3GPP TSG-RAN WG4 Meeting # 100-e R4-2115231

Electronic Meeting, August 16-27, 2021

**Agenda item:** 11.8.4

**Source:** Moderator (Huawei)

**Title:** Email discussion summary for [100-e][241] NB\_IOTenh4\_LTE\_eMTC6\_RRM

**Document for:** Information

# Introduction

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: Discuss the identified issues on neighbour cell measurements in connected mode before RLF for Rel-17 NB-IoT.
* 2nd round: Keep discussion on remaining issues.

# Topic #1: Neighbour cell measurements in connected mode before RLF or NB-IoT

*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** |
| R4-2114088 | Ericsson | **Proposal #1: RAN4 to postpone the discussions on exact section numbering until more progress is reached on the detailed requirements.**  **Proposal #2: When the target frequency carrier is different from the serving carrier, the maximum interval between two occasions shall be less than 5 seconds and the minimum length of measurement occasion shall be at least 400 ms for normal coverage.**  **Proposal #3: The work on defining the CONNECTED mode neighbor cell measurement requirements can be deprioritized from RAN4’s perspective.**  **Proposal #4: The UE shall support neighbour cell measurements on at least same number of carriers in CONNECTED mode as in IDLE mode.**  **Proposal #5: The conditions related to when the neighbor cell measurements can be performed without gaps and causing interruptions as agreed in [3] shall be taken into account when defining the requirements.** |
| R4-2114148 | Huawei, Hisilicon | **Observation 1: The serving cell could be in normal coverage and enhanced coverage.**  **Observation 2: The available time for neighbour cell measurement is limited which is from the point when the triggering conditions are met (channel quality deterioration) until the RLF is triggered.**  **Observation 3: The typical implementation is to find cell in good conditions within the limited time before RLF.**  **Observation 4: The time to detect/measure a cell in enhanced coverage is much more than that in normal coverage, which may result in all available time before RLF is wasted to find a cell in enhanced coverage that UE has not chance to found cells in good conditions.**  **Observation 5: Even a cell in enhanced coverage cell is found, UE should not be forced to only access to this cell without searching other cells in good conditions in RRC Re-establishment.**  **Proposal 1: RAN4 to define RRM requirements for neighbour cell measurement before RLF of a cell in normal coverage (Case#1/3) and it is up to UE implementations of neighbour cell measurement of a cell in enhanced coverage (Case#2/4).**  **Observation 6: Different from the gap-based measurement, the actual measurement occasion (duration and periodicity) could not be guaranteed for neighbour cell measurement of NB UE.**  **Observation 7: The minimum length of a measurement occasion and maximum interval shall be considered when defining the RRM requirements for neighbour cell measurement on carrier frequency which is different from the serving cell.**  **Proposal 2: When the target frequency carrier is different from the serving carrier, the maximum interval between two occasions shall be less than 5 seconds and the minimum length of a measurement occasion shall be at least 400 ms for normal coverage.**  **Proposal 3: For neighbour cell measurement in connected state, UE shall be able to monitoring at least the carrier which is same as the serving carrier and at least two carriers which are different from the serving carrier. Then detection/measurement delay shall be scaled by the number of carriers.** |
| R4-2114201 | Qualcomm Incorporated | **Observation 1: Evaluation of serving cell quality in connected mode for the purpose of triggering neighbor cell measurements could be modeled after radio link monitoring or on after cell re-selection in idle mode.**  **Proposal 1: RAN4 should wait for further progress in RAN2 regarding the mechanism for triggering neighbor cell measurements in connected mode.**  **Proposal 2: RAN4 should prioritize requirements for intra-frequency neighbor cell measurements in connected mode regardless of whether the serving frequency is anchor carrier or non-anchor carrier.**  **Proposal 3: It would be beneficial for the UE to measure neighbor cells detected in idle mode continuously (at least once every 5 seconds) during connected mode so that it can maintain a set of known candidate cells. Detection of new cells in connected mode would not be precluded.** |

## 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

**Issue 1-1-1: General**

* Proposals
  + Option 1: RAN4 to postpone the discussions on exact section numbering until more progress is reached on the detailed requirements. (Ericsson P1)
  + Option 2: The conditions related to when the neighbour cell measurements can be performed without gaps and causing interruptions as agreed in [3] shall be taken into account when defining the requirements. (Ericsson P5)
* Recommended WF
  + Agree on Option 1 AND option 2?

