**3GPP TSG RAN WG1 #100bis-e R1-2002876**

e-Meeting, April 20th – 30th, 2020

Source: NTT DOCOMO, INC.

Title: Summary on Email discussion [100b-e-NR-UEFeatures-URLLC/IIoT-09]

Agenda Item: 7.2.11.5

**Document for:** **Discussion and Decision**

# **Introduction**

This contribution summarizes the following email discussion in AI 7.2.11.5 regarding UE features for URLLC/IIoT.

[100b-e-NR-UEFeatures-URLLC/IIoT-09] Email discussion/approval on issues with capability signaling impacts on FGs related to other enhancements for URLLC (dates TBD) – Hiroki (DCM)

* Discuss followings on 11-5
  + Whether or not FG11-5 includes component 3, 6, 8, and 9
  + Whether report type should be per UE or per band
    - If it is per UE,
      * Confirm FG11-5 does not need “FDD/TDD differentiation” and “FR1/FR2 differentiation”
* Discuss followings on 11-6
  + Whether to add “a component for the supported maximum number of PUSCH repetitions” or to remove it
  + Whether or not report type should be per UE or per band
    - If it is per UE,
      * Whether FG11-6 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”
        + If differentiation is needed for both,

Whether/how to clarify capability interpretation for “support mixture of FDD/TDD and/or FR1/FR2”

* Discuss followings on 11-7
  + Whether report type should be per UE or per FS
    - If it is per UE,
      * whether FG11-7 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”
        + If differentiation is needed for both,

Whether/how to clarify capability interpretation for “support mixture of FDD/TDD and/or FR1/FR2”

* + - Confirm to remove the following FFS “FFS: Whether to add new FG with FG11-7 as prerequisite for the support of more than one monitoring occasion for DCI 2\_4 per slot? Can we just add the following note to address the concern?”
* Discuss followings on 11-8
  + Whether or not FG11-8 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”
    - If differentiation is needed for both,
      * Whether/how to clarify capability interpretation for “support mixture of FDD/TDD and/or FR1/FR2”
* Note that discussed FGs in this email discussion are derived by outcome of high priority email discussion in FL proposal 4

In the email discussion [100b-e-NR-UEFeatures-URLLC/IIoT-04], following agreements were made.

**Agreements:**

* Following FGs are included in UE features list for URLLC.
  + 11-6 PUSCH repetition Type A

# **11-6: PUSCH repetition Type A**

Based on agreements and [1], FG11-6 can be defined as below.

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 11.  NR\_L1enh\_URLLC | 11-6 | PUSCH repetition Type A | 1. PUSCH transmission with Rel-15 behavior with or without slot aggregation.   • With slot aggregation, the number of repetitions can be [either semi-statically configured (as in Rel-15) or] dynamically indicated (as agreed for Rel-16).  • When dynamically indicated, the number of repetitions is jointly coded with SLIV in TDRA table, by adding an additional column for the number of repetitions in the TDRA table. | 2-12, 2-13, 2-14, 2-15 (TBD) | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] | FFS: Whether to add a component for the supported maximum number of PUSCH repetitions | Optional with capability signalling |

**Companies are encouraged to provide feedbacks focusing on signaling design aspects (e.g., components with candidate values for reporting, Type, Need of xDD/FRx differentiation).**

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| Company | Comment |
| Huawei/HiSilicon | 1. Ok to remove the semi-static part also, i.e. remove the text in the bracket in the first sub-bullet. 2. Didn't see necessity to do differentiations. 3. As to “Whether to add a component for the supported maximum number of PUSCH repetitions”, we are open to discuss it though so far don't see the necessity. |
| Ericsson | 1. Prefer to remove the component on supported maximum number of PUSCH repetition. The values larger than present in Rel. 15 are 12 and 16. It is important to be able to use these values for increased coverage 2. No need to have FG5-17 as a prerequisite. FG5-17 is a mandatory feature in Rel-15, so all UEs should support that 3. Support per UE. This is very similar to FG5-17 which does not have FDD/TDD differentiation or FR1&FR2 differentiation. Also the feature is per UE in Rel-15 4. Seems okay to remove description in brackets since it describes Rel. 15 functionality which is in another FG5-17 |
| Qualcomm | 1. Adding a component for the maximum number of PUSCH repetitions 2. Removing the perquisite features 3. Per band capability signaling 4. As a note, for component 1, the candidate values are {semi-static only, both semi-static and dynamic} 5. For component 2, the candidate values are {1,2,3,4,7,8,12,16} |
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Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

