3GPP TSG-RAN WG1 Meeting #104-e R1-21xxxxx

e-Meeting, January 25th – February 5th, 2021

Agenda Item: 6.2.1

Source: Moderator (Ericsson)

Title: FL summary for Multi-TB issues for Rel-16 LTE-MTC

Document for: Discussion, Decision

# 1 Introduction

This document provides a summary of the following RAN1 email discussion.

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|  [104-e-LTE-eMTC5-02] Multi-TB issues – Johan (Ericsson)* Issue #1: Clarification of DCI definition for SPS validation ([R1-2100561](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2100561.zip))
* Issue #2: Clarification of multicast scheduling gap definition ([R1-2100761](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2100761.zip), [R1-2101279](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2101279.zip))
* Discussion and decision by 1/29, TPs by 2/5
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# Issue #1: Clarification of DCI definition for SPS validation

Contribution [1] discusses the need for clarification of the DCI definition for SPS validation for the case when the Rel-16 LTE-MTC multi-TB scheduling feature is configured and presents a TP for 36.213.

**Question 1.1: Companies are invited to comment below on the 36.213 TP in [1] for clarification of the DCI definition for SPS validation when multi-TB scheduling is configured.**

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| **Company** | **Comments** |
| Qualcomm | We think the only necessary change is to change the 4-bit HPN field to 3 bits for TDD, the other changes are not needed. For example, this change:- if *ce-PDSCH-MultiTB-Config* is configured, the ‘New data indicator’ in ‘Scheduling TBs for Unicast’ field in DCI format 6-1A is set to ‘0’;otherwise, the new data indicator field in DCI format 6-1A is set to '0'. - if *ce-PUSCH-MultiTB-Config* is configured, the ‘New data indicator’ in ‘Scheduling TBs for Unicast’ field in DCI format 6-0A is set to ‘0’;otherwise, the new data indicator field in DCI format 6-0A is set to '0'. Is not needed, since indeed DCI format 6-1A has an NDI field when a single TB is scheduled: - If one TB is scheduled- 5 bits set to zero- HARQ process number – 3 bits- New data indicator – 1 bitSo, the only change would be:

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|  | **DCI format 6-0A** | **DCI format 6-1A** |
| **HARQ process number** | set to '000' | FDD: set to '000'TDD: set to '0000’ if *ce-PDSCH-MultiTB-Config* is not configured, ‘000’ otherwise. |

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| Lenovo&MotoM | We share the similar view as Qualcomm. Since the same filed name for SPS validation is listed below the Scheduling TBs for Unicast field. |
| ZTE,sanechips | When multi-TB is configured, the SPS validation fields such as New data indicator, HARQ process number and Redundancy version do not exist since they are jointly coded in the ‘Scheduling TBs for Unicast’ field. More specifically, in subclause 7.1.7.1 of 36.213, regarding Modulation order and redundancy version determination, we have the following spec description:

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| - if , for the TB is determined by the 'Redundancy version' in the 'Scheduling TBs for Unicast' field in DCI format 6-1A- else if and the HARQ process IDs for each of the scheduled TBs are h1 and h2 (h1<h2),  of the scheduled TB with HARQ process ID h1 is determined by the 'Redundancy version for TB 1' in the 'Scheduling TBs for Unicast' field in DCI format 6-1A, and  of the scheduled TB with HARQ process ID h2 is determined as follows:- If the UE is configured with higher layer parameter *ce-PDSCH-64QAM-Config* and the repetition number field in the DCI indicates no PDSCH repetition, it is given by the 'Redundancy version for TB 1' in the 'Scheduling TBs for Unicast' field in DCI format 6-1A- else if the UE is configured with higher layer parameter *mpdcch-pdsch-HoppingConfig* set to 'on' and the repetition number field in the DCI indicates PDSCH repetition, it is given by the 'Redundancy version for TB 1' in the 'Scheduling TBs for Unicast' field in DCI format 6-1A- else it is given by the 'Redundancy version for TB 2' in the 'Scheduling TBs for Unicast' field in DCI format 6-1A- else if = 4 or 6 is indicated by the corresponding DCI,  for all scheduled TBs |

It is seen that the Redundancy version should be in the 'Scheduling TBs for Unicast' field. Similarly, SPS validation fields including New data indicator, HARQ process number and Redundancy version need the adjustments also.Additionally, for the TDD case, a correction for the 4-bit HPN field to 3 bits is necessary. |
| LG | We agree with Qualcomm and Lenovo&MotoM, and okay with the corrections provided by Qualcomm. |
| Huawei, HiSilicon | Share similar view with Qualcomm, there’s only one field named HARQ process number, even if it’s jointly encoded in Scheduling TBs for Unicast. For the correction proposed by Qualcomm, it’s better to be as following to remove any ambiguity:

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|  | **DCI format 6-0A** | **DCI format 6-1A** |
| **HARQ process number** | set to '000' | if *ce-PDSCH-MultiTB-Config* is configured,‘000’elseFDD: set to '000'TDD: set to '0000’ |

In fact, more concisely, we can use the wording for other fields such as “Resource block assignment” as below:

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|  | **DCI format 6-0A** | **DCI format 6-1A** |
| **HARQ process number** | set to '000' | Set to all '0's |

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| Nokia, NSB | We share similar view as Qualcomm. We are fine with either Qualcomm’s proposal or Huawei’s first proposal. In our view Huawei’s second proposal doesn’t explicitly mention *ce-PDSCH-MultiTB-Config* so it is not as clear. |
| Ericsson | If there are no issues with Qualcomm’s or Huawei’s TPs above, we prefer one of those due to their simplicity compared to the TPs in [1]. |
| Moderator (Ericsson) | Most responses argue that it will be enough to clarify that the content of the ‘HARQ process number’ should be set to zero in case of SPS validation, although there are some different preferences regarding how to express this in the specification. |

**Question 1.2: Will it be enough to clarify that the content of the ‘HARQ process number’ should be set to zero in case of SPS validation (according to one of the TPs from Qualcomm and Huawei above), or will some other clarification be needed?**

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| **Company** | **Comments** |
| Qualcomm | It is enough to clarify the ‘HARQ process number’. Either Huawei or our TP would be OK. |
| Lenovo, MotoM | We are OK the proposal from Huawei. |
| Nokia, NSB | Clarification on HARQ process number is enough. We are fine with either Qualcomm or Huawei TP.  |
| ZTE | We are OK with either Huawei or Qualcomm TP.  |
| Ericsson | It seems that the 36.213 DCI definition for SPS validation may need to be updated also for the case when 10 DL HARQ processes are defined, since ‘HARQ process number’ is then 5 bits according to the DCI format 6-1A definition in 36.212:- HARQ process number – 3 bits (for cases with FDD primary cell), 4 bits (for cases with TDD primary cell, or for cases with FDD primary cell when *ce-pdsch-tenProcesses-config* is configured by higher layers and the DCI is mapped onto the UE-specific search space given by the C-RNTI as defined in [3]). This field is not present when the format 6-1A CRC is scrambled with G-RNTI, or if *ce-PDSCH-MultiTB-Config* is enabled and the DCI is mapped onto the UE-specific search space given by C-RNTI as defined in [3].Huawei’s proposal to simply state ‘Set to all zeros’ would also capture this case. |
| Moderator (Ericsson) | Based on the responses, Proposal 1.3 below can be considered. |

**Proposal 1.3: In 36.213 Tables 9.2-1B/C, in the DCI format 6-1A columns, ‘HARQ process number’ is changed to ‘Set to all ‘0’s’.**

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| **Company** | **Comments** |
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# Issue #2: Clarification of multicast scheduling gap definition

Contributions [2] and [3] discuss clarification of the definition of scheduling gaps for Rel-16 LTE-MTC multi-TB scheduling for multicast SC-PTM transmission and present three alternative TPs for 36.213. Two of the TPs assume that the scheduling gap should be in terms of absolute subframes, whereas the third TP assumes that the scheduling gap should be in terms of BL/CE DL subframes. The TPs also address the indentation issue discussed in the previous RAN1 meeting [4].

**Question 2.1: Should the scheduling gap for multi-TB multicast transmission be in terms of BL/CE DL subframes or absolute subframes?**

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| **Company** | **Comments** |
| Qualcomm | Although we have no strong view, we think the current spec already captures the gap being in absolute subframes. About the large corrections in [2], we think the current spec (with indentation issue resolved) may be enough to describe the behavior. |
| Lenovo,MotoM | If we need to select one, counting by absolute subframe is our preference since the scheduling gap is counted by absolute subframe in NBIoT. e.g., uplink scheduling gap, and downlink gap in NBIoT. although we don’t have strong view.I don’t think the current TS36.213 correctly captures the agreement. The TB(s) have already mapped to continuous BL/CE DL subframe(s) based on spec, and then the spec gives a debug to insert a gap among TB(s) if configured. The behavior of UE is not clear due to the spec contradiction. |
| ZTE,sanechips | We are OK with the absolute subframes if the majority have the consensus.  |
| LG | We have similar view with Qualcomm. We believe that scheduling gap should be counted in terms of absolute subframe, and we think it is already captured in the current spec. |
| Nokia, NSB | Our preference is to use absolute subframe as already captured in the specification. We also agree with the TP to fix the indentation. |
| Ericsson | We are also fine with absolute subframes. |
| Moderator (Ericsson) | There seems to be consensus that the scheduling gap for multi-TB multicast transmission should be in terms of absolute subframes (rather than BL/CE DL subframes). |

