3GPP TSG-RAN WG2 Meeting #109 electronic draftR2-2001877

Electronic meeting, 24 Feb – 6 Mar 2020

Agenda Item: 7.1.5

Source: Ericsson (Rapporteur)

Title: Report of [AT109e][412][eMTC/NB-IoT] Scheduling multiple TBs: Open issues (Ericsson)

Document for: Report

# 1 Introduction

This document contains the report of the following offline discussion:

**[AT109e][412][eMTC/NB-IoT] Scheduling multiple TBs: Open issues (Ericsson)**

Scope: Further discussion on proposals 3, 4, 6, and 10 and identify potential agreements

Intended outcome: Report with a list of proposals categorized as agreeable, need further discussion, postpone. The outcome can be provided in R2-2001877

Deadline: Tuesday, Mar 3rd 17:00 CET

Schedule: Wednesday, Mar 4th, 06:30 - 07:30 CET

The referenced proposals from [R2-2001862](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109_e/Docs//R2-2001862.zip) [1] are the following:

Proposal 3 For unicast, multiple TBs scheduling is enabled separately for uplink and downlink for both LTE-M and NB-IoT.

Proposal 4 Discuss over email the details of unicast configuration for scheduling multiple TBs for 1) NB-IoT and 2) LTE-M.

Proposal 6 Discuss over email whether scheduling gap configuration is in SC-MTCH or in SIB20(-NB) for 1) NB-IoT and 2) LTE-M with details of configuration to be captured.

Proposal 10 Discuss whether multiple TBs scheduling in multicast is optional without capability reporting.

# 2 Discussion

## 2.1 Unicast configuration

In [2] (Huawei) in the text proposals, scheduling of multiple TBs can be enabled/disabled separately for uplink and downlink. In [3] (Ericsson) text proposal, enabling/disabling separately is possible for eMTC but this doesn't seem possible for NB-IoT. The text proposals are provided below for companies to comment on.

In [2] an explicit proposal was presented (for NB-IoT) on this and the following proposal was presented in the summary document:

**Proposal 3 For unicast, multiple TBs scheduling is enabled separately for uplink and downlink for both LTE-M and NB-IoT.**

This was however not agreed to during the brief online discussion. Companies are asked whether they agree to above proposal or if they have some concerns. Please elaborate in comments especially if not agreeable.

|  |  |  |
| --- | --- | --- |
| Company | Agree P3 for NB-IoT? | Comments |
| Huawei, HiSilicon | Agree | We have agreed to have separate capabilities for UL/DL so it should be possible to enable one or the other only. |
| Ericsson | Agree | There are separate capability indications for supporting multi-TB in uplink and downlink for NB-IoT in the draft RAN1 UE feature list R1-2000909, and separate capabilities for supporting in UL and DL has also been agreed in RAN2#106. |

|  |  |  |
| --- | --- | --- |
| Company | Agree P3 for eMTC? | Comments |
| Huawei, HiSilicon | Agree | Same as above. |
| Ericsson | Agree | There are separate capability indications for supporting multi-TB in uplink and downlink for eMTC in the draft RAN1 UE feature list R1-2000909, and separate capabilities for supporting in UL and DL has also been agreed in RAN2#106. Also, there are separate parameters for enabling multi-TB scheduling in UL and DL in the L1 parameter list for eMTC. |

Text proposals for NB-IoT on unicast configuration:

The following new information element is already captured in (endorsed) NB-IoT running TS 36.331 CR [4]:

#### *– MultiTB-Config-NB*

The IE *MultiTB-Config-NB* is used to specify the multiple TBs scheduling configuration for unicast transmission.

*MultiTB-Config-NB information element*

-- ASN1START

MultiTB-Config-NB-r16 ::= SEQUENCE {

 ...

}

-- ASN1STOP

The following text proposal has been provided in [2] (Huawei) for NB-IoT:

-- ASN1START

MultiTB-Config-NB-r16 ::= SEQUENCE {

 ul-MultiTB-Config-r16 ENUMERATED {interleaving, non-interleaving}

 OPTIONAL, -- Need OR

 dl-MultiTB-Config-r16 ENUMERATED {interleaving, non-interleaving}

 OPTIONAL, -- Need OR

 dl-HARQ-ACK-Bundling-r16 ENUMERATED {true} OPTIONAL, -- Cond dl-interleaving

 ...

}

-- ASN1STOP

The following text proposal has been proposed in [3] (Ericsson) for NB-IoT:

*– MultiTB-Config-NB*

The IE *MultiTB-Config-NB* is used to specify the multiple TBs scheduling configuration for unicast transmission.

