**3GPP TSG-RAN WG4 Meeting # 97-e** [**R4-20xxxxx**](http://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_97_e/Docs/R4-2009028.zip)

**Electronic Meeting, 2nd – 13th November, 2020**

**Agenda item:** 7.7

**Source:** Moderator (Intel Corporation)

**Title:** Email discussion summary for [97e][214] 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 7.7.3.1 RRM Perf requirements: General
* AI 7.7.3.2.1 Measurement accuracy requirements
* AI 7.7.3.2.2 Test cases
* AI 7.7.3.2.3 Other

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: General performance requirements for NR Positioning

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2015567**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015567.zip)  Work plan for NR Positioning RRM Performance part | Intel | **Proposal 1:** **The proposed work plan for NR positioning perf part can be:**   * **RAN4#97e (November 2020)**   1. **Accuracy requirements**      + **Align on the link level simulation result for RSTD, UE Rx-Tx time difference and PRS RSRP**      + **Agree on the principle to define the accuracy requirements for RSTD, UE Rx-Tx time difference and PRS RSRP**      + **Initial phase CR drafts**   2. **Test cases:**      + **Basis PRS configuration patterns**      + **Agree on the test case list for core and accuracy requirements**      + **Initial phase CR drafts** * **RAN4#98e (Jan 2021)**   1. **Accuracy requirements**      + **Agree on the accuracy requirements for RSTD, UE Rx-Tx time difference and PRS RSRP**      + **Final phase CR**   2. **Test cases:**      + **Test case drafts**      + **Final phase CR**   **Proposal 2: Adopt the following CR / Test case work split:**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Index** | **CR Title** | **Tentative section number in [2]** | **Responsible Company** |  | | **Draft Big CR** | | | | | |  | **Draft Big CR on NR Positioning Performance requirements** |  |  |  | | **UE Accuracy requirements. Report mapping** | | | | | | **P1** | **RSTD measurement accuracy requirements** | **10.1.23** | **[Intel]** |  | | **P2** | **PRS RSRP measurement accuracy requirements** | **10.1.24** |  |  | | **P3** | **UE Rx-Tx time difference measurement accuracy requirements** | **10.1.25** |  |  | | **UE Performance requirements** | | | | | | **TC0** | **PRS configuration patterns** | **A3.x.** | **Intel** |  | | **TC1-1** | **FDD RSTD measurement reporting in FR1** | **A6.6.x** | **Intel** |  | | **TC 1-2** | **TDD RSTD measurement reporting in FR1** | **A6.6.x** |  |  | | **TC 1-3** | **TDD RSTD measurement reporting in FR2** | **A7.6.x** |  |  | | **TC 2-1** | **FDD UE Rx-Tx time difference measurement reporting in FR1** | **A6.6.xx** |  |  | | **TC 2-2** | **TDD UE Rx-Tx time difference measurement reporting in FR1** | **A6.6.xx** |  |  | | **TC 2-3** | **TDD UE Rx-Tx time difference measurement reporting in FR2** | **A7.6.xx** |  |  | | **TC 3-1** | **FDD PRS RSRP measurement reporting in FR1** | **A6.6.xxx** |  |  | | **TC 3-2** | **TDD PRS RSRP measurement reporting in FR1** | **A6.6.xxx** |  |  | | **TC 3-3** | **TDD PRS RSRP measurement reporting in FR2** | **A7.6.xxx** |  |  | | **TC 4-1** | **FDD RSTD measurement accuracy in FR1** | **A6.7.x** |  |  | | **TC 4-2** | **TDD RSTD measurement accuracy in FR1** | **A6.7.x** |  |  | | **TC 4-3** | **TDD RSTD measurement accuracy in FR2** | **A7.7.x** |  |  | | **TC 5-1** | **FDD UE Rx-Tx time difference measurement accuracy in FR1** | **A6.6.xx** |  |  | | **TC 5-2** | **TDD UE Rx-Tx time difference measurement accuracy in FR1** | **A6.7.xx** |  |  | | **TC 5-3** | **TDD UE Rx-Tx time difference measurement accuracy in FR2** | **A7.7.xx** |  |  | | **TC 6-1** | **FDD PRS RSRP measurement reporting in FR1** | **A6.7.xxx** |  |  | | **6-2** | **TDD PRS RSRP measurement reporting in FR1** | **A6.7.xxx** |  |  | | **6-3** | **TDD PRS RSRP measurement reporting in FR2** | **A7.7.xxx** |  |  | | **gNB requirements** | | | | | |  | **TBA based on RAN4 #97e discussion** |  |  |  | |
| [**R4-2016398**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016398.zip)  General discussion on NR RRM positioning test cases | Ericsson | ***Proposal 3****: The work on NR RRM positioning test cases is divided into at least two phases.*  ***Proposal 4****: Specification structure with new NR positioning test cases sections for SA (in red) in TS 38.133:*  *A.6 NR standalone tests with all NR cells in FR1*  *...*  *A.6.6 Measurement procedure*  *...*  *A.6.6.7 RSTD measurements*  *A.6.6.8 PRS-RSRP measurements*  *A.6.6.9 UE Rx-Tx time difference measurements*  *A.6.7 Measurement Performance requirements*  *…*  *A.6.7.9 RSTD measurements*  *A.6.7.10 PRS-RSRP measurements*  *A.6.7.11 UE Rx-Tx time difference measurements*  *A.7 NR standalone tests with one or more NR cells in FR2*  *...*  *A.7.6 Measurement procedure*  *...*  *A.7.6.5 RSTD measurements*  *A.7.6.6 PRS-RSRP measurements*  *A.7.6.7 UE Rx-Tx time difference measurements*  *A.7.7 Measurement Performance requirements*  *...*  *A.7.7.6 RSTD measurements*  *A.7.7.7 PRS-RSRP measurements*  *A.7.7.8 UE Rx-Tx time difference measurements*  ***Proposal 5****: For NR-DC test cases, create a new section A.X in Annex A of TS 38.133.* |

## Open issues summary

### Sub-topic 1-1 Work plan of performance part

[*Moderator notes: In order to agree the specific work plan for the performance part requirements, companies can firstly clarify the general work scope and principle of NR Positioning performance requirements. ]*

* Option 1 (Intel): the parallel discussions for the accuracy requirements and test cases are needed to meet RAN4 current target.
* Option 2 (Ericsson): For the test cases, the two-phases approach is needed.

