**3GPP TSG-RAN WG4 Meeting # 96-e** [**R4-20xxxxx**](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_96_e/Docs/R4-2009028.zip)

**Electronic Meeting, August 17th- 28th , 2020**

**Agenda item:** 7.7.2.1.2, 7.7.2.1.4

**Source:** Moderator (Intel)

**Title:** Email discussion summary for [96e][216] NR\_pos\_RRM\_Part\_2

**Document for:** Information

# Introduction

The scope of this email discussion is UE RRM requirements for NR positioning from the following agenda items:

* AI 7.7.2.1.2 : PRS-RSRP measurements
* AI 7.7.2.1.4 : PRS-RSRP Link level simulation

In providing comments, companies are encouraged to:

* Be concise
* Provide comments on all topics/sub-topics of interest to them
* Ensure that their comments are inserted in the latest version of the document by checking the folder before uploading
* Use “Track changes” to help identify added comments/changes

# Topic #1: Measurement period

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2009742**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009742.zip) | Intel | Proposal 1 : PRS- RSRP measurement period requirement can be :   * + when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be same be max{T\_prsrsrp, T\_uerxtxdifference }     - “T\_prsrsrp” is the measurement period for PRS RSRP only     - “T\_uerxtxdifference” is the measurement period for UE Rx-Tx time difference depending on both PRS and SRS.   + when configured with RSTD, PRS-RSRP measurement period requirements can be same as that of RSTD measurement   + when not configured with either UE Rx-Tx or RSTD, the same requirement as RSTD. |
| [**R4-2009846**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009846.zip) | CATT | Proposal 1:  • when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be same as that of UE Rx-Tx time difference measurement  • when configured with RSTD, PRS-RSRP measurement period requirements can be same as that of RSTD measurement  • when not configured with either UE Rx-Tx or RSTD, measurement period requirements of RSTD can be reused for PRS-RSRP measurement. |
| [**R4-2009875**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009875.zip) | Qualcomm | Proposal 2a. When configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements to be the same as that of UE Rx-Tx time difference measurement.  Proposal 2b. When configured with RSTD, PRS-RSRP measurement period requirements to be the same as that of RSTD measurement.  Proposal 3. When PRS-RSRP is not configured with either UE Rx-Tx time difference or RSTD measurements (i.e, in DL-AoD), the measurement period shall be based on the same formulation as of RSTD.   * All parameters in RSTD formulation are identical in value for PRS-RSRP measurement except perhaps . |
| [R4-2011157](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2011157.zip) | Huawei, HiSilicon | Proposal 1: Adopt option 1 for the case when PRS-RSRP is configured for DL-TDOA or multi-RTT: the measurement period of PRS-RSRP is determined by that of RSTD and Rx-Tx time difference.  Proposal 2: Reuse the measurement period requirements of RSTD for PRS-RSRP. |
| [**R4-2011359**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2011359.zip) | Ericsson | **Proposal 12**: When measurement gaps are used, the measurement period TPRS-RSRP, without considering the dropped PRS impact, can be determined as:  TPRS-RSRP = ceil(NPRS-RSRP,req / KPRS) × max(TPRS, MGRP) × CSSF × X,  where:  NPRS-RSRP,req comb patterns are required for a PRS-RSRP measurement to meet the required accuracy,  KPRS is the number of comb patterns within the effective measurement time of a single measurement gap (NOTE: MGL can be longer than one PRS period),  TPRS is the PRS periodicity,  X is FFS (X≥1) related to UE measurement capability.  **Proposal 14**: If PRS-RSRP is not configured together with any of UE Rx-Tx or RSTD, the PRS-RSRP measurement is defined as TPRS-RSRP.  **Proposal 15**: If PRS-RSRP is configured together with UE Rx-Tx, then the measurement periods for both measurements are the same and defined as:  max(TPRS-RSRP,TUE Rx-Tx), where TPRS-RSRP and TUE Rx-Tx are the measurement periods for PRS-RSRP and UE Rx-Tx, when configured without other measurements.  **Proposal 16**: If PRS-RSRP is configured together with RSTD, then the measurement periods for both measurements are defined as:  max(TPRS-RSRP,TRSTD), where TPRS-RSRP and TRSTD are the measurement periods for PRS-RSRP and RSTD, when configured without other measurements. |

## Open issues summary

* Background : in the last meeting, the following agreements were achieved.

