**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-22XXXXX**

**Electronic Meeting, 10– 19 October 2022**

**Agenda item: 4.7.4**

**Source:** Moderator (Nokia, Nokia Shanghai Bell)

**Title:** Email discussion summary for [104-bis-e][209] NR\_IIOT\_URLLC\_enh

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

Following Issues were left for discussion in the agreed WF (R4-2214338) in RAN4#104 meeting:

1. PDC measurement period if PRS measurements occasionally/continuously collide with Type 1A/1B PPW/Type 2 PPW:
* Option 1: If PDC RS resources overlap with Type 1A/1B/2 PPW the UE is allowed longer measurement period for PDC measurements if the PRS has higher priority than CSI-RS.
* Option 2: Other.
1. how to account for overlap between PDC RS and Measurement Gaps
* Option 1: Introduce a scaling factor Kgap, to account for overlap between PDC RS and Measurement gaps.
* Option 2: Allow for additional delay if there is any overlap between PDC RSs and Measurement gaps
* Option 3: Do not define requirements if there is any overlap between PDC RSs and Measurement gaps
1. Companies to bring discussion and proposal for next meeting addressing the open issue: How to develop requirements when DRX is in use

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

* 1st round: All 3 Core requirement related Issues will be discussed during 1st round. Additionally, remaining aspects for performance requirements will be discussed.
	+ Sub-Topic 1-1: PDC measurement period if PRS measurements occasionally/continuously collide with Type 1A/1B PPW/Type 2 PPW
	+ Sub-topic 1-2: How to account for overlap between PDC RS and Measurement Gaps
	+ Sub-topic 1-3: How to develop requirements when DRX is in use
* 2nd round: Any open issues not resolved in 1st Round

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| Huawei | Li Zhang | zhangli164@huawei.com |

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)

# Topic #1: RRM core requirement maintenance

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2215873 | vivo | Proposal 1: If PDC RS resources overlap with Type 1A/1B/2 PPW the UE is allowed longer measurement period for PDC measurements.Proposal 2: Additional delay is allowed if there is any overlap between PDC RSs and Measurement gaps.Proposal 3: For PRS/TRS based UE Rx-Tx time difference measurement for TT-based PDC, DRX related requirements are specified with the assumption that UE measures once per DRX cycle.Proposal 4: The requirements when DRX is configured are specified as follows.For TRS based PDC measurements, $T\_{UERxTx,TRS}=N\_{sample} \*max⁡(T\_{TRS}, DRX cycle)$For PRS based PDC measurements, $T\_{UERxTx, PRS}=N\_{sample}\*max⁡(\left⌈\frac{N\_{PRS}^{slot}}{N^{'}}\right⌉\*T\_{effect}, DRX cycle)$ |
| R4-2216326 | Huawei, HiSilicon | Proposal 1: Allow for additional delay if there is any overlap between PDC RSs and MGs.Proposal 2: If PDC RS resources overlap with Type 1A/1B/2 PPW the UE is allowed longer measurement period for PDC measurements.Proposal 3: Define DRX requirements based on assumption that UE is take one sample per DRX cycle. |
| R4-2216422 | Ericsson | Observation 1: As pointed out above, accurate TSN clocks are delivered periodically. Will there be time for DRX sleep?Observation 2: Waking up after DRX is an inaccurate process the Te value alone is much bigger than the whole control-to-control budget of +/- 145-275 ns.Observation 3: Existing positioning requirements for UE Rx-Tx time difference apply without DRX as well as for any DRX configuration specified in TS 38.331.Proposal 1: Existing PDC accuracy requirements for UE Rx-Tx time difference apply without DRX as well as for any DRX configuration specified in TS 38.331. |
| R4-2216508 | Nokia, Nokia Shanghai Bell | 1. Define requirements including possible collision/overlap between one or more measurement gaps and DL PRS for PDC.
2. Introduce a scaling factor Kgap, to account for overlap between PDC RS and MG
3. RAN4 does not define PDC measurement period if PRS measurements occasionally/continuously collide with Type 1A/1B PPW/Type 2 PPW
4. Define requirements including when DRX is defined and in use.
 |
| R4-2216721 | Qualcomm Incorporated | Proposal 1: Introduce a scaling factor, like the scaling factor P for L1-RSRP, RLM and BFD measurements, to account for collisions between PDC RS resources and measurement gaps, including concurrent measurement gaps.Proposal 2: The measurement period for PDC can be longer if some of the PDC RS resources collide with Type 1A/1B/2 PPW instances.Proposal 3: PDC measurement requirements do not apply if all the PDC RS resources collide with Type 1A/1B/2 PPW instances.Proposal 4: Define PDC requirements so that one sample per DRX cycle is assumed when DRX is configured. |