***MultiTB-Config-NB information element***

-- ASN1START

MultiTB-Config-NB-r16 ::= SEQUENCE {

 multi-TB-DL-Unicast-Interleaving-r16 ENUMERATED {on} OPTIONAL, -- Need OR

 multi-TB-UL-Unicast-Interleaving-r16 ENUMERATED {on} OPTIONAL, -- Need OR

 multi-TB-HARQ-ACK-Bundling-r16 ENUMERATED {on} OPTIONAL -- Need OR

}

-- ASN1STOP

| ***MultiTB-Config-NB* field descriptions** |
| --- |
| ***multi-TB-DL-Unicast-Interleaving***Activation of interleaving of repetitions of separate transport blocks, when multiple downlink TBs are scheduled by one DCI, see TS 36.211 [21], TS 36.212 [22] and TS 36.213 [23]. |
| ***multi-TB-UL-Unicast-Interleaving***Activation of interleaving of repetitions of separate transport blocks, when multiple uplink TBs are scheduled by one DCI, see TS 36.211 [21], TS 36.212 [22] and TS 36.213 [23]. |
| ***multi-TB-HARQ-ACK-Bundling***Activation of HARQ-ACK feedback bundling, when a single DCI schedules multiple transport blocks for DL unicast, see TS 36.212 [22] and TS 36.213 [23]. HARQ-ACK bundling is only supported when interleaving is configured. |

|  |  |
| --- | --- |
| Company | Comments on above text proposals (from [2] and [3]) for NB-IoT: |
| Huawei, HiSilicon | 1. We think multi-TB-DL-Unicast-Interleaving-r16 (and for UL) can not cover all cases. If absent, does it mean multiple TBs scheduling is not configured or multiple TBs is configued but interleaved transmission is not allowed?2. We think condition for HARQ ACK Bundling configuration is needed as it only applies to DL interleaved transmission. |
| Ericsson | Huawei’s text proposal has clearer configuration of enabling Multi-TB configuration ofr uplink and/or downlink (in our text proposal it is more implicit). Also, the condition of dl-interleaving for HARQ-ACK bundling is included, thus Huawei’s text proposal seems good to us. |

Text proposals for eMTC on unicast configuration:

The following text proposal has been provided in [3] (Ericsson) for eMTC:

– *PDSCH-Config*

The IE *PDSCH-ConfigCommon* and the IE *PDSCH-ConfigDedicated* are used to specify the common and the UE specific PDSCH configuration respectively.

***PDSCH-Config* information element**

-- ASN1START

< removed unmodified part >

PDSCH-ConfigDedicated-v16xy ::= SEQUENCE {

 ce-PDSCH-MultiTB-AllocConfig-r16 CHOICE {

 release NULL,

 setup SEQUENCE {

 multi-TB-DL-Interleaving-r16 ENUMERATED {on} OPTIONAL, -- Need OR

 multi-TB-DL-HARQ-Bundling-r16 ENUMERATED {on} OPTIONAL -- Need OR

 }

 }

}

< removed unmodified part >

-- ASN1STOP

And following suggestions for field descriptions:

| ***multi-TB-DL-Interleaving***Activation of interleaving of repetitions of separate transport blocks, when a single DCI schedules multiple transport blocks for DL unicast in CE mode A/B in RRC\_CONNECTED, see TS 36.213 [23]. |
| --- |
| ***multi-TB-DL-HARQ-Bundling***Activation of HARQ-ACK feedback bundling, when a single DCI schedules multiple transport blocks for DL unicast in CE mode A in RRC\_CONNECTED, see TS 36.212 [22] and TS 36.213 [23]. |

– *PUSCH-Config*

The IE *PUSCH-ConfigCommon* is used to specify the common PUSCH configuration and the reference signal configuration for PUSCH and PUCCH. The IE *PUSCH-ConfigDedicated* is used to specify the UE specific PUSCH configuration.

***PUSCH-Config* information element**

-- ASN1START

< removed unmodified part >

PUSCH-ConfigDedicated-v16xy ::= SEQUENCE {

 ce-PUSCH-MultiTB-AllocConfig-r16 CHOICE {

 release NULL,

 setup SEQUENCE {

 multi-TB-UL-Interleaving-r16 ENUMERATED {on} OPTIONAL -- Need OR

 }

 }

}

< removed unmodified part >

-- ASN1STOP

And following suggestion for field description:

|  |
| --- |
| ***multi-TB-UL-Interleaving***Activation of interleaving of repetitions of separate transport blocks, when a single DCI schedules multiple transport blocks for UL unicast in CE mode A/B in RRC\_CONNECTED, see TS 36.213 [23]. |

|  |  |
| --- | --- |
| Company | Comments on above text proposals (from [3]) for eMTC |
| Huawei, HiSilicon | We are fine with above TP. |
| Ericsson | Agree with above text proposals, as they incorporate the parameters provided in the L1 parameter list to TS 36.331. |

Rapporteur summary:

On unicast configuration, both companies who have replied agree on P3. Both companies also agree on the configuration provided by Huawei for NB-IoT in [2]. Both companies agree to the text proposal for eMTC in [3], however, QC has additionally mentioned in corresponding offline email thread that corresponding configuration has already been captured in the running CR for R16 eMTC [5]. Thus, the text proposal provided in [3] is not needed to be specifically captured but further comments may be provided in the running CR.

