**3GPP TSG-RAN WG4 Meeting #94-e R4-20xxxxx**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 7.11.3

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for RAN4#94e\_#71\_NB\_IOTenh3\_RRM

**Document for:** Information

# Introduction

This email discussion will focus on the remaining issues about RRM requirements of additional enhancements for NB-IoT. Companies are encouraged to provide comments about the submitted papers and CRs. The targets for the 1st and 2nd rounds are listed below:

* 1st round:
  + Potential agreements of the remaining issues about RRM core part requirements.
  + Potential update suggestions about the submitted CRs.
  + Decide whether to discuss the performance part in the 2nd round.
  + Remaining issues for discussion in the 2nd round.
* 2nd round:
  + Agreements of the remaining issues based on the 1st round discussion.

# Topic #1: RRM core requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000730 | Qualcomm Incorporated | Observation 1. Scenarios of dense paging occasions require smaller values of repetition level for NPDCCH to avoid colliding of NPDCCH of neighbouring paging occasions. Small values of Rmax in turn imply good SNR conditions which do not require M=10 subframes to make a reliable measurement.  Proposal 1. UE to be allowed to make RRM measurements in dense paging occasions without preconditions.  Proposal 2. NRSRP measurements on non-anchor carrier can be filtered or combined with NRSRP measurement on anchor carrier after translating the non-anchor carrier measurement with parameter nrs-PowerOffsetNonAnchor without any conditions or prerequisites. |
| R4-2001552 | Huawei, HiSilicon | Observation 1 : It will take longer time for measurement to get enough NRS samples in dense PO scenarios.  Proposal 1: The performance and accuracy of serving cell measurement should be guaranteed whether on anchor carrier or non-anchor carrier.  Proposal 2: UE should follow the same requirements and no relaxation is allowed no matter the NRS distribution when the serving cell measurement is conducted on non-anchor carriers.  Proposal 3: It is left for UE implementation on which carriers to do the measurements to achieve desired measurement accuracy. |
| R4-2001752 | Ericsson | Proposal #1: RRM measurements on non-anchor carrier in non-sparse case is allowed only for measurements in normal coverage, thus option 3 is supported.  Proposal #2: The UE is allowed to combine the non-anchor NRSRP samples with anchor NRSRP samples using the power offset information signaled by the network provided that the difference between the samples is less than X, where X is TBD. |
| R4-2001917 | Nokia, Nokia Shanghai Bell | Proposal 1: The UE is allowed to combine the non-anchor and anchor NRSRP samples with signalled power offset compensation, if it determines to be in extreme coverage (evaluation criteria FFS).  Proposal 2: If the UE determines to not be in extreme coverage, it is allowed to combine the non-anchor and anchor NRSRP samples with signalled power offset compensation only, if the measurement combining criterion is fulfilled (i.e. the comparison of NRSRP samples between anchor and non-anchor carrier, taken during the same measurement period and accounting for the signal power offset, yields a difference within a predefined margin according to inequation (1)).  Proposal 3: The network signals the predefined margin THR\_NRSRPMC\_COMB to the UE as part of the RRC reconfiguration command details. A 2-bit value is appropriate with 4 code points, e.g. {0 dB, 2 dB, 3 dB, 6 dB}.  Proposal 4: If the UE determines to be in enhanced coverage (evaluation criteria FFS), any filtered results, either from anchor or non-anchor carrier or both, can trigger NC measurements or relaxed monitoring abortion.  If the UE determines not to be in enhanced coverage, any filtered results, either from anchor or non-anchor carrier can trigger NC measurements or relaxed monitoring abortion, in case the measurement combining criterion according to Proposal 2 is fulfilled, otherwise the UE is required to only use NRSRP samples from anchor carrier in case of triggering NC measurements. |
| R4-2001553 | Huawei, HiSilicon | Observation 1: For the scenarios where NR has already deployed without LTE-NR coexistence, the configured is inconsistent with supported value of NB-IoT.  Proposal 1:  Option 1: For the NR without LTE-NR coexistence case where the has been configured as 25600 Tc, reconfigure the current setting of the NR BS to 39936 Tc.  Option 2: For NB-IoT nodes, the configuration of 25600 Tc shall be supported. |