**Based on the feedbacks, at least following points should be discussed for FG11-6.**

* **Whether or not to remove the FFS “Whether to add a component for the supported maximum number of PUSCH repetitions”**
* **Whether or not FG5-17 is included as a prerequisite feature group**
* **Whether or not report type should be per UE or per band**
  + **If it is per UE,** 
    - **Whether FG11-6 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”**
* **Confirm the description with brackets from the component “[either semi-statically configured (as in Rel-15) or]” can be removed.**

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| [3] | vivo | We suggest to make following revision to component 1), as the semi-static part is Rel-15 feature thus no need to duplicate here.   |  | | --- | | 1) PUSCH transmission with Rel-15 behavior with or without slot aggregation.  • With slot aggregation, the number of repetitions can be ~~[either semi-statically configured (as in Rel-15) or]~~ dynamically indicated (as agreed for Rel-16). |   Regarding FFS Whether to add a component for the supported maximum number of PUSCH repetitions, we think there is no need to add. |
| [10] | CATT | We think it sufficient to include dynamic indication of repetition factor which is different from Rel-15 FG 5-17 PUSCH repetitions over multiple slots and we think FG 5-17 should be one of the prerequisite feature groups of FG 11-6.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 11-6 | PUSCH repetition Type A | 1) PUSCH transmission with Rel-15 behavior with or without slot aggregation.  • With slot aggregation, the number of repetitions can be ~~[either semi-statically configured (as in Rel-15) or]~~ dynamically indicated (as agreed for Rel-16).  • When dynamically indicated, the number of repetitions is jointly coded with SLIV in TDRA table, by adding an additional column for the number of repetitions in the TDRA table. | 2-12, 2-13, 2-14, 2-15, 5-17 | Yes | N/A |  | [Per UE] | [No] | [No] | [support mixture of FDD/TDD and/or FR1/FR2] | ~~FFS: Whether to add a component for the supported maximum number of PUSCH repetitions~~ | Optional with capability signalling | |
| [14] | Nokia, NSB | We do not see a need for separate capability on the number of supported repetitions. A similar approach has been followed in Rel-15 already. |
| [15] | Qualcomm | Following updates are proposed.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 11-6 | PUSCH repetition Type A | 1) PUSCH transmission with Rel-15 behavior with or without slot aggregation.  • With slot aggregation, the number of repetitions can be [either semi-statically configured (as in Rel-15) or] dynamically indicated (as agreed for Rel-16).  • When dynamically indicated, the number of repetitions is jointly coded with SLIV in TDRA table, by adding an additional column for the number of repetitions in the TDRA table.   1. Maximum number of PUSCH repetitions |  | Yes | N/A |  | PerBand | N/A | N/A |  | Componenet-1  candidate value set: {‘semi-static only’, ‘both semi-static and dynamic’}  Componenet-2  candidate value set: {1,2,3,4,7,8,12,16} | Optional with capability signalling | |

# **[11-5: PUSCH repetition type B]**

Based on [1], FG11-5 can be defined as below although it is still under the discussion in [100b-e-NR-UEFeatures-URLLC/IIoT-04].

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 11.  NR\_L1enh\_URLLC | 11-5 | PUSCH repetition type B | 1. For a transport block, one dynamic UL grant or one configured grant schedules two or more PUSCH repetitions that can be in one slot, or across slot boundary in consecutive available slots. 2. Dynamic indication of the nominal number of repetitions in the DCI scheduling dynamic PUSCH. 3. [The time window within which valid symbols are used for transmission is L\*K, starting from the first symbol indicated by the SLIV in TDRA field.] 4. PUSCH repetition type B is supported for DCI format 0\_1 and DCI format 0\_2 (for DG and type 2 CG). 5. S and L are separately indicated (4-bit for S and 4-bit for L). L <= 14. 6. [TBS is determined based on L indicated in TDRA table entry reusing Rel-15 mechanism.] 7. [Handling of interaction with DL/UL directions depending on whether dynamic SFI is configured or not, including both cases with and without higher layer parameter *InvalidSymbolPattern* configured] 8. [Supported maximum number of actual repetitions within a slot] 9. [Supported PUSCH hopping scheme] | TBD | Yes | N/A |  | [Per UE]  FFS: Per band | [No] | [No] | [N/A] | Candidate value for component 8):  {2, 3, 4, 7, [8], [12]}  FFS: just add some note here with an example below:  [The total number of unicast PUSCHs for different TBs per slot per CC is subjected to the capability reported by FG 5-12, 5-12a, 5-12b, 5-13d, 5-13e and 5-13f]  FFS: Can we just add some note here with an example below for compromise?  [PUSCH repetition type B with configured grant is applied only if UE reports the support of FG 5-19 or FG 5-20, and subjected to the capability of FG 5-19 and FG 5-20].  FFS: Can we just add some note here with an example below for compromise?  [The case that both dynamic SFI and InvalidSymbolPattern are configured is applied only if UE reports the support of FG3-6.] | Optional with capability signalling |

