**3GPP TSG RAN WG1 Meeting #107-e R1-21xxxxx**

**e-Meeting, November 11th – 19th, 2021**

**Agenda Item: 6**

**Source: Moderator (ZTE)**

**Title: Summary of email discussion on [107-e-LTE-6CRs-01]**

**Document for: Discussion and Decision**

# Introduction

This contribution provides discussion on clarification related to HARQ bundling for LTE-M MTB scheduling in FDD:

[107-e-LTE-6CRs-01] Email discussion/approval on HARQ bundling for LTE-M MTB scheduling in FDD – YouJun (ZTE)

* Discussion and decision on CR by 11/17, final check by 11/19

# Discussion

In the prep-phase discussion, it is identified there seems to be some potential inconsistency between clauses 7.3 and 10.2 in 36.213 (in one place M is the number of bundles and in the other place M is the bundling size). In [1], the detailed inconsistency has been discussed.

If *M* is the bundle size in clause 10.2 for FDD and referred to {1, 2, 3, 4}, then the number of bundles and number of TBs in each bundle is determined as following

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DCI field 'Multi-TB HARQ-ACK  bundling size'** |  |  |  |  |  |
| **00**  **(M=1)** |  |  |  |  |  |
| **01**  **(M=2)** | - |  |  |  |  |
| **10**  **(M=3)** | - | - |  |  |  |
| **11**  **(M=4)** | - | - |  |  |  |

The yellow highlighted part is the inconsistency with clause 10.2 table 7.3-1 in TS36.213. Therefore, inconsistency for bundling pattern between clauses 7.3 and 10.2 table 7.3-1 in 36.213 would happen. It causes that the uplink timing in clause 10.2 TS36.213 determined by the bundling rule in FDD for multiple TBs scheduling is not correct.

**Companies are invited to comment whether a CR is needed to correct the HARQ bundling pattern in clause 10.2 TS36.213 for LTE-M MTB scheduling in FDD.**

|  |  |
| --- | --- |
| Companies | Comments |
| Qualcomm | Yes |
| Lenovo, MotoM | Yes |
| NordicSemi | Yes |
| Nokia, NSB | Yes |
| Ericsson | Yes.  The highlighted cell in the table above for some reason has a different content than the corresponding cell in 36.213 Table 7.3-1. This is what 36.213 Table 7.3-1 looks like:  Table 7.3-1: Value of and *M* for different values of DCI field 'Multi-TB HARQ-ACK bundling size' and for different values of number of scheduled transport blocks   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | DCI field 'Multi-TB HARQ-ACK bundling size' |  |  |  |  |  | | **00** |  |  |  |  |  | | **01** | - |  |  |  |  | | **10** | - | - |  |  |  | | **11** | - | - |  |  |  |   Our understanding is that the DCI field determines which row in Table 7.3-1 that applies. Then ‘the number of TB bundles’ *M* corresponds to the maximum index *b* for the *Ab* listed in the relevant cell in Table 7.3-1. For example, on row ‘10’, in column ‘*NTB* = 4’, we find *A1*, *A2* and *A3*, meaning that the *M* = 3.  The problem is that 36.213 clause 10.2 uses *M* for ‘the multi-TB HARQ-ACK bundling size’ rather than ‘the number of TB bundles’ and this needs to be corrected in clause 10.2. |
| Huawei, HiSilicon | Yes |
| Moderator | All the companies agree that the CR is needed to correct the HARQ bundling pattern in clause 10.2 TS36.213 for LTE-M MTB scheduling in FDD. Please see the details description of the CR in the second round discussion. |

In contribution [2], it is proposed the description for multi-TB bundling in TS 36.213 clause 10.2 for FDD case in LTE-M should be modified by referring to TDD case. And the following text proposal is provided.

