**3GPP TSG RAN WG1 #100bis-e R1-2002877**

e-Meeting, April 20th – 30th, 2020

Source: NTT DOCOMO, INC.

Title: Summary on Email discussion [100b-e-NR-UEFeatures-URLLC/IIoT-10]

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-10] Email discussion/approval on issues with capability signaling impacts on FGs for NR IIoT (dates TBD) – Hiroki (DCM)

* Discuss followings on 12-1
	+ Whether or not report type is per FSPC or per UE
	+ Whether or not to modify the description of note “A UE supporting this feature shall also support ~~the LCP restriction based on DCI priority indication ([~~*~~lch-ToGrantPriorityRestriction-r16~~*~~]) and~~ intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*]).”
* Discuss followings on 12-2
	+ Clarify that the component 3 is about all serving cells within a cell group or across different cell groups
		- Candidate value for component 3)
	+ Whether report type should be per UE or per FSPC
		- If it is per UE,
			* whether FG11-1 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 whether FG12-2a 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 whether or not FG12-3 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 whether or not FG12-5 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 5

In the email discussion [100b-e-NR-UEFeatures-URLLC/IIoT-05], following agreements were made.

**Agreements**:

FG12-3 are split into two separate FGs, as one for DCI format 1\_1 and another for DCI format 1\_2

**Agreements:**

* Following FGs are included in UE features list for IIoT.
	+ 12-1 UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer
	+ 12-2 Multiple SPS configurations
	+ 12-2a Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell (already agreed)
	+ 12-3 SPS release by DCI format 1\_1 (already agreed)
	+ 12-3a SPS release by DCI format 1\_2 (already agreed)
	+ 12-5 Configuration of aggregation factor per SPS configuration
	+ New FG Support of SPS periodicity shorter than 10 ms

**Agreements:**

* Following FGs are included in UE features list for URLLC.
	+ [12-1a UL priority indication in DCI with mixed DCI formats]

# **12-1: UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer**

Based on agreements and [1], FG12-1 can be defined as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 12. NR\_IIOT | 12-1 | UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer | Support intra-UE multiplexing/prioritization of UL overlapping channels/signals with two priority levels in physical layer (PHY)1. Configuration of PHY priority level for CG PUSCH and SR, and dynamic indication of priority level for dynamic PUSCH
2. Multiplexing/prioritization between UL channels/signals with the same PHY priority level
3. Prioritization between UL channels/signals with different PHY priority levels
4. Additional number of symbols (d1) needed beyond the PUSCH preparation time for cancelling a low priority UL transmission.
5. Additional number of symbols (d2) needed beyond the PUSCH preparation time for scheduling a high priority UL transmission that cancels a low priority UL transmission
 | TBD | Yes | N/A |  | Per UE | No | No | [N/A] | A UE supporting this feature shall also support the LCP restriction based on DCI priority indication ([*lch-ToGrantPriorityRestriction-r16*]) and intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*]). The relationship between this feature and the feature of up to two HARQ-ACK codebooks of 11-4[x] including merging these features should be further discussed. | Optional with capability signalingCandidate value set for component 4: {0, 1, 2}Candidate value set for component 5: {0, 1, 2} |

**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 |
| Qualcomm | 1. The signaling type should be FS or FSPC. We can further discuss. However, per UE is not acceptable as the number of carriers involved in cancellation should be manageable.
2. Both notes can be removed.
 |
| Apple | * Change the note to “A UE supporting this feature shall also support intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*]).”
* Per FSPC
* Introduce a feature group 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 intra-UE prioritization.
 |
| Nokia, NSB | Per UE, no xDD/FRx differentiation |
|  |  |

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

**Based on the feedbacks, at least following points should be discussed for FG12-1.**

* **Whether or not report type is per FSPC or per UE**
* **Whether or not to modify the description of note “**A UE supporting this feature shall also support ~~the LCP restriction based on DCI priority indication ([~~*~~lch-ToGrantPriorityRestriction-r16~~*~~]) and~~ intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*]).”