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

### Sub-topic 1-2 Specification structure for Test case

*[Moderator notes: the proposed TS skeleton for test cases depending on the scope of test cases needed in Rel16.]*

* Option 1. (Intel)
  + Common PRS configuration in A3.x
  + TC for RSTD/PRS RSRP/UE Rx-Tx time difference measurement reporting in FR1 in A6.6
  + TC for RSTD/PRS RSRP/UE Rx-Tx time difference measurement reporting in FR2 in A7.6.
  + TC for RSTD/PRS RSRP/UE Rx-Tx time difference measurement accuracy in FR1 in A6.7
  + TC for RSTD/PRS RSRP/UE Rx-Tx time difference measurement accuracy in FR2 in A7.7.
* Option 2 (Ericsson)

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| * new NR positioning test cases sections **for SA** (in red) in TS 38.133:   *A.6 NR standalone tests with all NR cells in FR1*  *...*  *A.6.6 Measurement procedure*  *...*  *A.6.6.7 RSTD measurements*  *A.6.6.8 PRS-RSRP measurements*  *A.6.6.9 UE Rx-Tx time difference measurements*  *A.6.7 Measurement Performance requirements*  *…*  *A.6.7.9 RSTD measurements*  *A.6.7.10 PRS-RSRP measurements*  *A.6.7.11 UE Rx-Tx time difference measurements*  *A.7 NR standalone tests with one or more NR cells in FR2*  *...*  *A.7.6 Measurement procedure*  *...*  *A.7.6.5 RSTD measurements*  *A.7.6.6 PRS-RSRP measurements*  *A.7.6.7 UE Rx-Tx time difference measurements*  *A.7.7 Measurement Performance requirements*  *...*  *A.7.7.6 RSTD measurements*  *A.7.7.7 PRS-RSRP measurements*  *A.7.7.8 UE Rx-Tx time difference measurements*   * For **NR-DC test cases**, create a new section A.X in Annex A of TS 38.133. |

Recommended WF: *Currently we agree on the options for the test cases in SA ONLY*

## Companies views’ collection for 1st round

### Open issues

**Sub-topic#1-1 Work plan of performance part (e.g. test cases)**

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| **Company** | **Comments** |
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**Sub-topic#1-2 Specification structure for Test case**

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

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| **CR/TP number** | **Comments collection** |
| **[R4-2016400](C:\\Users\\rhuang5\\Documents\\my_work\\LTE_A\\RAN4\\97e\\Docs\\R4-2016400.zip)** NR RRM positioning test cases structure  (Ericsson) |  |
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## Summary for 1st round

### Open issues

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

[*Moderator notes: Depending on 1st round discussion, we can agree the CRs/TCs split among companies in this meeting.*]

**Sub-topic#1-1**

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| **Company** | **Comments** |
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**Sub-topic#1-2**

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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 Accuracy Requirements for PRS RSTD

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2014447**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014447.zip) | CATT | **Proposal 1: Side conditions for PRS RSTD measurements in FR2 are defined same as those in FR1, i.e. -13dB for neighbour cell and -6dB for serving cell.**  **Proposal 2: Accuracy requirements are defined based on number of PRS samples, where each samples includes a number of PRS repetitions. Single PRS sample is assumed for accuracy requirements.**  **Proposal 3: The accuracy requirements shall be agnostic to comb size when the number of PRS symbols is the same.**  **Proposal 4: If reference and neighbor PRS resources belong to different positioning frequency layers, the minimum PRS BW of the positioning frequency layers should be used for applicability of accuracy requirements.**  **Proposal 5: Applicable accuracy requirements depend on the state of UE being intra-frequency or inter-frequency after HO.**  **Proposal 6: UE selected parameter k2 is larger than or equal to k1.**  **Proposal 7: The range of k is {2,3,4,5} in FR1.**  *[Moderator Notes: in the last meeting, the parameter “k” was agreed [R4-2012260]]* |
| [**R4-2014450**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014450.zip) | CATT | CR on PRS RSTD accuracy requirements |
| [**R4-2014574**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014574.zip) | Intel | **Proposal 1: SINR side conditions for PRS-RSTD in FR2 can be**   * **PRS Es/Iot = -6 dB for reference cell and** * **PRS Es/Iot = -13 dB for neighbor cells**   **Proposal 2: A single PRS sample is assumed for accuracy requirements. And each sample includes a number of PRS repetitions**  **Proposal 3: Define the accuracy requirements depending on the comb-size.**  **Proposal 4: The minimum PRS BW of the positioning frequency layers should be used for applicability of accuracy requirements.**  **Proposal 5: RAN4 need not to define separate accuracy requirements for RSTD regarding to same or h different panels**  **Proposal 6: No need to consider TRS when performing PRS measurement.**  **Proposal 7:** **During the HO, the measurement accuracy shall be same as that of without HO.**  **Proposal 8:** **When defining RSTD and UE Rx-Tx time difference accuracy requirements, TDL-C channel model with 300 ns delay spread shall be taken considered also.** |
| [**R4-2015759**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015759.zip) | Huawei | **Proposal 1: Side condition for RSTD accuracy requirements in FR2 is PRS Es/Iot of -3 dB for reference cell and -10 dB for neighbor cells.**  **Proposal 2: RSTD accuracy requirements are defined based on a single PRS sample, where a PRS sample includes a number of PRS repetitions.**  **Proposal 3: RSTD accuracy requirements are defined agnostic to comb size, which is given by parameter *dl-PRS-CombSizeN-r16* in PRS configuration.**  **Proposal 4: RAN4 not to define separate accuracy requirements for RSTD measured with same panel and with different panels.**  **Proposal 5: If reference and neighbor PRS resources belong to different positioning frequency layers, the minimum PRS BW of the positioning frequency layers should be used for applicability of accuracy requirements**  **Proposal 6: RAN4 not to capture TRS presence or particular TRS setting as the applicability condition for the accuracy requirements. TRS is to be configured in the positioning test cases as in existing test cases.**  **Proposal 7: Applicable accuracy requirements is not impacted by HO.**  **Proposal 8: Exclude number from simulations for TDL-C channel model with 300 ns delay spread in FR1 for defining the RSTD accuracy requirements.**  **Proposal 9: RAN4 to decide the combinations of PRS BW and repetitions for which the requirements are defined. The combinations that were used in the agreed simulation can be used as a starting point.**  **Proposal 10: RAN4 to decide on the group delay calibration margin.**   * **The margin equals to zero if the reference and neighboring resources are on the same frequency layer in FR1** |
| [**R4-2015760**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015760.zip) | Huawei, HiSilicon | draftCR to introduce accuracy requirements for RSTD measurement |
| [**R4-2016404**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016404.zip) | Ericsson | ***Proposal 1****: RSTD side conditions for neighbour and reference cell in FR2: same as for FR1*  ***Proposal 2****: RAN4 specifies at least the RSTD accuracy requirements under the assumption of using the same antenna panel for receiving both the reference and neighbor PRS resources.*  ***Proposal 3****: For different antenna panels within the same RSTD measurement, a more relaxed RSTD measurement accuracy applies*  ***Proposal 4****: The same RSTD measurement accuracy requirements shall apply for intra-frequency HO and inter-frequency HO and regardless of the type of the cell change.*  ***Proposal 5****: The RSTD accuracy requirements shall apply for any DL-PRS-ResourceRepetitionFactor≥1 and any LPRS≥2 which is given by the higher-layer parameter dl-PRS-NumSymbols.*  ***Proposal 6****: For FR1, the RSTD measurement accuracy is as in Table 1.*  ***Proposal 7****: For FR2, the RSTD measurement accuracy is as in Table 2.* |
| [**R4-2016405**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016405.zip) | Ericsson | CR for RSTD measurement accuracy |
| [**R4-2016510**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016510.zip) | Qualcomm | **Proposal 1: -3dB for reference TRP and -10 dB for neighbor TRP**  **Observation 1: For a given PRS bandwidth, the number of PRS REs in the comb pattern is fixed, regardless of the comb size. The processing gain associated with one instance of the comb pattern is determined by the PRS bandwidth.**  **Proposal 2: Define accuracy requirements based on a single instance (sample) of a PRS resource, including all its repetitions within a PRS period.**  **Proposal 3: Accuracy requirements would be specified as a function of PRS bandwidth and the total number of comb pattern repetitions contained in one PRS sample.**  **Proposal 4: RAN4 not to define separate accuracy requirements for PRS-RSTD measured with same antenna panels/ports and with different antenna panels/ports.**  **Proposal 5: Exclude number from simulations for TDL-C channel model with 300 ns delay spread in FR1 from consideration for defining the RSTD and UE Rx-Tx timing difference accuracy requirements.**  **Proposal 6: In order to limit the impact of timing drift, PRS-RSTD measurement accuracy requirements should be subject to a proximity (in time) requirement between PRS resources involved in the RSTD calculation.**  **Proposal 7: Conformance tests for PRS-RSTD measurement accuracy should be designed to guarantee time proximity of ±X msec between PRS resources used to calculate RSTD. X can be further discussed.**  **Proposal 8: During a DL-TDOA positioning session, the UE should take into account proximity requirements between PRS resources when selecting the reference cell.** |