**Companies are encouraged to provide feedbacks focusing on signaling design aspects (e.g., components with candidate values for reporting, Type, Need of xDD/FRx differentiation).**

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| Company | Comment |
| Huawei/HiSilicon | 1. We prefer to keep these components. For example, it should be allowed for UE to report the actual repetitions within a lot by component 8), since more repetitions will increase the UE complexity. 2. We are open with the reporting type with FS. 3. As to the question “Whether to set separate UE capabilities for the total number of unicast PUSCHs for different TBs per slot per CC” and “Whether to set separate UE capabilities for different UE processing time capability” which may have impact on the structure of the FG, based on the views from companies, it seems common understanding is that there should be UE capability on the total number of unicast PUSCHs for different TBs per slot per CC. The key question is whether we need to add new FGs corresponding this, or we can just reuse the Rel-15 capabilities. According to the description of FG 5-12, 5-12a, 5-12b, 5-13d, 5-13e and 5-13f defined in Rel-15, it can be applicable here also. Therefore, for simplicity, instead of adding a bunch of new feature groups, adding the following note is sufficient in our understanding. However, we are open if people really wants to add separate UE capabilities.   *The total number of unicast PUSCHs for different TBs per slot per CC is subjected to the capability reported by FG 5-12, 5-12a, 5-12b, 5-13d, 5-13e and 5-13f*   1. Support of invalid symbol pattern will increase additional UE complexity, thus it is slightly preferred to set a separate UE capability. However, we are fine with no additional capability either. 2. We are fine with no separate of DCI format 0\_1 and DCI format 0\_2 here. |
| Ericsson | First of all, the wording in component 3 needs to be corrected. The starting symbol is not indicated by SLIV in TDRA field. It is indicated by S in TDRA field.  Also companies responses that are copied below seems to belong to another topic  Regarding component 8, it seems that it can be inherited from the 5-X feature groups. For component 9 we have introduced a new scheme here which is inter-repetition scheme. This might need a separate signalling. Intra PUSCH hopping exists in Rel-15 but PUSCH repetition type B is Rel-16.  The capability should be per-UE but it should be ok to differentiate between FR1/FR2 and TDD/FDD  Agree that total number of unicast PUSCHs for different TBs per slot per CC is subjected to the capability reported by FG 5-12, 5-12a, 5-12b, 5-13d, 5-13e and 5-13f  No need for separation between dynamic grant and configured grant  No need for separate capability for the support of invalid symbols from e.g. semi-static DL symbols, and most likely also from other symbols such as symbols used for SSB. Therefore the invalidsymbolpattern should also be supported as a basic part of the feature  No need for separate capability for DCI 0\_1 and DCI 0\_2 |
| Qualcomm | 1. This FG should be split based on the number of TBs, processing capability and self vs. xCC scheduling 2. Capability type is per Band 3. All the brackets for the components should be removed. 4. Configured grant and dynamic grant PUSCH should be separated. |
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Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

**Based on the feedbacks, at least following points should be discussed for FG11-5.**

* **Whether or not FG11-5 includes component 3, 6, 8, and 9**
* **Whether report type should be per UE or per band**
  + **If it is per UE,** 
    - **Confirm FG11-5 does not need “FDD/TDD differentiation” and “FR1/FR2 differentiation”**
* **Confirm The following FFSs and brackets of corresponding notes can be removed:**
  + **[The total number of unicast PUSCHs for different TBs per slot per CC is subjected to the capability reported by FG 5-12, 5-12a, 5-12b, 5-13d, 5-13e and 5-13f]**
  + **FFS: Whether to set separate UE capabilities for dynamic grant and configured grant. Can we just add some note here with an example below for compromise?**
  + **[PUSCH repetition type B with configured grant is applied only if UE reports the support of FG 5-19 or FG 5-20, and subjected to the capability of FG 5-19 and FG 5-20].**
  + **FFS: Whether to set separate UE capabilities for the case that dynamic SFI is configured and InvalidSymbolPattern is configured. Can we just add some note here with an example below for compromise?**
  + **[The case that both dynamic SFI and InvalidSymbolPattern are configured is applied only if UE reports the support of FG3-6.]**
  + **FFS: Whether to set separate UE capabilities for DCI format 0\_1 and DCI format 0\_2 for PUSCH repetition type B. Can we go majority view that no separate UE capability?**

