**3GPP TSG RAN WG1 #103-e R1-200xxxx**

**e-Meeting, October 26th – November 13th, 2020**

**Agenda Item:** 7.2.5

**Source:** Moderator (LG Electronics)

**Title:** Summary on maintenance of other aspects for URLLC/IIOT

**Document for:** Discussion and decision

# Introduction

This document summarizes the topics under AI 7.2.5 based on the contributions submitted to this AI [1-7], especially for related to other aspects for URLLC//IIOT, and provides FL recommendation to organize the subsequent email discussions.

# Issues in RAN1#103

* 1. Issue #1 SPS PDSCH release and SPS receptions with different PUCCH case

The issues related to timeline between SPS PDSCH release and SPS receptions had been discussed in previous meetings. In this meeting, [1][5][][] provides companies’ view as following

**From [1]**

***Proposal 1:******Support the case that SPS release PDCCH is received in a slot where SPS PDSCH is configured to be received for the same SPS configuration corresponding to the SPS release PDCCH if the HARQ-ACK for the SPS release and the SPS reception mapping to different PUCCHs.***

* ***The UE receives the SPS PDSCH and generates HARQ-ACK information for the SPS release and the SPS reception***
* ***Adopt the following TP accordingly***

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| ----------------------------------------------------- Start of text proposal --------------------------------------------9.1 HARQ-ACK codebook determination<unchanged text omitted>If a UE is configured to receive SPS PDSCHs in a slot for SPS configurations that are indicated to be released by a DCI format, and if the UE receives the PDCCH providing the DCI format in the slot where the end of a last symbol of the PDCCH reception is not after the end of a last symbol of any of the SPS PDSCH receptions, and if HARQ-ACK information for the SPS PDSCH release and the SPS PDSCH receptions would be multiplexed in a same PUCCH, the UE does not expect to receive the SPS PDSCHs, does not generate HARQ-ACK information for the SPS PDSCH receptions, and generates a HARQ-ACK information bit for the SPS PDSCH release.If a UE is configured to receive SPS PDSCHs in a slot for SPS configurations that are indicated to be released by a DCI format, no matter if the UE receives the PDCCH providing the DCI format in the slot where the end of a last symbol of the PDCCH reception is after or before the end of a last symbol of any of the SPS PDSCH receptions, if HARQ-ACK information for the SPS PDSCH release and the SPS PDSCH receptions would be transmitted in two different PUCCHs, the UE receives the SPS PDSCHs and generates HARQ-ACK information for the SPS PDSCH receptions and a HARQ-ACK information bit for the SPS PDSCH release.----------------------------------------------------- End of text proposal --------------------------------------------- |

**From [5]:**

***Proposal 1: Support SPS PDSCH and SPS release in the same slot, if HARQ-ACKs for the SPS release and the SPS reception map to different PUCCHs. And HARQ-ACKs are feedback in different PUCCHs for SPS release and SPS PDSCH separately.***

***Proposal 2: Timeline restriction is not necessary for the case that HARQ-ACKs for the SPS release and the SPS reception map to different PUCCHs.***

**From FL: This issue was discussed in the last meeting and has been concluded by chairman in GTW session as non-essential**

* 1. Issue #2 SPS PDSCH release and SPS receptions with repetitions

In [4], CR is provided for the case of SPS PDSCH release and SPS repetitions. According to [4], When a SPS PDSCH is configured with aggregation factor, some of the SPS PDSCH occasions within the repetition may end before the end of the release PDCCH while some others may end after the end of the release PDCCH, as shown below. In this regard, the figure may be effectively considered as a SPS PDSCH which ends in slot nD=3 and should be supported.



**Proposed changes from [4]:**

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| 9.1 HARQ-ACK codebook determination\*\*\* Unchanged text is omitted \*\*\*If a UE is configured to receive SPS PDSCHs in a slot for SPS configurations that are indicated to be released by a DCI format, and if the UE receives the PDCCH providing the DCI format in the slot where the end of a last symbol of the PDCCH reception is not after the end of a last symbol of any of the last occasions of SPS PDSCH receptions, if the last occasion is in the slot, and if HARQ-ACK information for the SPS PDSCH release and the SPS PDSCH receptions would be multiplexed in a same PUCCH, the UE does not expect to receive the SPS PDSCHs, does not generate HARQ-ACK information for the SPS PDSCH receptions, and generates a HARQ-ACK information bit for the SPS PDSCH release.\*\*\* Unchanged text is omitted \*\*\* |