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| [2] | ZTE | FG 12-1 is for UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer. However, it now only includes the support for SR and PUSCH. The support of 2-level priority of HARQ-ACK and related components, i.e. FG 11-4 should also be included for a same feature group. Thus, we have the following suggested revisions. Note that, FG 11-4 may have some further updates based on proposal 2 above. If any, the merged FG below can be further updated accordingly.

|  |  |  |
| --- | --- | --- |
| ***Suggested revision #7 on FG 11-4 for URLLC and FG 12-1 for IIoT*** |  |  |
| Index | Feature group | Components | Note | Mandatory/Optional |
|  ~~11-4~~ | ~~Up to two HARQ-ACK codebooks simultaneously constructed for supporting different service types for a UE~~ | ~~1) Supports up to two HARQ-ACK codebooks with different priorities to be simultaneously constructed.~~~~2) Supports separate PUCCH configuration for different HARQ-ACK codebooks~~~~3) Supports 2-level priority of HARQ-ACK for dynamically scheduled PDSCH and SPS PDSCH.~~~~4) Supports a DCI format (from the formats 0\_1/1\_1/0\_2/1\_2) scheduling PDSCH with different HARQ-ACK priorities or PUSCH with different priorities when only DCI format 0\_1/1\_1 is configured or only DCI format 0\_2/1\_2 is configured in USS per BWP~~ ~~5) Supports separate configuration of parameters PDSCH-HARQ-ACK-Codebook, UCI-OnPUSCH and ‘codeBlockGroupTransmission” for different HARQ-ACK codebooks.~~  |  | ~~Optional with capability signaling~~ |
| 12-1 | UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer | Support intra-UE multiplexing/prioritization of UL overlapping channels/signals with two priority levels in physical layer (PHY)1. Configuration of PHY priority level for CG PUSCH and SR, and dynamic indication of priority level for dynamic PUSCH
2. Multiplexing/prioritization between UL channels/signals with the same PHY priority level
3. Prioritization between UL channels/signals with different PHY priority levels
4. Supports up to two HARQ-ACK codebooks with different priorities to be simultaneously constructed.
5. Supports separate PUCCH configuration for different HARQ-ACK codebooks
6. Supports 2-level priority of HARQ-ACK for dynamically scheduled PDSCH and SPS PDSCH.
7. Supports a DCI format (from the formats 0\_1/1\_1/0\_2/1\_2) scheduling PDSCH with different HARQ-ACK priorities or PUSCH with different priorities when only DCI format 0\_1/1\_1 is configured or only DCI format 0\_2/1\_2 is configured in USS per BWP
8. Supports separate configuration of parameters PDSCH-HARQ-ACK-Codebook, UCI-OnPUSCH and ‘codeBlockGroupTransmission” for different HARQ-ACK codebooks.
9. Additional number of symbols (d1) needed beyond the PUSCH preparation time for cancelling a low priority UL transmission.
10. Additional number of symbols (d2) needed beyond the PUSCH preparation time for scheduling a high priority UL transmission that cancels a low priority UL transmission
 | A UE supporting this feature shall also support the LCP restriction based on DCI priority indication ([lch-ToGrantPriorityRestriction-r16]) and intra-UE prioritization in MAC ([lch-PriorityBasedPrioritization-r16]). ~~The relationship between this feature and the feature of up to two HARQ-ACK codebooks should be further discussed.~~ | Optional with capability signalingCandidate value set for component 9 ~~4~~: {0, 1, 2}Candidate value set for component 10 ~~5~~: {0, 1, 2} |

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| [4] | OPPO | * For 12-1, components related with PHY priority level have been included in 11-12 in URLLC, so only components related with MAC prioritization is kept. Note that 12-1 shall support with LCP restriction based on PHY priority indication. So it should be moved to component column. DCI priority indication does not include configured grant case, so we suggest to modify it as PHY priority indication.

