alt-a. |
| Moderator | **Companies’ preferences on Proposal 2-1 are summarized below:**   * **Alt-a:**   + Nokia/NSB, Intel, HW/HiSi, DCM, Futurewei, IDC, LG, WILUS, Panasonic, Sony, ZTE, MTK, Spreadtrum, OPPO, Asia Pacific, Sharp(2nd), ETRI(2nd) * **Alt-b:**   + QC, vivo, Ericsson, Samsung, Apple, CATT, Sharp(1st), ETRI(1st) * **Alt-a/Alt-b:**   + Lenovo/MOT: For large UE FFP, Alt-a, otherwise Alt-b   + ETRI: RRC configure between Alt-a/Alt-b   + Vivo:For UL with CG-UCI UE decides between Alta/Altb, otherwise Alta.     - Support: vivo, Sharp   **Companies’ view on Q2:**   * No: Intel, HW/Hi, Apple, Len/MOT, Nokia/NSB, LG, ETRI, Samsung, ZTE, Asia Pacific, DCM, Panasonic, vivo, Sharp * Yes: [CATT, Sony]   + Moderator: It seems the view is due to signalling aspects, not regulations.   **@CATT/Sony:** In my understanding what you refer to, is the signalling aspects that are part of the design. Please read also the explanations to others, e.g. FW. I hope it is clear now that from “regulation” point of view there is no restriction, but the eventual design may lead to restrictions.  **@LG:** To clarify, regulation is transparent, and the question is also applicable to the other side as you rightly pointed out. The reason for formulation like that was based on the descriptions in contributions. And completely agree that for design, we have to consider how gNB and UE properly communicate via implicit/explicit signalling.  **@Intel:** Interesting question. It makes me think that if the UE indicates to gNB to share the COT in CG-UCI, should the gNB follow UE or have the possibility to ignore? We need to discuss these signalling aspects.  **@FW:** Thank you for the good questions. The reason for question was not to be biased towards Alt-b, but rather to have a common understanding on regulations for the decision we make. I do agree that depending on the design and related signalling (implicit/explicit) between gNB and UE, the operation would be different from what regulation allows. Your questions (copied below) are [signalling] design related issue:  *For Alt-b, please clarify how the gNB during its initiated COT acknowledges (HARQ) an UL transmission from UE in a possible UE initiated COT when gNB COT and UE COT overlaps in time. Or equivalently how two initiating COT devices can communicate back and forth with each other during their overlapping COTs?*  I assume with overlapping COT, you don’t mean there is collision. My understanding of Alt-b is that if gNB detects UL transmission at the FFP boundary, it assumes UE initiated COT. For Alt-a, if gNB has already initiated COT, by detection of UL at UE FFP boundary within its FFP, assumes UEs shares its COT, otherwise assumes UE initiates its COT. And similarly, at the UE.  **@Sony:** Moderator’s understanding of the proposal is that for the case UE is configured with CG-UCI, UE would transmit anyway CG-UCI with PUSCH. If it doesn’t detect gNB initiated a COT, in that transmission can only indicate that UE initiated COT is used.  **@All:** With clarifications above on Q2, I hope all have the same understanding for the “regulations”. Please note that the communication between UE/gNB with explicit/implicit signalling is part of the 3gpp design as the task on our hands, which we continue to do so.  **@All:** On Alt-a and Alt-b Moderator observation is that the status has not changed. However, I would like to ask your view in the next round on **vivo’s compromised proposal**. I would like to mention that is seems the compromised proposal is only applicable to CG-PUSCH if CG-UCI is configured. For other configured UL transmission such as SR, PUCCH, as well as CG PUSCH without CG-UCI, Alt-a is applicable. Please vivo clarify if my understanding is incorrect.  **Proposal 2-1:**  Agreement:  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:   + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT   + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT.   **Vivo’s compromise Proposal 2-1:**  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * When a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP,   + if CG-UCI is configured, UE can decide and inform gNB whether the CG transmission uses gNB initiated COT or UE initiated COT;   + else if CG-UCI is not configured, Alt-a should be used. |

## 2.2.2 Discussion – 2nd round

**Companies’ preferences on Proposal 2-1 are summarized below:**

* **Alt-a:**
  + Nokia/NSB, Intel, HW/HiSi, DCM, Futurewei, IDC, LG, WILUS, Panasonic, Sony, ZTE, MTK, Spreadtrum, OPPO, Asia Pacific, Sharp(2nd), ETRI(2nd)
* **Alt-b:**
  + QC, vivo, Ericsson, Samsung, Apple, CATT, Sharp(1st), ETRI(1st)
* **Alt-a/Alt-b:**
  + Lenovo/MOT: For large UE FFP, Alt-a, otherwise Alt-b
  + ETRI: RRC configure between Alt-a/Alt-b
  + Vivo:For UL with CG-UCI UE decides between Alta/Altb, otherwise Alta.
    - Support: vivo, Sharp

**Proposal 2-1:**

Agreement:

In semi-static channel access mode when a UE can operate as UE-initiated COT,

* Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:
  + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT
  + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT.

**Vivo’s compromise Proposal 2-1:**

In semi-static channel access mode when a UE can operate as UE-initiated COT,

* When a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP,
  + if CG-UCI is configured, UE can decide and inform gNB whether the CG transmission uses gNB initiated COT or UE initiated COT;
  + else if CG-UCI is not configured, Alt-a should be used.

**Moderator observation/suggestions:**

* There is a common understanding on regulations where two devices can simultaneous be COT initiators.
* It is well understood that as part of design, explicit/implicit signalling is needed to communicate COT ownership between UE and gNB.
* The status has not changed, except **vivo’s compromised Proposal 2-1**.