## Open issues summary

### Sub-topic 1-1 Multi-carrier operations

**Issue 1-1-1: Measurement in dense paging occasions**

* Proposals
  + Option 1: UE to be allowed to make RRM measurements in dense paging occasions without preconditions. (QC R4-2000730, HW R4-2001552 )
  + Option 2: RRM measurement on non-anchor carrier in dense paging occasions is allowed only for measurements in normal coverage. (Ericsson R4-2001752)
* Recommended WF
  + Try to agree on Option 1

**Issue 1-1-2: Combining NRSRP samples between anchor carrier and non-anchor carriers**

* Proposals
  + Option 1: NRSRP measurements on non-anchor carrier can be filtered or combined with NRSRP measurement on anchor carrier after translating the non-anchor carrier measurement with parameter nrs-PowerOffsetNonAnchor without any conditions or prerequisites. (QC R4-2000730)
  + Option 2: The UE is allowed to combine the non-anchor NRSRP samples with anchor NRSRP samples using the power offset information signaled by the network provided that the difference between the samples is less than X, where X is TBD. (Ericsson, R4-2001752)
  + Option 3: (Nokia, R4-2001917)
    - The UE is allowed to combine the non-anchor and anchor NRSRP samples with signalled power offset compensation, if it determines to be in enhanced coverage (evaluation criteria FFS).
    - If the UE determines to not be in enhanced coverage, it is allowed to combine the non-anchor and anchor NRSRP samples with signalled power offset compensation only, if the measurement combining criterion is fulfilled.
    - The network signals the predefined margin THR\_NRSRPMC\_COMB to the UE as part of the RRC reconfiguration command details. A 2-bit value is appropriate with 4 code points, e.g. {0 dB, 2 dB, 3 dB, 6 dB}
* Recommended WF
  + Discussion is needed

**Issue 1-1-3: Neighbour cell measurement triggering and relaxed monitoring abortion**

* Proposals
  + Option 1: (Previous agreements, captured in WF R4-1915890 )

Any filtered results, either from anchor or non-anchor carrier, can trigger neighbour cell measurement and/or relaxed monitoring abortion.

* + Option 2: (Nokia, R4-2001917)
    - If the UE determines to be in enhanced coverage (evaluation criteria FFS), any filtered results, either from anchor or non-anchor carrier or both, can trigger NC measurements or relaxed monitoring abortion.
    - If the UE determines not to be in enhanced coverage, any filtered results, either from anchor or non-anchor carrier can trigger NC measurements or relaxed monitoring abortion, in case the measurement combining criterion according to Proposal 1 is fulfilled, otherwise the UE is required to only use NRSRP samples from anchor carrier in case of triggering NC measurements.
* Recommended WF
  + Follow the previous agreements, which is the Option 1.

### Sub-topic 1-2 TA offset setting for NR and NB-IoT coexistence

**Issue 1-2: TA offset setting for NR and NB-IoT coexistence**

* Proposals (HW, R4-2001552)
  + Option 1: For the NR without LTE-NR coexistence case where the TA offset has been configured as 25600 Tc, reconfigure the current setting of the NR BS to 39936 Tc.
  + Option 2: For NB-IoT nodes, the configuration of 25600 Tc shall be supported.
* Recommended WF
  + Discussion is needed.

