3GPP TSG-RAN WG1 Meeting #100bis-e R1-20xxxxx

e-Meeting, April 20th – 30th, 2020

Agenda Item: 6.2.1.3

Source: Moderator (Ericsson)

Title: Feature lead summary #2 for Multi-TB scheduling for LTE-MTC

Document for: Discussion, Decision

# Introduction

In the Rel-16 work item on “Additional MTC enhancements for LTE” [1], one of the objectives is to specify support for scheduling of multiple DL/UL transport blocks.

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| The objective is to specify the following set of improvements for machine-type communications for BL/CE UEs.[...]**Scheduling enhancement:*** Specify scheduling multiple DL/UL transport blocks with single DCI for SC-PTM and unicast [RAN1, RAN2]
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RAN1 agreements made until RAN1#99 are summarized in [2] and RAN1 agreements made in RAN1#100e are listed below. RAN2 agreements are summarized in [3]. The endorsed L1 configuration parameter list can be found in [4], the initial RAN1 UE feature list in [5], and the endorsed RAN1 CRs in [6] – [16].

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| [**R1-2001056**](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100_e/Docs/R1-2001056.zip) Feature lead summary for Multi-TB scheduling for LTE-MTC Ericsson[**R1-2001185**](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100_e/Docs/R1-2001185.zip) Feature lead summary#2 for Multi-TB scheduling for LTE-MTC Ericsson[**R1-2001220**](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100_e/Docs/R1-2001220.zip) Feature lead summary#3 for Multi-TB scheduling for LTE-MTC Ericsson[100e-LTE-eMTC5-Multi-TB-01] – Johan (Ericsson)Email discussion/approval onHARQ/NDI/RV/FH encoding for both FDD and TDDby 2/27; if there is a spec impact, followed by endorsing the corresponding TP by 3/2**Conclusion**For FDD case:* For 36.212, use Futurewei’s TP in [R1-2001086](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100_e/Docs/R1-2001086.zip) as a basis, possibly with the clarification “From MSB to LSB” in each section.
* For 36.211 and 36.213, take the provided comments and proposals into account in contributions to the next meeting.

For TDD case:* There is no consensus in RAN1#100e for optimization (or elimination) of the TDD HARQ process grouping. The 36.212 seems adequate and potential corresponding 36.213 text can be added in the next meeting.

As per email decision posted on Mar. 4th, two companies prefer not to add “From MSB to LSB”, so:Agreement: The text proposal in [R1-2001086](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100_e/Docs/R1-2001086.zip) is endorsed for inclusion into TS36.212 editor’s CR.[100e-LTE-eMTC5-Multi-TB-02] – Johan (Ericsson)Email discussion/approval onHARQ-ACK bundling for both FDD and TDDby 2/27; if there is a spec impact, followed by endorsing the corresponding TP by 3/2As per email decision posted on Mar. 5th,:Agreement: The TP provided in [R1-2001214](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100_e/Docs/R1-2001214.zip) for TS36.213 section 10.2 is endorsed. To be included as part of the editor’s CR for TS36.213.[100e-LTE-eMTC5-Multi-TB-03] – Johan (Ericsson)Email discussion/approval onscheduling gaps for both unicast and multicastby 2/27; if there is a spec impact, followed by endorsing the corresponding TP by 3/2**Conclusion**For the unicast case* There is no consensus in RAN1#100e for the proposal to specify explicit unicast scheduling gaps.
* Since unicast scheduling gaps are included in the draft RAN1 UE feature list, there may be a need to update the feature list, and this is something that can be brought up in the email discussion for the feature list.

For the multicast case* There is no consensus in RAN1#100e for the proposal to insert the scheduling gaps before each TB instead of after each TB.
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This document provides a prioritized list of issues and proposals based on the contributions in [17] – [23].

# Issue #3: HARQ-ACK bundling size

RAN1#100e identified a need to define the mapping between DCI field ‘Multi-TB HARQ-ACK bundling size’ in 36.212 and parameter ‘M’ in 36.213. The 36.212 editor’s interpretation of the earlier RAN1 agreements is presented in Futurewei’s contribution [23].

Huawei’s contribution [17] and ZTE’s contribution [18] propose to map 0-3 in 36.212 to 1-4 in 36.213, whereas Qualcomm’s contribution [20] proposes to use 1 instead of 2 bits in the DCI and derive the bundle size from a table in the specification (see Section 2.3 in Huawei’s contribution, Section 2.2.4 in ZTE’s contribution, Issue #1 in Qualcomm’s contribution and Issue #2 in Ericsson’s contribution for further discussion).

Proposal 3-1: Discuss and decide on a mapping between DCI field ‘Multi-TB HARQ-ACK bundling size’ in 36.212 and parameter ‘M’ in 36.213.

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| **Company** | **Comments on Proposal 3-1** |
| Qualcomm | We propose a **„1-bit field in the DCI“** that determines the size of the bundles for the purposes of HARQ-ACK bundling. We propose to **endorse TP1 in Section 1 of** [**R1-2002174**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002174.zip)**.**Please note the following **„technical“** reasons for this—in addition to the point that there is **no „agreement“ on this field**, as has been outlined by us in the past.1. For less than 4 TBs scheduled (which is a practical use case), **we don‘t even have 4 states** to be represented by 2 bits. Please recall the often painful negotiations during this work item on **„saving every bit“ in the DCI design**—we must respect that principle here. Indeed, each bit added to the DCI reduces MPDCCH coverage.
2. In several cases, **many of the states (represented by 4 codepoints) are worse than others, making the worse states redundant**. See the examples below, where **for Fig. 1, [4,4] is worse than [2,3,3]** and in **Fig. 2, [2,2] is worse than [2,1,1]** when number of PUCCH & PDSCH repetitions are 1.

Figure 1: Throughput comparison for 8 HARQ processes.Figure 2: Throughput comparison for 4 HARQ processes.Moreover, as we highlight in the examples above, the „timeline limitations“ become an important issue when PUCCH has 1 repetition, and PDSCH has one repetition or PDSCH interleaving (with granularity 1) is enabled. As a result, this case should be treated differently from the case where this „timeline limitation“ is no longer a bottleneck.Keeping these in mind, we propose to **endorse TP1 in Section 1 of** [**R1-2002174**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002174.zip), that essentially implements the following proposal:**Proposal 3-1-QC: The field “Multi-TB HARQ-ACK bundling size” is 1 bit that enables and disables HARQ-ACK bundling.** **- The bundle sizes are fixed in the specification depending on (#repetitions for PDSCH, #TBs, #reps for PUCCH, interleaving ON/OFF) as in the table below, where:** **- Case 1 is used if (“number of PDSCH repetitions = 1” or “interleaving is enabled”) and “number of PUCCH repetitions = 1”** **- Otherwise, case 2 is used**

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|  | **1TB** | **2TB** | **4TB** | **6TB** | **8TB** |
| **Case 1** | **M=[1]** | **M=[2]** | **M=[2,1,1]** | **M=[2,2,2]** | **M=[2,3,3]** |
| **Case 2** | **M=[1]** | **M=[2]** | **M=[2,2]** | **M=[3,3]** | **M=[4,4]** |

***FURTHER NOTES: To us, it is extremely disappointing how some companies are trying to imply that a certain wording allows for a certain way of DCI signalling, while expressly precluding other forms of DCI signalling. This cannot be farther from the truth.******The agreement was to signal the „actual bundle size“ in the DCI. „How“ this was to be signalled, was NOT discussed. To us, „all“ the proposals on the table are an equally „allowed“ means to signal the bundle size. That’s exactly what our proposal does too: a DCI field that—in conjunction with the RRC parameter—tells the UE the size of the bundles.******The interpretation that the bundle size determination will be done only according to the current equations in the specification, and any other forms of determination will be expressly prohibited, is extremely unfortunate—and if we may say so, plain wrong.******We would also like to point out that even the current equation doesn‘t lead to „one size for all bundles“ in many instances. It cannot be „implied understanding“ that the „only allowed way“ to have different sizes for different bundles in a multi-TB PDSCH when a „remainder operation after a division“ dictates it. To us, such lines of reasoning are a disappointing means to block the discussion of alternative proposals that may have technical merit.******We would kindly request the companies to try to judge each solution—all of which (including ours, and including the current placeholder text) are „not precluded“—on the technical merits of each. We hope we can do this. As a group, we deserve better for ourselves than to try to disallow legitimate solutions from discussion and consideration, based on arbitrarily-constructed and flimsy technicalities.*** |
| FUTUREWEI | As stated by the moderator, the views of the editor on the earlier agreements and how the specifications work are in [R1-2002654](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002654.zip), “HARQ-ACK bundling for Multi-TB scheduling”. We encourage companies to read that document, as we only summarize a few points here:1. The editors made their best effort to produce specifications from the available agreements, and their efforts should not be disparaged.
2. The current specifications work.
3. The proposal from Qualcomm, in our view, does not follow the agreements. We understand from the statements above that Qualcomm feels it does.
4. Our paper clearly states that we are not trying to stop *any* technical discussion, not only for aspects noted during the endorsement process, but any other proposed implementation.

The moderator had previously suggested that we need to sort out the understanding of the agreements. Our view is in the paper. However, in our limited time it may be more productive to focus on the technical discussion. Technically, it appears to be flexibility/simplicity versus lower overhead and the ability to select certain preferered bundling options. FUTUREWEI has a slight preference for flexibility/simplicity, but may be open to update our view after hearing other views. |
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# References

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6. [R1-1913684](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_99/Docs/R1-1913684.zip), Addition of feature for 36.213 (s10-s13)
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