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| **Questions:**   * Q1: Please provide your view on Vivo’s compromised Proposal 2-1. * Q2: Please provide any comments, including follow-up of discussion in previous if needed, or changes the status or suggestions to help to reach a consensus. | |
| **Company** | **Comment** |
| DCM | Thanks vivo for proposing a compromised solution. Regarding **”UE can decide and inform gNB whether the CG transmission uses gNB initiated COT or UE initiated COT”**, is it correct understanding that UE can decide either one of them without any conditions/restrictions? If yes, and gNB wants to transmit DL right after the CG-PUSCH reception, is it possible for gNB to decode the CG-UCI to determine LBT type before the DL transmission? |
| Apple | It is a bit unclear what concern the compromised proposal is trying to address. If it is just about gNB knows exactly whether the UL transmission is using gNB’s COT or UE’s COT, Alt-b can achieve it already. We would like to understand better the benefit of the compromise. |
| Samsung | Thanks vivo for the compromised solution. We also would like to better understand what concern the compromised proposal is trying to address.  Comparing with Alt-a, in our understanding, the compromised proposal can avoid the miss-alignment between gNB and UE. That is the benefit. But it seems UE can still prioritize its decision over gNB’s COT initiation (though Alt-b proponents support such behaviour), which is the mainly strong concern by Alt-a proponents.  Comparing with Alt-b, in our understanding, the compromised proposal can provide UE with more flexibility to initiate the COT or not. But it is unclear to us, what is the clear benefit for a UE to have such flexibility? For example, to avoid LBT? But as discussed in last meeting and in our tdoc, the chance of no LBT is very rare. Or, the benefit is, UE can decide whether drop the UL transmission overlapped with gNB idle period, or drop the UL transmission overlapped with UE idle period?  Besides, as commented by FL, CG-UCI is only applicable to CG PUSCH. So, it implies that other configured transmission, e.g. SR PUCCH cannot use Alt-b. SR PUCCH is also important for URLLC. Therefore, we think it is a bit restricted.  Furthermore, there was a long discussion on whether enable CG-UCI when cg retrnasmisison timer is not configured. If RAN1 finally agreed to always couple CG-UCI and cg retransmission timer together (we have strong concern on it), it seems Alt-a is used for most cases (because companies all think disabled cg\_retransmission timer is more typical in URLLC). No chance for UE itself to decide whether to initiate COT at all. We think it is undesirable. |
| vivo | Thanks a lot DCM, Apple and Samsung’s comments.  As you know, we also strongly support Alt-b for CG transmission. But, given current status, we stuck here. The purpose for the compromised solution is to support both Alt-a and Alt-b, it is not to address each Alternative’s concern. (Obviously, the proponents of Alt-a and Alt-b cannot convince each other, address each other’s concern for two meetings). For a CG transmission aligned with UE’s FFP boundary, UE should be the best entity to decide whether to use gNB’s COT or initiates its own COT. The compromised way is better than using RRC to configure either Alt-a or Alt-b, since by configuration, one Alt will be used for  all the cases.  **@DCM,** there is conditions on when UE can decide, that is CG-UCI is configured and CG resource is aligned with UE’s FFP boundary. If gNB would like to transmit DL right after the CG-PUSCH reception, gNB can decide whether to share UE’s COT or using its own COT for transmission. About LBT type, I am not sure I understand your question correctly, for this topic only FBE mode is used for gNB and UE.  **@Apple,** we also like Alt-b. The compromised solution is to support both Alt-a and b, since the Alt-a proponents would not agree support Alt-b only and Alt-b proponents would not agree support Alt-a only.  **@Samsung,** about the purpose for the compromised solution, see our views in the beginning. About the impact for DG, I agree with you there will be impact. If the compromised solution is agreed, then we need to update the Alt-b for DG case. |
| LG | First of all, thanks vivo for providing this proposal.  But, we agree with Samsung’s observations, especially in terms of limiting to CG-PUSCH only (differently from semi-static PUCCH), and differentiating between CG PUSCH and DG PUSCH.  Besides, one question is whether this proposal is also applicable to the CG PUSCH not aligned with UE FFP boundary, or whether the size of CG-UCI would be different according to whether the CG PUSCH is aligned or not with UE FFP boundary.  Another concern is that, considering another CG#2 closely placed after CG#1 aligned with UE FFP boundary, the gNB may not have enough time to decode CG-UCI in CG#1 to know how the CG#2 is transmitted from the UE (e.g. based on UE COT or gNB COT). |
| CATT | For the sake of progress, we suggestion modified compromise because CG-UCI isn’t always configured. Proposal 2-1 as below:  **CATT compromise Proposal 2-1:**  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * When a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, gNB initiated COT or UE initiated COT;   + if ~~CG-UCI~~ UCI (X) is configured, UE can decide and inform gNB whether the CG transmission uses gNB initiated COT or UE initiated COT;     - FFS : UCI (X)   + ~~else if CG-UCI is not configured~~ otherwise, Alt-a should be used. |
| ZTE | We are fine with vivo’s compromised proposal for the sake of progress. |
| Moderator | **Companies’ preferences on Proposal 2-1 are summarized below:**   * **Alt-a:**   + Nokia/NSB, Intel, HW/HiSi, DCM, Futurewei, IDC, LG, WILUS, Panasonic, Sony, ZTE, MTK, Spreadtrum, OPPO, Asia Pacific, Sharp(2nd), ETRI(2nd) * **Alt-b:**   + QC, vivo, Ericsson, Samsung, Apple, CATT, Sharp(1st), ETRI(1st) * **Alt-a/Alt-b:**   + Lenovo/MOT: For large UE FFP, Alt-a, otherwise Alt-b   + ETRI: RRC configure between Alt-a/Alt-b   + Vivo:For UL with CG-UCI UE decides between Alta/Altb, otherwise Alta.     - Support: vivo, Sharp, ZTE       * CATT(with additional modification)   **Proposal 2-1:**  Agreement:  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:   + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT   + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT.   **Vivo’s compromise Proposal 2-1:**  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * When a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP,   + if CG-UCI is configured, UE can decide and inform gNB whether the CG transmission uses gNB initiated COT or UE initiated COT;   + else if CG-UCI is not configured, Alt-a should be used.   **CATT compromise Proposal 2-1:**  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * When a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, gNB initiated COT or UE initiated COT;   + if ~~CG-UCI~~ UCI (X) is configured, UE can decide and inform gNB whether the CG transmission uses gNB initiated COT or UE initiated COT;     - FFS : UCI (X)   ~~else if CG-UCI is not configured~~ otherwise, Alt-a should be used |
| vivo | thanks a lot LG and CATT’s comments.  **@LG**, about your question, whether this proposal is also applicable to the CG PUSCH not aligned with UE FFP boundary, or whether the size of CG-UCI would be different according to whether the CG PUSCH is aligned or not with UE FFP boundary. For the CG PUSCH not aligned with UE FFP boundary, the agreement we made in RAN1#104-e meeting should be applied that is  “When a configured UL transmission starts after a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE:   * If the UE has already initiated the UE FFP, then UE assumes that the configured UL transmission corresponds to UE-initiated COT * Otherwise, If the transmission is confined within a gNB FFP before the idle period of that gNB FFP,and if the UE has already determined that gNB has initiated that gNB FFP, then UE assumes that the configured UL transmission corresponds to gNB-initiated COT.”   About the size of CG-UCI will keep the same and always Txed together with the CG-PUSCH once it is configured, regardless whether the CG PUSCH is aligned or not with UE FFP boundary. About your second concern, for CG#2, there is resource there, anyway gNB needs to detect it.  **@CATT**, we are fine with your modifications. We are open for the signalling design, X-UCI or CGUCI or other UCI. |
| Sony | Thanks for vivo’s compromised solution and effort to move this forward.  Is this indication in CG-UCI or UCI-X that tells the gNB whether the UE is the COT initiator/ownership when transmitting the UL PUSCH. a new indicator or is there already such an indicator?  If it is a new indicator, then although not our ideal preference, we can support CATT’s compromised proposal to move this forward from this stalemate. |
| vivo | **Reply to Sony**:  thanks for the comment. We are open for the signalling, either CG-UCI or X-UCI i.e., a new indicator is fine for us. :-)   * if it is CG-UCI, it can reuse the indicator of COT sharing information that already exists in CG-UCI. |
| Sony | **Reply to vivo:**  Thanks for the response. We are fine with CATT’s compromised proposal and can discuss the indicator later. |
| HW/HiSi | We appreciate vivo’s efforts in formulating a compromised proposal attempting to accommodate both Alta and Alt-b. We also thank CATT for their suggestion to address the limitation to PUSCH with CG-UCI.  Although the type of UCI is not our main concern with the compromised proposal, we wonder if it is implied that configuring other UL transmissions aligned with the UE FFP boundary yet not carrying UCI, such as periodic SRS, would be precluded. Could you please clarify?  In fact, our main concern with the compromised proposal is that it gives one UE the control to make a dynamic decision that could impact gNB’s ability to initiate a CO in a following gNB FFP regardless of the need of gNB to transmit in that following FFP.  In contrast, the benefit of introducing UE initiated CO is still fulfilled with Alt-a, without potential impact to gNB CO, in the sense that that the UE would be able to transmit in almost any of its configured FFPs according to its traffic needs by either sharing a gNB COT, or initiating its own COT if gNB did not initiate a preceding COT. |
| Intel | First of all, many thanks to both Vivo and CATT for the proposed compromised solutions. However, we share the same concerns as other companies: with both proposed solutions, we empower the UE from dynamically deciding whether it should operate as initiating or responding device, while this should be up to gNB. As highlighted by Huawei this would limit gNB’s scheduling capabilities and ability to initiated its own COT. Furthermore, from our understanding the option from Vivo would require additional explicit signaling from the UE to indicate whether this operates as initiating or responding device, which would  negatively impact overhead, and reliability.  Since at this point no convergence to a single alternative seems achievable, we would prefer to leave the choice of Alt-a or Alt-b up the gNB through UE-specific RRC signaling. |
| vivo | **Reply to HW:**  Thank you for your comments! The compromised proposal targets for CG transmission. For other configured UL transmissions, like PUCCH, SRS, Alt-a is used since gNB should well know where the UE will surely conduct the transmissions. But for CG, whether it will transmit at the configured CG resource and how long the transmission continues depends on UE’s buffer status, gNB may not know timely and sufficiently. So, for CG transmission, UE should have the chance to decide.  About your concern on “**it gives one UE the control to make a dynamic decision that could impact gNB’s ability to initiate a CO in a following gNB FFP”,** I think all proponents for Alt-b explained that UE initiated COT will not block gNB to initiate its own COT. With Alt-a, always sharing the gNB’s COT may not accommodate the CG traffic pattern well since UE needs to give up its CG transmission before gNB’s idle period; in addition, gNB may not know whether the UE will have CG to transmit or not, so it requires gNB always transmit something to occupy channel but the UE may not have CG data to transmit; thirdly, with Alt-a, we have concern on UE power consumption, and proponents of Alt-a claimed no need of LBT at UE side, but it is questionable on how to ensure the gap between the DL transmission and the UL transmission is less than or equal to 16 us.  Still I think proponents of Alt-a and Alt-b cannot convince each other. So, we should consider how to make the compromised option to solve the issue.  **Reply to Intel**  Thank you for your comments! I agree with you that gNB can control whether to give UE the right by configuring or not configuring the UCI-X. As for the blocking gNB to initiate its COT, I think this concern does not exist, as explained that there is no restriction on gNB since gNB can decide whether it will share or not share the UE-initiated COT. If gNB does not share, then gNB can transmit during the UE’s idle period if it transmits in the gNB-initiated COT. About the overhead and reliability, similar as CG-UCI, UCI-X is configurable. always share gNB’s COT will cause additional latency and reliability issue at UE side, since UE always needs to give up its CG transmission before gNB’s idle period even if UE has not finished its traffic transmission. By simply using RRC to configure as Alt-a or Alt-b is not flexible since for CG transmission in any situations, only one configured Alternative will be used. But I agree with your point that no convergence to a single alternative seems achievable, if majority like just using the RRC to configure Alt-a or Alt-b. We would be fine with it. |
| Samsung | Thanks vivo for further explanation, and thanks CATT for the updated compromised solution.  We better understand the motivation of the compromised solution now, but , sorry to say, we cannot support new UCI signaling for UE COT indication, which would require quite a lot additional standard effort, e.g. new signaling to configure new UCI, new UCI mapping rule, how to multiplex new UCI and other existing UCI, etc.  Though we still prefer Alt-b, we can live with RRC configuration between Alt-a and Alt-b to make progress. |
| Spreadtrum | Many thanks vivo and CATT for compromising alternatives. However, we cannot support this new UE COT sharing indication. Because it works for CG-PUSCH only, rather than all the configured UL transmission. for all the other configured UL transmission, we still have to do the choice between Alt-a or b. For example, gNB cannot know the status of SR on PUCCH, which is same as CG-PUSCH.  We can go with RRC configuration between Alt-a and Alt-b for progress. |
| LG | Q2: Considering the concern from Alt-b proponents that subsequent UL transmission after the configured UL is not guaranteed with Alt-a in some cases, we can consider the following way as a compromise.   * If the configured UL is confined within a gNB FFP before the idle period of that gNB FFP, and the interval between the gNB FFP starting and the configured UL is smaller than X (FFS), Alt-a is applied. * Otherwise, Alt-b is applied. |
| Moderator | **@All: Thank you** all for the continued efforts to have real discussions to understand/analyze the new proposals. Special thanks to vivo for proposing a new proposal and making efforts to answers the questions to provide more clarifications.  **@All:** Moderator tries to summarize the **c**ompromised **a**lternative (Alt-c) proposals. With respect to motivations/benefits of one Alt. or other, companies have clear vision.   * Alt-c1Compromised proposal based on CG-UCI (vivo):   + Applicable only to CG-PUSCH by reusing existing CG-UCI when configured. Any other configured UL would operate based on Alt-a. * Alt-c2: Compromised proposal based on UCI (CATT):   + Possible to be applicable to all configured uplink, based on UCI(X).   + This proposal has larger spec impact if other configured UL are not precluded.     - For CG-PUSCH, CG-UCI can be reused, but for other configured UL (SRS, SR/CSI on PUCCH, ...) new work is needed. * Alt-c3: Compromised proposal based on gap (LG):   + Based on the gap between gNB FFP and UL, Alt-a and Alt-b * Alt-c4: Configurability between Alt-a and Alt-b based on duration of UE FFP configuration (Len/MOT) * Alt-c5: Configurability between Alt-a and Alt-b (ETRI)   + Note that moderator understanding is that the configuration is not per UE-FFP but rather when UE is enabled to be a UE initiated COT, either follows behavior Alt-a, or Alt-b. If the configuration between Alt-a/Alt-b is per Ue FFP, please let me know to adjust the formulation of proposal.   ==========================================  **@All:** Following collects all the proposals, including Alt-a/Al-b and discussed compromised proposals as variant of Alt-c. **Please state your view on the compromised proposals in order to have a full picture on companies’ position.**  **Proposal 2-1 and compromised proposals:**  Agreement:  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:   + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT   + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT.   + **Alt-c1 (vivo):**      - If the configured UL transmission is a CG-PUSCH and if CG-UCI is configured for the CG-PUSCH, the UE can decide and inform gNB via CG-UCI whether the CG-PUSCH transmission uses gNB initiated COT or UE initiated COT     - Otherwise, Alt-a above is applied.   + **Alt-c2 (CATT):**     - If the configured UL transmission is configured with UCI(X), the UE can decide and inform gNB via UCI(X) whether the configured UL transmission uses gNB initiated COT or UE initiated COT       * FFS on structure/content of UCI(X) and whether it is applicable to any configured UL transmission     - Otherwise, Alt-a above is applied   + **Alt-c3 (LG)**:     - If the configured UL is confined within a gNB FFP before the idle period of that gNB FFP, and the interval between the gNB FFP starting boundary and the starting of the configured UL is smaller than X, Alt-a is applied.       * FFS on X     - Otherwise, Alt-b is applied.   + **Alt-c4 (Len/MOT)**:     - If the range value of UE-FFP periodicity is more than X ms Alt-a is applied.       * FFS on X, e.g. X=2.5ms     - Otherwise, Alt-b is applied.   + **Alt-c5 (ETRI)**:     - UE is RRC configured to apply Alt-a or Alt-b   **Companies’ preferences on Proposal 2-1 and compromised proposals are summarized below:**   * **Alt-a:**   + Nokia/NSB, Intel, HW/HiSi, DCM, Futurewei, IDC, LG, WILUS, Panasonic, Sony, ZTE, MTK, Spreadtrum, OPPO, Asia Pacific, Sharp(2nd), ETRI(2nd) * **Alt-b:**   + QC, vivo, Ericsson, Samsung, Apple, CATT, Sharp(1st), ETRI(1st) * **Alt-c1:**   + **Support:** vivo, ZTE   + **Not Support:** Intel, Samsung, HW/HiSi, Spreadtrum * **Alt-c2:**   + **Support:** CATT, vivo, Sony   + **Not Support:** Intel, Samsung, HW/HiSi?, Spreadtrum * **Alt-c3:**   + **Support:** LG   + **Not Support:** * **Alt-c4:**   + **Support:** Len/MOT   + **Not Support:** * **Alt-c5:**   + **Support:** ETRI, Intel, Samsung, vivo, Spreadtrum   + **Not Support:** |
| Intel | We prefer Alt.5c.  As pointed out in our prior comments, we do not support Alt-c1 and c2 because they will lead to scheduling restrictions due to the shift in controllability from the gNB to the UE. Furthermore, new explicit signaling would be required from the UE to indicate the COT initiator, which would require even larger spec impact and more overhead.  As for Alt-c3 and c4, these are technical sound solutions, but they will open additional discussions on which value of X or FFS should be used, which may elongate further a conclusion on this topic. In this sense, we believe Alt-c3 and c4 can be seen as special cases of Alt-c5, and the choice of when Alt-a or Alt-b should be used could be left up to gNB, and we do not need to necessarily impose some rules. |
| Len/MOT | We are fine with Alt-c5 |
| DCM | We don’t support Alt-c1/c2. They cause ambiguity on COT initiator determination at gNB when the UCI is not detected. Since we haven’t decided whether/how LBT is carried out when COT initiator is different between DL-UL or UL-DL for FBE, this may limit scheduling flexibility.  Regarding Alt-c3/4, we share the view with intel that they are technically good middle ground, but cause additional discussion on the value X.  Our first preference is to down-select to Alt-a, but given the situation, we can live with Alt-c5 to conclude the long discussion. |
| Apple | Reading the comments, I am still very puzzled (sorry for being slow here) why the gNB always needs to know whether the UE shares the gNB’s COT or initiates its own COT for an UL transmission? I would think the gNB only needs to know if the UE can share UE’s COT with the gNB, otherwise the gNB does not really care. In case of sharing, the UE would provide related info in CG-UCI anyway. As confirmed by most companies, there is nothing that prevents gNB and UE maintaining overlapping COTs as two devices.  Regarding Alt-cx, we feel it is overkill to go for some flavor of compromise that supports both. This would seem to be another failure resulting from us not being able to reach consensus. We would rather just down-select from Alt-a and Alt-b to make a hard decision. |
| ETRI | We prefer Alt-c5 as a compromised solution which does not bring additional issue. |
| WILUS | Thanks to companies who provide compromised solutions, i.e. Alt-cx. We are OK to consider Alt-c5 although this is not our first preference, Alt-a. |
| HW/HiSi | For the reasons we explained earlier, we do not support Alt-c1 and Alt-c2.  For Alt-c3, our understanding is that due to the different intervals between the start of each UE FFP boundary and the gNB FFP boundary, the result would be similar to a semi-statically configured pattern of UE FFPs for which, for instance, Alt-a is disabled (Alt-b enabled). However, the group has agreed to preclude this type of configuration for the same proposal, and thus we do not support Alt-c3.  For Alt-c4 and Alt-c5, Alt-c4 is essentially based on a UE FFP configuration parameter and therefore, it is equivalent to gNB deciding by semi-static configuration which alternative (Alt-a/Alt-b) to be used as in Alt-c5, yet without further discussion/specification of a threshold value. In any case, we think that this approach would unnecessarily increase the complexity and the specification effort in contradiction with the WI objective (with minimum specification impact), and also as the Moderator indicated earlier, it is not a good RAN1 practice. |
| QC | We prefer Alt.5c. |
| CATT | For the sake for the progress, we are fine with Alt.5c |
| Sony | 1st choice: Alt-a  2nd choice: Alt-c2  Can live with Alt-c5 if this is the only way to move things forward. |
| IDC | We are fine with Alt-c1 and Alt-c2 |
| Intel | On LG proposal (Alt-c3), as for this specific compromised solution, we believe this  is actually technical sound. However we prefer Alt. c5, since this is more generic and above proposed solution could be considered as a special case of Alt. c5. |
| FW | Many thanks to LG, vivo, CATT and all others that offered further solutions.  We do not support Alt-c1 and Alt-c2, they add unnecessary freedom for UE decision and additional UCI signaling. We do not support Alt-c3 and Alt-c4, which move the discussion to parameter X selection. The selection of such parameter of each these proposals is impacted by the duration of FFP periodicity of gNB relative to UE FFP periodicity, the type of traffic and processing time. While not our first preference, for the sake of compromise, we are OK to consider Alt-c5, which is most flexible of the additional alternatives proposed.  We note that all cx alternatives add complexity in the implementation (both Alt-a and Alt-b must be supported) and additional signaling. |
| LG | @Intel, Futurewei,  Thank you for providing the comments, and I admit that with the above proposal, anyhow, another (but may not be easy) discussion is needed on how to decide the value of X.  I’d like to say that I’m just trying to find a way of compromise for progress in this meeting.  Then, what about the following way?  The reason is that if semi-static DL symbol is contained within a gNB FFP, the gNB would try to initiate COT for the gNB FFP (then the UE needs to respect it), so it would be reasonable that the gNB COT is prioritized over the UE COT during the gNB FFP (otherwise, the UE COT is prioritized).   * **If the configured UL is confined within a gNB FFP before the idle period of that gNB FFP, and the gNB FFP contains semi-static DL symbol, Alt-a is applied.** * **Otherwise, Alt-b is applied.** |
| Samsung | Thanks LG for proposing compromised solutions. Sorry, we can not support these solutions. For Altc3, similar as commented by other companies, it requires additional effort for determination of X. For the updated compromised solution, let’s say Alt-c6, we don’t think semi-static DL symbol means gNB always has DL to transmit, e.g. it is just to align TDD configuration among operators.  If we have to choose one of compromised solutions. we still prefer Alt-c5. |
| Apple | Same comment as above that it is overkill to define some compromised solution that requires the UE to support both Alt-a and Alt-b. |
| WILUS | Thanks to companies who provide compromised solutions, i.e. Alt-cx. We are OK to consider Alt-c5 although this is not our first preference, Alt-a. And if it is overkill to require the UE to support both Alt-a and Alt-b, it may be desirable to go with a unified one, i.e., Alt-a regardless of whether or not a configured UL transmission that is aligned with a UE FFP boundary. |
| QC | we can compromise to Alt-c5. |
| Moderator | **@Apple:** On the question “why the gNB always needs to know whether the UE shares the gNB’s COT or initiates its own COT for an UL transmission?”, in Moderator’s view the information clarifies the behavior during the idle period. If UE shares gNB COT, no UL is expected during gNB’s idle period, while if UE initiates/shares its own COT, no UL transmission is expected during UE FFP idle period.  **@All:** Companies have discussed technical pros/cons of each alternative compromise solution.Based on companies input:   * There is concern with respect to Alt-c1 and Alt-c2, specially w.r.t to spec impact, and/or additional work. * Alt-c3 and Alt-c4 by some companies considered as special case of Alt-c5. * Some companies, for sake of compromise and progress, can consider Alt-c5 * Some companies are not convinced any of the compromised solutions are justified for extra implementation complexity to support both approaches.   **@All**: Moderator recommendation is for GTW to consider Alt-a and Alt-b and as the compromised approach, Alt-c5. It should be noted that Alt-5c is not supported by some companies.  **Companies’ preferences on Proposal 2-1 and compromised proposals are summarized below:**   * **Alt-a:**   + Nokia/NSB, Intel, HW/HiSi, DCM, Futurewei, IDC, LG, WILUS, Panasonic, Sony, ZTE, MTK, Spreadtrum, OPPO, Asia Pacific, Sharp(2nd), ETRI(2nd) * **Alt-b:**   + QC, vivo, Ericsson, Samsung, Apple, CATT, Sharp(1st), ETRI(1st) * **Alt-c1:**   + **Support:** vivo, ZTE, IDC   + **Not Support:** Intel, Samsung, Spreadtrum, DCM, FW, Apple (No cx) , HW/HiSi (No Cx) * **Alt-c2:**   + **Support:** CATT, vivo, Sony(2nd), IDC   + **Not Support:** Intel, Samsung, Spreadtrum, DCM, FW, Apple (No cx) , HW/HiSi (No Cx) * **Alt-c3:**   + **Support:** LG   + **Not Support:** FW, Apple (No cx) , HW/HiSi (No cx), Intel, Samsung * **Alt-c4:**   + **Support:** Len/MOT   + **Not Support:** FW, Apple (No cx) , HW/HiSi (No cx) * **Alt-c5:**   + **Support:** ETRI, Intel, Samsung, vivo, Spreadtrum, Len/MOT, DCM, WILUS, QC, CATT, Sony(3rd), FW, Samsung   + **Not Support:** Apple (No cx), HW/HiSi (No cx) * **Do not support any of Alt-c1 to Alt-c5**   + **Apple, HW/HiSi** |
| Moderator | **@All:** Moderator status update/recommendation is as the following:   * Stable/no change /no consensus on Alt-a or Alt-b or compromised Alt-c5 * Moderator recommendation: Decision needed to select one of the Alt-a, Alt-b or Alt-c5   **Companies’ preferences on Proposal 2-1 (Alt-a/Alt-b) and compromised proposal (Alt-c5) are summarized below:**   * **Alt-a:**   + Nokia/NSB, Intel, HW/HiSi, DCM, Futurewei, IDC, LG, WILUS, Panasonic, Sony, ZTE, MTK, Spreadtrum, OPPO, Asia Pacific, Sharp(2nd), ETRI(2nd) * **Alt-b:**   + QC, vivo, Ericsson, Samsung, Apple, CATT, Sharp(1st), ETRI(1st) * **Alt-c5:**   + **Support:** ETRI, Intel, Samsung, vivo, Spreadtrum, Len/MOT, DCM, WILUS, QC, CATT, Sony(3rd), FW, Samsung   + **Not Support:** Apple, HW/HiSi, Ericsson   **Proposal 2-1 and compromised proposal Alt-c5:**  Agreement:  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:   + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT   + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT..   + **Compromised Alt-c5:**     - UE is RRC configured to apply Alt-a or Alt-b |
| Moderator | **The following agreement was made during GTW May 25th:**  Agreement:  In semi-static channel access mode when a UE can operate as UE-initiated COT,   * To determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:   + If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT   **The discussion in this section is concluded for this meeting.** |