**10.2 Uplink HARQ-ACK timing**

**<Unchanged parts are omitted>**

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. The value of and the corresponding TBs in each bundle 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

**<Unchanged parts are omitted>**

**Companies are invited to comment any update for the above text proposal is needed.**

|  |  |
| --- | --- |
| Companies | Comments |
| Qualcomm | We are OK with correcting as proposed (seems the cleanest option), or by specifying that in this subclause M={1,2,3,4} for a DCI field of {00,01,10,11}. |
| Lenovo, MotoM | We are OK with the update in general. Hope to use parameter “*M*” instead of new parameter “*B*” as follow, Otherwise, we will also be confused by the relationship of parameter *B* and clause 7.3.  *transmit the HARQ-ACK response using the same  derived according to Clause 10.1.2.1 in subframe(s) with where M is determined according to clause 7.3.*  There is no need to mention“the corresponding TBs in each bundle is determined according to clause 7.3”since it has already been specified in 7.3 as follow:  Section 7.3  For a BL/CE UE, if the 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 format 6-1A with CRC scrambled by C-RNTI,  - for HARQ-ACK transmission associated with the corresponding DCI, the UE shall generate *M* HARQ-ACK bits by performing a logical AND operation of HARQ-ACKs across all TBs in each TB bundle where *b* = 1, …, *M*;  - the set of TBs that belong to TB bundle and the number of TB bundles *M* are given by Table 7.3-1;  - the value of is the number of scheduled TB determined in the corresponding DCI. |
| NordicSemi | We are OK with the editing proposed by moderator |
| Nokia, NSB | We are OK with the text proposal (that aligns to the wording used with TDD) |
| Ericsson | We would prefer to use *M* (rather than *B*) for ‘the number of TB bundles’ to align the terminology between 36.213 clauses 7.3 and 10.2. |
| Huawei, HiSilicon | It seems both M and B indicate the number of TB bundles, which is redundant. The update of Lenovo looks fine to me. |
| Moderator | The original draft CR is aligned with the TDD wording. As pointed by some companies, maybe we can use *M* for the number of TB bundles straightly. |

# Discussion in second round

According to the discussion, the following correction is proposed.

**10.2 Uplink HARQ-ACK timing**

**<Unchanged parts are omitted>**

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 scheduled TB determined in the corresponding DCI;

-  is determined according to clause 7.3;

**<Unchanged parts are omitted>**

The above correction is also incorporated into the draft CR document in the folder [**107-e-LTE-6CRs-01**]. Companies are invited to comment whether the above correction is OK and whether the draft CR is OK for endorsement.

**Companies are invited to comment any update for the above text proposal and draft CR in folder** [**107-e-LTE-6CRs-01**].

|  |  |
| --- | --- |
| Companies | Comments |
| Ericsson | Thanks for the draft CR.   * For improved readability, it would be good to write “M is the number of TB bundles, determined according to clause 7.3”. * The CR messes up the indentation and the heading of clause 10.2 has the wrong font and font size, which gives me the impression that the CR has not been created in the right way. The CR should be created by copying the CR cover sheet template to the specification document (and deleting the irrelevant specification clauses), not by copying text from the specification document to the CR cover sheet template document.   With the above changes, Ericsson would be happy to co-source the CR. |
| Moderator | Ericsson’s suggestion is incorporated into the updated draft CR. Companies are welcome to continue the comment based on the updated draft CR [[Draft CR] Clarification on HARQ bundling for LTE-M MTB scheduling in FDD v2](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_107-e/Inbox/drafts/6/107-e-LTE-6CRs-01/%5BDraft%20CR%5D%20Clarification%20on%20HARQ%20bundling%20for%20LTE-M%20MTB%20scheduling%20in%20FDD%20v2.docx). |
| Ericsson2 | Thanks, the updated draft CR looks fine. |

# Summary

TBD

# References

1. R1-2111064 Discussion on HARQ bundling for LTE-M MTB scheduling in FDD ZTE, Sanechips
2. R1-2111065 Clarification on HARQ bundling for LTE-M MTB scheduling in FDD ZTE, Sanechips