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| **Company** | **Comments** |
| XXX | **Issue 1-1-1** |
| Ericsson | We support recommend WF to agree on option 1 and 2. |
| Huawei | Support option 1 and 2, which should be considered when define the corresponding requirements when issues are concluded. |
| Qualcomm | We support with option1 and option2. Regarding option2, we think RAN4 should wait for more progress in RAN2. |
| Nokia | Support options 1 and 2. |

**Issue 1-1-2: Conditions on neighbour cell measurement when the target carrier is different from the serving carrier**

* Proposals
  + Option 1: When the target frequency carrier is different from the serving carrier, the maximum interval between two occasions shall be less than 5 seconds and the minimum length of measurement occasion shall be at least 400 ms for normal coverage. (Ericsson P2, Huawei P2)
* Recommended WF
  + Agree on Option 1?

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| **Company** | **Comments** |
| XXX | **Issue 1-1-2** |
| Ericsson | Option 1 is agreeable. |
| Huawei | Support option 1. |
| Qualcomm | We support the principle of measuring cells at least once every 5 seconds so that the cells remain known. It’s not clear to us if the proposed measurement duration of 400 ms is sufficient. |
| Nokia | We share Qualcomm’s view. Maximum duration of 5 sec is reasonable and was replied back to RAN2 in R4-2105800. For the 400 ms minimum duration of the measurement occasion for normal coverage, the proposed value should be further justified, since the value is considerably lower than what was replied to RAN2 in R4-2105800. |

**Issue 1-1-3: Neighbour cell measurements of a cell in enhanced coverage**

* Proposals
  + Option 1a: The work on defining the CONNECTED mode enhanced coverage neighbor cell measurement requirements can be deprioritized from RAN4’s perspective. (Ericsson P3)
  + Option 1b: RAN4 to define RRM requirements for neighbour cell measurement before RLF of a cell in normal coverage (Case#1/3) and it is up to UE implementations of neighbour cell measurement of a cell in enhanced coverage (Case#2/4). (Huawei P1)
* Recommended WF
  + Discuss above option 1a and 1b.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-3** |
| Ericsson | In option 1b, it is not clear to us what it means if enhanced coverage measurements are up to UE implementation. In our view, if enhanced coverage measurements are supported then the requirements should be clear and specified. We support option 1a where normal coverage work is prioritized and enhanced coverage work can be done if time allows in the WI. |
| Huawei | We would like to further clarify option 1b here which is a bit unclear. As analysed in our paper, neighbour measurement of a target cell in enhanced coverage is not a very typical scenarios for this this feature. As the cell search time is very long as agreed in past meeting, the conditions to measure a cell in enhanced overage will much more critical and stricter. For instance, it should be guaranteed that the available measurement occasion should be very long as the searching time and measurement time is much longer than NC case. And the overall time duration shall be guaranteed to be very long (triggered 🡪 RLF). So we think it is not very typical case to be considered.  Thus, we are fine with option 1a with some minor clarification to make it clear as follows:  The work on defining requirements for CONNECTED mode neighbour cell measurement **of a target cell in enhanced coverage** can be deprioritized from RAN4’s perspective. |
| Qualcomm | Regarding Huawei’s revised proposal (highlighted in yellow), does it mean that the measurement requirements to be introduced would be sufficient assuming the target cell is in normal coverage? |
| Nokia | We agree to option 1a. Cell identification and NRSRP measurement period are considerably longer for a target cell in enhanced coverage, i.e. more challenging to find a good target cell prior to RLF declaration. |