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 1-1: Multi-carrier operations  Issue 1-1-1: Measurement in dense paging occasions  We support option 1. As discussed in our paper, non-sparse paging configuration is only realistic in low NPDCCH repetition (consequently high SNR) scenarios which means the condition that is proposed in option 2 is not necessary. If non-sparse paging occasion is configured in low SNR requiring larger repetition values for NPDCCH, then the NPDCCH subframes of different paging occasions collide.  Issue 1-1-2: Combining NRSRP samples between anchor carrier and non-anchor carriers  We support option 1 and note that proposals in options 2 and 3 are new UE behaviors that did not exist in RRM measurements for anchor carrier (which has the same issues regarding mobility, fading channel conditions, …) and hence not needed. From TS 36.133, we have :” The UE shall filter the NRSRP and NRSRQ measurements of the NB-IoT serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.” Here, there is no rule on whether the two NRSRP values should be within X dB to allow filtering. Even in anchor carrier RRM, the two samples can be quite different particularly in longer DRX cycles and given the estimation accuracy of NB-IoT. Why should filtering with non-anchor carrier be different?  In response to option 3, we’d like to note that not only it is not possible to include any new RRC signalling in R16 (since RAN1/2 work is done), but as mentioned above, the concerns about mobility, frequency selectivity, load can all apply to anchor carrier only measurement, non-anchor carrier only measurement, and mix of anchor and non-anchor carrier measurement.  Issue 1-1-3: Neighbour cell measurement triggering and relaxed monitoring abortion  We support option 1.  Sub topic 1-2: TA offset setting for NR and NB-IoT coexistence  Issue 1-2: TA offset setting for NR and NB-IoT coexistence  We do not understand what the concern is. First, we think option 2 of HW proposal cannot work since legacy NB-IoT UEs do not support TA offset value of 400 Ts (25600 Tc). Second, the configuration of TA offset in RRC signalling already allows for both values. The correct configuration should be handled by eNB and there is no impact or requirement on UE. See below.  ServingCellConfigCommonSIB ::= SEQUENCE {  downlinkConfigCommon DownlinkConfigCommonSIB,  uplinkConfigCommon UplinkConfigCommonSIB OPTIONAL, -- Need R  supplementaryUplink UplinkConfigCommonSIB OPTIONAL, -- Need R  n-TimingAdvanceOffset ENUMERATED { n0, n25600, n39936 } OPTIONAL, -- Need S  ssb-PositionsInBurst SEQUENCE {  inOneGroup BIT STRING (SIZE (8)),  groupPresence BIT STRING (SIZE (8)) OPTIONAL -- Cond FR2-Only  },  ssb-PeriodicityServingCell ENUMERATED {ms5, ms10, ms20, ms40, ms80, ms160},  tdd-UL-DL-ConfigurationCommon TDD-UL-DL-ConfigCommon OPTIONAL, -- Cond TDD  ss-PBCH-BlockPower INTEGER (-60..50),  ...  }    Others: |
| Ericsson | Sub topic 1-1: Multi-carrier operations  Issue 1-1-1: Measurement in dense paging occasions  Certain configurations of M/N which can result in only very few NRS subframes available for measurement, e.g. see configuration corresponding to nB=4T. Using these to fulfil e.g. measurement requirements in enhanced coverage can be very challenging.  Issue 1-1-2: Combining NRSRP samples between anchor carrier and non-anchor carriers  We have similar view as Nokia. But we would like to use such threshold (i.e. indicating the difference between the samples) also in enhanced coverage because the measurement accuracy is already subject to large bias in enhanced coverage.  Issue 1-1-3: Neighbour cell measurement triggering and relaxed monitoring abortion  If the filtering can be done such that the difference between the samples is below a certain threshold, then such measurement can be used like any measurement.  Sub topic 1-2: TA offset setting for NR and NB-IoT coexistence  Issue 1-2: TA offset setting for NR and NB-IoT coexistence  Since this is the first time we see such proposals, we would like to see/do more analysis in this area before any decision can be made.  Others: |
| Huawei | Sub topic 1-1: Multi-carrier operations  Issue 1-1-1: Measurement in dense paging occasions  Support Option 1. Although there is no consecutive NRS in dense PO case, the number of NRs within a certain period is sufficient for RRM measurement. So there should not be other restrictions.  Issue 1-1-2: Combining NRSRP samples between anchor carrier and non-anchor carriers  Support Option 1. We share the same views as QC. The fading could happen on the same carrier. There is no need for the restriction.  Issue 1-1-3: Neighbour cell measurement triggering and relaxed monitoring abortion  Support Option 1. The previous agreements should be adopted.  Sub topic 1-2: TA offset setting for NR and NB-IoT coexistence  Issue 1-2: TA offset setting for NR and NB-IoT coexistence  The issues raised from some particular scenarios where the gNB is employed with the TA offset of 25600 Tc. If the NB is introduced in the further, the gNBs need to be powered off and reconfigured to 39936 Tc. Option 2 is another way to handle this, which is to introduce the new TA offset setting of 25600 Tc. |
| Ericsson2 | More comments:  Issue 1-1-1:  When the measurement requirements for NB-IOT was derived in release 13, the assumption was that UE performs coherent combining over at least 2 consecutive subframes. This was needed in especially in enhanced coverage. How is then possible that UE can fulfill the measurement requirements when this number of NRS subframes are not guaranteed? If we allow NRSRP measurement under dense paging scenario, then we need to make sure that the UE can fulfill the requirements in all operating scenarios. Otherwise, we should only limit the measurements to conditions where the UE can actually fulfill the requirements.  Issue 1-2:  Share similar understanding as Qualcomm, and more time is needed to investigate this (if) issue. |
| Nokia | Issue 1-2: we share the concerns raised by Qualcomm and Ericsson. A legacy NB-IoT UE cannot support the new default TAoffset value. |