## 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

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1: PDC measurement period if PRS measurements occasionally/continuously collide with Type 1A/1B PPW/Type 2 PPW**

* Proposals
	+ Option 1: If PDC RS resources overlap with Type 1A/1B/2 PPW the UE is allowed longer measurement period for PDC measurements.
	+ Option 2: RAN4 does not define PDC measurement period if PRS measurements occasionally/continuously collide with Type 1A/1B PPW/Type 2 PPW
	+ Option 3: PDC measurement requirements do not apply if all the PDC RS resources collide with Type 1A/1B/2 PPW instances.
* Summary:
	+ 3 companies support option 1.
	+ 1 company support option 2.
	+ 1 company support option 3
	+ 1 company is neutral.
* Recommended WF
	+ More discussion is needed. See if companies can compromise to option 1?

### Sub-topic 1-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-2: how to account for overlap between PDC RS and Measurement Gaps**

* Proposals
	+ Option 1: Introduce a scaling factor Kgap, to account for overlap between PDC RS and Measurement gaps.
	+ Option 2: Allow for additional delay if there is any overlap between PDC RSs and Measurement gaps
	+ Option 3: Do not define requirements if there is any overlap between PDC RSs and Measurement gaps.
* Summary:
	+ 2 companies support Option 1.
	+ 2 companies support Option 2.
	+ 1 company is neutral
	+ No company support option 3
* Recommended WF
	+ Agreement 1: Option 3 is no longer considered.
	+ Continue the discussion related to define UE requirements according to Option 1 or Option 2.

### Sub-topic 1-3

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-3: How to develop requirements when DRX is in use**

* Proposals
	+ Option 1: Assume 1 sample per DRX cycle.
* Summary:
	+ 3 companies support Option 1. No companies have concern.
	+ 1 company raise the issue that PDC accuracy requirements for UE Rx-Tx time difference apply without DRX as well as for any DRX configuration specified in TS 38.331.
* Recommended WF
	+ Agreement 1: Option 1: Define UE requirements assuming 1 sample per DRX cycle.
	+ Continue the discussion related to the UE accuracy requirements when DRX is in use.

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

Sub topic 1-1

Issue 1-1: PDC measurement period if PRS measurements occasionally/continuously collide with Type 1A/1B PPW/Type 2 PPW

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei  | Support option 1.In our view there is no fundamental difference between the options. Between “longer measurement period” and “no requirements apply”, we think the former is more generic and inclusive.  |

Sub topic 1-2

Issue 1-2: how to account for overlap between PDC RS and Measurement Gaps

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei | We are fine with either option 1 or option 2. |

Sub topic 1-3

Issue 1-3: How to develop requirements when DRX is in use

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei | We support option 1.We are also fine with the proposal that the same accuracy requirements apply for both non-DRX and DRX case. |

### 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.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2216327,CR on requirements for UE Rx-Tx measurement for PDC,Huawei, HiSilicon | Company A |
| Company B |
|  |
| R4-2216423,Requirements for DRX case,Ericsson | Company A |
| Company B |
|  |
| R4-2216509,CR on requirements for NR\_IIOT\_URLLC,Nokia, Nokia Shanghai Bell | Huawei: For DRX requirements, would it be more straightforward to follow the same way as in existing RRM requirements, i.e. by using MAX or LCM between RS period (TPRS or TTRS) and DRX cycle (TDRX)? |
| Company B |
|  |
| R4-2216672,CR to TS 38.133 Correction to measurements core requirements for PDC,vivo | Huawei: For PRS measurement requirements, the MAX should apply to Teffect and DRX cycle. |
| 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.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### 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)