**Issue 1-1-4: Intra-frequency and inter-frequency measurement.**

* Proposals
  + Option 1: RAN4 should prioritize requirements for intra-frequency neighbor cell measurements in connected mode regardless of whether the serving frequency is anchor carrier or non-anchor carrier. (Qualcomm P2)
* Recommended WF
  + Discuss on option 1 and clarify the intra-frequency and inter-frequency measurement with anchor and non-anchor carrier.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-4** |
| Ericsson | The conditions for the UE to measure on both intra- and inter-frequency carriers were discussed in R4-2105800. We think both type of measurements are feasible as observed in R4-2105800, and RAN4 should define requirements for both. Thus option 1 is not agreeable to us. |
| Huawei | We think it is also related to multiple carrier operations discussed in issue 1-1-5. We support UE shall be able to measure both intra-f and inter-f carrier for neighbour cell measurement. The detailed numbers are to be discussed in 1-1-5.  One thing to be clarified. From our understanding, neighbour cell measurement in connected mode, intra-frequency means the target cell is on a carrier which is same as the operating carrier in connected mode, which could be anchor or non-anchor carrier. |
| Qualcomm | RAN4 responded in R4-2105800 that when the carrier frequency of the neighor cell is different from the serving (operating) frequency, the UE has limited opportunities to perform measurements without causing interruptions to the serving cell. In addition, inter-frequency measurements would incur re-tuning overhead. These are two disadvantages of inter-frequency measurements vs. intra-frequency measurements.  To Huawei: Yes, intra-frequency measurements should be supported when the operating carrier is either anchor or non-anchor carrier, as mentioned in option 1. |
| Nokia | We agree to Ericsson, the UE shall be capable of measuring both intra- and inter-frequency carriers, so requirements need to be defined for both cases. However, the impact due to serving cell interruption is different as depicted in LS to RAN2 in R4-2105800 and thus the UE may prioritize NC measurements on intra-frequency carriers against inter-frequency carriers. |

**Issue 1-1-5: Multiple carriers for neighbour cell measurements.**

* Proposals
  + Option 1a: The UE shall support neighbour cell measurements on at least same number of carriers in CONNECTED mode as in IDLE mode. (Ericsson P4)
  + Option 1b: For neighbour cell measurement in connected state, UE shall be able to monitoring at least the carrier which is same as the serving carrier and at least two carriers which are different from the serving carrier. Then detection/measurement delay shall be scaled by the number of carriers. (Huawei P3)
* Recommended WF
  + Discuss option 1a and 1b.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-5** |
| Ericsson | We support option 1a, where the number of carriers in CONNECTED is reused form corresponding number in IDLE mode. |
| Huawei | Option 1a and 1b are actually the same.1 “intra-frequency” carrier and 2 “inter-frequency” carriers, which is same as IDLE mode.  So we suggest to rephrase option 1a and 1b as follows:  The UE shall support neighbour cell measurements on at least same number of carriers in CONNECTED mode as in IDLE mode, including the carrier which is same as the serving carrier and at least two carriers which are different from the serving carrier. Then detection and measurement delay shall be scaled by the number of carriers |
| Qualcomm | Is the intention to make option 1a/b mandatory or subject to UE capability? |
| Nokia | Agree to Huawei’s highlighted proposal. The last phrase should then read: “Then detection and measurement delay shall be scaled by the supported number of carriers.” |

**Issue 1-1-6: Triggering of neighbour cell measurements.**

* Proposals
  + Option 1: RAN4 should wait for further progress in RAN2 regarding the mechanism for triggering neighbour cell measurements in connected mode. (Qualcomm P1)
* Recommended WF
  + Agree on option 1.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-6** |
| Ericsson | We are fine to wait until further RAN2 progress. |
| Huawei | Support option 1. |
| Qualcomm | Support option 1. |
| Nokia | Support option 1. |

**Issue 1-1-7: Known cell in IDLE mode.**

* Proposals
  + Option 1: It would be beneficial for the UE to measure neighbour cells detected in idle mode continuously (at least once every 5 seconds) during connected mode so that it can maintain a set of known candidate cells. Detection of new cells in connected mode would not be precluded. (Qualcomm P3)
* Recommended WF
  + Discuss option 1 and the potential impact on neighbour cell measurement.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-7** |
| Ericsson | What is the expected specification impact of option 1? Option 1 is already possible and we don’t see any specification impact due to this option. For example, the UE may already search for a particular cell that were detected in IDLE mode, and this can be up to UE implementation. |
| Huawei | We share the similar views as Ericsson. In legacy requirements, there is no neighbour cell measurement, thus the known cell conditions already cover the case that the cell is detected during IDLE mode before entering Connected mode. |
| Qualcomm | We agree that this is not precluded and it could be pursued to some extent by UE implementation. However, if some of the known cells have carrier frequencies different from the operating carrier then it may be more difficult to support measurements at least every 5 seconds without any change in the specifications. This is related to issue 1-1-2.  One point to highlight in this proposal is that the UE may not necessarily wait for the link conditions to degrade before starting neighbor cell measurements. Of course, we can wait for more direction from RAN2 on this question. |
| Nokia | We agree, option 1 may have some merits and hence can be further studied by RAN4 in the scope of this work item. |

## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

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

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
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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** | **Issue 1-1-1: General**  4 Companies provided comments on this issue, which is mainly about guidance on how to capture the agreements and requirements in the spec. 4 companies agree on option 1 and option 2.  *Tentative agreements:*  RAN4 to postpone the discussions on exact section numbering until more progress is reached on the detailed requirements  The conditions related to when the neighbour cell measurements can be performed without gaps and causing interruptions as agreed in [R4-2105800] shall be taken into account when defining the requirements.  *Candidate options: NA*  *Recommendations for 2nd round: NA*  **Issue 1-1-2: Conditions on neighbour cell measurement when the target carrier is different from the serving carrier**  4 companies provided on comments on this issue, which is about the conditions for UE to perform neighbour cell measurement on different carriers. 2 companies agree with option 1, and 2 company what to further consider the value of 400ms.  *Tentative agreements: NA*  *Candidate options:*  Option 1: When the target frequency carrier is different from the serving carrier, the maximum interval between two occasions shall be less than 5 seconds and the minimum length of measurement occasion shall be at least 400 ms for normal coverage.  *Recommendations for 2nd round:*  Keep discussion on the exact value.  **Issue 1-1-3: Neighbour cell measurements of a cell in enhanced coverage**  4 companies provided on comments on this issue. Scenarios of neighbour cell measurement are discussed in terms of serving cell in NC/EC and target cell in NC and EC. 1 company commented that the scenario when serving cell is in EC shall be deprioritized and 2 company commented that the scenario when target cell is in EC shall be deprioritized.  *Tentative agreements: NA*  *Candidate options:*  Option 1: The work on defining the CONNECTED mode neighbor cell measurement requirements can be deprioritized from RAN4’s perspective when serving cell is in enhanced coverage.  Option 2: The work on defining the CONNECTED mode neighbor cell measurement requirements can be deprioritized from RAN4’s perspective when target cell is in enhanced coverage.  Option 3 (new added): Prioritize requirements when both serving cell and target cell are in normal coverage.  *Recommendations for 2nd round:*  Keep discussing the above options. It should be noted that option 3 is newly added by moderator based on option 1 and option 2.  **Issue 1-1-4: Intra-frequency and inter-frequency measurement.**  4 companies provided on comments on this issue about the priority of intra-frequency and inter-frequency measurements. 3 companies disagree with option 1 think both intra-frequency and inter-frequency measurement shall be considered. 1 company explained the disadvantages of inter-frequency measurement. During the discussion in the GTW session, all companies agreed to define requirements for both intra-frequency and inter-frequency. One companies suggest to further discuss the whether UE shall prioritize measurement on intra-frequency.  *Tentative agreements:*  Define requirements for both intra-frequency and inter-frequency measurement.  *Candidate options:*  Option 1: Whether UE shall prioritize intra-frequency measurement against inter-frequency measurement.  *Recommendations for 2nd round:*  Note that option 1 in candidate options are rephrased by moderator based GTW sessions. Companies are encouraged to discuss the above issue and identify the potential impact to the requirements.  **Issue 1-1-5: Multiple carriers for neighbour cell measurements.**  4 companies provided on comments on this issue about the priority of intra-frequency and inter-frequency measurements. 3 companies agreed that UE shall support neighbour cell measurement on at lease same number as in IDLE mode. 1 company asked whether this is mandatory.  *Tentative agreements:*   * Agreements (GTW 8/20):   + The UE with the support of CONNECTED mode neighbor cell measurements shall support neighbour cell measurements on at least same number of carriers in CONNECTED mode as in IDLE mode, including the carrier which is same as the serving carrier and at least two carriers, which are different from the serving carrier.   + Detection and measurement delay shall be scaled by the number of measured carriers   + Note: it is RAN4 understanding that support of CONNECTED mode neighbor cell measurements is an optional UE capability   *Candidate options: NA*  *Recommendations for 2nd round: NA*  **Issue 1-1-6: Triggering of neighbour cell measurements.**  4 companies provided on comments on this issue and all agreed to wait for further progress in RAN2 about the triggering mechanism, as there was not much progress since last meeting in RAN2.  *Tentative agreements:*  RAN4 should wait for further progress in RAN2 regarding the mechanism for triggering neighbour cell measurements in connected mode.  *Candidate options: NA*  *Recommendations for 2nd round: NA*  **Issue 1-1-7: Known cell in IDLE mode.**  4 companies provided on comments on this issue. 2 companies commented that the impact to the specification is not clear. 2 companies support option 1 and suggest to further study.  *Tentative agreements: NA*  *Candidate options:*  Option 1: It would be beneficial for the UE to measure neighbour cells detected in idle mode continuously (at least once every 5 seconds) during connected mode so that it can maintain a set of known candidate cells. Detection of new cells in connected mode would not be precluded.  *Recommendations for 2nd round:*  Companies are encouraged to further analysis what is the impact to the neighbour cell measurement requirements and whether there is impact from other working groups. |

