**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)

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| 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. |
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## 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** |
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### CRs/TPs

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

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| **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.  Copied from email reflector on 2020/08/26:  Thanks for your update. Ericson is fine with the current revised CRs for TS36.101/104/141. |
| Huawei, HiSilicon: Thank you for the comments.  We double checked R4-1711673 (Summary of NB-IOT enh UE simulation results with impairments) that Rel-14 LTE NPDSCH performance requirements did not consider the additional margin on top of the averaged impairment results before we uploaded the draft CR with SNR requirements.  By further checking the LTE Rel-13 NB-IoT UE performance requirements discussion, R4-1610553 (Simulation summary of NB-IoT UE demodulation requirements), (the averaged impairment results + STD from ideal results) was used to derive the final performance requirements.  We followed the method used in Rel-14 in our CR, but we would like to hear your views on this.  Copied from email reflector on 2020/08/25:  Thanks for your comments and updated results.  Huawei’s comments are added at  [draft Summary\_315\_2nd\_round\_v0\_Ericsson\_Huawei.docx](https://www.3gpp.org/ftp/tsg_ran/wg4_Radio/TSGR4_96_e/Inbox/Drafts/%5B315%5D%20NB_IOTenh3_Demod/2nd%20round/draft%20Summary_315_2nd_round_v0_Ericsson_Huawei.docx)  Due to some confusion caused by the CRs in the original folder, I created a new folder “2nd round CRs” for the revised CRs for 2nd round discussion, please share your comments based on the version in [2nd round CRs](https://www.3gpp.org/ftp/tsg_ran/wg4_Radio/TSGR4_96_e/Inbox/Drafts/%5B315%5D%20NB_IOTenh3_Demod/2nd%20round%20CRs). |
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## Summary on 2nd round

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2012599 | Agreeable |

# 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) **was revised to R4-2012750** | 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 | Withdrawn |

## 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.*

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| --- | --- |
| **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** |
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### CRs/TPs

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

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| **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.” |
| Huawei: Maybe some confusions were made by putting the 2nd round CRs together with the 1st round, now moderator created a new folder “2nd round CRs” to facilitate the review.  Based on our understanding, test applicability rules only need to be captured in TS 36.141, no need in TS 36.104, we removed the test applicability rule from the CR. |
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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.” |
| Huawei: Sorry for the confusion. Please review the draft CRs in the “2nd round CRs” with rewording of test applicability and updated SNR requirements by including further updated results from Nokia. |
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## Summary on 2nd round

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| R4-2012600 | Agreeable |
| R4-2012601 | Agreeable |