# Topic #2: RRM performance requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2216510 | Nokia, Nokia Shanghai Bell | Proposal 1: Apply averaging over companies’ TRS measurement accuracy simulation results. Proposal 2: Adopt the TRS measurement accuracy requirements in Table 2 and Table 3 addition with the group delay defined in TS 38.133 – 10.1.25.2. |
| R4-2216328 | Huawei, HiSilicon | Proposal 1: Use the average value in Table 1 for defining the accuracy number for TRS based PDC.Proposal 2: Capture BB and RF error in the separate tables in accuracy requirements for UE Rx-Tx for PDC. |
| R4-2216722 | Qualcomm Incorporated | Proposal 1: Rel-16 UE Rx-Tx accuracy requirements that were derived assuming a sampling rate higher than 32∙Tc do not apply to RTT-based PDC using PRS as the DL reference signal.Proposal 2: Simulation results assuming sampling rates higher than 32∙Tc will not be used to define measurement accuracy requirements for RTT-based PDC using TRS as the DL reference signal. |

## 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

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-1: TRS measurement accuracy requirements**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Summary:
	+ Two companies have provided averaged results based on the simulation results provided in earlier meetings by companies. For most scenarios the TUE-RX accuracy with TRS, 4 samples are similar except for 30 and 60KHz SCS in FR1. Additionally, some difference in the 60KHZ and 120KHz SCS results for FR2.
	+ FR1:
		- Difference between the results seems to come from using different results from Nokia where R4-2216328 use [88, 68, 40, 64, 40, 32] and R4-2216510 use [32.0, 16.0, 8.0, 16.0, 8.0, 4.0] for Average TUE-RX accuracy with TRS, 4 samples, AWGN, TDD, FR1
		- Other averaged results are similar
	+ FR2:
		- Difference in the averaged results for 120KHz SCS with TRS BW of 64 and 128 RBs. Difference seems to from the averaging.
* Recommended WF
	+ Agree on following tables with the FR2 120KHz SCS with TRS BW of 64 and 128 RBs in []:

|  |  |
| --- | --- |
|   | TUE-RX accuracy with TRS, 4 samples, AWGN, TDD |
| Accuracy (Tc) |
| SCS [KHz] | TRS bandwidth RB | Average |
| 15 | 24 | 103 |
| 52 | 53 |
| 104 | 26 |

* + - Average TUE-RX accuracy with TRS, 4 samples, AWGN, TDD, FR1

|  |  |
| --- | --- |
|  | TUE-RX accuracy with TRS, 4 samples, AWGN, TDD |
| Accuracy (Tc) |
| SCS [KHz] | TRS bandwidth RB | Average |
| 60 | 24 | 26 |
| 64 | 13 |
| 132 | 7 |
| 120 | 32 | 13 |
| 64 | [6, 7] |
| 128 | [3, 4] |

* + - Average TUE-RX accuracy with TRS, 4 samples, AWGN, TDD, FR2
	+ Further discuss and agree on the TUE-RX accuracy for FR2 with 120KHz SCS with TRS BW of 64 and 128 RBs
	+ Further clarify the differing results and agree on the averaged results marked FFS in the following table:

|  |  |
| --- | --- |
|   | TUE-RX accuracy with TRS, 4 samples, AWGN, TDD |
| Accuracy (Tc) |
| SCS [KHz] | TRS bandwidth RB | Average |
| 30 | 24 | FFS |
| 48 | FFS |
| 132 | FFS |
| 60 | 24 | FFS |
| 64 | FFS |
| 132 | FFS |

* + - Average TUE-RX accuracy with TRS, 4 samples, AWGN, TDD, FR1

### Sub-topic 2-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2: Adopt the TRS measurement accuracy requirements in Table 2 and Table 3 addition with the group delay defined in TS 38.133 – 10.1.25.2.**

* Proposals
	+ Option 1: Yes
	+ Option 2: No
* Recommended WF
	+ More discussion

### Sub-topic 2-3

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-3: Capture BB and RF error in the separate tables in accuracy requirements for UE Rx-Tx for PDC.**

* Proposals
	+ Option 1: Yes
	+ Option 2: No
* Recommended WF
	+ More discussion

### Sub-topic 2-4

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-4: Rel-16 UE Rx-Tx accuracy requirements that were derived assuming a sampling rate higher than 32∙Tc do not apply to RTT-based PDC using PRS as the DL reference signal.**

* Proposals
	+ Option 1: Yes
	+ Option 2: No
* Recommended WF
	+ Question from moderator: If this proposal is agreed, does this mean RAN4 need to a new round of simulations?
	+ More discussion needed.