## Open issues summary

### Sub-topic 2-1 SINR side condition for FR2

* Option 1 (QC, HW): -3dB for reference TRP and -10 dB for neighbor TRP
* Option 2 (CATT, Intel, Ericsson): -6dB for reference TRP and -13 dB for neighbor TRP

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

### Sub-topic 2-2 Number of samples for accuracy requirements

* Option 1. (CATT, Huawei, Intel, Qualcomm): Single PRS sample which includes a number of PRS repetitions.
* Option 2 (Ericsson): The RSTD accuracy requirements shall apply for any DL-PRS-ResourceRepetitionFactor≥1 and any LPRS≥2 which is given by the higher-layer parameter dl-PRS-NumSymbols.

*[Moderator Notes: Please the proponents of Option 2 to clarify whether the PRS resource within a single PRS sample. If yes, Option 2 is same as Option 1 indeed.]*

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

### Sub-topic 2-3 Whether accuracy requirements are agnostic to comb size

* Option 1 (CATT, Huawei): Yes
* Option 1a (CATT): Yes. Agnostic to comb size when the number of PRS symbols is the same
* Option 1b (Qualcomm): For a given PRS bandwidth, the number of PRS REs in the comb pattern is fixed, regardless of the comb size. The processing gain associated with one instance of the comb pattern is determined by the PRS bandwidth.
* Option 2 (Intel): No. Define the accuracy requirements depending on the parameter combinations include comb size at least.

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

### Sub-topic 2-4 Applicable PRS BW for defining accuracy

* Option 1. min {PRS\_BWi} of the positioning frequency layers should be used for applicability of accuracy requirements. (CATT, Intel, Huawei, Qualcomm)

Recommended WF: Agree on Option 1.

### Sub-topic 2-5 Antenna panel assumption

* Option 1. RAN4 not to define separate accuracy requirements for RSTD measured with same panel and with different panels. (Intel, Huawei, Qualcomm)
* Option 2. Different accuracy requirements of RSTD measurement shall be defined depending antenna panel assumption. (Ericsson)

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

### Sub-topic 2-6 Assumption on TRS setting for defining accuracy and test

* Option 1 (Intel, Huawei): No need to consider TRS when defining PRS measurement accuracy requirements.
* Option 2 (Qualcomm): To add proper TRS settings in both RSTD accuracy requirements and test cases.
  + Option 2a. (Qualcomm) PRS-RSTD measurement accuracy requirements should be subject to a proximity (in time) requirement between PRS resources involved in the RSTD calculation

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

### Sub-topic 2-7 Applicable accuracy requirement in case of HO

* Option 1 (CATT). Applicable accuracy requirements depend on the state of UE being intra-frequency or inter-frequency after HO
* Option 2. (Huawei, Intel, Ericsson, Qualcomm) Applicable accuracy requirements are not impacted by HO.

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

### Sub-topic 2-8 Applicable propagation channel for accuracy requirement

* Option 1 (Intel). No need to define the applicability with propagation channels for accuracy requirement. (e.g. TDL-C channel model with 300 ns delay spread shall be considered also)
* Option 2 (Huawei, Qualcomm): Need the applicability with propagation channels for accuracy requirement (e.g. Exclude number from simulations for TDL-C channel model with 300 ns delay spread in FR1 for defining the RSTD accuracy requirements.)

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

### Sub-topic 2-9 How to define the accuracy requirements with the combinations of PRS BW and repetitions

* Option 1 (Huawei). RAN4 to decide the combinations of PRS BW and repetitions for which the requirements are defined. The combinations that were used in the agreed simulation can be used as a starting point
* Option 1a (Qualcomm) Accuracy requirements would be specified as a function of PRS bandwidth and the total number of comb pattern repetitions contained in one PRS sample.