## 2.3 COT-initiator determination for scheduled UL transmissions

During the last meeting, determination of ownership of a COT for a scheduled UL transmission was extensively discussed and the following agreement was made with reduction of possible options to two main alternatives i.e. Alt-a and Alt-b. The discussion also led to the question whether the channel access field in Rel-16 DCI 0\_1 and 1\_1, should be extended to Rel-17 DCI 0\_2 and 1\_2, respectively.

On cross-FFP related discussions, the moderator would like to clarify the following:

* In the contributions for this meeting, few companies shared their views on the preferred alternatives Alt-a or Alt-b, along with the corresponding motivations, also addressed the cross-FFP scheduling, which is an FFS for DCI based method, i.e. Alt-a. However, in previous meeting, the FL summary had captured the discussions related to cross-FFP scheduling in section 2.8 of R1-21003960, which is not prioritized by Chair for this meeting (see section 1 above). Therefore, the discussion on this topic would be limited to clarifications that may be needed in order to progress and conclude the topics in this section unless companies prefer to discuss fully the cross-FFP remaining issues.

**On determination of COT initiator**

* Alt-a: Companies arguments in favour of Alt-a (DCI based COT determination) include at least the following:
  + Flexibility and efficiency
  + Simplification at UE due to following DCI rather than pre-determined rules
  + Reusing the already existing fields in DCI
  + Unified framework for scheduled uplink for both LBE and FBE
  + …
* Alt-b: Companies arguments in favour of Alt-a (DCI based COT determination) include at least the following:
  + LBT failure impacts/invalidates already indicated COT initiation assumptions in Alt-a:
    - Reduced flexibility and efficiency
    - The need for rule as in Alt-b when operating with Alt-a
  + Flexible since timing flexibility already involved in scheduling and COT determination in Alt-b
  + Unified framework for scheduled and configured UL transmissions in FBE.
  + …

**On absence of COT initiator indication in DCI if Alt-a is supported**

* Always present in DCI:
  + Similar approach as LBE and FBE in Rel-16
* Can be absent in DCI
  + DCI overhead, optionality and configurability to 0-bit filed for compact DCI

**On cross-FFP scheduling**

* Few options proposed:
  + Use a combination of Alt-a/Alt-b with consideration to UE processing timeline
  + Always assume UE initiated COT irrespective of indication for UL scheduled outside a COT initiated by gNB

**On extension of Rel-16 channel access fields to DCI X\_2**

* Extend
  + Enable same functionality as DCI X\_1
* Do Not extend
  + Optionality and configurability to 0-bit filed for compact DCI

## 2.3.1 Discussion – 1st round

**Proposals and summary of views:**

**Proposal 3-1:**

Agreement:

In semi-static channel access mode when a UE can operate as initiating device,

* Select one of the following alternatives to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT:
* Alt-a: Determination based on the content in the scheduling DCI
  + FFS on whether the corresponding field(s) can be absent in DCI
    - If absent, determination based on the rules applied for configured UL transmissions is applied
  + FFS whether/how to handle the case when the gNB schedules an UL transmission in the next gNB’s FFP period
  + Alt-b: Determination based on the rules applied for a configured UL transmission

**Companies’ preferences on Proposal 3-1 are summarized below:**

* **Alt-a (Based on DCI content)**
  + QC, Nokia/NSB, Ericsson, Samsung, Apple, Futurewei, IDC, CATT, WILUS, Panasonic, Sony, Sharp, Len/MOT, ETRI, Spreadtrum, OPPO, Intel, [DCM]
* **Alt-b (Based on config. UL rule)**
  + Vivo, HW/HiSi, LG, ZTE, MTK, [DCM]
* **In case Alt-a is supported:**
  + Corresponding COT determination field(s) always present in DCI
    - Nokia/NSB, Ericsson, Futurewei, Sony, Len/MOT, Apple, Intel
  + Corresponding COT determination field(s) can be absent in DCI
    - DCM, CATT, Panasonic, ETRI, Spreadtrum

**Proposal 3-2:**

Select one of the following:

* Option 1: Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively.
* Option 2: Study whether to support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively

**Companies’ preferences on Proposal 3-2 are summarized below:**

* **Option 1:** Nokia, Ericsson, Intel, Sharp, ETRI, DCM (can be absent), Intel, Sony, Apple, FW
* **Option 2:** vivo, HW/HiSi

|  |  |
| --- | --- |
| **Questions:**   * Q1: Companies are kindly requested to provide any update/correction of their positions with respect to Proposal 3-1 and Proposal 3-2 * Q2: Please provide any other comments if needed. | |
| **Company** | **Comment** |
| Sony | Proposal 3-1: We still prefer Alt-a. And the new indicator in the DCI is always present for UE configured to initiate its own COT.  Proposal 3-2: We support Option 1. |
| Intel | Many thanks for the moderator effort in summarizing the view from all companies and for the proposal. However, our view is missing for proposal 3.1. We support Alt. a, and our view is that the field carrying information related to the COT initiator should be always carried in both fall-back and non fall-back DCI.  As for proposal 3.2, we support 1, and we believe that the extension of unlicensed functionalities (and in this case, channel access & COT initiator information) in the compact DCIs X\_2 is quite important to support the reliability targets imposed in Rel.16 for URLLC. |
| Apple | For propose 3-2, we support Option 1. |
| Len/MOT | We think we can continue the high-level designs and decide on fields of DCI x\_2 afterwards |
| HW/HiSi | Proposal 3-1: We still support Alt-b.  We cannot agree with Alt-a as it is sufficient to address the cases in which the gNB schedules the UL transmission and indicates it is associated to a forthcoming UE/gNB COT. In such cases, if the indicated COT has not been initiated, either a rule similar to that of Alt-b has be applied disregarding the DCI indication or the additional dynamic signaling has to be used to cancel the scheduled UL. This in fact defeats the purposes of simplicity at UE (by just following DCI), providing more control/flexibility to gNB, and efficiency (when dynamic cancellation need to be signaled)  Proposal 3-2: We are OK with Option 2  For the question on whether the DCI filed is always/can be present in the scheduling DCI, it is related to the outcome of Propsal 3-2 and the study in its Option 2. That is, if the fields in DCI formats x\_0 and x\_1 are not agreed to be extended to DCI formats X\_2, the field can be absent. |
| FW | We still support Alt-a for Proposal 3.1 , and Option 1 for Proposal 3.2 |
| CATT | Proposal 3-1: we support Alt.-a  Proposal 3-2: we prefer to Option 1. |
| vivo | For Proposal 3.1, we support Alt-b. We think it may be better to first discuss whether the COT determination field(s) always exist in all the scheduling DCI formats: 0-0, 0-1 and 0-2. As we know, the channel access fields in Rel-16 is mainly for LBE mode. It is not necessary for FBE mode. To support URLLC and ensure the reliability, compact DCI is one important feature. We did not find strong reason why the channel access fields mainly for LBE mode is mandated to be always there in all the UL scheduling DCI formats. |
| LG | P3-1: We support Alt-b for unified solution to address cross-FFP scheduling as well as multi-carrier transmission, without additional arguments/efforts on various solutions.  P3-2: We prefer to Option 2, but not prefer to additional enhancement on the field itself including configurable absence of the field in DCI. |
| ETRI | Proposal 3-1: We still prefer Alt-a.  Proposal 3-2: We support Option 1. |
| ZTE | Proposal 3-1: We still prefer Alt-b.  Proposal 3-2: We support Option 2. FBE only support a channel sensing of 9us and the channel access filed in Rel-16 DCI 0\_1 and 1\_1 may not be mandatory in Rel-17 compact DCI 0\_2 and 1\_2. |
| Samsung | For Proposal 3-1: We still prefer Alt-a.  For proposal 3-2, we support option 1. Regarding the channel access fields in Rel-16, we think LBT type and CP extension is also important for FBE mode, e.g. it helps to reduce LBT overhead and reduce LBT failure, which is also beneficial for URLLC. |
| Panasonic | For Proposal 3-1, we still prefer Alt-a. For Alt-a, we also supportive to the condition that the corresponding field cannot be absent in the scheduling DCI.  For Proposal 3-2, we support Option 1. |
| QC | Proposal 3-1: We still prefer Alt-a.  Proposal 3-2: We support Option 1. |
| Sharp | Proposal 3-1: support Alt-a  Proposal 3-2: support Option 1 |
| Asia Pacific | Proposal 3-1: support Alt-a  Proposal 3-2: support Option 1 |
| Spreadtrum | Proposal 3-1: Alt-a.  Proposal 3-2: We support Option 1. |
| OPPO | Proposal 3-1: We still prefer Alt-a.  Proposal 3-2: We support Option 1. |
| Moderator | **Companies’ preferences on Proposal 3-1 are summarized below:**   * **Alt-a (Based on DCI content)**   + QC, Nokia/NSB, Ericsson, Samsung, Apple, Futurewei, IDC, CATT, WILUS, Panasonic, Sony, Sharp, Len/MOT, ETRI, Spreadtrum, OPPO, Intel, Asia Pacific, [DCM] * **Alt-b (Based on config. UL rule)**   + Vivo, HW/HiSi, LG, ZTE, MTK, [DCM] * **In case Alt-a is supported:**   + Corresponding COT determination field(s) always present in DCI     - Nokia/NSB, Ericsson, Futurewei, Sony, Len/MOT, Apple, Intel, Panasonic, Intel   + Corresponding COT determination field(s) can be absent in DCI     - DCM, CATT, Panasonic, ETRI, Spreadtrum   **Companies’ preferences on Proposal 3-2 are summarized below:**   * **Option 1:** Nokia, Ericsson, Intel, Sharp, ETRI, DCM (can be absent), Intel, Sony, Apple, FW, CATT, LG, Samsung, QC, Asia Pacific, Spreadtrum, OPPO * **Option 2:** vivo, HW/HiSi, ZTE   **@All:** On Proposal 3-1, the arguments and the status with respect to Alt-a/Alt-b in Proposal 3-1 have not changed, with majority of companies see the benefit of Alt-a. With respect to flexibility, the proponents of Alt-b consider that following rule-based approach would provide enough flexibility. It is also argued that Alt-a limits the flexibility.  **@All:** On Proposal 3-2, majority of the companies are supportive of Option 1. However, one of the arguments from the proponents of Option 2 is the lack of configurability to 0-bits field. It is not clear how reliability of DCI is at risk if the corresponding field is not present.  **@All: The motivations for Alt-a/Alt-b seems originate from different perspective on design. Moderator suggests to focus on concluding this proposal.** |