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| [2] | ZTE | Suggest merging FG 11-10 and FG 11-11. In addition, the special bit fields in a DCI format for releasing a Type 2 CG configuration and a SPS configuration is the same. We don’t see any difference in terms of UE complexity between support of CG release and SPS release. Therefore, we propose the following revisions.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | ***Suggested revision #5 on FG 11-10/11-11 for URLLC and FG 12-3 for IIoT*** | | | | | | Index | Feature group | Components | Prerequisite feature groups | Note | | 11-10 | A single release in a DCI for one configured grant Type 2 configuration or one SPS configuration for a given BWP of a serving cell | 1. Support of type 2 configured grant release by DCI format 0\_1 and SPS release by DCI format 1\_1.   2)Support of type 2 configured grant release by DCI format 0\_2 and SPS release by DCI format 1\_2. | *downlinkSPS*  *or*  *configuredUL-GrantType2* | A UE supporting component 1) and 11-1 (DCI format 0\_2/1\_2) shall also support component 2) .  A UE supporting component 2) shall also support component 1) . | | ~~11-10~~ | ~~Type 2 configured grant release by DCI format 0\_1~~ | ~~Support of type 2 configured grant release by DCI format 0\_1~~ |  | ~~[A UE supporting this feature and 11-1 (DCI format 0\_2/1\_2) shall also support 11-11 (Type 2 configured grant release by DCI format 0\_2).]~~  ~~FFS: Whether to merge with FG 11-11~~ | | ~~11-11~~ | ~~Type 2 configured grant release by DCI format 0\_2~~ | ~~Support of type 2 configured grant release by DCI format 0\_2~~ |  | ~~[A UE supporting this feature shall also support 11-10 (Type 2 configured grant release by DCI format 0\_1).]~~  ~~FFS: Whether to merge with FG 11-10~~ | | ~~12-3~~ | ~~SPS release by DCI format 1\_1 and 1\_2~~ | ~~Support of SPS release by DCI format 1\_1~~  ~~Support of SPS release by DCI format 1\_2~~ |  | ~~A UE supporting component 1 and 11-1 (DCI format 0\_2/1\_2) shall also support component 2 (SPS release by DCI format 1\_2).~~ | |
| [3] | vivo | We are fine to merge 11-10 and 11-11 to reduce the number of feature groups. |
| [7] | Media Teck Inc. | Combine FG11-10 and FG11-11 into one feature group. |
| [8] | LGE | On FG11-10/11, we are fine to combine FG 11-10 and FG 11-11 as one feature group for simplicity.  It may be necessary to add notes “Type 2 configured grant release by DCI format 0\_2 is subjected to the capability reported by FG 11-1”. |
| [10] | CATT | It was proposed to merge the two FGs as for SPS FG 12-3. |
| [14] | Nokia, NSB | Propose to merge in a single feature group. |
| [15] | Qualcomm | Following updates are proposed.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 11-10 | Type 2 configured grant release by DCI format 0\_1 and 0\_2 | 1. Support of type 2 configured grant release by DCI format 0\_1 2. Support of type 2 configured grant release by DCI format 0\_2 |  | Yes | N/A |  | Per UE | Yes | Yes | The capability interpretation is from the perspective of a carrier on which the release DCI is received | [A UE supporting component 1 and 11-1 (DCI format 0\_2/1\_2) shall also support component 2 (Type 2 configured grant release by DCI format 0\_2).] | Optional with capability signalling | |

# **[11-7: UL cancelation scheme]**

Based on [1], FG11-7 can be defined as below although it is still under the discussion in [100b-e-NR-UEFeatures-URLLC/IIoT-04].

