**3GPP TSG-RAN WG4 Meeting # 96-e R4-2012723**

**Electronic Meeting, 17 – 28 August, 2020**

**Agenda item:** 6.2.3

**Source:** Moderator (Huawei, HiSilicon)

**Title:** Email discussion summary for [96e][315] NB\_IOTenh3\_Demod

**Document for:** Information

# Introduction

During last RAN4#95-e meeting, R4-2008759 WF on LTE UE and BS performance requirements for additional enhancements of NB-IoT was approved with the following agreements:

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| * NPDSCH   + Define NPDSCH performance requirements with multi-TB scheduled transmission by using the following simulation assumptions  |  |  | | --- | --- | | **Parameter** | **Value** | | System bandwidth | 200 kHz | | Operation mode | Stand alone | | Antenna configuration | 1T1R | | Channel model | ETU 1Hz | | Frequency error | 0 Hz | | Timing error | 0μs | | Performance target | SNR@70% of maximum throughput | | NSF | 10 | | Repetition number | 32 | | Transmission mode | Interleaved | | HARQ process | 2 | | Carrier Type | Non-anchor | | TB Size | 1032 | | Duplex mode | HD-FDD |  * Interested companies are welcome to provide simulation results in the next meeting * NPUSCH format 1   + Define NPUSCH format 1 performance requirements with multi-TB scheduled transmission by using the following simulation assumptions  |  |  | | --- | --- | | **Parameter** | **Value** | | Number of tones | 12 | | SCS | 15kHz | | Antenna configuration | 1T2R | | Channel model | ETU 1Hz | | Frequency error | 0 Hz | | Timing error | 0μs | | Performance target | SNR@70% of maximum throughput | | NRU | 5 | | Repetition number | 64 | | HARQ process | 2 | | Transmission mode | Interleaved | | TB Size | 1032 |  * + Interested companies are welcome to provide simulation results in the next meeting |

This is for the 1st round discussion based on the agreements reached in last meeting.

Further discussions are summarized in the following as per the submitted contributions.

2nd round:

All agreements reached in the 1st round discussion have been captured in the revised CRs for NPDSCH performance requirements in TS 36.101, revised CRs for NPUSCH format 1 performance requirements in TS 36.104 and TS 36.141, further comments can be based on the revised CRs.

# Topic #1: NPDSCH performance requirements

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2010476**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010476.zip) | Ericsson | Simulation results and proposal:  **Proposal: Introduce NPDSCH demodulation requirements with interleaved multi-TB transmission for UE capable of 1) Cat-NB2, 2) multiTB-DL, and 3) multiTB-DL-Interleaving.** |
| [**R4-2010969**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010969.zip) | Huawei, HiSilicon | Simulation results only |
| [**R4-2010970**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010970.zip) | Huawei, HiSilicon | ***Proposal 1: No change to Noc level***  ***Proposal 2: Use following test parameters in Table 4***  **Table 4 Test parameters**   |  |  |  | | --- | --- | --- | | Parameter | Unit | Value | | DCI format |  | DCI format N1 | | scheduling delay field () |  | 1 | | (*ack-NACK-NumRepetitions-r13*) |  | 1 | | ACK/NACK resource field |  | 0 | | Repetition number of NPDCCH |  | 128 | | *Rmax* |  | 128 | | *G* |  | 1.5 | |  |  | 0 | |
| [**R4-2010971**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010971.zip) | Huawei, HiSilicon | CR for introduction of NPDSCH performance requirements for multi-TB interleaved into TS 36.101 and RFC definition |
| R4-2010975 | Huawei, HiSilicon | Summary of simulation results for LTE NPDSCH with multi-TB interleaved transmission. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1 Test parameters

**Issue 1-1-1: Noc level**

* Proposals
  + Option 1: Use =-93dBm/15kHz,  = -99dBm/15kHz (Huawei)
  + Option 2:
* Recommended WF
  + TBA

**Issue 1-1-2: Other parameters**

* Proposals
  + Option 1: (Huawei)

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| DCI format |  | DCI format N1 |
| scheduling delay field () |  | 1 |
| (*ack-NACK-NumRepetitions-r13*) |  | 1 |
| ACK/NACK resource field |  | 0 |
| Repetition number of NPDCCH |  | 128 |
| *Rmax* |  | 128 |
| *G* |  | 1.5 |
|  |  | 0 |