**From FL:**

The above case hasn’t been discussed since it is not the issue we focused. In the previous meeting, what makes problem is that the SPS PDSCH and SPS release are mapped to same UCI bit in the same PUCCH. In the figure brought by [4], if they are mapped to same PUCCH, those HARQ-ACK are mapped to different UCI bits due to different K1 value. Though the specification changes may be necessary to clarify previous agreement, but it is not clear whether to consider the last occasion of SPS PDSCH.

**FL recommendation: Discuss the above case with [4] and following TP.**

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| 9.1 HARQ-ACK codebook determination\*\*\* Unchanged text is omitted \*\*\*If a UE is configured to receive SPS PDSCHs in a slot for SPS configurations that are indicated to be released by a DCI format, and if the UE receives the PDCCH providing the DCI format in the slot where the end of a last symbol of the PDCCH reception is not after the end of a last symbol of any of the SPS PDSCH receptions, and if HARQ-ACK information for the SPS PDSCH release and the SPS PDSCH receptions would be multiplexed with same value of $b\_{r,k,n\_{D}}$ in a same PUCCH, the UE does not expect to receive the SPS PDSCHs, does not generate HARQ-ACK information for the SPS PDSCH receptions, and generates a HARQ-ACK information bit for the SPS PDSCH release.\*\*\* Unchanged text is omitted \*\*\* |

* 1. Issue #3 Processing timeline for SPS PDSCH release

According to [5], it is not clearly defined when SPS PDSCH is actually release by SPS PDSCH release via PDCCH. In [5] an example of potential ambiguity of this issue is provided as shown in below.

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| **From [5]:*** For SPS release occasion, overlapping status may change and processing time to update overlapping status is necessary for UE. However, due to there is no processing time defined in spec, it will lead misunderstanding between gNB and UE.

As shown in Figure 1, due to there is no processing time to update overlapping status due to SPS release in spec, gNB will assume that SPS configuration 1 is released at once after DCI indicating SPS release for SPS configuration 1 is transmitted. SPS PDSCHs for SPS configuration 2 and 3 are received and HARQ-ACKs for SPS configuration 2 and 3 are expected. However, in fact, UE needs time to update overlapping status, similar as processing time after DCI for SPS activation. Before UE finishes updating overlapping status, UE does not detect SPS PDSCH for SPS configuration 3 and still detects SPS PDSCHs for SPS configuration 1 and 2. UE transmits HARQ-ACKs for SPS configuration 1 and 2. Usually, UE fails to decode SPS PDSCH for SPS configuration 1 due to no data transmission in SPS PDSCH for SPS configuration 1 and decodes SPS PDSCH for SPS configuration 2 successfully, then UE feedbacks {NACK, ACK}, but gNB regards {NACK, ACK} for SPS configuration 2 and 3 ,which is completely different understanding from UE. It leads redundant retransmission for SPS configuration 2 and data missing for SPS configuration 3. What is more serious is the issue cannot be solved even by complex algorithm, e.g. blind decoding.to align understanding on active SPS configurations between gNB and UE, processing time for overlapping update due to SPS release needs to be considered. Similarly, processing time for DCI format indicating SPS activation, i.e. 14 symbols, can be applied for SPS release. |

**From [5]:**

***Proposal 3: Processing time for overlapping update due to SPS release, i.e. 14 symbols, is required. And the above TP is suggested to capture in 38.214 section 5.1.***

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| ------------------------------------ Start of TP 38.214 V16.3.0 section 5.1---------------------------------<unchanged text omitted>If more than one PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot, and any PDSCH of more than one PDSCH starts before 14symbols after a last symbol of the corresponding SPS release reception, if any, after resolving overlapping with symbols in the slot indicated as uplink by *tdd-UL-DL-ConfigurationCommon*, or by *tdd-UL-DL-ConfigurationDedicated*, a UE receives one or more PDSCHs without corresponding PDCCH transmissions in the slot as specified below.‒ Step 0: set *j=0*, where *j* is thenumber of selected PDSCH(s) for decoding. *Q* is the set of activated PDSCHs without corresponding PDCCH transmissions within the slot‒ Step 1: A UE receives one PDSCH with the lowest configured *sps-ConfigIndex* within *Q*, set *j=j+1*. Designate the received PDSCH as survivor PDSCH.‒ Step 2: The survivor PDSCH in step 1 and any other PDSCH(s) overlapping (even partially) with the survivor PDSCH in step 1 are excluded from *Q*. Step 3: Repeat step 1 and 2 until Q is empty or j is equal to the number of unicast PDSCHs in a slot supported by the UE<unchanged text omitted>------------------------------------ End of TP 38.214 V16.3.0 section 5.1--------------------------------- |