## 2.3.2 Discussion – 2nd round

**Companies’ preferences on Proposal 3-1 are summarized below:**

* **Alt-a (Based on DCI content)**
  + QC, Nokia/NSB, Ericsson, Samsung, Apple, Futurewei, IDC, CATT, WILUS, Panasonic, Sony, Sharp, Len/MOT, ETRI, Spreadtrum, OPPO, Intel, Asia Pacific, [DCM]
* **Alt-b (Based on config. UL rule)**
  + Vivo, HW/HiSi, LG, ZTE, MTK, [DCM]
* **In case Alt-a is supported:**
  + Corresponding COT determination field(s) always present in DCI
    - Nokia/NSB, Ericsson, Futurewei, Sony, Len/MOT, Apple, Intel, Panasonic, Intel
  + Corresponding COT determination field(s) can be absent in DCI
    - DCM, CATT, Panasonic, ETRI, Spreadtrum, HW/HiSi

**Companies’ preferences on Proposal 3-2 are summarized below:**

* **Option 1:** Nokia, Ericsson, Intel, Sharp, ETRI, DCM (can be absent), Intel, Sony, Apple, FW, CATT, Samsung, QC, Asia Pacific, Spreadtrum, OPPO, LG (without additional enhancement to LBT field itself including absence of the field in DCI),
* **Option 2:** vivo, HW/HiSi, ZTE, LG

**Proposal 3-1:**

Agreement:

In semi-static channel access mode when a UE can operate as initiating device,

* Select one of the following alternatives to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT:
* Alt-a: Determination based on the content in the scheduling DCI
  + FFS on whether the corresponding field(s) can be absent in DCI
    - If absent, determination based on the rules applied for configured UL transmissions is applied
  + FFS whether/how to handle the case when the gNB schedules an UL transmission in the next gNB’s FFP period
  + Alt-b: Determination based on the rules applied for a configured UL transmission

**Proposal 3-2:**

Select one of the following:

* Option 1: Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively.
* Option 2: Study whether to support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively

**Moderator observation/suggestion:**

* Considering the observations/clarifications by Moderator in the previous section, let’s focus on concluding Proposal 3-1 at least.

|  |  |
| --- | --- |
| **Questions:**   * Q1: Please provide any comments, including follow-up of discussion in previous if needed, or changes the status or suggestions to help to reach a consensus. | |
| **Company** | **Comment** |
| LG | Considering main concern from Alt-b proponents that DCI missing/LBT failure/UL skipping for a scheduled UL aligned with UE FFP boundary and its negative impacts to subsequent UL transmission after the scheduled UL, we can consider the following way as a compromise.   * If a scheduled UL is allocated to be aligned with UE FFP boundary, Alt-a is applied for the scheduled UL. * Otherwise, Alt-b is applied. |
| Moderator | **@LG:** Thanks for sharing the suggestion for way forward.  Few clarifications, questions to the compromised proposal: It appears that with respect to LBT failure, and consequent impacts, both Alt-a and Al-b are on the same foot.  With respect to DCI missing, the scheduled transmission is missed irrespective of which Alt-a or Alt-b should be used for the corresponding assumption of COT initiator of the transmission.  Can you clarify more on what is intended with UL skipping?  Is this a correct understanding that for scheduled UL after boundary, UE discard DCI format content for COT determination since the DCI format can be used for scheduling of a Ul at FFP boundary?  **@All: Please share your view on LG proposal whether it can be considered as way forward or** |
| Intel | Many thanks to LG for the compromised proposal. As commented above, our preference is still for Alt-a, and we are not in favor for the compromised proposal: in our understanding this solution would open even more questions and issues, e.g., would the gNB still indicate COT initiator information when Alt-b is used; what value of X should we chosen? Also as for the drawbacks claimed by proponents of Alt-b regarding Alt-a, we believe that in case of miss-detection, both alternatives would suffer from similar problematics, and it is not worth to overcomplicate the design to over optimize for corner cases. |
| FW | Thanks LG for the compromised proposal. Our preference is still for Alt-a. |
| Sharp | We can support compromised proposal from LG in addition to our first preference Alt-a.  Regarding one concern from Intel “would the gNB still indicate COT initiator information when Alt-b is used”, the gNB can indicate COT initiator information, irrespective of the scheduled UL is aligned with UE FFP or not. From UE’s perspective, the COT initiator information is only needed when the scheduled UL is aligned with UE FFP. For the case the scheduled UL is not aligned with UE FFP, the COT initiator is gNB with no ambiguity and UE can just ignore the indicated COT initiator information. |
| vivo | We would like to first have an agreement on whether the channel access field is mandated to be always exist in all the DCI scheduling format(s). |
| LG | @Intel,  Thank you for providing the comment.  Firstly, the part ”what value of X should we chosen?” seems to be a comment related to my proposal for configured UL (rather than this proposal ^^).  Secondly, regarding the part ”would the gNB still indicate COT initiator information when Alt-b is used”, Sharp correctly provided the answer that DCI can indicate COT initiator information but UE use it only when the scheduled UL is aligned with UE FFP boundary (in other cases, UE applies the rule for configured UL).  Thirdly, concern on Alt-a itself is not only due to DCI missing but also due to LBT failure or UL skipping for a scheduled UL aligned with UE FFP boundary. |
| ETRI | Many thanks to LG for the compromised solution. However, we think Alt-a is a superset which covers the identified cases, assuming that LBT failure would not much happen in a well-controlled environment. Our preference is still Alt-a. |
| WILUS | Thanks to LG for providing compromised proposal. We still prefer Alt-a regarding moderator’s proposal 3-1. For moderator’s proposal 3-2, we support Option-1. |
| QC | We prefer Alt-a for proposal 3-1 and support Option-1 for proposal 3-2. |
| Samsung | Thanks LG for compromised solution.  We’d like to ask some clarification for better understanding :)  For ”Otherwise, Alt-b is applied”,  1. Does ’otherwise’ mean the scheduled UL transmission after a UE FFP boundary?  If yes, it seems the issue is not about whether the UE can initiate the COT, because anyway a UL transmission (no matter it is scheduled or configured UL transmission) after UE FFP boundary cannot initiate the COT.  2. Does ’Alt-b is applied’ refer to the agreement made in RAN1 103e meeting as below?  Agreement:  When a configured UL transmission starts after a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE:   * If the UE has already initiated the UE FFP, then UE assumes that the configured UL transmission corresponds to UE-initiated COT * Otherwise, If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and if the UE has already determined that gNB has initiated that gNB FFP, then UE assumes that the configured UL transmission corresponds to gNB-initiated COT.   It means, UE drops the UL transmission, if neither gNB nor UE has initiated the COT, otherwise, UE transmits UL ? |
| CATT | Thanks so much to LG for providing compromised proposal. But we still prefer Alt-a for proposal 3-1 and Option-1 for proposal 3-2 |
| LG | @Samsung,  Thank you so much for asking the question.  My intention of ”Otherwise, Alt-b is applied” was the latter between what you explained.  It means, if a scheduled UL is allocated after UE FFP boundary, UE just applies the rule agreed for the configured UL not aligned with UE FFP boundary. |
| Sony | Thanks for LG’s compromised proposal. For scheduled UL transmission in the middle of the UE’s FFP, that shouldn’t be an issue. If it is this UL transmission is the 1st one within the UE’s FFP then it has to be transmitted based on gNB’s initiated COT.  On the Alternatives/Options:   * Proposal 3-1: Alt-a * Proposal 3-2: Option 1 |
| Moderator | **@All:** Based on the discussion it seems the companies have concern on the compromised proposal by LG and prefer to consider the original Alt-a and Alt-b in proposal 3-1.  **@All:** No change in status. |
| Moderator | **@All:** Moderator status update/recommendation is as the following:   * **Status:**   + Proposal 3-1     - Stable between Alta&Altb/no consensus       * FFS depends on outcome and Proposal 3-2     - No consensus or majority support on proposed compromised proposals   + Proposal 3-2     - Depends on outcome of Proposal 3-1 * **Moderator recommendation:** Decision needed at least on **Proposal 3-1**   **Companies’ preferences on Proposal 3-1 are summarized below:**   * **Alt-a (Based on DCI content)**   + QC, Nokia/NSB, Ericsson, Samsung, Apple, Futurewei, IDC, CATT, WILUS, Panasonic, Sony, Sharp, Len/MOT, ETRI, Spreadtrum, OPPO, Intel, Asia Pacific, [DCM] * **Alt-b (Based on config. UL rule)**   + Vivo, HW/HiSi, LG, ZTE, MTK, [DCM] * **In case Alt-a is supported:**   + Corresponding COT determination field(s) always present in DCI     - Nokia/NSB, Ericsson, Futurewei, Sony, Len/MOT, Apple, Intel, Panasonic, Intel   + Corresponding COT determination field(s) can be absent in DCI     - DCM, CATT, Panasonic, ETRI, Spreadtrum, HW/HiSi   **Companies’ preferences on Proposal 3-2 are summarized below:**   * **Option 1:** Nokia, Ericsson, Intel, Sharp, ETRI, DCM (can be absent), Intel, Sony, Apple, FW, CATT, Samsung, QC, Asia Pacific, Spreadtrum, OPPO, LG (without additional enhancement to LBT field itself including absence of the field in DCI), * **Option 2:** vivo, HW/HiSi, ZTE, LG   **Proposal 3-1:**  Agreement:  In semi-static channel access mode when a UE can operate as initiating device,   * Select one of the following alternatives to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT: * Alt-a: Determination based on the content in the scheduling DCI   + FFS on whether the corresponding field(s) can be absent in DCI     - If absent, determination based on the rules applied for configured UL transmissions is applied   + FFS whether/how to handle the case when the gNB schedules an UL transmission in the next gNB’s FFP period   + Alt-b: Determination based on the rules applied for a configured UL transmission   **Proposal 3-2:**  Select one of the following:   * Option 1: Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively. * Option 2: Study whether to support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively |
| Moderator | **The following agreement was made during GTW May 25th:**  Agreement:  In semi-static channel access mode when a UE can operate as initiating device,   * To determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT: * Determination based on the content in the scheduling DCI   + FFS on whether the corresponding field(s) can be absent in DCI     - If absent, determination based on the rules applied for configured UL transmissions is applied   + FFS whether/how to handle the case when the gNB schedules an UL transmission in the next gNB’s FFP period   **The discussion in this section is continued in 3rd round to progress on the remaining issues.** |

## 2.3.3 Discussion – 3rd round

In the remaining of the discussion, it is recommended to discuss the following two related topics:

* Proposal 3-2 on extension of Rel-16 channel access fields to DCI X\_2
* FFS in agreement on whether the corresponding field(s) can be absent in DCI (formulated as Proposal 3-3).

**Proposal 3-2 (updated):**

Select one of the following:

* Option 1: Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively.
* Option 2: Study whether to support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively

**Proposal 3-3:**

In semi-static channel access mode when a UE can operate as initiating device,

* The corresponding field(s) in DCI to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT:
  + Option 1: can be absent
  + Option 2: are always present

The motivation and corresponding position on any of these issues are summarized below:

**On extension of Rel-16 channel access fields to DCI X\_2 (Proposal 3-2):**

* Option 1: Extend
  + Support same functionality as DCI X\_1, importance of channel access fields in all scheduling DCI
    - Indication of LBT type and CP extension for FBE mode, reduces LBT overhead and LBT failure, being beneficial for URLLC.
* Option 2: Do Not extend
  + Configurability to 0-bit filed for compact DCI, channel access fields not necessary for FBE.
    - The channel access field is mainly for LBE mode. It is not necessary for FBE mode. To support URLLC and ensure the reliability, compact DCI is one important feature. No strong reason why the channel access fields are mandated to be always present in all the UL scheduling DCI formats.

**On absence of COT initiator indication (Proposal 3-3)**

* Option1: Can be absent in DCI
  + DCI overhead, optionality and configurability to 0-bit filed for compact DCI
* Option 2: Always present in DCI:
  + Similar approach as LBE and FBE in Rel-16

**Companies’ preferences on Proposal 3-2 are summarized below:**

* **Option 1:** Nokia, Ericsson, Intel, Sharp, ETRI, DCM (can be absent), Intel, Sony, Apple, FW, CATT, Samsung, QC, Asia Pacific, Spreadtrum, OPPO, LG (without additional enhancement to LBT field itself including absence of the field in DCI),
* **Option 2:** vivo, HW/HiSi, ZTE, LG

**Companies’ preferences on Proposal 3-3 are summarized below:**

* **Option 1:** Corresponding COT determination field(s) can be absent in DCI
  + DCM, CATT, Panasonic, ETRI, Spreadtrum, HW/HiSi
* **Option 2:** Corresponding COT determination field(s) always present in DCI
  + Nokia/NSB, Ericsson, Futurewei, Sony, Len/MOT, Apple, Intel, Panasonic, Intel

**Moderator analysis:**

It seems in general the field can be absent by configuration in non-fall back DCI 0\_1 and 1\_1 as specified in 38.212, while the field always present in fall-back DCI:

|  |
| --- |
| 7.3.1.1.2 Format 0\_1 ChannelAccess-CPext-CAPC – 0, 1, 2, 3, 4, 5 or 6 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-0-1* or in Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided for operation in a cell with shared spectrum channel access; otherwise 0 bit. One or more entries from Table 7.3.1.1.2-35 are configured by the higher layer parameter *ul-AccessConfigListDCI-0-1* |
| 7.3.1.2.2 Format 1\_1 ChannelAccess-CPext – 0, 1, 2, 3 or 4 bits. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-1-1* or in Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided for operation in a cell with shared spectrum channel access; otherwise 0 bit. One or more entries from Table 7.3.1.2.2-6 are configured by the higher layer parameter *ul-AccessConfigListDCI-1-1.* |

Moreover, as some companies commented, whether the LBT type (i.e. no sensing or 9us sensing) or CP extension should always be indicated to the UE, is more motivated in case of LBE. However, even in that case the field can be configured to be absent. Therefore, to have an option of not using the field for DCI X\_2, seems to be reasonable. It also makes sense for DCI X\_2 since it would be consistent with the principle of configurability of fields to 0-bits. As the consequence, the DCI content for COT determination in case of FBE could be absent too.