### CRs/TPs 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/TP number** | **Comments collection** |
| R4-2001550 | Ericsson1: quite many agreements in PUR are missing in this CR. Since this discussion is also ongoing for MTC, it is recommended to wait for the progress in MTC and align the NB-IOT agreements accordingly. |
| Nokia: We agree CRs on PUR for MTC and NB-IoT should be aligned and can be jointly agreed. |
|  |
| R4-2001551 | Company A |
| Company B |
|  |

## 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** | Issue 1-1-1: Measurement in dense paging occasions  *Tentative agreements:* More discussions are needed in the 2nd round.  *Candidate options:*   * Option 1: UE to be allowed to make RRM measurements in dense paging occasions without preconditions * Option 2: RRM measurements in dense paging occasions are allowed under certain conditions (FFS).   *Recommendations for 2nd round:*  Further discussion on the RRM measurement in dense PO scenarios  Issue 1-1-2: Combining NRSRP samples between anchor carrier and non-anchor carriers  *Tentative agreements:*  No consensus in the 1st round, further discussion are needed in the 2nd round  *Candidate options:*   * Option 1: NRSRP measurements on non-anchor carrier can be filtered or combined with NRSRP measurement on anchor carrier after translating the non-anchor carrier measurement with parameter nrs-PowerOffsetNonAnchor without any conditions or prerequisites. * Option 2: NRSRP measurements on non-anchor carrier can be filtered or combined with NRSRP measurement on anchor carrier after translating the non-anchor carrier measurement with parameter nrs-PowerOffsetNonAnchor with the condition is fulfilled, where the condition is FFS.   *Recommendations for 2nd round:*  Further discussion is on filtering and combinations of samples from anchor and non-anchor carriers.  Issue 1-1-3: Neighbour cell measurement triggering and relaxed monitoring abortion  *Tentative agreements:*  Issues 1-1-3 is related to the conclusion of Issue 1-1-2, which will be further discussed in the 2nd round. |
| **Sub-topic#2** | TA offset setting for NR and NB-IoT coexistence  Tentative agreements: Need further investigation |

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | Way forward on RRM requirements of R16 enhancement for NB-IoT | Huawei |

### 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** |
| R4-2001550 | To be revised |
| R4-2001551 | To be revised |

## Discussion on 2nd round

### Open issues summary

Issue 1-1-1: Measurement in dense paging occasions

* Option 1: UE to be allowed to make RRM measurements in dense paging occasions without preconditions
* Option 2: RRM measurements in dense paging occasions are allowed under certain conditions (FFS).

Issue 1-1-2: Combining NRSRP samples between anchor carrier and non-anchor carriers

* Option 1: NRSRP measurements on non-anchor carrier can be filtered or combined with NRSRP measurement on anchor carrier after translating the non-anchor carrier measurement with parameter nrs-PowerOffsetNonAnchor without any conditions or prerequisites.
* Option 2: NRSRP measurements on non-anchor carrier can be filtered or combined with NRSRP measurement on anchor carrier after translating the non-anchor carrier measurement with parameter nrs-PowerOffsetNonAnchor with the condition is fulfilled, where the condition is FFS.