**From FL:**

According to current specification on UE MAC, the time when SPS PDSCH is release by SPS release PDCCH is specified as after the PDCCH reception. Though PDCCH decoding time is not specified in spec, it should be less than PDSCH processing time. On the other hand, even If we assume that SPS PDSCH occasion to be cancelled is placed right after SPS release reception, the HARQ-ACK transmission for the SPS PDSCH occasion should met PUCCH processing timeline between end of SPS PDSCH and start of PUCCH for SPS HARQ-ACK. It means that, UE always have processing time for SPS release and its effect. Based on above observation, the issues is not realistic. Moreover, if SPS PDSCH is release by RRC re-configuration, the ambiguity exists anyway.

**FL recommendation: No specification changes are needed**

* 1. Issue #4 PDSCH aggregation when multiple repetition factor are configured

It has been remained as FFS to determine UE behavior when both RepNumR16 and multiple pdsch-Aggregation factor are configured. In this meetings, [1] provides companies view as following

**From [1]:**

***Proposal 2:******If RepNumR16 is provided, N\_PDSCH^(repeat,max) is the maximum value among pdsch-AggregationFactor in SPS-Config or PDSCH-Config and RepNumR16 in PDSCH-TimeDomainResourceAllocation.***

**From FL:**

it seems necessary to specify UE behavior when UE is configured with both RepNumR16 and pdsch-aggregation factor in SPS-config. However, it is not clear whether to discuss this issue in this AI or MIMO AI.

* 1. Issue #5 Dynamic grant PDSCH overriding SPS PDSCH repetition

According to [3], it is necessary to clarify whether DG PDSCH overriding SPS PDSCH repetition is performed per SPS PDSCH configuration or per SPS PDSCH configuration in Rel-15 and Rel-16, in order to align UE behavior between DL and UL.

**From [3]:**

***Proposal 1: RAN1 to conclude whether DG PDSCH overriding SPS PDSCH repetition is performed per SPS PDSCH configuration or per SPS PDSCH repetition.***

**From FL:**

According to current specification, it is clear that DG PDSCH can be overlapped if specified timeline satisfied. Considering that collision among SPS PDSCHs are handled per SPS PDSCH repetitions, it seems natural to handle per PDSCH repetition.

Regarding to UE behavior overriding SPS PDSCH, whether for DG PDSCH to override SPS PDSCH is specified in TS 38.321. According to TS 38.321, only if the PDSCH duration of the configured downlink assignment does not overlap with the PDSCH duration of a downlink assignment received on the PDCCH for this Serving Cell, SPS PDSCH can be received. On the other hands, UE doesn’t expect to receive PDSCH with a HARQ process if the HARQ process is still running with different PDSCH. It means that DG PDSCH may not overlap SPS PDSCH once SPS PDSCH starts to be received. From these specification, it seems already clear how UE works, as following.

* For same HARQ processes between DG PDSCH and SPS PDSCH, UE doesn’t expect to receive PDCCH scheduling DG PDSCH which overlaps the SPS PDSCH other than first repetitions.
* For different HARQ processes between DG PDSCH and SPS PDSCH, DG PDSCH can be scheduled if timeline met. UE MAC would prioritizes DG PDSCH per SPS PDSCH repetition.

**FL recommendation: No specification changes are necessary.**

* 1. Issue #6 PUCCH power control for HARQ-ACK codebook of multiple SPS PDSCH receptions

In [3], an issue is raised for PUCCH power control when all the SPS PDSCHs are cancelled by DCI/dynamic SFI and the UCI only contains the HARQ-ACK codebook for SPS PDSCHs.