Therefore, it seems one approach would be as the following:

* While the channel access fields are supported to be extended in DCI X\_2, the fields could be also absent by configuration similarly to DCI X\_1 for both LBE and FBE.
  + As the consequence, the DCI content used for COT determination in case of FBE could be absent.

The above approach can be obtained by Option 3 in updated Proposal 3-2 (that is Option 1 with addition of the sub-bullet) and Option 1 in Proposal 3-3:

**Proposal 3-2 (updated):**

Select one of the following:

* Option 1: Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively.
* Option 2: Study whether to support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively
* Option 3: Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively.
  + The channel access fields in Rel-17 DCI 0\_2 and 1\_2 can be present or absent by configuration.

**Proposal 3-3:**

In semi-static channel access mode when a UE can operate as initiating device,

* The corresponding field(s) in DCI to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT:
  + Option 1: can be absent
  + Option 2: are always present

|  |  |
| --- | --- |
| **Questions:**   * Q1: Please indicate your preferred Option in Updated Proposal 3-2 (Option 1 or 2 or 3) and Proposal 3-3 (Option 1 or Option 2). * Q2: Please provide any other comments if needed. | |
| **Company** | **Comment** |
| Ericsson | * Q1:   P3-2: Option 3  P3-3: Option 1 |
| vivo | * Q1:   P3-2: Option 3  P3-3: Option 1 |
| ETRI | * Q1:   P3-2: Option 3  P3-3: Option 1 |
| CATT | * Q1:   P3-2: Option 3  P3-3: Option 1 |
| DCM | * Q1:   P3-2: Option 3  P3-3: Option 1 |
| Panasonic | * Q1:   P3-2: Option 3  P3-3: Option 1 |
| Mot/Len | * Q1:   P3-2: Option 2  P3-3: Option 2   * Q2   We prefer to decide on both cases next meeting/after finishing any remaining high level design aspects (as these two aspects seem to be of a lower level design aspect). For P3-3, we can support option 1 if no special handling/patches needed to adopt the configured grant rules in case the field is absent in the DCI (we can investigate/discuss that next meeting). |
| LG | * Q1:   P3-2: Option 2 (or Option 1 without further enhancement over Rel-16 channel access fields)  P3-3: Option 2 |
| Sony | * Q1:   **P3-2:**  What’s the difference between Option 1 and Option 3? Is the last sentence:  "The channel access fields in Rel−17 DCI 0\_2 and 1\_2 can be present or  absent by configuration."  part of Option 3 or common to all Options?  We are fine with either Option 1 or Option 3.  **P3-3:** Option 2. |
| Moderator | (Regarding comment above from Sony)  Your understanding is correct. The reason I added Option 3 is that is clearly supports the fields can be present or absent by configuration. I didn’t not want to change the already existing options for not creating so much unnecessary changes. |
| Intel | * Q1   P3-2: Either Option 1 or Option 3 is fine.  P3-3: Option 2 to avoid to define any fallback mechanism in case the field is not present. |
| Sharp | * Q1:   P3-2: Option 1  P3-3: Option 2 |
| HW/HiSi | * **Q1:**   **Updated Proposal 3-2:**  We support Option 2.  We share the same view as other companies explained on the reflector that in Rel.16 both fallback and non-fallback DCIs would always carry 2 bits for semi-static channel access mode and there is no strong technical motivation in changing this procedure. The subbullet in Option 3 would be inaccurate as such  given that *ChannelAccessMode-r16* = ”*semistatic*” is provided.  Supporting the channel access fields as in Rel-16 DCI 0\_1/1\_1 in Rel-17 DCI 0\_2/1\_2 means in the first place, mandating the presence of 2-bits field for FBE, and secondly, supporting the presence of upto 6/4 bits field for LBE, in these compact DCI formats. Besides, we think that discussing the latter support is not  within the scope of this WID.  **Proposal 3-3:**  We think Option 1 is the realistic assumption so far at least accounting for the case when DCI formats X\_2 are used for scheduling UL in FBE. |
| Samsung | * Q1   P3-2: Option 1 (1st preference), Option 3(2nd preference)  P3-3: Option 2 (if option 1 in P3-2), Option 1 (if option 3 in P3-2)   * Q2:   Before providing the answer to question 1, we’d like to share our understanding whether 0 bit is supported for Rel-16 FBE.  According to the description in DCI 1-1 or 0-1, ‘The bitwidth for this field is determined as ceil (log 2(I)) bits, where *I* is the number of entries in the higher layer parameter *ul-AccessConfigListDCI-1-1* or in Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = ”*semistatic*” is provided for operation in a cell with shared spectrum channel access; otherwise 0 bit’. Because Table 7.3.1.1.1-4A has 3 entries, I=3, so log2(3)=2 bits. It means, there is always 2 bits for FBE case.  For LBE, if gNB only configures 1 entry by *ul-AccessConfigListDCI,* then, 0 bit.  In summary, in our understanding, 0 bit is supported for LBE, but not for FBE. |
| Moderator | Regarding comment above from Samsung (Q2), Moderator agrees with Samsung. It seems for LBE one can have 0 bit.  It seems that me that is an issue that we should fix in maintenance of Rel-16 because it is strange for LBE, 0 bit is supported and not for LBE.  Basically, we should have had that for FBE, the RRC configured table should be from Table 7.3.1.1.1-4A. |
| WILUS | * Q1:   P3-2: Option 3  P3-3: Option 1 |
| FW | * Q2   Thanks Samsung for their comment. We have a similar understanding with Samsung and other companies (Apple, Intel) that there is always 2 bits for FBE case. We do not see any strong reason to change this and allow the absence of the field (zero bit) , which would require the definition of UE default behavior. |
| Apple | * Q2:   On the channel access field in DCI format 0\_1/1\_1, we share the same understanding with Samsung. Given that there is no behavior defined if the field is absent for FBE, the field has to be always present for FBE.  The question is whether there is a strong motivation to change this or not for DCI 0\_2/1\_2. It would require some default behavior to be defined even without UE-initiated COT. At least from our side, we do not see a strong motivation for it. |
| Intel | * Q2    We also share the same understanding as other companies that in Rel.16 both fallback and non-fallback DCIs would always carry 2 bits for semi-static channel access mode. Also we share same view as Apple, that there is no strong technical motivation in changing this procedure and propagate it to the compact DCIs x\_2, and if changed we will need to define a UE behavior in terms of both channel access procedure and COT initiation when this field is absent.  As for the feedback related to proposal 3-2/3-3, we have embedded Intel’s view through NVM. However, just to clarify our position for proposal 3-2, our preference would be Option 1, but we would be OK with Option 3 if the second bullet is left as FFS. |
| Sharp | * Q2:   I would be appreciated if the following can be clarified:  Whether these two DCI fields in Proposal 3-2 and 3-3 (channel access field and the corresponding field(s) in DCI to determine whether a scheduled UL transmission) are assumed the same or different?  If they are assumed the same field, supporting Option 3 in Proposal 3-2 and supporting Option 2 in Proposal 3-3 seems to be contradictive, i.e., “can be present or absent by configuration” vs. “are always present”. If they are assumed different fields, is the intention to independently discuss Proposal 3-2 and 3-3? |
| Moderator | Reply to Sharp (Q2)  My understanding of the contributions so far, is that the companies intend to use the same fields but I cannot be certain of that.  This is an important question that we need to answer for the next design step.   * How the DCI content provides information on COT determination? Based on using the LBT field in DCI or other means? |
| LG | * Q2   We also share the same view with other companies including Apple, Intel, Futurewei that the DCI formats (both fallback and non-fallback DCI) for Rel-16 FBE always contains 2-bit channel access field.  And we also agree with Intel that there is no motivation/technical reason to change the procedure for DCI format x\_2, and moreover, the change (i.e., configurable absence of the field in DCI) would require to define default UE behavior not only for channel access but also for COT initiation in case of absence of the field.  So, it doesn’t seem to be aligned with aiming for minimum specification impact. |
| vivo | * Q2   For DCI format 0\_0 and 0\_1, the channel access field for FBE in Rel-16 may always exist. But we disagree to extend this rule to DCI format 0\_2, it does not align with the design principle of compact DCI in Rel-16 for URLLC that the field existence should be configurable especially such field does not exist in Rel-16 for DCI format 0\_2.  About additional effort to define the default rule in case such field does not exist, the effort is the same as we will handle the issue of cross-FFP scheduling.  Therefore, if the DCI format 0\_2 is supported in Rel-17 for unlicensed band URLLC, we do not agree to mandate the channel access field always exist in the DCI format 0\_2. |
| LG | One question for my clarification is, are all the fields in DCI configurable for DCI format x\_2? Or, some fields are configurable while the others are kept not configurable as in DCI x\_0/x\_1? |
| vivo | * Q2:   (Reply to LG clarification question above) : Of course not all the fields in DCI is configurable for DCI format x\_2. It depends on the necessity and flexibility.  From our understanding for FBE, the field is not necessary for FBE mode although it may be always exist for Rel-16 fallback DCI and DCI format 0\_1.  But making the field that does not exist for DCI format x\_2 in Rel-16 to be mandatorily exist and with fixed bit size does not make sense and violates the design principle of compact DCI format. In addition, we have not agreed to support DCI format x\_2 for Rel-17 unlicensed URLLC. |
| LG | * Q2:   (Reply to vivo’s feedback above)  Thank you for the response.  Then, we may need to have a consensus first on the necessity of configurability to the field (and also need to take into account potential impacts by doing so), and if not, it doesn’t violate the principle of DCI x\_2. J  Anyhow, It seems more companies’ views are necessary. |
| Nokia/NSB | * Q2:   Our understanding is as follows:   * for semi-static channel access, in Rel-16 the 2-bit ChannelAccess-CPext-CAPC -field is meant to be always present, i.e. current specifications are correct. * we support inclusion of this field also in DCI 0\_2 and 1\_2. The field should always be present when operating on shared spectrum, as otherwise the operation would be severely restricted (e.g. all the gaps in the channel occupancy should be of same duration.) |

## 2.4 Other issues

Companies discussed other issues mainly related to scheduled UL transmissions with respect to at least the following topics:

Single DCI scheduling multiple PUSCHs

**Proposal 4-1:**

* In semi-static channel access mode when a UE can operate as initiating device, all the PUSCH transmissions scheduled by a single DCI is based on UE-initiated COT or sharing a gNB-initiated COT based on the same content in the scheduling DCI.
  + Support: CATT

On Early termination of FFP

**Proposal 4-2**

* In semi-static channel access mode, early termination or cancellation of a FFP is enabled by allowing the gNB to overwrite through scheduling DCI any prior decision regarding the initiator of the COT.
  + Support: Intel

## 2.4.1 Discussion – 1st round

|  |  |
| --- | --- |
| **Questions:**   * Please share your view on Proposal 4-1 and 4-2. | |
| **Company** | **Comment** |
| Sony | Proposal 4-1: It isn’t clear what it means by ”based on the same content in the scheduling DCI.”  Proposal 4-2: Support. |
| Intel | Our suggestion is to come back to these proposals once we have progressed in the topic of the COT initiation. |
| Apple | The two proposals are not very clear to us, but we can come back to these proposals later. |
| Len/MOT | We can discuss these aspects after the decision is taken on the question in section 2.2. |
| HW/HiSi | We think the two proposlas need further clarification |
| CATT | For proposal 4-1, we would like to clarify it.  Based on agreement in RAN1#104b-e meeting as below, single DCI scheduling multiple PUSCHs is allowed.  Agreement**:**   * In semi-static channel access mode, the gNB can schedule by a DCI UL transmission(s) in a later g-FFP that is different from the g-FFP that carries the scheduling DCI.   + The UL transmission can occur only if the corresponding channel access requirements are met.   + FFS on details.   In this case, we need further consider whether these scheduled UL transmissions are based on UE-initiated COT or sharing a gNB-initiated COT based on the content in the scheduling DCI or not.  Of course**,** we need also consider the decision in section 2.3.  For proposal 4-2, the motivation need be clarified. |
| vivo | Further clarification is needed for the two proposals. |
| LG | P4-1: It seems better to discuss later since a specific assumption which is not agreed is used.  P4-2: It seems better to discuss later with further clarification as other companies commented. |
| ETRI | Proposal 4-1: This issue is related to Proposal 3-1. Can be discussed together with Proposal 3-1, or can be discussed later after single PUSCH case is clear. Either approach is fine for us.  Proposal 4-2: The proposal is not clear to us. |
| DCM | We can come back once further progress is made in Sections 2.2 and 2.3 |
| ZTE | The two proposals can be discussed after the proposals in other sections are clarified. |
| Samsung | we can come back later, if time allows. |
| QC | More further discussion is needed for the two proposals. |
| Moderator | **@All:** Moderator suggests deprioritizing this section for further discussions at this meeting.  Needless to mention that companies are welcome to provide more comments if they wish. |