* + Option 2:
* Recommended WF
  + TBA

### Sub-topic 1-2 Test applicability

**Issue 1-2-1: Test applicability**

* Proposals
  + Only applicable for UE supporting:
    - ue-Category-NB: NB2
    - multiTB-DL-r16: support multiple TB scheduling in downlink
    - multiTB-DL-Interleaving-r16: support interleaved transmission when multiple TBs
* Recommended WF
  + Capture the above test applicability rule in TS 36.101

### Sub-topic 1-3: Final performance requirements

**Issue 1-3-1: Final performance requirements for NPDSCH with multi-TB interleaved transmission**

* Proposals
  + Collect both the ideal and impairment results during this meeting, and set the final performance requirements based on the averaged impairment results.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Sub topic 1-1: Test parameters  Issue 1-1-1: Noc level  We are fine if the intension is to set Noc1 = -99dBm/15kHz for NPDSCH transmission and set -93dBm/15kHz for NPDCCH transmission.  Issue 1-1-2: Other parameters  G=1.5 seems too small. Since one TB transmits with 32 repetitions and N\_SF=10, effective transmission length is 320 per TB. Because of 2 TB transmission, NPDSCH is scheduled every 640 subframes. Since NPDCCH repetition is 128, G could be 8.  Sub topic 1-2: Test applicability  Agree with the recommended WF.  Sub topic 1-3: Final performance requirements  [20200818]  For Issue 1-1-2, we understand your intention. G=1.5 is fine with us. |
| Huawei, HiSilicon | Sub topic 1-1: Test parameters  Issue 1-1-1: Noc level  Yes, Noc1 = -99dBm/15kHz is for NPDSCH transmission and Noc2 = -93dBm/15kHz is for NPDCCH transmission as per CR R4-2010971.  Issue 1-1-2: Other parameters  NPDCCH repetition number is 128 (Rmax), if we use G=1.5, and based on the total transmission duration including NPDCCH+NPDSCH+NPUSCH format 2 is 789ms as per the proposed value for scheduling delay (IDelay=1) and number of *ack-NACK-NumRepetitions =1,* there will be additional 171ms prolongation for one transmission duration, but if we choose G=8, then there will be additional 235ms prolongation for one transmission duration. To minimize the transmission gap impact for the performance, maybe G=1.5 is feasible.  Sub topic 1-2: Test applicability  Agree with the recommended WF.  Sub topic 1-3: Final performance requirements  Agree with the proposal |

### CRs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

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| --- | --- |
| **CR number** | **Comments collection** |
| [**R4-2010971**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010971.zip) | Ericsson: Add the applicability rule. |
| Huawei: we will capture the applicability rule in the revised CR. |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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|  | **Status summary** |
| **Sub-topic#1-1 Test parameters** | **Issue 1-1-1: Noc level**  *Tentative agreements:*  Use = -93dBm/15kHz for NPDSCH transmission,  = -99dBm/15kHz for NPDCCH transmission.  **Issue 1-1-2: Other parameters**  *Tentative agreements:*  Use following test parameters for NPDSCH performance requirements:   |  |  |  | | --- | --- | --- | | Parameter | Unit | Value | | DCI format |  | DCI format N1 | | scheduling delay field () |  | 1 | | (ack-NACK-NumRepetitions-r13) |  | 1 | | ACK/NACK resource field |  | 0 | | Repetition number of NPDCCH |  | 128 | | Rmax |  | 128 | | G |  | 1.5 | |  |  | 0 |   *Recommendations for 2nd round:*  All tentative agreements are captured in the revised CR R4-2010971, further comments can be based on the revised CR if needed. |
| **Sub-topic 1-3: Test applicability** | **Issue 1-2-1: Test applicability**  *Tentative agreements:*  Capture the following test applicability rule in TS 36.101:   * + The performance requirements are only applicable for UE supporting:     - ue-Category-NB: NB2     - multiTB-DL-r16: support multiple TB scheduling in downlink     - multiTB-DL-Interleaving-r16: support interleaved transmission when multiple TBs   *Recommendations for 2nd round:*  Tentative agreements are captured in the revised CR R4-2010971, further comments can be based on the revised CR if needed. |
| **Sub-topic 1-3: Final performance requirements** | **Issue 1-3-1: Final performance requirements for NPDSCH with multi-TB interleaved transmission**  *Tentative agreements:*  According to the summary of simulation results R4-2010975, the averaged impairment results can be added to TS 36.101.  *Recommendations for 2nd round:*  Averaged impairments results are captured in the revised CR R4-2010971, company can double check them in the revised CR. |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2010971 | To be revised |