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| 12-1 | UL intra-UE prioritization of overlapping channel/signals based on MAC prioritization | 1. Prioritization between UL channels/signals based on MAC prioritizationl
2. Additional number of symbols (d1) needed beyond the PUSCH preparation time for cancelling a low priority UL transmission.
3. Additional number of symbols (d2) needed beyond the PUSCH preparation time for scheduling a high priority UL transmission that cancels a low priority UL transmission
4. Support the LCP restriction based on PHY priority indication
 |

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| [5] | Ericsson | One FFS point is raised: “FFS: Whether and how to combine FG 11-4 and FG 12-1”. FG 12-1 (shown below) is necessary before HARQ-ACK codebook of different priorities can be supported. Thus FG 12-1 should be prerequisite feature group of FG 11-4. |
| [8] | LGE | On FG 12-1, as noted above in the comment on FG 11-4, the benefit and methodology are a bit questionable to merge two FGs into a FG.In addition to the current FGs, it is necessary to further discuss on whether to define the following FGs:* Support of SPS periodicity shorter than 10 ms
	+ Although this is just a straightforward extension of Rel-15 SPS operation, this is not included anywhere so better to clarify.
* Support of SPS activation by DCI format 1\_2

Similarly, it would be good to clarify whether there is a need to include this functionality somewhere. |
| [9] | Intel | * ***Rapporteur****: The relationship between this feature and the feature of up to two HARQ-ACK codebooks of 11-4[x] including merging these features should be further discussed.*
	+ ***Intel:*** Currently, FG #11-4 and FG #12-1 are mutually exclusive (#11-4 is about prioritization of HARQ-ACK, while #12-1 covers other applicable channels/procedures). Thus, these should not be coupled from a functionality perspective either.
* From Component 4) of FG #11-4, the parts related to priorities for PUSCH should be moved to FG #12-1.
* In the Note column, modify as: A UE supporting this feature shall also support ~~the LCP restriction based on DCI priority indication ([~~*~~lch-ToGrantPriorityRestriction-r16~~*~~]) and~~ intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*]). Technical reason below:
	+ The support of LCP restriction based on DCI priority requires support of 12-1 as a pre-requisite, and this dependency is sufficient. A UE reporting support of FG #12-1 should not be mandated to also support DCI indication based LCP restriction.
 |
| [10] | CATT | As we discussed under FG 11-4, we think a UE supporting FG 12-1 does not necessarily support FG 11-4. |
| [12] | Apple | For intra-UE prioritization/multiplexing, the cancellation of an ongoing transmission and the initiation of another transmission (especially PUSCH canceling PUSCH) have significant impact on the UE implementation, so this capability may have dependency on the number of CCs being configured. In addition, it may not be so necessary practically speaking to support the intra-UE prioritization/multiplexing behavior on many CCs at the same time. Therefore, we propose the corresponding FG to be defined as per FSPC.**Proposal 6: Define FG 12-1 to be per FSPC.****CBG retransmission handling for PUSCH cancelation**Per specification, the TB CRC is generated as part of L1 processing. If CBG-based operation is configured and the initial transmission is cancelled, it may be possible that a full TB CRC may not be available for CBG-based retransmission. Therefore, we would like to propose an additional UE feature to add the restriction that the UE does not expect to be scheduled with a partial TB retransmission (without including all CBGs) in a HARQ retransmission in case the initial HARQ transmission is cancelled.**Proposal 9: Introduce a FG (e.g. 12-1a) 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 intra-UE prioritization.** |
| [14] | Nokia, NSB | 12-1 /11-4 Merge: These feature groups are strongly related. One cannot operate 11-4 (having PUSCH & 2 CBs of different HARQ-Ack priorities) without the related multiplexing / prioritization which is part of 12-1 and vice versa. Propose to combine 11-4 and 12-1 into a single feature group. |
| [15] | Qualcomm | Following updates are proposed.

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| 12-1 | UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer | Support intra-UE multiplexing/prioritization of UL overlapping channels/signals with two priority levels in physical layer (PHY)1. Configuration of PHY priority level for CG PUSCH and SR, and dynamic indication of priority level for dynamic PUSCH
2. Multiplexing/prioritization between UL channels/signals with the same PHY priority level
3. Prioritization between UL channels/signals with different PHY priority levels
4. Additional number of symbols (d1) needed beyond the PUSCH preparation time for cancelling a low priority UL transmission.
5. Additional number of symbols (d2) needed beyond the PUSCH preparation time for scheduling a high priority UL transmission that cancels a low priority UL transmission
 |  | Yes | N/A |  |  FSPC | N/A | N/A |  | [A UE supporting this feature shall also support the LCP restriction based on DCI priority indication ([*lch-ToGrantPriorityRestriction-r16*]) and intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*])]. The relationship between this feature and the feature of up to two HARQ-ACK codebooks of 11-4[x] including merging these features should be further discussed. | Optional with capability signalingCandidate value set for component 4: {0, 1, 2}Candidate value set for component 5: {0, 1, 2} |