# 3 Conclusion

TBD

# 4 References

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | [**R1-2104200**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104200.zip) | UE initiated COT for semi-static channel access | FUTUREWEI |
| **2** | [**R1-2104219**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104219.zip) | Enhancements for IIoT/URLLC on Unlicensed Band | Ericsson |
| **3** | [**R1-2104265**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104265.zip) | Uplink enhancements for URLLC in unlicensed controlled environments | Huawei, HiSilicon |
| **4** | [**R1-2104328**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104328.zip) | Discussion on unlicensed band URLLC/IIoT | ZTE |
| **5** | [**R1-2104355**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104355.zip) | Enhancements for unlicensed band URLLC/IIoT | vivo |
| **6** | [**R1-2104422**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104422.zip) | Discussion on enhancements for unlicensed band URLLC/IIoT | Spreadtrum Communications |
| **7** | [**R1-2104514**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104514.zip) | Enhancements for unlicensed band URLLC/IIoT | CATT |
| **8** | [**R1-2104665**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104665.zip) | Uplink enhancements for URLLC in unlicensed controlled environments | Qualcomm Incorporated |
| **9** | [**R1-2104804**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104804.zip) | Enhancements for unlicensed band URLLC/IIoT | OPPO |
| **10** | [**R1-2104901**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2104901.zip) | On the Harmonization of UL CG between NR-U and URLLC and COT-initiator Determination | Intel Corporation |
| **11** | [**R1-2105099**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105099.zip) | URLLC uplink enhancements for unlicensed spectrum | Apple |
| **12** | [**R1-2105142**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105142.zip) | Further UL enhancements for IIoT/URLLC in unlicensed controlled environment | Nokia, Nokia Shanghai Bell |
| **13** | [**R1-2105143**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105143.zip) | Enhancements for unlicensed band URLLC/IIoT | Panasonic Corporation |
| **14** | [**R1-2105162**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105162.zip) | Considerations on unlicensed URLLC | Sony |
| **15** | [**R1-2105213**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105213.zip) | Enhancements for unlicensed band URLLC/IIoT | ETRI |
| **16** | [**R1-2105304**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105304.zip) | Enhancements for unlicensed band URLLC/IIoT | Samsung |
| **17** | [**R1-2105400**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105400.zip) | Enhancements for unlicensed band URLLC/IIoT | InterDigital, Inc. |
| **18** | [**R1-2105409**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105409.zip) | Enhancements for unlicensed band URLLC/IIoT | NEC |
| **19** | [**R1-2105427**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105427.zip) | Discussion on unlicensed band URLLC/IIOT | LG Electronics |
| **20** | [**R1-2105632**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105632.zip) | Enhancements for unlicensed band URLLC/IIoT | Sharp |
| **21** | [**R1-2105695**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105695.zip) | Discussion on enhancements for unlicensed band URLLC | NTT DOCOMO, INC. |
| **22** | [**R1-2105734**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105734.zip) | On the enhancements for unlicensed band URLLC/IIoT | MediaTek Inc. |
| **23** | [**R1-2105768**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105768.zip) | Enhancements for unlicensed band URLLC/IIoT | Lenovo, Motorola Mobility |
| **24** | [**R1-2105873**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_105-e/Docs/R1-2105873.zip) | Discussion on enhancement for unlicensed URLLC/IIoT | WILUS Inc. |

# 5 Appendix

## 5.1 List of agreements

### 5.1.1 Agreements in RAN1#102-e

Agreements:

* For semi-static channel access mode,
* If sensing is needed, it is performed immediately before the configured/scheduled transmission opportunity.
* For operation with semi-static channel access, the Rel-16 random starting offsets for UL configured grants with Full BW allocation when UE initiates a COT, is not supported.

Agreements:

* For semi-static channel access mode,
  + When gNB operates as an initiating device
    - The gNB is not allowed to transmit during the idle period of any FFP associated with the gNB in which the gNB initates a COT
  + When a UE operates as an initiating device
    - The UE is not allowed to transmit during the idle period of any FFP associated with the UE in which the UE initates a COT
  + When a UE shares a COT initiated by the gNB during an FFP associated with the gNB
    - The UE is not allowed to transmit during the idle period of that FFP in which the UE shares the COT initiated by the gNB
  + When the gNB shares a COT initiated by a UE during an FFP associated with the UE
    - The gNB is not allowed to transmit during the idle period of that ~~the~~ FFP in which the gNB shares the COT initiated by the UE
  + FFS whether/how to support additional restrictions to the idle period

Agreements:

* For semi-static channel access mode, support using the transmission of any scheduled/configured UL channel/signal to initiate a COT by a UE in RRC\_CONNECTED mode
  + FFS the case when the UE is IDLE/INACTIVE mode

Agreements:

* A UE initiates a COT in an FFP associated with the UE, if the UE transmits a UL transmission burst starting at the beginning of the FFP and ending at any symbol before the FFP’s idle period after a successful CCA of 9us immediately before the UL transmission burst.

Update on 8/26

Agreements:

* At least for FBE, configuration of (*cg-RetransmissionTimer*) should not be mandated when configured grant Type 1 or Type 2 are configured on unlicensed spectrum.

**Conclusion:**

Further study and decide how to harmonize the CG features for Rel-16 URLLC and Rel-16 NR-U. Table 1 in [R1-2005376](file:///C:/Users/wanshic/OneDrive%20-%20Qualcomm/Documents/Standards/3GPP%20Standards/Meeting%20Documents/TSGR1_102/Docs/R1-2005376.zip) can be used as a starting point for the corresponding discussion and decision.

Agreements:

* Conditions on the channel access procedures with respect to sensing duration and transmission gap for UE-initiated COT with UE-to-gNB COT sharing is similar as those for gNB initiated COT and gNB-to-UE COT sharing in Rel-16 by exchanging UE and gNB roles.

Agreements:

* UE-to- gNB COT sharing in semi-static channel access mode is supported.
  + The gNB determines a COT in an FFP associated to a UE, that is initiated by the UE, if the gNB detects a UL transmission from the UE starting from the beginning of the FFP and ending before the idle period of the FFP.
    - FFS details
  + When the gNB determines a UE has initiated a COT in an FFP associated to the UE, the gNB can transmit within the FFP and before the idle period corresponding to the FFP.
    - FFS whether/how UE to gNB COT sharing when the gap is >16us

Update from 8/28 GTW

Agreements:

For semi-static channel access mode,

o    Start of FFP for UE-initiated COT can be different from the start of FFP for gNB-initiated COT.

o    FFS: FFP Periodicity for UE-initiated COT can be different from the FFP periodicity for gNB-initiated COT.

Agreements:

* For semi-static channel access mode,
* FFP parameters for UE-initiated COT can be provided to the UE by at least dedicated RRC signaling.
  + FFS on to be provided by SIB-1
* FFS whether the UE FFP periodicity is explicitly configured, or implicitly determined based on other higher layer parameters

### 5.1.2 Agreements in RAN1#103-e

Agreements:

* In semi-static channel access mode, a single FFP (periodicity and offset) is associated to an initiating device (gNB or UE) at a given time which can be used for the purpose of channel occupancy. The FFP configuration that is used for initiating channel occupancy purposes, is such that it shall not be changed for at least 200ms

**Conclusion:**

* For operation on unlicensed channels and irrespective of the adopted LBT mechanism (LBE or FBE), all transmissions in DL and UL are controlled by gNB similarly to licensed channels, and potential collisions or blocking are controlled/mitigated by gNB.

Agreements:

* + UE-to-gNB COT sharing in semi-static channel access mode with a gap > 16us is supported

**Conclusion:**

If a device X at a given time is initiating a COT, the applicable FFP for the device X is the FFP associated with X.

If a device X at a given time is sharing a COT initiated by a device Y, the applicable FFP for the device X is the FFP associated with Y.

Note 1: One of the devices X and Y is a UE and the other is its serving gNB.

Note 2: Whether or not there is additional restriction on idle period is still FFS.

**Agreements:**

Down-select one of the following options (target RAN1#104-e):

* **Option 1:** Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. *cg-RetransmissionTimer-r16*.
* **Option 2-a:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and *cg-RetransmissionTimer-r16,* respectively.
* **Option 2-b:** “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and new parameter Y, respectively, where X and Y are different from *cg-RetransmissionTimer-r16.*
* **Option 3:** CG-UCI based procedures are supported for unlicensed. CG-DFI based procedures are enabled or disabled for unlicensed using one RRC parameter *i.e. cg-RetransmissionTimer-r16*
* Note: Procedures based on CG-UCI rely on UE including CG-UCI in CG PUSCH at least as in Rel-16 where the values of the respective fields of CG-UCI are decided by UE.
* Note: Procedures based on CG-DFI rely on automatic re-transmission on CG configuration and reception of CG downlink feedback information (DFI) in DCI for re-transmissions.

Agreements:

* The gNB configures a UE to initiate semi-static CO in an unlicensed channel(s) only if the gNB configures the UE also with the higher layer parameters of the gNB’s initiating semi-static CO in the same channel(s).
  + Note: UE initiated FBE configuration is configured per serving cell

Agreements:

In semi-static channel access mode, FFP Period for UE-initiated COT is separately provided from FFP period for gNB-initiated COT.

o    Note: Any value for the period, shall be at least 1ms and at most 10ms.

o    Note: Aim for low complexity operation to handle gNB and UE COT interactions

Agreements:

In semi-static channel access mode, a UE should be able to determine whether a scheduled UL transmission should be transmitted according to shared gNB COT or UE-initiated COT.

* UE determines the initiator of a COT based on at least one of the following alternatives:
  + Alt 1: Introduce additional bit field in the scheduling DCI
  + Alt 2: Based on ChannelAccess-CPext field in DCI
  + Alt. 3: Based on a predetermined rule(s)
  + Alt. 4: Based on RRC signalling
  + Alt. 5: Based on MAC CE
  + FFS other alternatives
* FFS on overriding possibility and/or the assumption
* Note: A scheduled UL transmission cannot be transmitted according to both shared gNB COT and UE-initiated COT.

Agreements:

In semi-static channel access mode:

* When a configured UL transmission is aligned with a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE, down-select one of the following:
  + Alt-a: If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT
  + Alt-b: The UE assumes that the configured UL transmission corresponds to UE-initiated COT.
  + Alt-c: The UE assumption on whether the configured UL transmission is allowed to correspond to UE-initiated COT is based on gNB configuration.
* When a configured UL transmission starts after a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE:
  + If the UE has already initiated the UE FFP, then UE assumes that the configured UL transmission corresponds to UE-initiated COT
  + Otherwise, If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and if the UE has already determined that gNB has initiated that gNB FFP, then UE assumes that the configured UL transmission corresponds to gNB-initiated COT.
* FFS on other conditions for determining the corresponding UE or gNB initiated COT
* Note: A configured UL transmission cannot be transmitted according to both shared gNB COT and UE-initiated COT.

### 5.1.3 Agreements in RAN1#104-e

Agreement:

* PUSCH repetition Type B is supported for unlicensed band operation when using NR IIoT Rel-16 based CG
  + FFS whether/how to enhance

Agreement**:**

* In semi-static channel access mode, UE FFP periodicity is chosen from the following set of values in ms: {1, 2, 2.5, 4, 5,10}.
  + FFS on other values

Agreement:

* In semi-static channel access mode:
  + An FFP period for UE-initiated COT is configured as the same, integer multiple of, or inter-factor of the FFP period configured for gNB-initiated COT
  + FFP period for UE-initiated COT can be configured independently from FFP period of gNB-initiated COT, if the UE indicates the corresponding capability
  + FFP offset for UE-initiated COT is the starting point of first UE FFP relative to the radio frame X boundary.
    - The offset value range is 0 ≤ offset ＜FFP period of UE-initiated COT
      * FFS on X (e.g. X=0, or X= even index number)

Agreement:

In semi-static channel access mode when a UE can operate as initiating device,

* Select one of the following alternatives to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT:
* Alt-a: Determination based on the content in the scheduling DCI
  + FFS on whether the corresponding field(s) can be absent in DCI
    - If absent, determination based on the rules applied for configured UL transmissions is applied
  + FFS whether/how to handle the case when the gNB schedules an UL transmission in the next gNB’s FFP period
  + Alt-b: Determination based on the rules applied for a configured UL transmission

Agreement:

In semi-static channel access mode when a UE can operate as UE-initiated COT,

* Select one of the following alternatives to determine whether a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, is based on UE-initiated COT or sharing a gNB-initiated COT:
  + **Alt-a:** If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT
  + **Alt-b:** The UE assumes that the configured UL transmission corresponds to UE-initiated COT.

Agreement:

* In semi-static channel access mode, sharing a UE initiated COT through the gNB to other intra-cell UEs for UL transmissions, is not supported.

### 5.1.3 Agreements in RAN1#104bis-e

Agreements**:**

* Support explicit RRC configuration for the UE-FFP parameters including period and offset in RRC connected mode.

Agreements**:**

* For semi-static channel access mode, the offset value for configuration of a UE-FFP for a serving cell has a symbol level granularity.

The following agreements were made during the GTW on 16th:

Agreement:

* For semi-static channel access mode, in addition to the agreed set of period values for configuration of a UE-FFP for a serving cell:
  + Do not support any additional period value

Agreement**:**

* For semi-static channel access mode, the starting point of first UE FFP for a serving cell
  + is relative to the boundary of the radio frame of even index number (i.e. X=even indexed number in RAN1#104-e agreement).

Agreement**:**

* In semi-static channel access mode, the gNB can schedule by a DCI UL transmission(s) in a later g-FFP that is different from the g-FFP that carries the scheduling DCI.
  + The UL transmission can occur only if the corresponding channel access requirements are met.
    - FFS on details.

Agreement**:**

* In semi-static channel access mode, the gNB can schedule by a DCI DL transmission(s) in a later g-FFP that is different from the g-FFP that carries the scheduling DCI.
  + The DL transmission can occur only if the corresponding channel access requirements are met.
    - FFS on details.