Given that PRS-RSRP can be configured in different NR positioning methods, the principle for defining PRS- RSRP measurement period requirement can FFS :

* + Option 1:
    - when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be same as that of UE Rx-Tx time difference measurement
    - when configured with RSTD, PRS-RSRP measurement period requirements can be same as that of RSTD measurement
    - FFS: when not configured with either UE Rx-Tx or RSTD.
  + Option 2:
    - when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be same (e.g longest period needed for UE Rx-Tx and for PRS-RSRP without UE Rx-Tx) as that of UE Rx-Tx time difference measurement
    - when configured with RSTD, PRS-RSRP measurement period requirements can be same (e.g., the longest period needed for RSTD and for PRS-RSRP without RSTD) as that of RSTD measurement
    - FFS: when not configured with either UE Rx-Tx or RSTD.

Companies views on this issue can be leveraged from the same discussion on PRS-RSTD measurement period.

### Sub-topic 1-1 Principles for defining measurement period for PRS RSRP

Can the same principals in the definition of PRS-RSTD measurement period be applicable to PRS-RSRP measurement period?

* Option 1: (CATT, Huawei)
  + when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be same as that of UE Rx-Tx time difference measurement
  + when configured with RSTD, PRS-RSRP measurement period requirements can be same as that of RSTD measurement
  + when not configured with either UE Rx-Tx or RSTD, measurement period requirements of RSTD can be reused for PRS-RSRP measurement.
* Option 1a: (Intel)
  + when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be
    - max{T\_prsrsrp, T\_uerxtxdifference }
      * “T\_prsrsrp” is the measurement period for PRS RSRP only
      * “T\_uerxtxdifference” is the measurement period for UE Rx-Tx time difference depending on both PRS and SRS.
  + when configured with RSTD, PRS-RSRP measurement period requirements can be same as that of RSTD measurement
  + when not configured with either UE Rx-Tx or RSTD, measurement period requirements of RSTD can be reused for PRS-RSRP measurement.
* Option 1b: (Qualcomm)
  + when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be same as that of UE Rx-Tx time difference measurement
  + when configured with RSTD, PRS-RSRP measurement period requirements can be same as that of RSTD measurement
  + When PRS-RSRP is not configured with either UE Rx-Tx time difference or RSTD measurements (i.e, in DL-AoD), the measurement period shall be based on the same formulation as of RSTD.
    - All parameters in RSTD formulation are identical in value for PRS-RSRP measurement except perhaps .
* Option 2: (Ericsson)
  + when configured with UE Rx-Tx time difference, PRS-RSRP measurement period requirements can be:
    - max(TPRS-RSRP,TUE Rx-Tx), where TPRS-RSRP and TUE Rx-Tx are the measurement periods for PRS-RSRP and UE Rx-Tx, when configured without other measurements
  + when configured with RSTD, PRS-RSRP measurement period requirements can be :
    - max(TPRS-RSRP,TRSTD), where TPRS-RSRP and TRSTD are the measurement periods for PRS-RSRP and RSTD, when configured without other measurements
  + If PRS-RSRP is not configured together with any of UE Rx-Tx or RSTD, the PRS-RSRP measurement is defined as TPRS-RSRP.

Recommended WF: Further discussion needed. Collect companies’ views.

### Sub-topic 1-2 Measurement period for PRS-RSRP

* Option 1 (Ericsson):
  + When measurement gaps are used, the measurement period TPRS-RSRP, without considering the dropped PRS impact, can be determined as:
  + TPRS-RSRP = ceil(NPRS-RSRP,req / KPRS) × max(TPRS, MGRP) × CSSF × X,

where:

* + - NPRS-RSRP,req comb patterns are required for a PRS-RSRP measurement to meet the required accuracy,
    - KPRS is the number of comb patterns within the effective measurement time of a single measurement gap (NOTE: MGL can be longer than one PRS period),
    - TPRS is the PRS periodicity,
    - X is FFS (X≥1) related to UE measurement capability.

Recommended WF: Discussion option 1 up to the conclusion of sub-topic 3-1

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
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### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| **[R4-2011158](C:\\Users\\rhuang5\\Documents\\my_work\\LTE_A\\RAN4\\96e\\Docs\\R4-2011158.zip)** (Huawei, Hi Silicon) | Company A |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#1-1** | **Principles for defining measurement period for PRS RSRP**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#1-2** | **Measurement period for PRS-RSRP**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
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## Discussion on 2nd round

Please only comment on topics that are selected for discussion in 2nd round.

**Sub-topic#1-1 Principles for defining measurement period for PRS RSRP**

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| **Company** | **Comments** |
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## Summary on 2nd round

No further agreement was reached in the 2nd round.