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# **[12-1a: UL priority indication in DCI with mixed DCI formats]**

Based on agreements and [1], FG12-1a 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 | [12-1a] | [UL priority indication in DCI with mixed DCI formats] | [UL priority indication in DCI with mixed DCI formats] | TBD | Yes | N/A | FFS | Per UE | [No] | [No] | [N/A]  |  | 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 |
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# **12-2: Multiple SPS configurations**

Based on agreements and [1], FG12-2 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 |
| 12. NR\_IIOT | 12-2 | Multiple SPS configurations | 1. Support of up to 8 configured SPS configurations in a BWP of a serving cell and up to 32 configured SPS configurations in a cell group, including separate RRC parameters and separate activation/release for different SPS configurations
2. The max number of active SPS configurations in a BWP of a serving cell
3. The max number of active SPS configurations across all serving cells
4. The related HARQ-ACK enhancements to support multiple active SPS configurations
 | downlinkSPS (TBD) | Yes | N/A |  | Per UE | No | No | [N/A] |  | Optional with capability signalingComponent-2, candidate value set is {1, 2, …, 8}Component-3, candidate value set is {2, …, [32]} |

**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 |
| Qualcomm  | 1. Removing “up to 32 configured SPS configurations in a cell group”
2. Capability is per Band
3. The max value for component 3 is 16.
 |
| Apple | * for component 2: [1:8], per FSPC
* for component 3: range is [1:16], counted across cell groups, per UE
 |
| Nokia, NSB | We prefer to keep the description saying “up to 32” in component 1For Component 3 range should be 2:32Per UE, no xDD/FRx differentiation |
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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 FG12-2.**

* **Clarify that the component 3 is about all serving cells within a cell group or across different cell groups**
	+ **Candidate value for component 3)**
* **Whether report type should be per UE or per FSPC**
	+ **If it is per UE,**
		- **whether FG11-1 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”**
			* **Whether capability interpretation is “support mixture of FDD/TDD and/or FR1/FR2”**

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| [3] | vivo | We think in component 3) the meaning of “all serving cell” should be clarified, is it about all serving cell within a cell group, or across different cell groups. And the type should be discussed (per UE or per FSPC) to be consistent with configured grant feature group 11-9**Proposal 14: For FG12-2*** **To clarify that the component 3 is about all serving cells within a cell group or across different cell groups**
* **The type should be consistent with configure grant FG 11-9**
 |
| [4] | OPPO | * For 12-2. Yes for note, the same principle as multiple configured grant.
 |
| [10] | CATT | Following updates are proposed.

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| 12-2 | Multiple SPS configurations | 1. Support of up to 8 configured/active SPS configurations in a BWP of a serving cell and up to 32 configured/active SPS configurations in a cell group, including separate RRC parameters and separate activation/release for different SPS configurations
2. The max number of configured/active SPS configurations in a BWP of a serving cell
3. The max number of configured/active SPS configurations across all serving cells within a cell group
4. The related HARQ-ACK enhancements to support multiple active SPS configurations
 | downlinkSPS | Yes | N/A |  | Per UE | No | No | support mixture of FDD/TDD and/or FR1/FR2  |  | Optional with capability signalingComponent-2, candidate value set is {1, 2, …, 8}Component-3, candidate value set is {2, …, [32]} |

 |
| [15] | Qualcomm | Following updates are proposed.