According to [3], If all SPS PDSCH corresponding to a PDCCH is cancelled by dynamic SFI, will be 0. If is 0, the HARQ-ACK codebook contains all NACKs and gNB knowns that the HARQ-ACK codebook contains all NACKs. In such case, if =0 and =0,  will be -∞. This should be avoided. In this case, a PUCCH has no SR, no CSI, and all HARQ-ACK bits are known (have NACK values), there is no information in the PUCCH, therefore, UE should not transmit the PUCCH.

**From [3]:**

***Proposal 2: For a PUCCH transmission using PUCCH format 2 or PUCCH format 3 or PUCCH format 4 and for a number of UCI bits smaller than or equal to 11, if UCI only contains all known NACKs for the cancelled SPS PDSCHs in the HARQ-ACK codebook, UE does not transmit the PUCCH. The following TP should be adopted.***

**From FL:**

This issues has been discussed in the previous meetings [8]. Some proponents thought it can be handled by gNB. In addition, another discussion point was whether transmission with minus infinity TX power can be interpreted no transmission in the UE perspective. If the assumption is acceptable, it wouldn’t be an issue.

**FL recommendation: Based on the previous discussion, no specification changes are necessary.**

* 1. Issue #7 Whether to use UL slot or DL slot for description on PDSCH repetition

In [2], it is mentioned that, there is an issue on how to interpret “slot” for the quantity of pdsch aggregation factor. If downlink BWP and uplink BWP are using same SCS, UE may report HARQ-ACK information in a slot n+k for a PDSCH receptions in slot n or PDSCH receptions form slot n-Nrepeat+1. However, if different SCS is used, it may be necessary to determine “slot n” per uplink and downlink.

In [2], it is proposed to use UL slot size for both slots for PDSCH repetition and HARQ-ACK timing.

From [2]:

Proposal 1 To determine HARQ-ACK information for the PDSCH reception in the PUCCH in slot $n+k$, the PDSCH reception should be considered from slot $n-\left⌊N\_{PDSCH}^{repeat}\frac{2^{μ,PUCCH}}{2^{μ,PDSCH}}\right⌋+1$ or $n-\left⌊repetitionNumber-r16\frac{2^{μ,PUCCH}}{2^{μ,PDSCH}}\right⌋+1$.

Below is Text proposal reflecting above proposal in TS38.213:

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| 9.1.2 Type-1 HARQ-ACK codebook determination\*\*\* Unchanged text is omitted \*\*\*If the UE is provided *pdsch-AggregationFactor* in *SPS-Config* or *PDSCH-Config* and no entry in *pdsch-TimeDomainAllocationList* and *pdsch-TimeDomainAllocationListForDCI-Format1-2-r16* includes *repetitionNumber-r16* in *PDSCH-TimeDomainResourceAllocation-r16*, $N\_{PDSCH}^{repeat,max}$ is a maximum value of *pdsch-AggregationFactor* in *SPS-Config* or *PDSCH-Config*; otherwise $N\_{PDSCH}^{repeat,max}=1$. The UE reports HARQ-ACK information for a PDSCH reception- from slot $n-\left⌊N\_{PDSCH}^{repeat}\frac{2^{μ,PUCCH}}{2^{μ,PDSCH}}\right⌋+1$ $n-N\_{PDSCH}^{repeat}+1$ to slot $n$, if $N\_{PDSCH}^{repeat}$ is provided by *pdsch-AggregationFactor* [6, TS 38.214], or - from slot $n-\left⌊repetitionNumber-r16\frac{2^{μ,PUCCH}}{2^{μ,PDSCH}}\right⌋+1$ $n-repetitionNumber-r16+1$ to slot $n$, if the Time domain resource assignment field in the DCI format scheduling the PDSCH reception indicates an entry containing *repetitionNumber-r16,* or - in slot $n$, otherwise only in a HARQ-ACK codebook that the UE includes in a PUCCH or PUSCH transmission in slot $n+k$, where $k$ is a number of slots indicated by the PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ\_feedback timing indicator field is not present in the DCI format. If the UE reports HARQ-ACK information for the PDSCH reception in a slot other than slot $n+k$, the UE sets a value for each corresponding HARQ-ACK information bit to NACK. \*\*\* Unchanged text is omitted \*\*\* |

This issue had been discussed in the preparation phase in RAN1#102[8], and also has been concluded to handle in Rel-15 NR maintenance session since the issue also exists in Rel-15 specification. It is highly encouraged for proponents to submit CR to the NR Rel-15 maintenance AI as well.

**FL recommendation: it seems essential, but it is recommended to treat this issue in NR Rel-15 maintenance AI.**

* 1. Issue #8 An ambiguity for type-1 HARQ-ACK codebook determination

According to [6], there is an ambiguity that a UE reports HARQ-ACK information in a PUCCH only for a SPS PDSCH release or a PDSCH reception scheduled by DCI, and HARQ-ACK information bits are in response to more than one SPS PDSCH receptions.

**From [6]:**

**Observation: It’s ambiguous that a UE reports HARQ-ACK information in a PUCCH only for a SPS PDSCH release or a PDSCH reception scheduled by DCI, and HARQ-ACK information bits are in response to more than one SPS PDSCH receptions.**

**Proposal: RAN1 adopts Text proposal 1.**

Text proposal 1 for TS 38.213 [1]

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| 9.1.2 Type-1 HARQ-ACK codebook determination…If a UE reports HARQ-ACK information in a PUCCH only for - a SPS PDSCH release indicated by DCI format 1\_0 with counter DAI field value of 1, or- a PDSCH reception scheduled by DCI format 1\_0 with counter DAI field value of 1 on the PCell, or - SPS PDSCH reception(s)within the  occasions for candidate PDSCH receptions as determined in Clause 9.1.2.1, the UE determines a HARQ-ACK codebook only for the SPS PDSCH release or only for the PDSCH reception or only for one or more SPS PDSCH reception(s) according to corresponding  occasion(s) on respective serving cell(s), where the value of counter DAI in DCI format 1\_0 is according to Table 9.1.3-1 and HARQ-ACK information bits in response to more than one SPS PDSCH receptions that the UE is configured to receive are ordered according to the following pseudo-code; otherwise, the procedures in Clause 9.1.2.1 and Clause 9.1.2.2 for a HARQ-ACK codebook determination apply. |

**From FL:**

The part of specification in the proposal has been changed in the previous meeting for the same reason. The specification has two parts:

* within the  occasions for candidate PDSCH receptions as determined in Clause 9.1.2.1,
	+ the UE determines a HARQ-ACK codebook only for the SPS PDSCH release or only for the PDSCH reception or only for one SPS PDSCH reception according to corresponding  occasion(s) on respective serving cell(s), where the value of counter DAI in DCI format 1\_0 is according to Table 9.1.3-1
	+ and HARQ-ACK information bits in response to more than one SPS PDSCH receptions that the UE is configured to receive are ordered according to the following pseudo-code;

In the first part of specification, UE follow Rel-15 way, when there is only one PDSCH reception or SPS PDSCH release with counter DAI field value of 1, and/or only one SPS PDSCH reception.

In the second part, UE use Rel-16 pseudo code, in order to cover multiple SPS PDSCH case.

In those observation, current specification seems clear and well separated for each scenarios.

**FL recommendation: No specification changes are necessary.**

* 1. Issue #9 HARQ-ACK bit position for SPS release PDCCH on Type-1 HARQ-ACK Codebook

In section 3 of [7], an issue has been raised for type-1 HARQ-ACK codebook construction.

According to [7], If a UE is configured to use the type-1 HARQ-ACK codebook, there are 4 HARQ-ACK bit positions to multiplex HARQ-ACKs for 4 SPS PDSCHs and the HARQ-ACKs for 4 SPS PDSCHs can be multiplexed using the type-1 HARQ-ACK codebook. If the UE receives SPS release PDCCH and the UE would multiplex HARQ-ACK for the SPS release PDCCH in the same type-1 HARQ-ACK codebook, the HARQ-ACK position for the SPS release PDCCH is same as the HARQ-ACK position for a corresponding SPS PDSCH reception as per TS38.213 specification in Rel-16 due to no dedicated HARQ-ACK bit for SPS release PDCCH. However, there is an ambiguity in the TS38.213 specification, in which HARQ-ACK bit position for SPS PDSCH reception should be used as HARQ-ACK bit position for SPS release PDCCH.