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

### Sub-topic 2-10 How to define the accuracy requirements with the repetitions factor

* Option 1(Qualcomm): *PRS\_TotalRepetition* = (*DL-PRS-NumSymbols* x *DL-PRS\_ResourceRepetitionFactor*) / *DL-PRS-CombSizeN*

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

### Sub-topic 2-11 Group delay calibration margin

* Option 1 (Huawei). RAN4 to decide on the group delay calibration margin.
  + margin equals to zero if the reference and neighbouring resources are on the same frequency layer in FR1

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

### Sub-topic 2-12 RSTD accuracy requirements for FR1

*[Moderator notes: the exact accuracy requirements can be discussed after the principles above agreed.]*

* Option 1 (Ericsson)

**Table 1: RSTD accuracy in FR1**

|  |  |
| --- | --- |
| **Accuracy [Tc]** | **PRS BW [PRB]** |
| ±90 | TBD ≤ BW ≤ 48 |
| ±50 | 48 < BW≤ 132 |
| ±35 | BW >132 |

* Option 2 (Qualcomm)

Table 5‑1: RSTD accuracy requirements for FR1 with a single positioning frequency layer

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| **Total measurement accuracy (ns)**  Note 1 | **Simulated measurement error – 90th percentile (ns)** | **UE Rx delay calibration error (ns)** | **Error due to timing drift (ns)**  Note 2 | **PRS Es/Iot (dB)** | **PRS BW (MHz)** | ***PRS-TotalRepetition*** |
| ± [69.5] | ± [67] | ±[0] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | ≥ [10] | ≥ [4] |
| ± [46.5] | ± [44] | ±[0] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | ≥ [20] | ≥ [2] |
| ± [33.5] | ± [31] | ±[0] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | ≥ [50] | ≥ [2] |
| ± [32.5] | ± [30] | ±[0] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | [100] | ≥ [1] |
| Note 1: These requirements apply for PRS resources in a single positioning frequency layer.  Note 2: Based on UE frequency error requirement in TS 38.101-1 clause 6.4.1 and assuming a maximum time separation of 25 msec between reception of PRS resources. | | | | | | |

Recommended WF: Further discussion needed. Collect companies’ views.  *[Moderator notes: the exact accuracy requirements can be discussed after the principles above agreed.]*

### Sub-topic 2-13 RSTD accuracy requirements for FR2

* Option 1(Ericsson)

**Table 2: RSTD accuracy in FR2**

|  |  |
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| **Accuracy [Tc]** | **PRS BW [PRB]** |
| ±80 | TBD ≤ BW ≤ 32 |
| ±40 | 32 < BW≤ 64 |
| ±30 | BW >64 |

* Option 2 (Qualcomm)

Table 6‑1: RSTD accuracy requirements for FR2 with a single positioning frequency layer

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| **Total measurement accuracy (ns)**  Note 1 | **Simulated measurement error – 90th percentile (ns)** | **UE Rx delay calibration error (ns)** | **Error due to timing drift (ns)**  Note 2 | **PRS Es/Iot (dB)** | **PRS BW (MHz)** | ***PRS-TotalRepetition*** |
| ± [35.5] | ± [33] | ±[0] | ±[2.5] | (PRS Es/Iot)ref ≥ -3  (PRS Es/Iot)i≥ -10 | ≥ [50] | ≥ [1] |
| ± [29.5] | ± [27] | ±[0] | ±[2.5] | (PRS Es/Iot)ref ≥ -3  (PRS Es/Iot)i≥ -10 | ≥ [100] | ≥ [1] |
| ± [18.5] | ± [16] | ±[0] | ±[2.5] | (PRS Es/Iot)ref ≥ -3  (PRS Es/Iot)i≥ -10 | ≥ [200] | ≥ [1] |
| Note 1: These requirements apply for PRS resources in a single positioning frequency layer.  Note 2: Based on UE frequency error requirement in TS 38.101-2 clause 6.4.1 and assuming a maximum time separation of 25 msec between reception of PRS resources. | | | | | | |

Where,

***PRS\_TotalRepetition* = (*DL-PRS-NumSymbols* x *DL-PRS\_ResourceRepetitionFactor*) / *DL-PRS-CombSizeN***

Recommended WF: Further discussion needed. Collect companies’ views.  *[Moderator notes: the exact accuracy requirements can be discussed after the principles above agreed.]*

## Companies views’ collection for 1st round

### Open issues

**Sub-topic 2-1 SINR side condition for FR2**

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| **Company** | **Comments** |
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**Sub-topic 2-2 Number of samples for accuracy requirements**

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| **Company** | **Comments** |
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**Sub-topic 2-3 Whether accuracy requirements are agnostic to comb size**

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| **Company** | **Comments** |
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**Sub-topic 2-4 Applicable PRS BW for defining accuracy**

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| **Company** | **Comments** |
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**Sub-topic 2-5 Antenna panel assumption**

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| **Company** | **Comments** |
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**Sub-topic 2-6 Assumption on TRS setting for defining accuracy and test**

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| **Company** | **Comments** |
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**Sub-topic 2-7 Applicable accuracy requirement in case of HO**

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| **Company** | **Comments** |
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**Sub-topic 2-8 Applicable propagation channel for accuracy requirement**

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| **Company** | **Comments** |
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**Sub-topic 2-9 How to define the accuracy requirements with the combinations of PRS BW and repetitions**

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| **Company** | **Comments** |
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**Sub-topic 2-10 How to define the accuracy requirements with the repetitions factor**

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| **Company** | **Comments** |
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**Sub-topic 2-11 Group delay calibration margin**

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| **Company** | **Comments** |
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**Sub-topic 2-12 RSTD accuracy requirements for FR1**

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| **Company** | **Comments** |
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**Sub-topic 2-13 RSTD accuracy requirements for FR2**

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

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| **CR/TP number** | **Comments collection** |
| [**R4-2015760**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015760.zip) (Huawei, Hi Silicon) | Company A |
| Company B |
|  |
| [**R4-2014450**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014450.zip)  (CATT) |  |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#2-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |
| **Sub-topic#2-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-5** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-6** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-7** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-8** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-9** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-10** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-11** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-12** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#2-13** | *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 2-1**

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| **Company** | **Comments** |
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**Sub-topic 2-2**

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**Sub-topic 2-3**

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**Sub-topic 2-4**

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**Sub-topic 2-5**

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**Sub-topic 2-6**

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**Sub-topic 2-7**

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**Sub-topic 2-8**

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**Sub-topic 2-9**

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**Sub-topic 2-10**

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**Sub-topic 2-11**

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**Sub-topic 2-12**

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**Sub-topic 2-13**

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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: Measurement Accuracy Requirements for PRS RSRP