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| 12-2 | Multiple SPS configurations | 1. Support of up to 8 configured SPS configurations in a BWP of a serving cell, including separate RRC parameters and separate activation/release for different SPS configurations
2. The max number of active SPS configurations in a BWP of a serving cell
3. The max number of active SPS configurations across all serving cells
4. The related HARQ-ACK enhancements to support multiple active SPS configurations
 |  5-18 | Yes | N/A |  | Per UE | Yes |  Yes | differentiation is from the perspective of cell applying activation/release |  | Optional with capability signalingComponent-2, candidate value set is {1, 2, …, 8}Component-3, candidate value set is {1, …, 16}The total number in FR1 is not greater than X value reported for FR1.Total number in FR2 is not greater than X value reported for FR2.Total number across FR1 and FR2 is not greater than the larger of the FR1 and FR2 values |

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# **12-2a: Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell**

Based on agreements and [1], FG12-2a 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 |
| 12. NR\_IIOT | 12-2a | Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell | 1. M<=4 bits indication in the Release DCI is used for indicating which SPS configuration(s) is/are released, where the association between each state indicated by the indication and the SPS configuration(s) is

• Up to 2^M states are higher layer configurable, where each of the state can be mapped to a single or multiple SPS configurations to be released• In case of no higher layer configured state(s), separate release is used where the release corresponds to the SPS configuration index indicated by the indication1. The related HARQ-ACK enhancements to support joint release
 | 12-2 (TBD) | Yes | N/A |  | Per UE | No | No | [N/A] |  | 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 |
| Qualcomm | Signaling type is per band  |
| Apple | Per UE, no differentiation according to TDD/FDD, FR1/FR2 |
| Nokia, NSB | Per UE, no xDD/FRx differentiation |
|  |  |

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

**Based on the feedbacks, at least following points should be discussed for FG12-2a.**

* **Whether FG12-2a needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”**
* **Whether to add the description “The related HARQ-ACK enhancements to support joint release” in component**

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| [4] | OPPO | * For 12-2a, the related HARQ-ACK enhancement for joint release is missed and we suggest to add in component.

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| 12-2a | Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell | M<=4 bits indication in the Release DCI is used for indicating which SPS configuration(s) is/are released, where the association between each state indicated by the indication and the SPS configuration(s) is• Up to 2^M states are higher layer configurable, where each of the state can be mapped to a single or multiple SPS configurations to be released• In case of no higher layer configured state(s), separate release is used where the release corresponds to the SPS configuration index indicated by the indicationThe related HARQ-ACK enhancements to support joint release | 12-2 |

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| [15] | Qualcomm | Following updates are proposed.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 12-2a | Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell | 1. M<=4 bits indication in the Release DCI is used for indicating which SPS configuration(s) is/are released, where the association between each state indicated by the indication and the SPS configuration(s) is

• Up to 2^M states are higher layer configurable, where each of the state can be mapped to a single or multiple SPS configurations to be released• In case of no higher layer configured state(s), separate release is used where the release corresponds to the SPS configuration index indicated by the indication1. The related HARQ-ACK enhancements to support joint release
 | 12-2 | Yes | N/A |  | Per UE |  Yes |  Yes |  differentiation is from the perspective of cell applying release |  | Optional with capability signaling |

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# **12-3: SPS release by DCI format 1\_1**

Based on agreements and [1], FG12-3 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 |
| 12. NR\_IIOT | 12-3 | SPS release by DCI format 1\_1 | 1. Support of SPS release by DCI format 1\_1
 | downlinkSPS (TBD) | Yes | N/A |  | Per UE | No | No | [TBD] | [A UE supporting this FG and 11-1 (DCI format 0\_2/1\_2) shall also support FG12-3a (SPS release by DCI format 1\_2).] | 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 |
| Qualcomm | Signaling type is per band. |
| Apple | Per UE, no differentiation according to TDD/FDD, FR1/FR2 |
| Nokia, NSB | Per UE, no xDD/FRx differentiation |
|  |  |

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

**Based on the feedbacks, at least following points should be discussed for FG12-3.**

* **Whether or not FG12-3 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”**
* **Confirm prerequisite feature group is FG5-18 instead of ‘downlinkSPS’.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [5] | Ericsson | In FG 12-3, the support of SPS release by DCI format 1\_1 and 1\_2 are combined. However, this is not consistent with the way UL CG releases are constructed. As shown below, two FG, 11-10 and 11-11, are defined, with FG 11-10 having no dependency to FG 11-1, but with FG 11-11 depends on FG 11-1 as a prerequisite. In our view, the way used for UL CG release is appropriate, since support of DCI format 1\_2 needs FG 11-1 before it can be used for SPS release.