**From [7]:**

* + ***Proposal 4: For type-1 HARQ-ACK codebook, a HARQ-ACK bit position for SPS release PDCCH is same as the last corresponding SPS PDSCH reception among the multiple SPS PDSCH receptions.***
	+ ***Proposal 5: Adopt the following TP3 for TS38.213***

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| **TP3**9.1.2.1 Type-1 HARQ-ACK codebook in physical uplink control channel=============================Unchanged part is omitted===================================For the set of slot timing values, the UE determines a set of  occasions for candidate PDSCH receptions or SPS PDSCH releases according to the following pseudo-code. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to a single SPS PDSCH release is same as for ~~a~~the last corresponding SPS PDSCH reception. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to multiple SPS PDSCH releases by a single DCI format is same as for ~~a~~the last corresponding SPS PDSCH reception with the lowest SPS configuration index among the multiple SPS PDSCH releases.=============================Unchanged part is omitted=================================== |

**From FL:**

First of all, according to current specification, Option 1 in [7] are currently used.

For determining HARQ-ACK bit location, DL slot index, K1 value, SLIV row are needed. Based on my reading of specification, those are determined as following

* DL slot index: a slot where DCI format carrying SPS PDSCH release is received:
	+ See section 9.1.2 and 9.2.3 in TS 38.213
* K1 value: a value of a PDSCH-to-HARQ\_feedback timing indicator field in the DCI format carrying SPS PDSCH release
	+ See section 9.1.2 and 9.2.3 in TS 38.213
* SLIV row: SLIV entries of corresponding SPS PDSCH. For joint release, SPS PDSCH with lowest configuration index is used.
	+ See the conclusion in RAN1#94b

In RAN1#94b,

**Conclusion**:

* For semi-static HARQ-ACK codebook, clarify that location of HARQ-ACK for SPS PDSCH release is same as for the SLIV of SPS PDSCH
	+ Editor to check if clarification is needed in the spec

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| **From 38.213 Section 9.1.2:**A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ-ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to- HARQ\_feedback timing indicator field in a corresponding DCI format 1\_0 or DCI format 1\_1.**From 38.213 Section 9.1.2.1:**For the set of slot timing values, the UE determines a set of  occasions for candidate PDSCH receptions or SPS PDSCH releases according to the following pseudo-code. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to a single SPS PDSCH release is same as for a corresponding SPS PDSCH reception. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to multiple SPS PDSCH releases by a single DCI format is same as for a corresponding SPS PDSCH reception with the lowest SPS configuration index among the multiple SPS PDSCH releases.**From 38.213 Section 9.2.3:**With reference to slots for PUCCH transmissions, if the UE detects a DCI format scheduling a PDSCH reception ending in slot $n$ or if the UE detects a DCI format indicating a SPS PDSCH release through a PDCCH reception ending in slot $n$, or if the UE detects a DCI format that requests Type-3 HARQ-ACK codebook report and does not schedule a PDSCH reception through a PDCCH reception ending in slot $n$, as described in Clause 9.1.4, the UE provides corresponding HARQ-ACK information in a PUCCH transmission within slot $n+k$, where $k$ is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, or by *dl-DataToUL-ACKForDCIFormat1\_2* for DCI format 1\_2. $k=0$ corresponds to the last slot of the PUCCH transmission that overlaps with the PDSCH reception or with the PDCCH reception in case of SPS PDSCH release or in case of the DCI format that requests Type-3 HARQ-ACK codebook report and does not schedule a PDSCH reception.  |

Based on the above specification, there seems no ambiguity in the specification. In addition, the problematic case of option 1 can be handled with different K1 value by gNB scheduling.

**FL recommendation: No specification changes are needed.**

# References

1. R1-2007636, Corrections on SPS enhancements, Huawei, HiSilicon
2. R1-2007704, Maintenance of UCI for NR URLLC, Ericsson
3. R1-2008137, Maintanence on SPS PDSCH, Samsung
4. R1-2008138, Draft CR on SPS release for PDSCH with aggregation, Samsung
5. R1-2008278, Remaining issues on DL SPS enhancement, OPPO
6. R1-2008636, Remaining issues for DL SPS enhancement, ASUSTeK
7. R1-2008725, Corrections on HARQ-ACK codebooks for Rel-16 URLLC, WILUS Inc.
8. R1-2006296, Summary on maintenance of other aspects for URLLC/IIOT, Moderator (LG Electronics)