**Proposal 2.2: RAN1 confirms that the scheduling gap for multi-TB multicast transmission is in terms of absolute subframes.**

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| **Company** | **Comments** |
| Qualcomm | Yes |
| Lenovo, MotoM | Agree the proposal |
| Nokia, NSB | Agree  |
| ZTE | Yes |
| Ericsson | Agree |
| Moderator (Ericsson) | Based on the responses, it seems that Proposal 2.2 can be accepted. |
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**Question 2.3: What (if any) specification updates are needed assuming that the scheduling gap for multi-TB multicast transmission should be in terms of absolute subframes?**

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| **Company** | **Comments** |
| Lenovo, MotoM | Based on the current TS36.213, the TB will be mapped to consecutive BL/CE DL subframes, for example, TB1 is mapped to subframe 0 to subframe 3 and TB2 is mapped to subframe 4 to subframe 7. But if the gap is configured, the TB mapping to subframe is not correctly captured. TB1 should be subframe 0 to subframe 3 and TB2 should be subframe 6-9, not the originally mapping subframe 4-7 specified in the first bullet of the following spec.If we have the common understanding that the last bullet can correct/debug the first bullet TBs mapping to subframe if gap configured, we are OK to keep the current spec.C:\Users\yanzhi1\AppData\Local\Temp\1611759394(1).png |
| ZTE | We are OK with the current spec about the description of absolute subframes. However, to avoid the confusion that the *multiTB-Gap* can be configured for 1 TB, a minor editing modification is needed as following:

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| - otherwise,- BL/CE DL subframes  with  are associated with TB*r+*1 ,,- for  and PDSCH corresponding to an MPDCCH with DCI CRC scrambled by G-RNTI, if higher layer parameter *multiTB-Gap* is configured*,* a scheduling gap with a length equal to the indicated value of *multiTB-Gap* is inserted between TB*r* and TB*r+*1, *r=*0,1,2.*..,NTB*-2. |

A similar modification in R1-2101279 is also fine with us, and it seems that we are missed. |
| Ericsson | Not sure, we may need some more time to analyze this.  |
| Qualcomm | Now we see the point from Lenovo, it is indeed true that the first and last bullets may be misinterpreted when written together. Would something as follows work? (to minimize the changes)**<Unchanged parts are omitted>**7.1.11 PDSCH subframe assignment for BL/CE UEA BL/CE UE shall upon detection of a MPDCCH with DCI format 6-1A/6-1B/6-2 intended for the UE, decode the corresponding PDSCH in subframe(s) *n+ki* with *i = 0, 1, …, NTBN-1* according to the MPDCCH, where- subframe *n* is the last subframe in which the MPDCCH is transmitted and is determined from the starting subframe of MPDCCH transmission and the DCI subframe repetition number field in the corresponding DCI;- the value of is the number of scheduled TB determined in the corresponding DCI if present, otherwise;- subframe(s) *ni* = *n+ki* with *i=0,1,…, NTBN-1* are *NTBN* consecutive BL/CE DL subframe(s) (excluding subframes used for scheduling gaps) where,  , the value of  is determined by the repetition number field in the corresponding DCI, where  are given in Table 7.1.11-1, Table 7.1.11-2 and Table 7.1.11-3, respectively and subframe *n+x* is the second BL/CE DL subframe after subframe *n*. - for , - if the UE is configured with higher layer parameter *interleaving* in *ce-PDSCH-MultiTB-Config*, and PDSCH corresponding to a MPDCCH with DCI CRC scrambled by C-RNTI and where  for BL/CE UE configured with CEModeA,  for BL/CE UE configured with CEModeB, - BL/CE DL subframes  with  are associated with TB*r+*1 ,- otherwise,- BL/CE DL subframes, with  are associated with TB*r+*1 ,, where , and is the first BL/CE DL subframe after subframe , where is given by higher layer parameter *multiTB-Gap*, if configured and the PDSCH corresponds to an MPDCCH with DCI CRC scrambled by G-RNTI, and is zero otherwise.**<Unchanged parts are omitted>** |
| Moderator (Ericsson) | Companies are encouraged to continue working on the TP details corresponding to Proposal 2.2.  |
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# References

1. [R1-2100561](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2100561.zip), “Corrections on scheduling enhancement for MTC”, ZTE

1. [R1-2100761](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2100761.zip), “Corrections on multicast gap in Multiple TB”, Lenovo, Motorola Mobility

1. [R1-2101279](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2101279.zip), “Corrections on multi-TB scheduling for eMTC”, Huawei, HiSilicon

1. [R1-2009295](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104-e/Docs/R1-2009295.zip), “FL summary for Multi-TB issues for Rel-16 LTE-MTC”, Moderator (Ericsson)