Agreement:

* Select one of the following options (aiming for RAN1#105-e):
  + Option 1: Do not support PUSCH repetition Type B~~when using~~ based on NR-U Rel-16 ~~based~~ CG for unlicensed band operation.
  + Option 2: Support enhancements of PUSCH repetition Type B ~~when using~~ based on NR-U Rel-16~~based~~ CG for unlicensed band operation. FFS whether/how to enhance

Agreements

* For PUSCH repetition Type B enhancements on unlicensed spectrum, further study whether PUSCH segmentation should take into account the idle period of an FFP.
  + FFS on details

Agreements

* For PUSCH repetition Type B enhancements on unlicensed spectrum, further study whether orphan symbol(s) are transmitted if they are between two actual repetitions that are transmitted. FFS on details

**Conclusion:**

* In semi-static channel access mode, a UE as an initiating device, is allowed to transmit during the idle period of any FFP associated with the serving gNB if the UE transmission is based on UE initiated COT
  + Note: the gNB may disallow UL transmission during symbols of the idle period by configuring them either as semi-static DL symbols, or indicating them as DL with SFI.

Agreement:

* Option 2-b and option 3 are not considered further for the agreement in RAN1#103-e regarding CG harmonization

## 5.2 List of observations and proposals in contributions

R1-2104665 Qualcomm Incorporated [Uplink enhancements for URLLC in unlicensed controlled environments](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104665%20Qualcomm%20Uplink%20enhancements%20for%20URLLC%20in%20unlicensed%20controlled%20environments.docx)

**Proposal 1**: gNB indicates UE to initiate a COT based on ChannelAccess-CPext field in DCI.

**Proposal 2**: The UE assumption that the configured UL transmission is allowed to correspond to UE-initiated COT when the configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP.

**Proposal 3**: Study ED thresholds selection when UE share its COT to gNB.

**Observation 1**: Either supporting UE initiated COT in IDLE/INACTIVE mode or allowing PRACH transmission in idle period can provide more chances for the UE to send PRACH.

**Proposal 4**: Study the following alternatives for PRACH transmission in idle mode:

Alt.1: Supporting UE initiated COT by PRACH transmission in idle mode;

Alt.2: Allowing PRACH transmission in idle period of an FFP.

**Proposal 5**: Study the following two alternatives for SSB to PRACH mapping:

Alt.1 Divide PRACH occasions into two groups and SSB is mapped to PRACH occasion per group;

Alt.2: Introduce two PRACH configurations and SSB is mapped to PRACH occasions per PRACH configuration.

**Proposal 6**: Study the following alternatives for MsgA transmission in idle mode:

Alt.1: Supporting UE initiated COT by MsgA transmission in idle mode;

Alt.2: Allowing MsgA transmission in idle period of an FFP.

**Proposal 7**: Study the following for RO-to-PO mapping:

Alt.1: Divide PUSCH occasions into two groups and PRACH occasion is mapped to PUSCH occasion per group;

Alt.2: Introduce two sets of PUSCH configurations and each PUSCH configuration is associated with one PRACH configuration.

**Proposal 8**: “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and cg-RetransmissionTimer-r16, respectively.

**Proposal 9**: When cg-RetransmissionTimer is not configured, CG-CUI can be configured including at least HARQ process ID, RV ID and COT sharing information.

**Proposal 10**: For LBE, configuration of (cg-RetransmissionTimer) should be mandated when configured grant Type 1 or Type 2 are configured on unlicensed spectrum.

**Proposal 11**: NR-U CG-PUSCH shall support type A PUSCH repetition introduced in Rel.16 URLLC by reinterpreting the # of repetitions in consecutive slots as the # of repetitions in consecutive transmission occasions.

**Proposal 12**: NR-U CG-PUSCH shall support type B PUSCH repetition introduced in Rel.16 URLLC with the proposal in this contribution.

**Proposal 13**: NR-U CG-PUSCH shall support type B PUSCH repetition introduced in Rel.16 URLLC with the proposal in this contribution.

**Proposal 14**: CP extension can be used to handle the non-transmission of orphan symbol for Tpye B PUSCH repetition

**Proposal 6**: gNB can send a dynamic indicator in a DCI for UE to initiate COT by LBT, while gNB maintains

R1-2105142 Nokia, Nokia Shanghai Bell [Further UL enhancements for IIoT URLLC in unlicensed controlled environment](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105142%20Nokia%20Further%20UL%20enhancements%20for%20IIoT%20URLLC%20in%20unlicensed%20controlled%20environment.docx)

**Observation 1**: Back-to-back PUSCH repetitions are already supported with NR-U as part of Type A repetitions.

**Proposal 1**: Non-back-to-back Type A repetitions are not supported in unlicensed band.

**Proposal 2**: The use of PUSCH repetition Type B together with NR-U based multi-slot allocations should not be considered.

**Proposal 3**: For PUSCH repetition type B, symbols overlapping with an idle period of an FFP where the UE is not allowed to transmit should be specified as invalid symbol.

**Proposal 4**: A 1-symbol cyclic prefix extension (i.e. repetition of the following symbol) can be transmitted for filling the orphan symbol(s) gap that is between two actual repetitions that are transmitted, in order to avoid missing a COT during a type B repetition to other initiating device.

**Proposal 5**: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter (Option 1 from RAN1#103-e), i.e. when cg-RetransmissionTimer is not configured, NR-U specific CG features such as CG-UCI, COT sharing indication, UE-selected HARQ process ID and RV, autonomous retransmission, consecutive allocations for different TB and CG-DFI are not supported.

**Proposal 6**: PHY multiplexing/prioritization introduced in Rel-16 is supported also with NR-U CG. Interaction of CG-UCI and HARQ-ACK codebooks of different priorities is FFS.

On the support for UE-initiated COT for FBE:

**Proposal 7**: Alt-a is used for determination of the COT initiator for intra-FFP scheduled UL transmissions.

**Proposal 8**: The field(s) indicating the COT initiator in the scheduling DCI cannot be absent. Channel access related fields in Rel-16 DCI 0\_1 and 1\_1 are included in Rel-17 DCI 0\_2 and 1\_2, respectively and supported with both dynamic as well as semi-static channel access.

**Proposal 9**: Use a combination of Alt-a and Alt-b for determination of the COT initiator for cross-FFP scheduled UL transmissions. The UE processing delay for gNB COT detection should also be taken into account. Details are FFS.

**Proposal 10**: Alt-a is chosen for determination of the COT initiator for configured grant UL transmissions.

**Observation 2**: With semi-static channel occupancy, the mechanism used by a legacy (Rel-16) UE to detect and share a serving gNB COT needs further clarifications if UE-to-gNB COT sharing is supported in Rel-17.

R1-2104901 Intel Corporation [On the Harmonization of UL CG between NR-U and URLLC and COT-initiator Determination](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104901%20Intel%20On%20the%20Harmonization%20of%20UL%20CG%20between%20NR-U%20and%20URLLC%20and%20COT-initiator%20Determination.docx)

**Proposal 1**: If a gNB operates as an initiating device and schedules an UL transmission outside of its FFP, then the UE must assume that the scheduled UL transmission would need to be performed as if the UE is the initiating device irrespectively from any explicit indication provided by the gNB within the scheduled DCI or any implicit assumptions that the UE may be able to make.

**Proposal 2**: If a gNB operates as an initiating device and schedules via a DCI a DL transmission outside of its FFP, no special considerations are needed in terms of channel access requirements or COT initiator.

**Proposal 3**: In semi-static channel access mode, a UE performing scheduled UL transmissions determines the initiator of the COT based on the content of the scheduling DCI (Alt-a). In particular the bitfield ChannelAccess-CPext jointly indicates not only the channel access type and CP extension to use, but also whether a UE should operate as initiating or responding device.

**Proposal 4**: In semi-static channel access mode, early termination or cancellation of a FFP is enabled by allowing the gNB to overwrite through scheduling DCI any prior decision regarding the initiator of the COT.

**Proposal 5**: When a configured UL transmission is aligned with a u-FFP boundary and ends before the idle period of that u-FFP, if the transmission is confined within a g-FFP before the idle period of that g-FFP, and the UE has already determined that gNB has initiated that g-FFP, then the UE assumes that the configured UL transmission corresponds to gNB-initiated COT (Alt-a). Otherwise, the UE assumes that the configured UL transmission corresponds to UE-initiated COT.

**Proposal 6**: When operating on multiple carriers, the assumptions regarding the COT initiator are aligned across all carriers/ LBT BWs. In this case, a UE could assume to operate:

as an initiating device over all RBs if for at least one LBT BW i) the UE assesses that it shall operate as initiating in that LBT BW or ii) the UE has received indication to the gNB that it shall operate as an initiating device; or

as a responding device over all RBs, if for each LBT BW i) the UE assesses that it shall operate as a responding device or ii) the UE has received indication from the gNB that it shall operate as responding device.

**Proposal 7**: The “CG-UCI based procedures” is enabled or disabled through a new RRC parameter, while the “CG-DFI based procedures” is enabled or disabled based on the cg-RetransmissionTimer-r16 (Option 2-a).

R1-2104355 vivo [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104355%20vivo%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Observation 1**: No LBT for CG UL transmission within the gNB-initiated COT is not feasible.

**Observation 2**: Prioritizing the idle period of UE’s FFP is not necessary. gNB can transmit during this idle period if it does not share the UE-initiated COT.

**Observation 3**: With Alt-a, all the CG PUSCHs not confined within the gNB-initiated COT will not be transmitted if they arrive after a first CG PUSCH which is aligned with the UE’s PPF boundary and confined within the gNB-initiated COT

**Observation 4**: Alt-a will cause misunderstanding between the gNB and the UE, and additional effort is needed to avoid the confusion.

**Observation 5**: Indicating the COT sharing scheme in advance will reduce the flexibility and transmission efficiency for FBE in unlicensed band due to the uncertainty of the channel availability.A

**Proposal 1**: The equipment can be either an initiating device or responding device per active FFP.

**Proposal 2**: UE assumes that the configured UL transmissions corresponds to UE-initiated COT if it is aligned with the UE FFP boundary.

**Proposal 3**: Predetermined rules should be used for UE to determine whether a scheduled UL transmission should be transmitted according to shared gNB COT or UE-initiated COT

**Proposal 4**: Support option 1 as the framework for harmonization of UL Configured Grant (CG).

Option 1: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16.

**Proposal 5**: Do not support PUSCH repetition Type B when using NR-U Rel-16 based CG for unlicensed band operation.

R1-2104265 Huawei, HiSilicon [Uplink enhancements for URLLC in unlicensed controlled environments](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104265%20Huawei%20Uplink%20enhancements%20for%20URLLC%20in%20unlicensed%20controlled%20environments.docx)

**Proposal 1**: For determining the COT initiator for configured UL transmissions in semi-static channel access, support Alt-a in the agreement of RAN1#104-e

**Observation 1**: Given that gNB can control the timing of the scheduled UL transmission which is already involved in the determination of the COT initiator, and given the above cases in which the indication would be disregarded, in addition to the resulting inconsistency of UE behavior across configured and scheduled UL, there is no need to introduce a dynamic indication and increasing the dynamic overhead for the gNB to cancel the UL transmission if the corresponding channel access conditions are not met.

**Proposal 2**: For determining the COT initiator for scheduled UL transmissions in semi-static channel access, support Alt-b (Determination based on the rules applied for a configured UL transmission depending on whether or not the scheduled UL is confined within an initiated gNB COT) in the agreement of RAN1#104-e.

For Harmonization of CG enhancements:

**Proposal 3**: Support Option 1, i.e., both ‘CG-UCI based procedures’ and ‘CG-DFI based procedures’ are enabled/disabled using the cg-RetransmissionTimer-r16.

R1-2104219 Ericsson [Enhancements for IIoT URLLC on Unlicensed Band](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104219%20Ericsson%20Enhancements%20for%20IIoT%20URLLC%20on%20Unlicensed%20Band.docx)

**Proposal 1**: When a first DL transmission at a gNB FFP boundary is assumed to initiate a gNB-COT for that gNB FFP, if a UL transmission at a UE FFP boundary is assumed to initiate a UE COT for that UE FFP and the UL transmission is confined within that gNB FFP, a second DL transmission in that gNB FFP after the UL transmission may be associated to gNB initiated COT.

**Proposal 2**: When a first UL transmission at a UE FFP boundary is assumed to initiate a UE-COT for that UE FFP, if a DL transmission at a gNB FFP boundary is assumed to initiate a gNB COT for that gNB FFP and the DL transmission is confined within that UE FFP, a second UL transmission in that UE FFP after the DL transmission may be associated to UE initiated COT.

**Proposal 3**: In semi-static channel access mode, when a configured UL transmission is aligned with a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE, the UE assumes that the configured UL transmission corresponds to UE-initiated COT (Alt-b)

**Proposal 4**: Support inclusion of channel access fields ChannelAccess-CPext-CAPC and ChannelAccess-CPext in DCI formats 0\_2 and 1\_2, respectively with baseline functionality as in Rel-16. Further study additional enhancements

**Proposal 5**: In semi-static channel access mode, for a scheduled UL transmission the content in the scheduling DCI determines whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT (Alt-a). The corresponding fields are assumed to be present in DCI

**Proposal 6**: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16 (i.e. Option 1).

R1-2105695 NTT DOCOMO, INC. [Discussion on enhancements for unlicensed band URLLC](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105695%20NTT%20Discussion%20on%20enhancements%20for%20unlicensed%20band%20URLLC.docx)

**Proposal 1**:

When a first DL transmission at a gNB FFP boundary is assumed to initiate a gNB-COT for that gNB FFP, if a UL transmission at a UE FFP boundary is assumed to initiate a UE COT for that UE FFP and the UL transmission is confined within that gNB FFP, a second DL transmission in that gNB FFP after the UL transmission may be associated to gNB initiated COT.

When a first UL transmission at a UE FFP boundary is assumed to initiate a UE-COT for that UE FFP, if a DL transmission at a gNB FFP boundary is assumed to initiate a gNB COT for that gNB FFP and the DL transmission is confined within that UE FFP, a second UL transmission in that UE FFP after the DL transmission may be associated to UE initiated COT.

**Proposal 2**:

When a configured UL transmission is aligned with a UE FFP boundary and ends before the idle period of that UE FFP,

If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT.

Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT

**Proposal 3**:

For a scheduled UL transmission, support one of the following alternatives for the COT-initiator determination

Alt-a: Determination based on the content in the scheduling DCI

The corresponding field(s) can be absent in DCI. If absent, determination based on the rules applied for configured UL transmissions is applied

Alt-b: Determination based on the rules applied for a configured UL transmission

**Proposal 4**:

Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively

The field can be absent in DCI

**Proposal 5**:

Support Option 1: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16.