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2014007**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014007.zip) | ZTE | **Proposal 1: At least define requirements for relative accuracy** |
| **R4-2014006** | ZTE | 1. The side condition is defined for neighbour cells only. |
| [**R4-2014448**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014448.zip) | CATT | **Proposal 1: Serving cell/TRP side conditions need to be specified (in addition to neighbour cells) as -6dB**  **Proposal 2: One sample is a PRS resource set that includes a number of PRS repetitions. One PRS repetition means one comb pattern which includes the combsize in frequency domain and the number of symbols in time domain.**  **Proposal 3: The accuracy requirements of PRS-RSP measurement is defined based on 1 sample.** |
| [**R4-2014451**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip) | CATT | CR on PRS RSRP accuracy requirements |
| [**R4-2014578**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014578.zip) | Intel | Proposal 1: PRS RSRP accuracy requirements can be based on single sample including resource repetitions within a PRS occasion.  Proposal 2: Define both absolute and relative accuracy requirements.  Proposal 2a: Define relative accuracy requirements in Rel16 with higher priority.  Proposal 3: For PRS RSRP measurement in DL DoA positioning method, the side condition shall be applicable the neighbor cells/TRPs only. |
| [**R4-2014579**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014579.zip) | Intel | Link-level simulation results for PRS RSRP measurement |
| [**R4-2015761**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015761.zip) | Huawei | **Proposal 1: For DL-AoD, the side condition of PRS RSRP is specified for neighbour cell/TRP only.**  **Proposal 2: PRS-RSRP accuracy requirements are defined based on a single PRS sample, where a PRS sample includes a number of PRS repetitions.**  **Proposal 3: For PRS-RSRP, RAN4 to define relative accuracy only, or define both absolute and relative accuracy.** |
| [**R4-2015762**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015762.zip) | Huawei | draftCR to introduce accuracy requirements for PRS-RSRP measurement |
| [**R4-2016402**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016402.zip) | Ericsson | ***Observation 1****: For DL-AoD, no need to further discuss neighbor TRP side conditions for PRS-RSRP (it was earlier agreed that they are the same as for RSTD, e.g., in [2] or in [4]).*  ***Proposal 1****: For DL-AoD, serving cell/TRP side conditions are specified for PRS-RSRP.*   * + *Serving TRP side condition is -3 dB.*   ***Proposal 2****: When configured with RSTD, the applicable side conditions for PRS-RSRP are the side conditions specified for RSTD.*  ***Proposal 3****: When configured with UE Rx-Tx, the applicable side conditions for PRS-RSRP are the side conditions specified for UE Rx-Tx.*  *[Moderator Notes: P2 and P3 were agreed in [R4-2009139]. No need to discuss this]*  ***Observation 2****: There must be absolute accuracy requirements defined for PRS-RSRP.*  ***Observation 3****: 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 but calculated as a difference to the absolute one by the UE.*  ***Proposal 4****: At least the absolute accuracy requirements for PRS-RSRP are defined.*  ***Proposal 5****: FFS the need to define relative accuracy requirements for PRS-RSRP.*  ***Proposal 6****: The PRS-RSRP accuracy requirements shall apply for any DL-PRS-ResourceRepetitionFactor≥1 and any LPRS≥2 which is given by the higher-layer parameter dl-PRS-NumSymbols.*  ***Proposal 7****: For FR1, the PRS-RSRP measurement accuracy is as in Table 1.*  ***Proposal 8****: For FR2, the PRS-RSRP measurement accuracy is as in Table 2.* |
| [**R4-2016403**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016403.zip) | Ericsson | CR of PRS-RSRP measurement accuracy |
| [**R4-2016509**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016509.zip) | Qualcomm | **Proposal 1: Reference cell/TRPs side conditions need to be specified (in addition to neighbour cells). Same as that for the reference cell in PRS-RSTD.**  **Proposal 2a: Define accuracy requirements based on a single instance (sample) of a PRS resource, including all its repetitions within a PRS period.**  **Proposal 2b: Accuracy requirements would be specified as a function of PRS bandwidth and the total number of comb pattern repetitions contained in one PRS sample.**  **Proposal 3: For PRS-RSRP, define only relative accuracy requirements.** |

## Open issues summary

### Sub-topic 3-1 SINR side condition

Background: the latest agreements on RSRP side conditions:

* For DL-AoD, the side condition of PRS RSRP can be specified
  + Option 1: for both serving cell/TRP and neighbor cell/TRPs.
    - For serving cell:
      * Option 1: -6 dB
      * Option 2. -3 dB
  + Option 2: for neighbor cell/TRPs ONLY.
  + Option 3: For the reference cell/TRPs and neighbour cell/TRPs
    - Same as that for the reference cell in PRS-RSTD
  + Option 4: same as for multi-RTT

Candidate options:

* Option 1a (Ericsson): -3dB for serving TRP
* Option 1b (CATT): -6dB for serving TRP
* Option 2 (Intel, Huawei, ZTE): for neighbor cell/TRPs ONLY
* Option 3 (Qualcomm): For the reference cell/TRPs and neighbour cell/TRPs
  + Same as that for the reference cell in PRS-RSTD

Recommended WF: Further discussion needed. Collect companies’ views

### Sub-topic 3-2 Number of samples for PRS RSRP accuracy requirements

* Option 1. (Intel, Huawei, Qualcomm) One sample including resource repetitions within the PRS occasion
* Option 1a. (Qualcomm): Accuracy requirements would be specified as a function of PRS bandwidth and the total number of comb pattern repetitions contained in one PRS sample.
* Option 1b. (CATT) **T**he accuracy requirements of PRS-RSP measurement is defined based on 1 sample.
  + One sample is a PRS resource set that includes a number of PRS repetitions. One PRS repetition means one comb pattern which includes the combsize in frequency domain and the number of symbols in time domain.
* Option 2. (Ericsson) The PRS RSRP accuracy requirements shall apply for any DL-PRS-ResourceRepetitionFactor≥1 and any LPRS≥2 which is given by the higher-layer parameter dl-PRS-NumSymbols.

*[Moderator Notes: Please the proponents of Option 2 clarify whether the PRS resource within a single PRS sample. If yes, Option 2 is same as Option 1 indeed.]*

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

### Sub-topic 3-3 Type of requirements

* Option 1. (Intel, Huawei, Qualcomm) Define ONLY relative accuracy requirements for PRS-RSRP
* Option 2. (Intel, Huawei) Define both absolute and relative accuracy requirements for PRS-RSRP
* Option 2a. (Ericsson, ZTE)
  + At least the absolute accuracy requirements for PRS-RSRP are defined
  + FFS the need to define relative accuracy requirements for PRS-RSRP Option 3. Do NOT define relative accuracy requirements for PRS-RSRP but the absolute one (Ericsson)

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

### Sub-topic 3-4 How to define the accuracy requirements with the combinations of PRS BW and repetitions

* Option 1 (Huawei). RAN4 to decide the combinations of PRS BW and repetitions for which the requirements are defined. The combinations that were used in the agreed simulation can be used as a starting point

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

### Sub-topic 3-5 Link level simulation results

*[Moderator notes: the simulation results can be collected separately for reference information.]*

### Sub-topic 3-6 PRS RSRP accuracy requirements

*[Moderator notes: the exact accuracy requirements can be discussed after the principles above agreed.]*

* Option 1 (Ericsson)

**Table 1: PRS-RSRP accuracy in FR1**

|  |  |  |
| --- | --- | --- |
| **Accuracy [dB]** | **Es/Iot [dB]** | **PRS BW [PRB]** |
| ±3 | -3 | TBD ≤ BW ≤ 48 |
| ±2.5 | 48 < BW≤ 132 |
| ±2 | BW >132 |
| ±4.5 | -6 | TBD ≤ BW ≤ 48 |
| ±3.5 | 48 < BW≤ 132 |
| ±2.5 | BW >132 |
| ±7 | -13 | TBD ≤ BW ≤ 48 |
| ±5 | 48 < BW≤ 132 |
| ±3 | BW >132 |