Therefore, following are proposed to be agreed:

* **For unicast, multiple TBs scheduling is enabled separately for uplink and downlink for both LTE-M and NB-IoT.**
* **Capture TP for *MultiTB-Config-NB* in [2] in the running RRC CR for NB-IoT.**

## 2.2 Configuration for scheduling gap

The following proposals related to scheduling gap configuration are proposed by Huawei and Ericsson:

* *multiTB-Gap* is introduced in *SC-MTCH-Info-NB-r14* to indicate the scheduling gap for each SC-MTCH configured with multiple TBs scheduling. [2] (Huawei)
* Scheduling gaps for multi-TB scheduling with multicast are configured in SIB20 for LTE-M.[3] (Ericsson)
* Scheduling gaps for multi-TB scheduling with multicast are configured in SIB20-NB for NB-IoT.[3] (Ericsson)

Thus, the two companies who have provided input on this issue to this meeting have different view on whether the configuration should be in SC-MCCH or in system information. Related proposal in [1] is:

**Proposal 6 Discuss over email whether scheduling gap configuration is in SC-MTCH or in SIB20(-NB) for 1) NB-IoT and 2) LTE-M with details of configuration to be captured.**

Companies are asked to provide their views and preferences on this:

|  |  |  |
| --- | --- | --- |
| Company | Scheduling gap configuration in SC-MCCH or in SIB20(-NB)? | Comments |
| Huawei, HiSilicon | SC-MCCH | We think SIB20 should be used to configure SC-MCCH transmission. Configuration for SC-MTCH should be siganlled in SC-MCCH. |
| Ericsson | SIB20(-NB) | As has been agreed in RAN1, scheduling gap configuration for SC-MTCH is cell-specific both for LTE-M and NB-IoT (The L1 parameter list for NB-IoT incorrectly says SC-MTCH specific in the “UE-specific or Cell-specific“ -column, however, the comment field for this parameter states the RAN1 agreement saying it is cell specific). Being cell-specific, there is no point to signal the same configuration separately to each SC-MTCH in SC-MCCH as it would just waste bits. Rather, it should be signalled in SIB20(-NB), where it can be received by all UEs interested in SC-PtM, as SIB20(-NB) configures SC-PtM specific information and is only received by UEs interested in SC-PtM. |

The rapporteur suggestion is to first try to achieve consensus on above and then look at possible text proposals, as those should not be very controversial once the location is agreed.

Rapporteur summary:

Two companies have provided input but they have different views on whether the configuration is in SIB20(-NB) or in SC-MCCH. HW have also provided clarifying comment in the offline email thread that the configuration should be in SCPTMConfiguration(-NB).

Therefore, the proposal is

* **RAN2 to further discuss whether scheduling gap configuration is in SCPTMConfiguration(-NB) (SC-MCCH) or in SIB20(-NB).**

## 2.3 Capabilities

The following proposal was also not agreed during online discussion, and companies are welcome to provide their views on this:

**Proposal 10 Discuss whether multiple TBs scheduling in multicast is optional without capability reporting.**

|  |  |
| --- | --- |
| Company | Scheduling multiple TBs in multicast is optional without capability reporting? Please elaborate.  |
| Huawei, HiSilicon | We support this. |
| Ericsson | Agree on 1) Optional, this should be straightforward.And agree on 2) without capability reporting. Multicast in the form of SC-PtM is best effort service, the UEs do not have any related uplink transmissions/feedback, and the transmissions are not dedicated, thus the network is not aware anyway which UEs or how many UEs are listening to the SC-PtM channels, therefore network does not do anything with the information of whether or not certain UEs support multi-TB scheduling capability with multicast. |

Rapporteur summary:

Both companies who have replied agree that scheduling multiple TBs in multicast is optional without capability signalling. Therefore, the following proposal is made:

* **Multiple TBs scheduling in multicast is optional without capability reporting.**

# 3 Summary

Based on the company inputs and offline discussion over email, the following are proposed to be agreed:

1. For unicast, multiple TBs scheduling is enabled separately for uplink and downlink for both LTE-M and NB-IoT.
2. Capture TP for *MultiTB-Config-NB* in [2] in the running RRC CR for NB-IoT.
3. RAN2 to further discuss whether scheduling gap configuration is in SCPTMConfiguration(-NB) (SC-MCCH) or in SIB20(-NB).
4. Multiple TBs scheduling in multicast is optional without capability reporting.

# References

1. [R2-2001862](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109_e/Docs//R2-2001862.zip), Summary of contributions on scheduling multiple Dl/UL transport blocks, Ericsson, RAN2#109-e, February 2020

1. [R2-2000644](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109_e/Docs//R2-2000644.zip), Signalling aspect of multiple TBs scheduling for NB-IoT, Huawei, HiSilicon, RAN2#109e, February 2020

1. [R2-2000977](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109_e/Docs//R2-2000977.zip), Scheduling enhancements for LTE-M and NB-IoT, Ericsson, RAN2#109e, February 2020

1. [R2-2000620](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109_e/Docs//R2-2000620.zip), Introduction of additional enhancements for NB-IoT in TS 36.331, Huawei, RAN2#109-e, February 2020.

1. [R2-2000433](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_109_e/Docs//R2-2000433.zip), Introduction of Rel-16 eMTC enhancements (running CR for TS 36.331), Qualcomm Inc, RAN2#109-e, February 2020.