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
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# Topic #2: Measurement capability for PRS RSRP

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2009846**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009846.zip) | CATT | Proposal 2: RAN4 shall not define minimum measurement capability in terms of number of PRS layers, TRPs, resource sets and resources that UE shall be able to measure. |
| [**R4-2009875**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009875.zip) | Qualcomm | Observation 1. Minimum capabilities defined in RAN1 are more than sufficient to make DL-TDOA, multi-RTT, or DL-AoD work in any scenario.  Proposal 1. RAN4 to not define a minimum value for number of PRS-RSRP measurements that UE shall be capable of reporting. |
| [**R4-2011157**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2011157.zip) | Huawei, HiSilicon | Proposal 3: RAN4 not to define any measurement capability requirements for PRS measurement. |

## Open issues summary

### Sub-topic 2-1 Whether RAN4 should define minimum capability

Based on agreements in RAN1, multiple capability signaling (X1, X2, …, X7) are provisioned. The issue is whether RAN4 should define a minimum capability requirement for any of the X1, X2, …, X7.

* Option 1. RAN4 not to define measurement capability in terms of number of PRS layers, TRPs, resource sets and resources that UE shall be able to measure (CATT, Qualcomm, Huawei,).

Recommended WF: RAN4 not to define a minimum value for number of RSRP measurements that UE shall be capable of reporting.

## Companies views’ collection for 1st round

### Open issues

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### CRs/TPs comments collection

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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#2-1** | **Whether RAN4 should define minimum capability**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
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## Discussion on 2nd round

Please only comment on topics that are selected for discussion in 2nd round.

**Sub-topic#2-1 Whether RAN4 should define minimum capability**

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| **Company** | **Comments** |
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## Summary on 2nd round

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
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# Topic #3: Side conditions

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2009742**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009742.zip) | Intel | Proposal 4: For PRS RSRP measurement in DL DoA positioning method, the side condition shall be applicable the neighbor cells/TRPs only. |
| [**R4-2009846**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009846.zip) | CATT | Proposal 3: The side condition of PRS RSRP can be specified for both serving cell/TRP and neighbor cell/TRPs. The value is -6dB for serving cell and -13dB for neighbour cell. |
| [**R4-2009875**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009875.zip) | Qualcomm | Proposal 6. On PRS-RSRP side conditions:   1. Serving cell side condition is not needed 2. Reference cell side condition is not needed but if strong views exists on its presence, it shall be the same as PRS-RSTD reference cell side condition for all positioning methods. |
| [**R4-2010204**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2010204.zip) | MTK | Proposal 3:  - No need to define side condition for serving cell  - Reference cell: Same as that for the reference cell in PRS-RSTD |
| [**R4-2011157**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2011157.zip) | Huawei, HiSilicon | Proposal 4: Adopt option 2 for side conditions for PRS-RSRP measurement: defined for neighbour cell/TRPs only. |
| [**R4-2011359**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2011359.zip) | Ericsson | Proposal 1: No need to further discuss neighbor TRP side conditions for PRS-RSRP in DL-AoD (it was earlier agreed that they are the same as for RSTD, e.g., in [4] or in [8]).  Proposal 2: Serving cell/TRP side conditions are specified for PRS-RSRP for DL-AoD.   * + Serving TRP side condition is -3 dB. |

## Open issues summary

### Sub-topic 3-1 Side conditions for PRS-RSRP for DL-AoD

*[Moderator : PRS RSRP side condition to be FFS in this meeting is for the measurement in DL-AoD positioning method only. ]*

* Option 1a (Ericsson):
  + *Serving cell/TRP side conditions are specified for PRS-RSRP for DL-AoD.*
    - *Serving TRP side condition is -3 dB*
* Option 1b (CATT)
  + The side condition of PRS RSRP can be specified for both serving cell/TRP and neighbor cell/TRPs.
    - -6dB for serving cell
    - -13dB for neighbour cell.
* Option 2(Qualcomm, MTK)
  + Serving cell side condition is not needed
  + Reference cell side condition can be the same as PRS-RSTD reference cell side condition for all positioning methods
* Option 3 ( Intel, Huawei, Qualcomm)
  + Define for the neighbour cell/TRPs only (which was agreed in R4#95e).

Recommended WF: Further discussion needed. Collect companies’ views

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#3-1** | **Set of side conditions for PRS-RSRP for DL-AoD**  *Tentative agreements:*      *Candidate options:*  *Recommendations for 2nd round:* |

## Discussion on 2nd round

Please only comment on topics that are selected for discussion in 2nd round.