**Table 2: PRS-RSRP accuracy in FR2**

|  |  |  |
| --- | --- | --- |
| **Accuracy [dB]** | **Es/Iot [dB]** | **PRS BW [PRB]** |
| ±4 | -3 | TBD ≤ BW ≤ 32 |
| ±3.5 | 32 < BW≤ 64 |
| ±3 | BW >64 |
| ±6 | -6 | TBD ≤ BW ≤ 32 |
| ±5 | 32 < BW≤ 64 |
| ±4 | BW >64 |
| ±9 | -13 | TBD ≤ BW ≤ 32 |
| ±7 | 32 < BW≤ 64 |
| ±6 | BW >64 |

## Companies views’ collection for 1st round

### Open issues

**Sub-topic 3-1 SINR side condition**

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| **Company** | **Comments** |
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**Sub-topic 3-2 Number of samples for PRS RSRP accuracy requirements**

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**Sub-topic 3-3 Type of requirements**

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| **Company** | **Comments** |
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**Sub-topic 3-4 How to define the accuracy requirements with the combinations of PRS BW and repetitions**

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| **Company** | **Comments** |
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**Sub-topic 3-5 Link level simulation results**

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**Sub-topic 3-6 PRS RSRP accuracy requirements**

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

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### CRs/TPs

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| **CR/TP number** | **Comments collection** |
| [**R4-2014451**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip)  **(CATT)** |  |
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| [**R4-2015762**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015762.zip)  **(Huawei)** |  |
| **R4-2016403**  **(Ericsson)** |  |

## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#3-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#3-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#3-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |
| **Sub-topic#3-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#3-6** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
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### 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.

## Summary on 2nd round

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| **CR/TP/LS/WF number** | **T-doc status update recommendation** |
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# Topic #4: Measurement Accuracy Requirements for UE Rx-Tx Time Difference

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| **R4-2014003** | ZTE | **Proposal 2: The Rx-Tx calibration error budget at UE and gNB shall be defined to be of the same scale.** |
| [**R4-2014449**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014449.zip) | CATT | **Proposal 1：Only one set of accuracy requirements applicable to both serving and neighbor cells to be defined.**  **Proposal 2: UE Rx-Tx time difference accuracy requirements do not apply with HO during the measurement period.**  **Proposal 3: RAN4 not to capture applicability of UE Rx-Tx time difference accuracy requirements under NTA\_offset change during the measurement period.**  **Proposal 4: UE selected parameter k2 is larger than or equal to k1.**  **Proposal 5: The range of k is {2,3,4,5} in FR1.**  *[Moderator Notes: in the last meeting, the parameter “k” was agreed [R4-2012260]]* |
| [**R4-2014452**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014452.zip) | CATT | CR on UE Rx-Tx time difference accuracy requirements |
| [**R4-2014576**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014576.zip) | Intel | ***Proposal 1: Only one set of accuracy requirements applicable to both serving and neighbor cells to be defined***  **Observation 1: Rx-Tx calibration error budget at UE and gNB shall be defined with the same scale**.  ***Proposal 2 : UE Rx-Tx measurement requirements in TS38.133 shall be applicable unless the NTA\_offset changes during the measurement period.***  ***Proposal 3***: ***UE Rx-Tx time difference accuracy requirements was not applicable when HO during the measurement period.*** |
| [**R4-2014577**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014577.zip) | Intel | Link level simulation resutls |
| [**R4-2015763**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015763.zip) | Huawei | **Proposal 1: RAN4 to specify one set of accuracy requirements for UE Rx-Tx time difference based on side conditions for neighbor cells.**  **Proposal 2: RAN4 to decide on the margin to account for the group delay calibration error for both Rx chain and Tx chain for UE Rx-Tx. The same margin should be discussed for gNB separately.**  **Proposal 3: UE Rx-Tx time difference accuracy requirements do not apply with HO during the measurement period**  **Proposal 4: RAN4 not to capture applicability of UE Rx-Tx time difference accuracy requirements under NTA\_offset change during the measurement period.** |
| [**R4-2015764**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015764.zip) | Huawei | CR |
| [**R4-2016406**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016406.zip) | Ericsson | ***Proposal 1****: In addition to -13 dB, also a higher side condition (e.g., -3 dB) is defined for UE Rx-Tx measurements, for both FR1 and FR2*  ***Proposal 2****: RAN4 specifies at least the UE Rx-Tx accuracy requirements under the assumption of using the same antenna panel for transmitting SRS and receiving PRS for the same UE Rx-Tx measurement.*  ***Proposal 3****: For different antenna panels within the same UE Rx-Tx measurement, a more relaxed UE Rx-Tx accuracy is allowed.*  ***Proposal 4****: The same UE Rx-Tx measurement accuracy requirements shall apply before and after the cell change which does not impact SRS configuration, when the UE continues the measurement.*  ***Proposal 5****: Clarify in section 10.1.25.2 in TS 38.133: “UE Rx-Tx time difference accuracy requirements shall not apply if NTA\_offset defined in Table 7.1.2-2 in 38.133 changes during the UE Rx-Tx measurement period.”*  ***Proposal 6****: UE Rx-Tx measurement accuracy requirements shall not apply if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment or based on network-configured TA*  ***Proposal 7****: The UE Rx-Tx accuracy requirements shall apply for any DL-PRS-ResourceRepetitionFactor≥1 and any LPRS≥2 which is given by the higher-layer parameter dl-PRS-NumSymbols.*  ***Proposal 8****: For FR1, the UE Rx-Tx measurement accuracy is as in Table 1.*  ***Proposal 9****: For FR2, the UE Rx-Tx measurement accuracy is as in Table 2.* |
| [**R4-2016407**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016407.zip) | Ericsson | CR |
| [**R4-2016511**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016511.zip) | Qualcomm | **Proposal 1: Only one set of accuracy requirements applicable to both serving and neighbor cells to be defined**  **Proposal 2: The Rx-Tx calibration error budget at UE and gNB shall be defined to be of the same scale.**  **Proposal 3:** **UE Rx-Tx time difference accuracy requirements do not apply with HO during the measurement period.**  **Proposal 4: RAN4 not to capture applicability of UE Rx-Tx time difference accuracy requirements under NTA\_offset change during the measurement period.** |

## Open issues summary

### Sub-topic 4-1 whether to define separate measurement accuracy requirements for serving and neighbor cells

* Option 1. Yes (Ericsson)
  + In addition to -13 dB, also a higher side condition (e.g., -3 dB) is defined for UE Rx-Tx measurements, for both FR1 and FR2
* Option 2. No (Qualcomm, Huawei, Intel, CATT)