|  |  |  |  |
| --- | --- | --- | --- |
| 11-10  | Type 2 configured grant release by DCI format 0\_1  | Support of type 2 configured grant release by DCI format 0\_1 |  |
| 11-11  | Type 2 configured grant release by DCI format 0\_2 | Support of type 2 configured grant release by DCI format 0\_2 | 11-1 |

Thus, SPS release should be supplied with two FG, as shown below.

|  |  |  |  |
| --- | --- | --- | --- |
| 12-3  | SPS release by DCI format 1\_1  | Support of SPS release by DCI format 1\_1 | downlinkSPS |
| 12-4  | SPS release by DCI format 1\_2 | Support of SPS release by DCI format 1\_2 | downlinkSPS, 11-1 |

1. Two FG are defined for SPS release, with release by DCI format 1\_2 having prerequisite of FG 11-1.
 |
| [11] | Samsung | * It should be separated into 1\_1 and 1\_2 because some UE may not support to monitor 1\_2 depending on 11-1.
 |
| [15] | Qualcomm | Following updates are proposed.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 12-3 | SPS release by DCI format 1\_1 and 1\_2 | 1. Support of SPS release by DCI format 1\_1
2. Support of SPS release by DCI format 1\_2
 |  5-18 | Yes | N/A |  | Per UE |  Yes |  Yes | differentiation is from the perspective of cell applying release | 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). | Optional with capability signaling |

 |

# **12-3a: SPS release by DCI format 1\_2**

Based on agreements and [1], FG11-11 can be defined as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 12. NR\_IIOT | 12-3a | SPS release by DCI format 1\_2 | Support of SPS release by DCI format 1\_2 | downlinkSPS (TBD) | Yes | N/A |  | Per UE | No | No | [TBD] |  | 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 |
| Qualcomm | Signaling type is per band |
| Apple | Per UE, no differentiation according to TDD/FDD, FR1/FR2 |
| Nokia, NSB | Per UE, no xDD/FRx differentiation |
|  |  |

# **12-5: Configuration of aggregation factor per SPS configuration**

Based on agreements and [1], FG12-5 can be defined as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 12. NR\_IIOT | 12-5 | Configuration of aggregation factor per SPS configuration | 1. Support of configurable PDSCH aggregation factor ({1, 2, 4, 8}) per DL SPS configuration | downlinkSPS (TBD) | Yes | N/A |  | Per UE | No | No | [N/A] |  | 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 |
| Qualcomm | Signaling type is per band. |
| UE | * Per UE
 |
| Nokia, NSB | Per UE, no xDD/FRx differentiation |
|  |  |

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

**Based on the feedbacks, at least following points should be discussed for FG12-5.**

* **Whether or not FG12-5 needs “FDD/TDD differentiation” and “FR1/FR2 differentiation”**
* **Confirm prerequisite feature group is FG5-18 instead of ‘downlinkSPS’.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [15] | Qualcomm | Following updates are proposed.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 12-5 | Configuration of aggregation factor per SPS configuration | Support of configurable PDSCH aggregation factor ({1, 2, 4, 8}) per DL SPS configuration | 5-18 | Yes | N/A |  | Per UE | Yes |  Yes |  differentiation is from the perspective of cell applying activation/release |  | Optional with capability signaling |

 |

# **12-6: Support of SPS periodicity shorter than 10 ms**

Based on agreements, a new FG12-6 can be defined as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | 12-6  | Support of SPS periodicity shorter than 10 ms | Support of SPS periodicity shorter than 10 ms | TBD | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A]  |  | 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).**

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Per UE, no xDD/FRx differentiation |
|  |  |
|  |  |
|  |  |

