**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.**

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| --- | --- |
| 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**].

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| --- | --- |
| Companies | Comments |
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# 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