Indication of COT sharing information included in CG-UCI is separately enabled/disabled from the configuration of cg-RetransmissionTimer-r16

R1-2105304 Samsung [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105304%20Samsung%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: When a configured UL transmission aligns with a UE FFP boundary and ends before the idle period of that UE FFP, the UE assumes that the configured UL transmission corresponds to UE-initiated COT (Alt-b).

**Proposal 2**: For a scheduled UL transmission, the UE determines whether the UL transmission should be transmitted according to shared gNB COT or UE-initiated COT according to LBT indication by existing bit field ChannelAccess-CPext in the scheduling DCI (Alt-a).

**Proposal 3**: Support option 2-a for IIOT over unlicensed band:

Option 2-a: “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and cg-RetransmissionTimer-r16, respectively.

R1-2105099 Apple [URLLC uplink enhancements for unlicensed spectrum](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105099%20Apple%20URLLC%20uplink%20enhancements%20for%20unlicensed%20spectrum.docx)

**Proposal 1**-1: When a configured UL transmission is aligned with a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE, adopt Alt-b, i.e., the UE assumes that the configured UL transmission corresponds to UE-initiated COT.

**Proposal 1**-2: When a configured UL transmission overlaps with the UE FFP’s idle period,

If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the UL transmission corresponds to gNB-initiated COT using Cat-2 LBT.

Otherwise, it is not transmitted.

**Proposal 1**-3: For a scheduled UL transmission, the scheduling DCI always indicates whether the UE initiates its own COT or shares gNB’s COT (Alt-a), and the corresponding LBT scheme (Cat-1 or Cat-2 with proper CP extension).

**Proposal 2**-1: Adopt Option 2-a, i.e., “CG-UCI based procedures” are enabled or disabled for unlicensed using a new RRC parameter, and “CG-DFI based procedures” are enabled or disabled for unlicensed using cg-RetransmissionTimer-r16.

If cg-RetransmissionTimer-r16 is configured, “CG-UCI based procedures” should also be enabled.

R1-2105409 NEC [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105409%20NEC%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: Predetermined rules are supported for both configured transmission and scheduled transmission.

**Proposal 2**: gNB may send a PDCCH to cancel a low priority UE’s transmission and release the corresponding UE initiated COT in order to support high priority URLLC transmission of another UE.

**Proposal 3**: Once a UE initiated COT is released by gNB, the UE may not initiate another COT for the same transmission/service until gNB reschedules its UL transmission.

**Proposal 4**: Support both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16.

R1-2104200 FUTUREWEI [UE initiated COT for semi-static channel access](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104200%20FUTUREWEI%20UE%20initiated%20COT%20for%20semi-static%20channel%20access.docx)

**Observation 1**: gNB controls UEs channel access, potential collisions and blocking, therefore UEs always should defer the channel access and control to gNB.

**Observation 2**: Alt-a may lead to a better spectrum utilization, while Alt-b may save some energy when UE is not required to determine if gNB initiated a COT.

**Observation 3**: Alt-b requires further clarifications if and how two initiating COT devices can communicate to each other during their COTs overlap.

**Observation 4**: In Alt-b when there are multiple UEs initiating COTs transmissions in UL to a gNB initiating COT and gNB responds with multiple DL transmissions, further clarifications on the COT gNB use are necessary.

**Observation 5**: Alt-b cannot be considered without the required clarifications mentioned in the above observations.

**Proposal 1**: Support Alt-a for configured UL transmissions that are aligned with UE FFP boundary.

**Observation 6**: With an explicit DCI indication of the COT type (gNB/UE) the gNB can control exactly each UE behavior for each UL UE transmission in each gNB FFP.

**Proposal 2**: Support determination based on the content in the scheduling DCI whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT (Alt-a). The corresponding field(s) cannot be absent in DCI.

**Proposal 3**: When the gNB schedules an UL transmission in the next gNB’s FFP period support determination based on the content in the scheduling DCI whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT (Alt-a).

R1-2105400 InterDigital, Inc. [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105400%20InterDigital%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: Use Alt-a for configured UL transmissions occurring at the beginning of a UE FFP.

**Proposal 2**: Use Alt-a for scheduled UL transmissions.

**Proposal 3**: For an UL transmission scheduled in a subsequent g-FFP, the UE operates based on the rules applied for a configured UL transmission.

**Proposal 4**: CG-UCI based procedures and CG-DFI based procedures are independently enabled or disabled for unlicensed (Option 2a)

R1-2105427 LG Electronics [Discussion on unlicensed band URLLC IIOT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105427%20LG%20Discussion%20on%20unlicensed%20band%20URLLC%20IIOT.docx)

**Proposal #1**: Alt-a is preferred for the configured UL transmission aligned with UE FFP boundary, with consideration of LBT burden at UE and COT management at gNB.

**Proposal #2**: Alt-b is preferred for a scheduled UL transmission, for unified/consistent UE behaviour on any UL transmission including multi-carrier transmission and cross-FFP scheduling.

**Proposal #3**: Option 1 is preferred for the harmonization of NR-U CG and URLLC CG, with consideration of UE complexity and specification impacts.

R1-2104514 CATT [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104514%20CATT%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: In semi-static channel access mode when a UE can operate as initiating device, UE determines whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT based on the content in the scheduling DCI if present and based on the rules applied for a configured UL transmission otherwise.

**Proposal 2**: In semi-static channel access mode when a UE can operate as initiating device, all the PUSCH transmissions scheduled by a single DCI is based on UE-initiated COT or sharing a gNB-initiated COT based on the same content in the scheduling DCI.

**Proposal 3**: In semi-static channel access mode when a UE can operate as UE-initiated COT, UE assumes that a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP corresponds to UE-initiated COT.

**Proposal 4**: Support Option 1 “Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16”.

R1-2105873 WILUS Inc. [Discussion on enhancement for unlicensed URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105873%20WILUS%20Discussion%20on%20enhancement%20for%20unlicensed%20URLLC%20IIoT.docx)

**Proposal 1**: We support an explicit or implicit signaling mechanism based on the content in the scheduling DCI to determine whether a scheduled UL transmission should be transmitted according to UE-initiated COT or gNB-shared COT.

**Proposal 2**: We support Alt-a with the same UE behavior on determination of gNB and UE’s COT for the configured UL transmission regardless of whether or not the configured UL transmission is starting from being aligned with a UE’s FFP boundary.

Alt-a: If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT.

**Proposal 3**: It should be further discussed whether or not to possibly transmit configured-grant PUSCH with repetition at candidate SS/PBCH block positions for the same SS/PBCH block index after the detection of the SS/PBCH block index.

**Proposal 4**: To enhance PUSCH repetition Type-B for URLLC/IIoT in the unlicensed band, it should be further discussed how to handle on LBT gap/switching gap between segmented transmissions of nominal repetition by slot boundary or between non-contiguous PUSCH Type-B repetitions by DL reception (e.g., candidate SS/PBCH blocks, or others).

R1-2105143 Panasonic Corporation [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105143%20Panasonic%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: In semi-static channel access mode, when a configured UL transmission is aligned with a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE, if the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT.

**Proposal 2**: In semi-static channel access mode, when a UE can operate as an initiating device, whether a scheduled UL transmission is based on a UE-initiated COT or sharing a gNB-initiated COT is determined based on the content in the scheduling DCI. If the corresponding field(s) is absent, the determination is based on the rules applied for configured UL transmission.

**Proposal 3**: When configured grant Type 1 or Type 2 are configured on unlicensed spectrum, it would be useful that at least functions related to autonomous retransmission on CG and COT sharing are separately enabled/disabled by the configuration.

**Proposal 4**: The functions related to autonomous transmission on CG (e.g., DFI, indication of NDI and RV on CG-UCI) are enabled or disabled for unlicensed using one RRC parameter i.e., cg-RetransmissionTimer-r16.

**Proposal 5**: The functions related to COT sharing information in CG-UCI is independently enabled or disabled.

R1-2105162 Sony [Considerations on unlicensed URLLC](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105162%20Sony%20Considerations%20on%20unlicensed%20URLLC.docx)

**Observation 1**: If the UE always assumes that it is the COT initiator for a configured uplink transmission that starts at the UE’s FFP (i.e. Alt-b), the gNB would have to refrain from transmitting during the UE’s CCA despite not knowing whether the UE would perform an uplink transmission. This limits the gNB scheduling flexibility.

**Observation 2**: The UE power saving in not detecting whether gNB has initiated a COT in the case where UE always assumes it is the COT initiator for a configured uplink transmission that starts at the UE’s FFP (i.e. Alt-b), is marginal.

We therefore propose the following:

**Proposal 1**: The UE determines the COT initiator based on an indication in the scheduling DCI. A UE that is configured to enable COT initiation is also configured with a COT ownership indicator in the scheduling DCI (Alt-a).

**Proposal 2**: The COT ownership indicator should not be absent for a UE configured for COT initiation.

**Proposal 3**: For a configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP, the COT initiator is determined as follows:

If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that the gNB had initiated a COT in that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT (Alt-a)

**Proposal 4**: “CG-UCI based procedures” and “CG-DFI based procedures” are independently enabled or disabled for unlicensed using respective RRC parameter, i.e. new parameter X and cg-RetransmissionTimer-r16, respectively. (i.e. Option 2-a)

R1-2105632 Sharp [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105632%20Sharp%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: When a configured UL transmission is aligned with a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE, the UE assumes that the configured UL transmission corresponds to UE-initiated COT (Alt-b as the first preference). Alt-a can be supported as the second preference.

**Proposal 2**: Whether a UE-initiated COT is initiated to transmit a dynamic scheduled PUSCH is indicated by the DCI format scheduling the PUSCH, reusing ChannelAccess-CPext/ChannelAccess-CPext-CAPC field in the DCI format.

**Proposal 3**: In Rel-17 DCI 0\_2 and 1\_2, include ChannelAccess-CPext/ChannelAccess-CPext-CAPC field.

**Proposal 4**: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using cg-RetransmissionTimer-r16. (Option 1 can be supported).

R1-2105734 MediaTek Inc. On the enhancements for unlicensed band URLLC IIoT

**Proposal 1:** Support Alt-a with further reduction to the transmission confining interval to take UE processing time into consideration.

**Proposal 2:** Support Alt-b to determine whether a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT.

* Alt-b: Determination based on the rules applied for a configured UL transmission

**Proposal 3:** Support Option 1:

Option 1: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16.

R1-2105768 Lenovo, Motorola Mobility [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105768%20Lenovo%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: For configured UL transmissions,

for large UE-FFP periodicities (e.g., {4, 5, 10} ms) adopt Alt-a, and

for small UE-FFP periodicities (e.g., { 1, 2, 2.5} ms) adopt Alt-b.

**Proposal 2**: In semi-static channel access mode when a UE can operate as initiating device, the UE determines if a scheduled UL transmission is based on UE-initiated COT or sharing a gNB-initiated COT according to the scheduling DCI (i.e., adopt Alt-a).

The COT initiator field is always present

The UE would not transmit the scheduled UL transmission if the indicated COT initiation cannot be achieved.

R1-2104328 ZTE [Discussion on unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104328%20ZTE%20Discussion%20on%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: When a scheduled/configured UL transmission that is aligned with a UE FFP boundary and ends before the idle period of that UE FFP:

If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the scheduled/configured UL transmission corresponds to gNB-initiated COT.

Otherwise, UE assumes that the scheduled/configured UL transmission corresponds to UE-initiated COT.

**Proposal 2**: Option 1 is supported, i.e., both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16.

R1-2105213 ETRI [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2105213%20ETRI%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Observation 1**: Alt-b may provide a larger flexibility of choosing a COT-initiator (i.e., choosing whether or not to utilize gNB FFP idle period for transmission) for subsequent UL transmissions.

**Proposal 2**: For COT-initiator determination for configured UL, support one of the followings:

Down-select to Alt-b. (1st preference)

Support RRC configuration between Alt-a and Alt-b. (1st preference)

Down-select to Alt-a. (2nd preference)

**Proposal 3**: Support the channel access fields in Rel-16 DCI 0\_1 and 1\_1 to be included in Rel-17 DCI 0\_2 and 1\_2, respectively.

**Proposal 4**: For COT-initiator determination for scheduled UL, support Alt-a. If the field is absent in DCI, the determination is based on the rules applied for configured UL transmissions.

**Proposal 5**: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16 (Option 1).

R1-2104422 Spreadtrum Communications [Discussion on enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104422%20Spreadtrum%20Discussion%20on%20enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: For scheduled UL transmission, the initiator of a COT can be:

Alt-a: Determination based on the content in the scheduling DCI

the corresponding field(s) can be absent in DCI

If absent, determination based on the rules applied for configured UL transmissions is applied

**Proposal 2**: When a configured UL transmission is aligned with a UE FFP boundary and ends before the idle period of that UE FFP associated to the UE:

Alt-a: If the transmission is confined within a gNB FFP before the idle period of that gNB FFP, and the UE has already determined that gNB is initiated that gNB FFP, UE assumes that the configured UL transmission corresponds to gNB-initiated COT. Otherwise, UE assumes that the configured UL transmission corresponds to UE-initiated COT

**Proposal 3**: Support Option 1 for CG-PUSCH harmonization.

Option 1: Both “CG-UCI based procedures” and “CG-DFI based procedures” are enabled or disabled for unlicensed using one RRC parameter i.e. cg-RetransmissionTimer-r16.

R1-2104804 OPPO [Enhancements for unlicensed band URLLC IIoT](file:///C:\3GPP_RAN1\RAN1_105_e\8.3\R1-2104804%20OPPO%20Enhancements%20for%20unlicensed%20band%20URLLC%20IIoT.docx)

**Proposal 1**: UE should determine the initiator of a COT based on content in DCI.

**Proposal 2**: Alt-a should be adopted for UE to determine the initiator of a COT for configured grant uplink transmission.

**Proposal 3**: Option 1 is preferred that CG-UCI procedure and CG-DFI procedure follow R16 NR-U mechanism.

**Proposal 4**: cg-RetransmissionTimer can be configured for each configured grant independently.