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

### Sub-topic 4-2 Antenna panel assumption

*[Moderator notes: the same conclusion be leveraged from that for RSTD]*

* Option 1. RAN4 specifies at least the UE Rx-Tx accuracy requirements under the assumption of using the same antenna panel for transmitting SRS and receiving PRS for the same UE Rx-Tx measurement. For different antenna panels within the same UE Rx-Tx measurement, a more relaxed UE Rx-Tx accuracy is allowed (Ericsson)

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

### Sub-topic 4-3 Rx-Tx calibration error budget at UE and gNB

* Option 1 (Qualcomm, Intel, ZTE): The Rx-Tx calibration error budget at UE and gNB shall be defined to be of the same scale
* Option 2 (Huawei): RAN4 to decide on the margin to account for the group delay calibration error for both Rx chain and Tx chain for UE Rx-Tx. The same margin should be discussed for gNB separately

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

### Sub-topic 4-4 Applicability of accuracy requirements in the case of NTA\_offset change

* Option 1: RAN4 not to capture applicability of UE Rx-Tx time difference accuracy requirements under NTA\_offset change during the measurement period (Qualcomm, Huawei, CATT)
* Option 2: Clarify in section 10.1.25.2 in TS 38.133: “UE Rx-Tx time difference accuracy requirements shall not apply if NTA\_offset defined in Table 7.1.2-2 in 38.133 changes during the UE Rx-Tx measurement period.” (Ericsson, Intel)

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

### Sub-topic 4-5 Applicability of accuracy requirements in the case of HO

* Option 1. UE Rx-Tx time difference accuracy requirements do NOT apply with HO during the measurement period (Qualcomm, Huawei, Intel, CATT).
* Option 2: The same UE Rx-Tx measurement accuracy requirements shall apply before and after the cell change which does not impact SRS configuration, when the UE continues the measurement (Ericsson)

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

### Sub-topic 4-6 Applicability of accuracy requirements under TA adjustment

* Option 1. UE Rx-Tx measurement accuracy requirements shall not apply if the uplink transmission timing changes during the UE Rx-Tx measurement period due to autonomous adjustment or based on network-configured TA (Ericsson)

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

### Sub-topic 4-7 Link level simulation results

*[Moderator notes: the simulation results can be collected separated for reference information.]*

### Sub-topic 4-8 UE Rx-Tx time difference measurement accuracy requirements for FR1

* Option 1 (Qualcomm)

Table 5‑1: UE Rx-Tx time difference accuracy requirements for FR1 with SRS and PRS in the same band

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Total measurement accuracy (ns)**  Note 1 | **Simulated measurement error – 90th percentile (ns)** | **UE Tx/Rx group delay calibration error (ns)** | **Error due to timing drift (ns)**  Note 2 | **PRS Es/Iot (dB)** | **PRS BW (MHz)** | ***PRS-TotalRepetition*** |
| ± [116.5] | ± [74] | ±[40] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | ≥ [10] | ≥ [4] |
| ± [78.5] | ± [56] | ±[20] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | ≥ [20] | ≥ [2] |
| ± [51.5] | ± [41] | ±[8] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | ≥ [50] | ≥ [2] |
| ± [43.5] | ± [37] | ±[4] | ±[2.5] | (PRS Es/Iot)ref ≥ -6  (PRS Es/Iot)i≥ -13 | [100] | ≥ [1] |
| Note 1: These requirements apply when positioning SRS and PRS resources are allocated in the same frequency band and all PRS resources are in a single positioning frequency layer.  Note 2: Based on UE frequency error requirement in TS 38.101-1 clause 6.4.1 and assuming a maximum time separation of 25 msec between SRS transmission and PRS reception. | | | | | | |

***PRS\_TotalRepetition* = (*DL-PRS-NumSymbols* x *DL-PRS\_ResourceRepetitionFactor*) / *DL-PRS-CombSizeN***

* Option 2 (Ericsson)

**Table 1: UE Rx-Tx accuracy in FR1**

|  |  |  |
| --- | --- | --- |
| **Accuracy [Tc]** | **Es/Iot [dB]** | **PRS BW [PRB]** |
| ±60 | -3 | TBD ≤ BW ≤ 48 |
| ±30 | 48 < BW≤ 132 |
| ±20 | BW >132 |
| ±70 | -6 | TBD ≤ BW ≤ 48 |
| ±40 | 48 < BW≤ 132 |
| ±25 | BW >132 |
| ±90 | -13 | TBD ≤ BW ≤ 48 |
| ±50 | 48 < BW≤ 132 |
| ±30 | BW >132 |

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

### Sub-topic 4-9 UE Rx-Tx time difference measurement accuracy requirements for FR2

* Option 1. (Qualcomm)

Table 6‑1: UE Rx-Tx time difference accuracy requirements for FR2 with SRS and PRS in the same band

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Total measurement accuracy (ns)**  Note 1 | **Simulated measurement error – 90th percentile (ns)** | **UE Tx/Rx group delay calibration error (ns)** | **Error due to timing drift (ns)**  Note 2 | **PRS Es/Iot (dB)** | **PRS BW (MHz)** | ***PRS-TotalRepetition*** |
| ± [56.5] | ± [46] | ±[8] | ±[2.5] | (PRS Es/Iot)ref ≥ -3  (PRS Es/Iot)i≥ -10 | ≥ [50] | ≥ [1] |
| ± [47.5] | ± [41] | ±[4] | ±[2.5] | (PRS Es/Iot)ref ≥ -3  (PRS Es/Iot)i≥ -10 | ≥ [100] | ≥ [1] |
| ± [44.5] | ± [40] | ±[2] | ±[2.5] | (PRS Es/Iot)ref ≥ -3  (PRS Es/Iot)i≥ -10 | ≥ [200] | ≥ [1] |
| Note 1: These requirements apply when positioning SRS and PRS resources are allocated in the same frequency band and all PRS resources are in a single frequency layer.  Note 2: Based on UE frequency error requirement in TS 38.101-2 clause 6.4.1 and assuming a maximum time separation of 25 msec between SRS transmission and PRS reception. | | | | | | |

* Option 2(Ericsson)

**Table 2: UE Rx-Tx accuracy in FR2**

|  |  |  |
| --- | --- | --- |
| **Accuracy [Tc]** | **Es/Iot [dB]** | **PRS BW [PRB]** |
| ±70 | -3 | TBD ≤ BW ≤ 32 |
| ±40 | 32 < BW≤ 64 |
| ±25 | BW >64 |
| ±90 | -6 | TBD ≤ BW ≤ 32 |
| ±50 | 32 < BW≤ 64 |
| ±30 | BW >64 |
| ±100 | -13 | TBD ≤ BW ≤ 32 |
| ±60 | 32 < BW≤ 64 |
| ±40 | BW >64 |