### Sub-topic 2-5

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-5: Simulation results assuming sampling rates higher than 32∙Tc will not be used to define measurement accuracy requirements for RTT-based PDC using TRS as the DL reference signal.**

* Proposals
	+ Option 1: Yes
	+ Option 2: No
* Recommended WF
	+ Question from moderator: If this proposal is agreed, does this mean RAN4 need to a new round of simulations?
	+ More discussion

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1

Issue 2-1: TRS measurement accuracy requirements

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei  | For FR2 with 120KHz SCS with TRS BW of 64 and 128 RBs, suggest to use 7 and 4.For FR1 remaining cases, more discussion is needed. It is fine if companies would like to update their results and we should take the latest results into account. However, it seems the Nokia’s new results in 6510 for the FR1 remaining cases are almost half of the results from other companies. Since it is for AWGN channel, the accuracy would be somehow predictable based on the TRS BW, so we are wondering if Nokia’s new results are based on over-sampling. It is noted that in Rel-16 the accuracy requirements are derived based on nominal sampling rate and no over-sampling was assumed. |

Sub topic 2-2

Issue 2-2: Adopt the TRS measurement accuracy requirements in Table 2 and Table 3 addition with the group delay defined in TS 38.133 – 10.1.25.2.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei  | Not sure if we need to have explicit agreement on this proposal. We agree that the accuracy will be based on sum of BB error and RF calibration error. The BB error is discussed in issue 2-1, and for RF calibration error it is straightforward to re-use the Rel-16 requirements. |

Sub topic 2-3

Issue 2-3: Capture BB and RF error in the separate tables in accuracy requirements for UE Rx-Tx for PDC.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei  | This is our proposal and we support it.In Rel-16 spec, the BB and calibration error are already captured in separate tables, and we should follow the same approach for PDC Rx-Tx measurement. |

Sub topic 2-4

Issue 2-4: Rel-16 UE Rx-Tx accuracy requirements that were derived assuming a sampling rate higher than 32∙Tc do not apply to RTT-based PDC using PRS as the DL reference signal.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei  | We do not see clear need for the proposed limit.In our view, the accuracy and reporting granularity are different. Using a granularity of 32Tc does not mean UE cannot achieve accuracy on the level of 4Tc, as we assume the sampling rate used by the UE for measurement does not depend on the granularity to be used for the reporting.  |

Sub topic 2-5

Issue 2-5: Simulation results assuming sampling rates higher than 32∙Tc will not be used to define measurement accuracy requirements for RTT-based PDC using TRS as the DL reference signal.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Huawei  | Similar comment as for issue 2-4. |

### 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** |
| R4-2216511,CR on UE Rx-Tx time difference measurement accuracy requirements for RTT-based PDC,Nokia | Huawei: The BB error depends on issue 2-1, and whether to capture BB and RF error in separate tables is discussed in issue 2-3. |
| Company B |
|  |
| R4-2216792,Draft CR to verify measurements for UE Rx-Tx time difference measurement with TRS for RTT based PDC in FR2 SA,Nokia | Company A |
| Company B |
|  |
| R4-2216329,CR on PDC measurement accuracy requirements,Huawei | Company A |
| Company B |
|  |
| R4-2216330,CR on TCs for PDC measurement,Huawei | 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.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### 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**  |
| 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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2216327 |  | CR on requirements for UE Rx-Tx measurement for PDC | Huawei, HiSilicon | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2216423 |  | Requirements for DRX case | Ericsson |  |  |
| R4-2216509 |  | CR on requirements for NR\_IIOT\_URLLC | Nokia, Nokia Shanghai Bell |  |  |
| R4-2216672 |  | CR to TS 38.133 Correction to measurements core requirements for PDC | vivo |  |  |
| R4-2216511 |  | CR on UE Rx-Tx time difference measurement accuracy requirements for RTT-based PDC | Nokia, Nokia Shanghai Bell |  |  |
| R4-2216792 |  | Draft CR to verify measurements for UE Rx-Tx time difference measurement with TRS for RTT based PDC in FR2 SA | Nokia, Nokia Shanghai Bell |  |  |
| R4-2216329 |  | CR on PDC measurement accuracy requirements | Huawei, HiSilicon |  |  |
| R4-2216330 |  | CR on TCs for PDC measurement | Huawei, HiSilicon |  |  |

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** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | 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