# **Conclusion**

FL proposal

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 12. NR\_IIOT | 12-1 | UL intra-UE multiplexing/prioritization of overlapping channel/signals with two priority levels in physical layer | Support intra-UE multiplexing/prioritization of UL overlapping channels/signals with two priority levels in physical layer (PHY)1. Configuration of PHY priority level for CG PUSCH and SR, and dynamic indication of priority level for dynamic PUSCH
2. Multiplexing/prioritization between UL channels/signals with the same PHY priority level
3. Prioritization between UL channels/signals with different PHY priority levels
4. Additional number of symbols (d1) needed beyond the PUSCH preparation time for cancelling a low priority UL transmission.
5. Additional number of symbols (d2) needed beyond the PUSCH preparation time for scheduling a high priority UL transmission that cancels a low priority UL transmission
 | TBD | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] | A UE supporting this feature shall also support the LCP restriction based on DCI priority indication ([*lch-ToGrantPriorityRestriction-r16*]) and intra-UE prioritization in MAC ([*lch-PriorityBasedPrioritization-r16*]). The relationship between this feature and the feature of up to two HARQ-ACK codebooks of 11-4[x] including merging these features should be further discussed. | Optional with capability signalingCandidate value set for component 4: {0, 1, 2}Candidate value set for component 5: {0, 1, 2} |
| 11. NR\_L1enh\_URLLC | [12-1a] | [UL priority indication in DCI with mixed DCI formats] | [UL priority indication in DCI with mixed DCI formats] | TBD | Yes | N/A | FFS | Per UE | [No] | [No] | [N/A]  |  | Optional with capability signalling |
| 12. NR\_IIOT | 12-2 | Multiple SPS configurations | 1. Support of up to 8 configured SPS configurations in a BWP of a serving cell [and up to 32 configured SPS configurations in a cell group,] including separate RRC parameters and separate activation/release for different SPS configurations
2. The max number of active SPS configurations in a BWP of a serving cell
3. The max number of active SPS configurations across all serving cells
4. The related HARQ-ACK enhancements to support multiple active SPS configurations
 | downlinkSPS (TBD) | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signalingComponent-2, candidate value set is {1, 2, …, 8}Component-3, candidate value set is [{2, …, [32]}] |
| 12. NR\_IIOT | 12-2a | Joint release in a DCI for two or more SPS configurations for a given BWP of a serving cell | 1. M<=4 bits indication in the Release DCI is used for indicating which SPS configuration(s) is/are released, where the association between each state indicated by the indication and the SPS configuration(s) is

• Up to 2^M states are higher layer configurable, where each of the state can be mapped to a single or multiple SPS configurations to be released• In case of no higher layer configured state(s), separate release is used where the release corresponds to the SPS configuration index indicated by the indication1. The related HARQ-ACK enhancements to support joint release
 | 12-2 (TBD) | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signaling |
| 12. NR\_IIOT | 12-3 | SPS release by DCI format 1\_1 | 1. Support of SPS release by DCI format 1\_1
 | downlinkSPS (TBD) | Yes | N/A |  | [Per UE] | [No] | [No] | [TBD] | [A UE supporting this FG and 11-1 (DCI format 0\_2/1\_2) shall also support FG12-3a (SPS release by DCI format 1\_2).] | Optional with capability signaling |
| 12. NR\_IIOT | 12-3a | SPS release by DCI format 1\_2 | Support of SPS release by DCI format 1\_2 | downlinkSPS (TBD) | Yes | N/A |  | [Per UE] | [No] | [No] | [TBD] |  | Optional with capability signaling |
| 12. NR\_IIOT | 12-5 | Configuration of aggregation factor per SPS configuration | 1. Support of configurable PDSCH aggregation factor ({1, 2, 4, 8}) per DL SPS configuration | downlinkSPS (TBD) | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A] |  | Optional with capability signaling |
| 11. NR\_L1enh\_URLLC | 12-6  | Support of SPS periodicity shorter than 10 ms | Support of SPS periodicity shorter than 10 ms | TBD | Yes | N/A |  | [Per UE] | [No] | [No] | [N/A]  |  | Optional with capability signalling |

# **References**

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[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

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[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] R1-2002872 Summary on Email discussion [100b-e-NR-UEFeatures-URLLC/IIoT-05] Moderator (NTT DOCOMO, INC.)