### CRs/TPs

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

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **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)

**Issue 1-1-2: Conditions on neighbour cell measurement when the target carrier is different from the serving carrier**

* Proposals
  + Option 1: When the target frequency carrier is different from the serving carrier, the maximum interval between two occasions shall be less than 5 seconds and the minimum length of measurement occasion shall be at least 400 ms for normal coverage. (Ericsson P2, Huawei P2)
* Recommended WF

Moderator: Companies are encouraged to comment on the value of the length of measurement occasion and the relation to detection/measurement time in LS reply R4-2105800

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| **Company** | **Comments** |
| XXX | **Issue 1-1-2** |

**Issue 1-1-3: Neighbour cell measurements of a cell in enhanced coverage**

* Proposals
  + Option 1: The work on defining the CONNECTED mode neighbor cell measurement requirements can be deprioritized from RAN4’s perspective when serving cell is in enhanced coverage.
  + Option 2: The work on defining the CONNECTED mode neighbor cell measurement requirements can be deprioritized from RAN4’s perspective when target cell is in enhanced coverage.
  + Option 3 (new added): Prioritize requirements when both serving cell and target cell are in normal coverage.
* Recommended WF

Moderator: Option 3 is added by moderator based on 1st round discussion merged by option 1 and option 2. Companies are encouraged to comment whether option 3 can be taken as a prioritized scenario to be considered.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-3** |

**Issue 1-1-4: Intra-frequency and inter-frequency measurement.**

* Proposals
  + Option 1: Whether UE shall prioritize intra-frequency measurement against inter-frequency measurement.
* Recommended WF

Moderator: Based on GTW discussion, companies agreed that both intra-frequency and inter-frequency measurement requirements shall be defined without prioritization. Companies want to further discuss whether UE shall prioritize the intra-frequency measurements. Companies are encouraged to answer following questions:

**Q1: Whether UE shall prioritize intra-frequency measurement against inter-frequency?**

**Q2: If the answer to Q1 is yes, whether/how to include the prioritization in requirements?**

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| **Company** | **Comments** |
| XXX | **Issue 1-1-4** |

**Issue 1-1-7: Known cell in IDLE mode.**

* Proposals
  + Option 1: It would be beneficial for the UE to measure neighbour cells detected in idle mode continuously (at least once every 5 seconds) during connected mode so that it can maintain a set of known candidate cells. Detection of new cells in connected mode would not be precluded. (Qualcomm P3)
* Recommended WF

Moderator: Companies are encouraged to comment on what is the impact of option 1 on neighbour cell measurement requirements.

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| **Company** | **Comments** |
| XXX | **Issue 1-1-7** |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on RRM requirements for Rel-17 NB-IoT and LTE-MTC | Huawei, HiSilicon | To capture the agreements in 1st and 2nd rounds. |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
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**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
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Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

Contact information

|  |  |  |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)