**Sub-topic#3-1 Set of side conditions for PRS-RSRP**

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## Summary on 2nd round

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| **CR/TP/LS/WF number** | **T-doc status update recommendation** |
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# Topic #4: Accuracy requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2009742**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009742.zip) | Intel | Proposal 2: PRS RSRP accuracy requirements can be based on single sample including resource repetitions within a PRS occasion.  Proposal 3: Define both absolute and relative accuracy requirements.  Proposal 3a: Define relative accuracy requirements in Rel16 with higher priority. |
| [**R4-2009846**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009846.zip) | CATT | Proposal 4: One sample means one PRS occasion which includes the repetition of PRS resources.  Proposal 5: The accuracy requirements of PRS-RSP measurement is defined based on 1 sample. |
| [**R4-2009875**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2009875.zip) | Qualcomm | Proposal 4. PRS-RSRP measurement accuracy requirements to be defined using samples from only one PRS resource occasion.   * Definition of a PRS resource “occasion” is the same as that in PRS-RSTD measurement.   Observation 1. In DL-AoD positioning method, differential PRS-RSRP measurement is used for positioning calculation. In multi-RTT or DL-TDOA with PRS-RSRP used as a weighting factor for other timing related measurements, differential RSRP serves the purpose and there is no need to have absolute PRS-RSRP requirements.  Proposal 5. RAN4 to define only differential measurement accuracy requirements for PRS-RSRP. |
| [**R4-2010204**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2010204.zip) | MTK | **Proposal 1**: No need to define absolute PRS-RSRP accuracy requirements  **Proposal 2**: RAN4 to define relative accuracy requirements for PRS-RSRP |
| [**R4-2011157**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2011157.zip) | Huawei, HiSilicon | Proposal 5: PRS-RSRP accuracy requirements are defined based on single shot measurement.  Proposal 6: Adopt option 2 or option 3 for defining PRS-RSRP accuracy requirements: define relative accuracy only, or define both absolute and relative accuracy. |
| [**R4-2011359**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\96e\Docs\R4-2011359.zip) | Ericsson | Observation 1: There must be absolute accuracy requirements defined for PRS-RSRP.  Observation 2: The UE performs absolute measurements and applies differential to them reporting, so no need in relative measurement accuracy requirements, since relative measurements are not performed by the UE.  Proposal 6: At least the absolute accuracy requirements for PRS-RSRP are defined.  Proposal 7: FFS the need to define relative accuracy requirements for PRS-RSRP |

## Open issues summary

### Sub-topic 4-1 Number of samples for accuracy requirements

* Option 1. single sample including resource repetitions within a PRS occasion (Intel,CATT, Huawei)

Recommended WF: PRS RSRP accuracy requirements can be defined with a single sample including resource repetitions within a PRS occasion.

### Sub-topic 4-2 Type of requirements: relative accuracy requirements

* Option 1. Define relative accuracy requirements for PRS-RSRP (Intel, Qualcomm, Huawei, MTK)

Recommended WF: Define relative accuracy requirements for PRS-RSRP with higher priority.

### Sub-topic 4-3 Type of requirements: absolute accuracy requirements

* Option 1. Define absolute accuracy requirements for PRS-RSRP (Ericsson)
* Option 2. Do not define absolute accuracy requirements for PRS-RSRP (MediaTek, Qualcomm)

Recommended WF: Further discussion needed. Collect companies’ views.

### Sub-topic 4-4 Test case

* Option 1. DL-AoD test cases, at least two TRPs should be configured, and at least two PRS resources (2 beams) should be associated with each TRP (MediaTek)
* Others

## Companies views’ collection for 1st round

### Open issues

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| **Company** | **Comments** |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#4-1** | **Number of samples for accuracy requirements**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#4-2** | **Types of requirements: relative accuracy requirements**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#4-3** | **Types of requirements: absolute accuracy requirements**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |
| **Sub-topic#4-4** | **Test cases**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |

## Discussion on 2nd round

Please only comment on topics that are selected for discussion in 2nd round.

**Sub-topic#4-1 Number of samples for accuracy requirements**

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**Sub-topic#4-2 Types of requirements: relative accuracy requirements**

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**Sub-topic#4-3 Types of requirements: absolute accuracy requirements**

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## Summary on 2nd round

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| **CR/TP/LS/WF number** | **T-doc status update recommendation** |
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# Topic #5: Link level simulation for PRS RSRP

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **R4-2011161** | Huawei, HiSilicon | Observation 2: The impact of resource repetition within a slot on PRS-RSRP performance is similar to that of repetition on slot level. |

## Open issues summary

### Sub-topic 6-1 Impact of resource repetition within a slot on PRS-RSRP performance

* Option 1: Similar as that of **repetition on slot level.**

Recommended WF: Further discussion needed. Collect companies’ views.

## Companies views’ collection for 1st round

### Open issues

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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#5-1** | **Impact of resource repetition within a slot on PRS-RSRP performance**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |

## Discussion on 2nd round

Please only comment on topics that are selected for discussion in 2nd round.

**Sub-topic#5-1 Impact of resource repetition within a slot on PRS-RSRP performance**

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## Summary on 2nd round

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| **CR/TP/LS/WF number** | **T-doc status update recommendation** |
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