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 11.  NR\_L1enh\_URLLC | 11-7 | UL cancelation scheme | 1. Supports group common DCI (i.e. DCI format 2\_4) for cancelation indication 2. UL cancelation for PUSCH  * Cancellation is applied to each PUSCH repetition individually in case of PUSCH repetitions  1. UL cancelation for SRS symbols that overlap with the cancelled symbols 2. [For the serving cell, the UE determines the first symbol of the symbols to be the first symbol that is after from the end of a PDCCH reception where the UE detects the DCI format 2\_4, where is provided by higher layer.] | TBD | Yes | N/A |  | [Per UE]  FFS: FS | [No] | [No] | [N/A] | FFS: Can we just add the following note to address the concern?  [More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b] | Optional with capability signalling |

**Companies are encouraged to provide feedbacks focusing on signaling design aspects (e.g., components with candidate values for reporting, Type, Need of xDD/FRx differentiation).**

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| Company | Comment |
| Huawei/HiSilicon | 1. We are open with FS though don’t see the necessity. 2. Keep the note “More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b”. Agree with some companies that it can depend on Rel-15 UE capability, if UE report the support of FG 3-5/FG 3-5a/FG 3-5b, then it means that it can support more than one monitoring occasion within 1 slot. However, I guess the concern from companies is that if we don't say anything here, it may mean if a UE wants to support FG 11-7 simulteanously it needs to support FG 3-5/FG3-5a/FG 3-5b, even it only intends to support one monitoring occasion per slot. Therefore, instead of adding a new FG the note is sufficient. 3. We still don’t see the necessity for separate FG for self-carrier and cross-carrier still. Would like to see the motivations first. |
| Ericsson | 1. The reporting should be per UE. In our view there is no reason to differentiate FDD and TDD. Regarding frequency range 2. Regarding more than one monitoring occasion per slot, we we don’t need to introduce a new FG. Having a note to FG11-7 is ok. 3. We do not see a need in addition of timeline description. This is written already in TS38.213. Instead, we can clarify that UE supports configuration of d\_delta\_offset RRC parameter as the feature component |
| Qualcomm | 1. Separate FGs for self-carrier cancellation vs. x-CC cancellation 2. Signaling Type is FS 3. Additional FGs for supporting more than one monitoring occasion for DCI 2\_4 per slot on the same CC and on different CC. |
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Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

**Based on the feedbacks, at least following points should be discussed for FG11-7.**

* **Whether report type should be per UE or per FS**
  + **If it is per UE,** 
    - **whether FG11-7 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”**
  + **Confirm to remove the following FFS “FFS: Whether to add new FG with FG11-7 as prerequisite for the support of more than one monitoring occasion for DCI 2\_4 per slot? Can we just add the following note to address the concern?”**
* **Whether or not to add unit for the timeline description. For example, “after Tproc, 2 +d symbol” or “after d symbol after Tproc, 2”.**

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| [3] | vivo | Regarding the 1st FFS in note, we think it make sense to have separate feature groups for same CC and cross-CC UL CI operation.  Regarding the 2nd FFS in note, we think have a note as proposed should be fine. |
| [4] | OPPO | For 11-7, it is suggested to add cancellation timeline in component due to it impacts UE implementation. |
| [7] | Media Tek Inc. | For FG11-7, we have the following suggestions:   * Support the addition of the following note as proposed by the rapporteur: *“More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b”*. * Set separate UE capabilities for UL CI on the same CC and on another CC. Same-CC cancellation and cross-CC cancellation have different implementation complexity, and should be reported separately. |
| [8] | LGE | On FG 11-7, Tproc, 2 is in absolute time unit, however, d would be a value in symbol level. For simplicity, we would like to add unit. For example, “after Tproc, 2 +d symbol” or “after d symbol after Tproc, 2”.  Regarding FFS on more than one monitoring occasion, we support raportuer’s suggestion. If UE can monitor UL grant with <1 slot periodicity, UE should be able to monitor UL CI with <1 slot periodicity as well. It is not necessary to make specific monitoring capabilty only for UL CI. Moreover, UL CI already has restrcition in terms of the number of BD. If UL CI has same restriction on type 3 CSS like other DCI format, there won’t be a problem. |
| [10] | CATT | Component 4) has been captured in the physical specification and our understanding is that it should be followed once UL cancellation is supported. It doesn’t need to be included in the UE capability.  UL cancellation indication is used to cancel the uplink transmission within the target resource region, there is nothing about whether the UL CI is transmitted on the same CC or different CC. It is similar to pre-empted indication which can be transmitted on the same CC or different CC with PDSCH. The same logic should be applied here.  Whether more than one monitoring occasions for DCI format 2\_4 per slot is applied depends on the FG 3-5 or FG3-5a or FG-3-5b. We don’t see the necessity to add new FG with FG11-7 as prerequisite for the support of more than one monitoring occasion for DCI format 2-4 per slot. |
| [12] | Apple | We do not see the need to have a separate feature defined for the case with more than one monitoring occasions within a slot for DCI format 2\_4. The configuration should be allowed as long as it is supported by the UE PDCCH monitoring capability (e.g. the UE supports FG 3-5/3-5a/3-5b/11-2).  **Proposal 13: Do not define a separate feature for the case with more than one monitoring occasions within a slot for DCI format 2\_4.**  On the same-CC and cross-CC monitoring of DCI format 2\_4, we would prefer to separate them. The same-CC and cross-CC handling may be very different in UE implementation, and the timeline consideration can also be different.  **Proposal 14: Split FG 11-7 into two FGs, one for same-CC monitoring and one for cross-CC monitoring of DCI format 2\_4.**  For FG 11-7a, we support adding this FG to capture what was concluded in RAN1#100-e email discussions.  **Proposal 15: Introduce FG 11-7a.**  On the handling of CBG-based transmission, there is the same issue on PUSCH cancelation as in intra-UE prioritization. Similarly, we propose:  **Proposal 16: Introduce a FG (e.g. 11-7b) that a UE is not expected to be scheduled with a CBG-based HARQ retransmission that does not include the full TB if the initial HARQ transmission was cancelled in case of inter-UE cancelation.** |
| [13] | Panasonic | Question 1: Whether to set separate UE capabilities for >1 monitoring occasion within 1 slot when 1-slot is the configured UL CI monitoring periodicity?  Rapporteur agree with some companies that it can depend on Rel-15 UE capability, if UE report the support of FG 3-5/FG 3-5a/FG 3-5b, then it means that it can support more than one monitoring occasion within 1 slot. However, rapporteur guesses the concern from companies who said yes is that if we don't say anything here, it may mean if a UE wants to support FG 11-7 simultaneously it needs to support FG 3-5/FG3-5a/FG 3-5b, even it only intends to support one monitoring occasion per slot. Therefore, instead of adding a new FG, Can we just add the following to the Note column?  *More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b.*  We are ok with rapporteur's suggestion.  Question 2: Whether to set separate UE capabilities for UL CI on the same CC and on another CC?  It seems no explicit reason provided here why we need separate UE capability for the case of same CC and the case of UL CI on another CC. We may need more discussion, If you prefer separate UE capability, can you provide your detailed reason here?  Cross carrier UL CI requires cross-carrier related implementation where can impact the parallel processing per CC. Therefore, we see separate capability would be more reasonable. |
| [14] | Nokia, NSB | * + Rapporteur proposal on the monitoring: We are fine to have a note there. Anyhow, it should be clear that if UE does not support more than one PDCCH occasion per slot, then this would equally apply for UL CI monitoring.   + Rapporteur Question 2: We don’t see a need for separate capability for cross-carrier UL CI indication.   + Addition of component 4 could be fine. |
| [15] | Qualcomm | Following updates are proposed.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 11-7a | UL cancelation scheme on same CC | 1) Supports group common DCI (i.e. DCI format 2\_4) for cancelation indication on the same CC as PUSCH or SRS  2) UL cancelation for PUSCH  • Cancellation is applied to each PUSCH repetition individually in case of PUSCH repetitions  3) UL cancelation for SRS symbols that overlap with the cancelled symbols  [4) For the serving cell, the UE determines the first symbol of the symbols to be the first symbol that is after from the end of a PDCCH reception where the UE detects the DCI format 2\_4, where is provided by higher layer.] |  | Yes | N/A |  | FS | N/A | N/A |  | [More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b] | Optional with capability signalling | | 11-7b | More than one monitoring occasion for DCI 2\_4 per slot on same CC | Monitoring occasions per slot for DCI 2\_4 reception on the same CC as PUSCH or SRS  Supported combinations of (X, Y), where X is the minimum gap between monitoring occasions measured from beginning to beginning of the monitoring occasions, including across slots, and Y is the duration of the monitoring occasion, with both X and Y in units of symbols | 11-7a | Yes | N/A |  | FS | N/A | N/A |  | Candidate value set:  (X, Y) =  {(7, 3),  (7, 3) and (4, 3),  (7, 3) and (4, 3) and (3,2),  (7, 3) and (4,3) and (3,2) and (2,2),  (7,3) and (4,3) and (2,2)} | Optional with capability signaling | | 11-7c | UL cancellation scheme on another CC | 1) Supports group common DCI (i.e. DCI format 2\_4) for cancelation indication on a different CC as PUSCH or SRS  2) UL cancelation for PUSCH  • Cancellation is applied to each PUSCH repetition individually in case of PUSCH repetitions  3) UL cancelation for SRS symbols that overlap with the cancelled symbols  [4) For the serving cell, the UE determines the first symbol of the symbols to be the first symbol that is after from the end of a PDCCH reception where the UE detects the DCI format 2\_4, where is provided by higher layer.] |  | Yes | N/A |  | FS | N/A | N/A |  |  | Optional with capability signaling | | 11-7d | More than one monitoring occasion for DCI 2\_4 per slot on another CC | Monitoring occasions per slot for DCI 2\_4 reception on a different CC from PUSCH or SRS  Supported combinations of (X, Y), where X is the minimum gap between monitoring occasions measured from beginning to beginning of the monitoring occasions, including across slots, and Y is the duration of the monitoring occasion, with both X and Y in units of symbols | 11-7c | Yes | N/A |  | FS | N/A | N/A |  | Candidate value set:  (X, Y) =  {(7, 3),  (7, 3) and (4, 3),  (7, 3) and (4, 3) and (3,2),  (7, 3) and (4,3) and (3,2) and (2,2), (7,3) and (4,3) and (2,2)} | Optional with capability signaling | |
| [16] | Huawei, HiSilicon | * + No strong motivation to set separate UE capabilities for the UL CI on the same CC and on another CC.   + As to whether to add new FG with FG11-7 as prerequisite for the support of more than one monitoring occasion for DCI 2\_4 per slot, we don’t see strong motivation. The note “*More than one monitoring occasion for DCI format 2\_4 per slot is applied only if the UE reports to support FG 3-5 or FG 3-5a or FG 3-5b*” is enough. |