## Discussion on 2nd round

### CRs comments collection

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| --- | --- |
| **CR number** | **Comments collection** |
| **[R4-2012599](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010971.zip)**  CR for TS 36.101: Introduce NPDSCH performance requirements for multi-TB interleaved transmission | Ericsson: It looks the set requirements are average of impairment results, i.e., -6.0dB. We are wondering the requirements need to consider additional margin on top of that. |
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## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: NPUSCH format 1 performance requirements

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2010276**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010276.zip) | Samsung | Ideal and impairment simulation results, and Observation:  **Observation 1: About 0.64 dB gain can be achieved with multi-TB interleaving scheduling compared with continuous scheduling for NPUSCH** |
| [**R4-2010477**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010477.zip) | Ericsson | Simulation results and proposals:  **Proposal 1: Introduce NPUSCH format 1 demodulation requirements with interleaved multi-TB transmission for BS supporting multiTB-UL and multiTB-UL-Interleaving.**  **Proposal 2: The performance requirements for NPUSCH format 1 demodulation requirements with interleaved multi-TB transmission are optional.** |
| [**R4-2010968**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010968.zip) | Huawei, HiSilicon | Simulation results only |
| [**R4-2010972**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010972.zip) | Huawei, HiSilicon | CR: Introduce NPUSCH format 1 performance requirements for multi-TB interleaved transmission for TS 36.104 |
| [**R4-2010973**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010973.zip) | Huawei, HiSilicon | CR: Introduce NPUSCH format 1 test requirements for multi-TB interleaved transmission for TS 36.141 |
| R4-2010974 | Huawei, HiSilicon | Summary of simulation results for LTE NPUSCH format 1 with multi-TB interleaved transmission. |
| [**R4-2011504**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011504.zip) | Nokia, Nokia Shanghai Bell | Simulation results and Observation:  **Observation 1: For interleaved multi-TB transmission, the gain versus non-interleaved transmission is FFS.** |
| R4-2011505 | Nokia, Nokia Shanghai Bell | Revision with simulation results. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1 UL transmission gap

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| As per TS 36.211 section 10.1.3.6:  After transmissions and/or postponements due to NPRACH of  time units, for frame structure type 1, a gap of  time units shall be inserted where the NPUSCH transmission is postponed. |

**Issue 2-1-1: UL transmission gap**

* Proposals
  + Option 1: It is implicitly reflected in the simulation considering that it is mandatory behaviour and not configurable.
  + Option 2:
* Recommended WF
  + TBA

### Sub-topic 2-2 Test applicability

**Issue 2-2-1: Test applicability**

* Proposals
  + Only applicable for BS supporting 2 HARQ processes, multiTB-UL-r16 and multiTB-UL-Interleaving-r16.
* Recommended WF
  + Add the test applicability rule in TS 36.141: The NPUSCH format 1 Only applicable for BS supporting 2 HARQ processes, multiTB-UL-r16 and multiTB-UL-Interleaving-r16

### Sub-topic 2-3: Final performance requirements

**Issue 2-3-1: Performance requirements definition**

* Proposals
  + Collect both the ideal and impairment results during this meeting, and set the final performance requirements based on the averaged impairment results.
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Sub topic 2-1-1:  We have also same understanding as option 1.  Sub topic 2-2-1:  Support the recommended WF.  Sub topic 2-3: |
| Samsung | Sub topic 2-1:  We are fine with option1. It is similar understanding with Rel-15 NPRACH format2, UL transmission gap is existed, and there is no need to explicitly reflect. Meanwhile, the performance impact is limited  Sub topic 2-2:  We are fine with recommended WF |
| Huawei, HiSilicon | Issue 2-1-1:  We have same understanding as option 1.  Issue 2-2-1:  Support the recommended WF  Issue 2-3-1:  Support the proposal. |
| Nokia | Issue 2-1-1:  We agree proceeding according option 1. We will take into account UL transmission gap of 40 ms in our evaluation and will resubmit revised figures within next 3 working days. In our understanding the performance impact is rather limited, though. Can the moderator please allocate a Tdoc number for revision of R4-2011505.  Issue 2-2-1:  We support the recommended WF.  Issue 2-3-1:  We included our impairment results as well to the NPUSCH performance summary sheet.  Both our ideal and impairment results may need to be revised according the above. |