Issue 1-1-3: Neighbour cell measurement triggering and relaxed monitoring abortion

* Related to the discussion of Issue 1-1-2
* Option 1: Any filtered results, either from anchor or non-anchor carrier, can trigger neighbour cell measurement and/or relaxed monitoring abortion;
* Option 2: Filtered results can trigger neighbour cell measurement and/or relaxed monitoring abortion under certain conditions, which are FFS.

### Companies views collection for the 2nd round

#### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Issue 1-1-1: Measurement in dense paging occasions  We support option 1. Enabling dense paging occasions in enhanced coverage mode (poor SNR) is a NW misconfiguration as we discussed in our paper. In other words, the condition that Ericsson is proposing in their paper is already guaranteed. Also, other than “under normal condition”, what other condition is being proposed? I am wondering why the specific proposal from Ericsson turned to FFS in option 2 above.  Issue 1-1-2: Combining NRSRP samples between anchor carrier and non-anchor carriers  Varying channel condition and/or interference level can occur both in time and frequency domain. Existing requirements allows filtering over samples taken in different time samples. In other words, time-domain fluctuation is allowed particularly in long DRX cycles. We fail to understand why frequency-domain fluctuation should be treated differently even if the measurements are taken from different NB carriers. To us, this is a new and unnecessary behavior which limits the usefulness of this power-saving feature. In idle mode, UE has to meet the implicit accuracy requirements anyway. We cannot agree to option 2.  Issue 1-1-3: Neighbour cell measurement triggering and relaxed monitoring abortion  Based on our views in isse 1-1-2, we support option 1. |

#### CRs/TPs comments collction

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| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
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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: RRM performance part

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000729 | Qualcomm Incorporated | Proposal 1. RAN4 to specify performance tests for MSG3 DL channel quality reporting in non-anchor carrier with AWGN channel using 4-bit table. R15 tests can be used as guidelines.  Proposal 2. RAN4 to specify separate test cases for channel quality reporting in connected mode. The test must ensure that the channel condition (i.e., SNR) is different in the evaluation period compared to the time prior to it so that UE only relies on the specified evaluation period for estimation of DL quality. As in R15 tests, 4-bit version in AWGN channel should be tested.  Proposal 3. RAN4 to not specify any performance tests for group WUS.  Proposal 4. RAN4 to further consult RAN5 on how to make UE generate MO-data in RRC idle in order to test PUR feature.  Proposal 5. RAN4 to not specify performance tests for NRSRP measurements on the non-anchor carrier as this is a UE choice. A UE may opt not to do RRM measurements on the non-anchor carrier at all or may opt to sometimes perform RRM measurements on the non-anchor carrier but not always. |

## Open issues summary

### Sub-topic 2-1

**Issue 2-1: Whether the performance part shall be discussed during RAN4#94-e**

* Proposals
  + Option 1: Yes.
  + Option 2: No.
* Recommended WF
  + According to the arrangement and guidelines for the RAN4#94-e, it is suggested to focus on the core part for the Rel-16 WI. Since there is only 1 contribution about the performance part, it is suggested to only focus on the core part this meeting.

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Issue 2-1: Whether the performance part shall be discussed during RAN4#94-e  The TU spreadsheet from WID allocates online time for performance aspect of R16 NB-IoT. Discussions on the demod side started from RAN4#93 meeting and the performance discussions on RRM aspects should also start according to the plan. We support option 1. |
| Ericsson | We are OK to focus on the core part of the Rel-16 WI in this e-meeting. |
| Huawei | We thinks it better to focus on the core part in this meeting, since we don’t have too much inputs about the performance part. |
| Nokia | We agree with Ericsson and Huawei. |

### CRs/TPs 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/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## 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** | *Tentative agreements:*  Postpone the discussion of the performance parts to RAN4#94 bis meeting, and focus on the core requirements during RAN4#94-e meeting.  *Candidate options:*  *Recommendations for 2nd round:* |

*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*

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## 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*

|  |  |
| --- | --- |
| **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”* |