# **[11-7a: Cancellation of the overlapping PUSCHs in an intra-band UL CA without indication in the DCI format 2-4]**

Based on [1], FG11-7a can be defined as below although it is still under the discussion in [100b-e-NR-UEFeatures-URLLC/IIoT-04].

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 11.  NR\_L1enh\_URLLC | [11-7a] | Cancellation of the overlapping PUSCHs in an intra-band UL CA without indication in the DCI format 2-4 | 1. For a UE indicating the capability of *pa-PhaseDiscontinuityImpacts*, and if the PUSCH on at least one serving cell is cancelled, the UE may cancel the (repetition of the) PUSCHs transmission on all other intra-band serving cell(s). The cancellation of the (repetition of the) PUSCH transmission on a the set of intra-band serving cell(s) includes all symbols from the earliest symbol that is overlapping with the first cancelled symbol of the PUSCH on the serving cell for which the DCI format 2\_4 is applicable to. | 6-23, 11-7 (TBD) | Yes | N/A |  | [PerBand] | [N/A] | [N/A] | TBD | FFS: Whether to add this FG and the content for each column if added | Optional with capability signaling |

**Companies are encouraged to provide feedbacks focusing on signaling design aspects (e.g., components with candidate values for reporting, Type, Need of xDD/FRx differentiation).**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | We are ok to keep FG 11-7a, i.e. removing the bracket. |
| Ericsson | Its ok to introduce this. But it needs to be clarified that for a UE indicating *pa-PhaseDiscontinuityImpacts* but not FG [11-7a], UL CI cannot be applied in the scenario of intra-band UL CA |
| Qualcomm | 1. Keep 11-7a. 2. Signaling type is FS. |
|  |  |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [3] | vivo | There was following conclusion in RAN1#100e based on which 11-7a should be kept.  Conclusion:   * It is possible for a UE to indicate both  *pa-PhaseDiscontinuityImpacts*  (i.e. 6-23) and the support of UL CI for intra-band UL CA * For a UE indicates a capability to cancel overlapping PUSCHs on different intra-band serving cells (if any), and the capability of *pa-PhaseDiscontinuityImpacts*, and if the PUSCH on at least one serving cell is cancelled, the UE cancels the (repetition of the) PUSCHs transmission on all other intra-band serving cell(s). The cancellation of the (repetition of the) PUSCH transmission on a the set of intra-band serving cell(s) includes all symbols from the earliest symbol that is overlapping with the first cancelled symbol of the PUSCH on the serving cell for which the DCI format 2\_4 is applicable to.   **Proposal 10: Keep FG 11-7a.** |
| [4] | OPPO | In CA scenario, if UE reports the capability of *pa-PhaseDiscontinuityImpacts*, and the PUSCH on at least one serving cell is cancelled, the UE cancels the (repetition of the) PUSCHs transmission on all other intra-band serving cell(s). it is suggested to add as sub-feature group of 11-7 |
| [5] | Ericsson | While we recognize that FG [11-7a] reflects a RAN1 conclusion on intra-band cancellation, the meaning of this FG should be clarified. As stated in the conclusion, for a UE with indication of UL CI and capability of *pa-PhaseDiscontinuityImpacts*, the UE performs the cancellation on all other intra-band serving cells if intra-band UL CA is configured. Thus it is not straightforward why the UE need to report FG [11-7a]. It should be clarified that for a UE indicating *pa-PhaseDiscontinuityImpacts*, when FG [11-7a] is not indicated, UL CI cannot be applied in the scenario of intra-band UL CA.   1. FG [11-7a] is introduced with clarification that for a UE indicating *pa-PhaseDiscontinuityImpacts* but not FG [11-7a], UL CI cannot be applied in the scenario of intra-band UL CA. |
| [14] | Nokia, NSB | 11-7a: we have not identified the need for separate capability here for *pa-PhaseDiscontinuityImpacts*. A UE indicating 11-7 and 6-23, should automatically support also 11-7a. If needed, this could be spelled out as a new component in 11-7 if needed, but clearly no independent reporting is seen as needed. |
| [15] | Qualcomm | Following updates are proposed.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 11-7e | Cancellation of the overlapping PUSCHs in an intra-band UL CA without indication in the DCI format 2-4 | 1) For a UE indicating the capability of *pa-PhaseDiscontinuityImpacts*, and if the PUSCH on at least one serving cell is cancelled, the UE may cancel the (repetition of the) PUSCHs transmission on all other intra-band serving cell(s). The cancellation of the (repetition of the) PUSCH transmission on a the set of intra-band serving cell(s) includes all symbols from the earliest symbol that is overlapping with the first cancelled symbol of the PUSCH on the serving cell for which the DCI format 2\_4 is applicable to. | 6-23, 11-7 | Yes | N/A |  | PerBand | N/A | N/A |  |  | Optional with capability signaling | |
| [16] | Huawei, HiSilicon | FG 11-7a should be kept as separate UE capability. |

# **Conclusion**

TBD

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 11.  NR\_L1enh\_URLLC | 11-6 | PUSCH repetition Type A | 1. PUSCH transmission with Rel-15 behavior with or without slot aggregation.   • With slot aggregation, the number of repetitions can be [either semi-statically configured (as in Rel-15) or] dynamically indicated (as agreed for Rel-16).  • When dynamically indicated, the number of repetitions is jointly coded with SLIV in TDRA table, by adding an additional column for the number of repetitions in the TDRA table. | 2-12, 2-13, 2-14, 2-15 (TBD) | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] | FFS: Whether to add a component for the supported maximum number of PUSCH repetitions | Optional with capability signalling |

# **References**

[1] R1-2001484 RAN1 UE features list for Rel-16 NR after RAN1#100-E Moderator (AT&T, NTT DOCOMO, INC.)

[2] R1-2001632 Discussion on UE feature for URLLC/IIoT ZTE

[3] R1-2001721 Discussion on Rel-16 URLLC/IIOT UE features vivo

[4] R1-2001782 Discussion on UE features for URLLC/IIoT OPPO

[5] R1-2001791 On UE Features for URLLC and IIoT Ericsson

[6] R1-2001795 UE features for URLLC China Unicom

[7] R1-2001828 Views on Rel-16 UE features for NR URLLC/IIoT MediaTek Inc.

[8] R1-2001927 Discussion on UE features for URLLC/IIoT LG Electronics

[9] R1-2002019 On UE features for Rel-16 eURLLC and IIoT Intel Corporation

[10] R1-2002070 Discussion of UE features for NR URLLC/IIoT CATT

[11] R1-2002154 UE features for URLLC/IIoT Samsung

[12] R1-2002352 Discussions on UE Features for URLLC/IIoT Apple

[13] R1-2002399 UE features for URLLC/IIoT Panasonic Corporation

[14] R1-2002482 On UE features for URLLC/IIOT Nokia, Nokia Shanghai Bell

[15] R1-2002566 Discussion on eURLLC and IIOT UE features Qualcomm Incorporated

[16] R1-2002591 Rel-16 UE features for URLLC Huawei, HiSilicon

[16] R1-2002871 Summary on Email discussion [100b-e-NR-UEFeatures-URLLC/IIoT-04] Moderator (NTT DOCOMO, INC.)