### CRs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR number** | **Comments collection** |
| [**R4-2010972**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010972.zip) | Ericsson: Need applicability rule. Also need to mention this is optional. |
| Samsung: similar view with Ericsson, the requirement for NPUSCH format1 with multi-TB interleaved scheduling is optional. |
| Huawei: thanks for the comments, we will capture the test applicability rule in the revised CR and indicate it is optional. |
| Nokia: We agree with above views on test applicability rule and optional indication. In Table 8.5.1.1.1-4 it is stated in Note 1: “This requirement is applicable to UE support interleaved transmissions …”. However, it is a requirement for eNB here. Thus, we propose following rewording: “This requirement is only applicable if UE supports interleaved transmissions …”. |
| Huawei: thanks for the comments. The comments has been captured in Revised CR v1.  To Nokia, the requirement in this CR has been revised based on your updated impairment results. |
| [**R4-2010973**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010973.zip) | Ericsson: Same comment as 10972. |
| Samsung: similar view with Ericsson, the requirement for NPUSCH format1 with multi-TB interleaved scheduling is optional. |
| Huawei: thanks for the comments, we will capture the test applicability rule in the revised CR and indicate it is optional. |
| Nokia: We have the same comments as for R4-2010972. |
| Huawei: thanks for the comments. The comments has been captured in Revised CR v1.  To Nokia, the requirement in this CR has been revised based on your updated impairment results. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary** |
| **Sub-topic#2-1** | **Issue 2-1-1: UL transmission gap**  *Tentative agreements:*  Companies have common understanding that UL gap is implicitly reflected in simulation and not configurable, it has limited impact on performance.  *Recommendations for 2nd round:*  No further discussion is needed. |
| Sub-topic#2-2 | **Issue 2-2-1: Test applicability**  *Tentative agreements:*  Add the following test applicability into TS 36.104 and TS 36.141: the performance requirements for NPUSCH format 1 with multi-TB interleaved transmission are only applicable for BS supporting 2 HARQ processes, multiTB-UL-r16 and multiTB-UL-Interleaving-r16.  *Recommendations for 2nd round:*  Agreements are captured in the revised CR R4-2010972 and R4-2010973, further comments can be based on the revised CRs if needed. Companies can check if it is necessary to capture it in TS 36.104. |
| Sub-topic# 2-3 | **Issue 2-3-1: Performance requirements definition**  *Tentative agreements:*  According to the summary of simulation results R4-2010974, the averaged impairment results can be captured in TS 36.104 and TS 36.141 with TT*.*  *Recommendations for 2nd round:*  Averaged impairments results are captured in the revised CRs R4-2010972 and R4-2010973, company can double check them in the revised CRs. |

*Suggestion on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2010972 | To be revised |
| R4-2010973 | To be revised |

## Discussion on 2nd round

### CRs comments collection

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| **CR number** | **Comments collection** |
| **[R4-2012600](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010972.zip)**  CR for TS 36.104: Introduce NPUSCH format1 performance requirements for multi-TB interleaved transmission | Ericsson: Fix typo: “… when multiple TBs are scheduled for performance rqeuirements.”  => “… when multiple TBs are scheduled for performance requirements.” |
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| **[R4-2012601](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010973.zip)**  CR for TS 36.141: Introduce NPUSCH format1 conformance testing for multi-TB interleaved transmission | Ericsson: We prefer to align the applicability sentence with TS36.104, like:  “The requirements defined in Table 8.5.1.1.1-4 for two HARQ processes and interleaved transmissions are applicable to NB-IoT Base Station supporting two HARQ processes, multiple TB scheduling and interleaving transmission when multiple TBs are scheduled for performance requirements.” |
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## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |