**3GPP TSG-RAN WG1 Meeting #114bisR1-230xxxx**

**Xiamen, China, October 9th - October 13th, 2023**

**Agenda Item: 6**

**Source: Moderator (Lenovo)**

**Title: Summary on HARQ timing for CEMode B**

**Document for: Discussion and decision**

# Introduction

This document summarizes the discussions during RAN1#114bis agenda 6 on the following CR.

R1-2309791 Draft CR on HARQ timing for CEMode B Lenovo

R1-2309887 Clarification on UL timing for CE Mode B Ericsson

# Discussion

## Summary of the CR

As observed by [Lenovo, Ericsson], for FDD, the HARQ timing for multiple TBs scheduling for UE configured with CEMode B is missing. The corresponding CRs are proposed.

TP1a from Lenovo in R1-2309791

TS36.213

## 10.2 Uplink HARQ-ACK timing

For TDD or for FDD-TDD and primary cell frame structure type 2 or for FDD-TDD and primary cell frame structure type 1, if a UE configured with *EIMTA-MainConfigServCell-r12* for a serving cell, "UL/DL configuration" of the serving cell in Clause 10.2 refers to the UL/DL configuration given by the parameter *eimta-HARQ-ReferenceConfig-r12* for the serving cell unless specified otherwise.

**<Unchanged parts are omitted>**

For FDD, if a BL/CE UE is configured with CEModeA, the UE is not configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI, or if the UE is configured with CEModeB and multiple TB are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which an HARQ-ACK shall be provided, transmit the HARQ-ACK response using the same  derived according to Clause 10.1.2.1 in subframe(s) with , *i =0,1, …, N-1*, where

- is the number of scheduled TB determined in the corresponding DCI;

- if the UE is not configured with higher layer parameter *interleaving* in *ce-PDSCH-MultiTB-Config* and the UE is not in half-duplex FDD operation

- ,

- otherwise

- **,**

**<Unchanged parts are omitted>**

TP2a from Ericsson in R1-2309887

TS36.213

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## 10.2 Uplink HARQ-ACK timing

For TDD or for FDD-TDD and primary cell frame structure type 2 or for FDD-TDD and primary cell frame structure type 1, if a UE configured with *EIMTA-MainConfigServCell-r12* for a serving cell, "UL/DL configuration" of the serving cell in Clause 10.2 refers to the UL/DL configuration given by the parameter *eimta-HARQ-ReferenceConfig-r12* for the serving cell unless specified otherwise.

------------------------------------------ Text Omitted ---------------------------------------------------------

For FDD, if a BL/CE UE is configured with CEModeA or CEModeB, and if the UE is not configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which an HARQ-ACK shall be provided, transmit the HARQ-ACK response using the same  derived according to Clause 10.1.2.1 in subframe(s) with , *i =0,1, …, N-1*, where

## Discussion

**Question 1: Do you agree with the intention of the CR?**

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We agree to fix the issue that CEModeB is missing. |
| Huawei, HiSilicon | We agree to fix |
| Lenovo | We agree to fix |
| Ericsson | Yes, we do. |
| ZTE, Sanechips | We understand the intention, just want to discuss a little bit more. In RAN1#99 meeting, we have the following agreement   |  | | --- | | **Agreement**  For multi-TB scheduling with single DCI:  For DL unicast with bundled HARQ feedback in HD-FDD, the starting (absolute) subframe for the ACK transmission corresponding to TB bundle is determined as:  where denotes the last (absolute) subframe index for bundle ; denotes the last (absolute) subframe index of the multi-TB transmission; denotes the number of absolute subframes required to transmit the HARQ ACK for bundle . |   The formula is applied for bundled HARQ in HD-FDD according to the agreement. In this case, CEModeA can support bundled HARQ in HD-FDD. We are not sure whether bundling is supported for CEMode B, whether HD-FDD is supported for CEMode B, whether both of them can be supported for CEModeB?  If the answer is Yes, then we can further discuss whether we should have two corrections for the following two paragraphs, or only have one correction for bundling case(second paragraph highlighted with yellow) or non-bundling case(first paragraph highlighted with yellow).   |  | | --- | | For FDD, if a BL/CE UE is configured with CEModeA, and if the UE is not configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which an HARQ-ACK shall be provided, transmit the HARQ-ACK response using the same  derived according to Clause 10.1.2.1 in subframe(s) with , *i =0,1, …, N-1*, where  - is the number of scheduled TB determined in the corresponding DCI;  - if the UE is not configured with higher layer parameter *interleaving* in *ce-PDSCH-MultiTB-Config* and the UE is not in half-duplex FDD operation  - ,  - otherwise  - **,**  - is the last subframe in which the PDSCH containing TB is transmitted;  - subframe is the last subframe in which the PDSCH is transmitted;  - denotes the number of consecutive subframes including non-BL/CE subframes where the PUCCH with HARQ ACK for TB with repetition number of *N* is transmitted;  and  *- 0≤k0<k1<…,kN-1* and the value of and  is provided by higher layer parameter *pucch-NumRepetitionCE-format1,* if configured, otherwise it is provided by higher layer parameter *pucch-NumRepetitionCE*-*Msg4-Level0-r13, pucch-NumRepetitionCE-Msg4-Level1-r13, pucch-NumRepetitionCE-Msg4-Level2-r13* or *pucch-NumRepetitionCE-Msg4-Level3-r13* depending on whether the most recent PRACH coverage enhancement level for the UE is 0, 1, 2 or 3, respectively; and  if *N>1*  - subframe(s) with *i=0,1,…,N-1* for TB are *N* consecutive BL/CE UL subframe(s) immediately after subframe , and the set of BL/CE UL subframes are configured by higher layers;  otherwise  - k0 =0  For FDD, if a BL/CE UE is configured with CEModeA, and if the UE is configured with higher layer parameter *harq-AckBundling* in *ce-PDSCH-MultiTB-Config* and multiple TB are scheduled in the corresponding DCI, the BL/CE UE shall upon detection of a PDSCH intended for the UE and for which an HARQ-ACK shall be provided, transmit the HARQ-ACK response using the same  derived according to Clause 10.1.2.1 in subframe(s) with , *i =0,1, …, N-1*, where  -  is the number of TB bundles, and is determined according to clause 7.3;  - if the UE is not configured with higher layer parameter *interleaving* in *ce-PDSCH-MultiTB-Config* and the UE is not in half-duplex FDD operation  - ,  - otherwise  - subframe **,**  - subframe is the last subframe in which the PDSCH containing TB bundle is transmitted;  - subframe is the last subframe in which the PDSCH is transmitted;  - denotes the number of consecutive subframes including non-BL/CE subframes where the PUCCH with HARQ ACK for TB bundle with repetition number of *N* is transmitted;  and  *- 0≤k0<k1<…,kN-1* and the value of and  is provided by higher layer parameter *pucch-NumRepetitionCE-format1,* if configured, otherwise it is provided by higher layer parameter *pucch-NumRepetitionCE*-*Msg4-Level0-r13, pucch-NumRepetitionCE-Msg4-Level1-r13, pucch-NumRepetitionCE-Msg4-Level2-r13* or *pucch-NumRepetitionCE-Msg4-Level3-r13* depending on whether the most recent PRACH coverage enhancement level for the UE is 0, 1, 2 or 3, respectively; and  if *N>1*  - subframe(s) with *i=0,1,…,N-1* for TB bundle are *N* consecutive BL/CE UL subframe(s) immediately after subframe , and the set of BL/CE UL subframes are configured by higher layers;  otherwise  - k0 =0 | |
| Nokia, NSB | We agree with the intention. |
| FL | In RAN1-98 we have the following agreement, so we should add the CEMode B to non-HARQ-ACK bundling case only.  **Conclusion**  There is no consensus on the support of HARQ-ACK bundling in CE mode B for unicast multi-TB scheduling. |

**Question 2: Do you agree with the any of CR above? If not, what is your proposal?**

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | We slightly prefer a simpler version:  “For FDD, if a BL/CE UE is not configured” |
| Huawei, Hisilicon | QC’s version looks even simpler. |
| Lenovo | If companies believe the update from QC or E/// will not lead to the misunderstanding that UE configured with CEMode B can be configured with HARQ bundling, we are OK with either proposal, QC’s proposal seems simpler. |
| Ericsson | In our contribution R1-2309887 we also mentioned the so called “QC’s version,” the reason we why we did not propose it was because we checked some other clauses (e.g., clause 12) and we found an explicit approach has been used stating “CEModeA or CEModeB,” thus aiming at being consistent with legacy (and to be clear we are incorporating something that was missing) we added “or CEModeB”.  So, we also prefer a simple fix, but including “or CEModeB”:  “For FDD, if a BL/CE UE is configured with CEModeA or CEModeB, and …” |
| ZTE, Sanechips | We agree with the QC’s principle that the spec change should be minimized. And the CR depends on the discussion of the first question. |
| Nokia, NSB | To maintain consistency, we have a slight preference for the fix suggested by Ericsson. |
| FL | Since there is not much difference among these CRs proposal and QC’s version seems simpler, let’s take QC’s version as the final CR. |

# References

1. R1-2309791 Draft CR on HARQ timing for CEMode B Lenovo
2. R1-2309887 Clarification on UL timing for CE Mode B Ericsson