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

## Companies views’ collection for 1st round

### Open issues

**Sub-topic 4-1 Whether to define separate measurement accuracy requirements for serving and neighbor cells**

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |
|  |  |
|  |  |

**Sub-topic 4-2 Antenna panel assumption**

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |
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|  |  |

**Sub-topic 4-3 Rx-Tx calibration error budget at UE and gNB**

|  |  |
| --- | --- |
| **Company** | **Comments** |
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|  |  |

**Sub-topic 4-4 Applicability of accuracy requirements in the case of NTA\_offset change**

|  |  |
| --- | --- |
| **Company** | **Comments** |
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**Sub-topic 4-5 Applicability of accuracy requirements in the case of HO**

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| --- | --- |
| **Company** | **Comments** |
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**Sub-topic 4-6 Applicability of accuracy requirements under TA adjustment**

|  |  |
| --- | --- |
| **Company** | **Comments** |
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**Sub-topic 4-7 link level simulation results**

|  |  |
| --- | --- |
| **Company** | **Comments** |
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**Sub-topic 4-8 UE Rx-Tx time difference measurement accuracy requirements for FR1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
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|  |  |

**Sub-topic 4-9 UE Rx-Tx time difference measurement accuracy requirements for FR2**

|  |  |
| --- | --- |
| **Company** | **Comments** |
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### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2015764**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015764.zip)  **(Huawei)** |  |
|  |
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| [**R4-2016407**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016407.zip)  **(Ericsson)** |  |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#4-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#4-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#4-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |
| **Sub-topic#4-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |

### CRs/TPs

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

## Discussion on 2nd round

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

**Sub-topic#4-1**

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

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

# Topic #5: Test cases

*Main technical topic can be the scope of test case. Then the test case list can be agreed. .*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2014571**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014571.zip)  Discussion on NR Positioning test cases configuration and list | Intel | ***Proposal 1: The PRS configuration patterns in Table 1 for NR Positioning measurement tests can be specified in the Annex A.3.x of TS 38.133.***    ***Proposal 2: SRS configuration pattern 1 for timing accuracy test in [2] can be reused for NR positioning measurements.***  ***Proposal 3: NO DRX case will be tested only for NR positioning measurement requirements in Rel16.***  ***Proposal 4-1: 3 cells deployment scenarios (one is serving/reference cell , the other two neighbor cells) can be used for NR RSTD .***  ***Proposal 4-2: 2 cells deployment scenarios (one is serving/reference cell , the other neighbor cell) can be used for UE Rx-Tx time difference, PRS RSRP and E-CID measurement tests.***  ***Proposal 5: The synchronous cells will be tested for the measurement delay requirements test.***  ***Proposal 6: For the core requirements test cases, only the non-muting PRS configuration will be used.***  ***Proposal 7: The number of positioning frequency layers measured can not be larger than 2.***  ***Proposal 8: Gap pattern #0 and #24 can be used for NR Positioning tests.***  ***Proposal 9: No need to define the new test cases for NR E-CID measurement requirements in TS38.133.***  ***Proposal 10: It is enough to define the test cases for NR standalone cells.***  ***Proposal 11: The following test cases for core requirement (e.g. reporting delay tests) and accuracy requirements are listed in Table 3.1 and Table 3.2 respectively.*** |
| [**R4-2015370**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015370.zip) | CATT | CR to introduce the conditions for NR RSTD measurement in 38.133. |
| [**R4-2015765**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015765.zip) | Huawei, HiSilicon | **Proposal 1: Define measurement delay and measurement accuracy tests for the following cases (totally 12 test cases)**   * **Case 1: RSTD measurement delay test for FR1 SA** * **Case 2: RSTD measurement delay test for FR2 SA** * **Case 3: PRS-RSRP measurement delay test for FR1 SA** * **Case 4: PRS-RSRP measurement delay test for FR2 SA** * **Case 5: Rx-Tx measurement delay test for FR1 SA** * **Case 6: Rx-Tx measurement delay test for FR2 SA**   **Proposal 2: There are one PRS frequency layer and two TRPs in the test case. Each TRP transmits 2 PRS resources in a single slot. The PRS resources from two TRPs are with different comb offsets. Muting is not enabled.**  **Proposal 3: PRS comb size is 2 for all test cases. PRS periodicity is 160ms with 10ms offset in all test cases.**  **Proposal 4: For combination of PRS symbols size, slot repetition and BW**   * **For measurement delay test, use symbol size 4, slot repetition 1, and PRS BW same as CH BW** * **For measurement accuracy test, verify performance of different combinations with subtests** |
| [**R4-2015766**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015766.zip) | Huawei, HiSilicon | draftCR on PRS RMC for positioning test cases |
| [**R4-2016399**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016399.zip) | Ericsson | ***Proposal 1****: RAN4 develops NR positioning test cases, based on the test case list in Table 1.*    ***Proposal 2****: Time plan for developing NR positioning test cases:*   * + *RAN4#97-e (Nov 2020):*      - *Agree on high-level list for test cases, work split, and specification structure*   + *RAN4#98-e (Jan 2021):*     - *Discuss and agree on basic common configurations and configuration details at least for Phase I test cases*   + *RAN4#98-bis-e (April 2021):*     - *Provide first drafts for Phase I test cases*     - *Agree on common configurations and configuration details for Phase II test cases*   + *RAN4#99-e (May 2021):*      - *Provide final CRs for Phase I test cases.*     - *Provide first drafts for Phase II test cases.*   + *RAN4#100(August 2021):*      - *Provide final CRs for Phase II test cases.*   *[Moderator notes: In the last RAN plenary meeting, the target time to complete this WI is March 2021]* |
| [**R4-2016398**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016398.zip) General discussion on NR RRM positioning test cases | Ericsson | ***Proposal 1****: RAN4 will develop at least the following test cases for NR PRS-based positioning measurements in Rel-16:*   * + *SA (FR1 and FR2) without CA,*   + *NR-DC with FR1 PCell.*   ***Proposal 2****: The following NR positioning test cases can be deprioritized in Rel-16:*   * + *NE-DC test cases,*   + *E-CID positioning test cases,*   *CA test cases* |
| [**R4-2016400**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016400.zip) | Ericsson | CR |
|  |  |  |

## Open issues summary

### Sub-topic 5-1 Test cases for the different positioning method

* Option 1. (Intel, Ericsson, Huawei) No need to define separated E-CID test case in Rel16

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

### Sub-topic 5-2 Test cases for the different deployment scenarios

* Option 1 (Intel, Huawei): Only need to define the test cases for SA
* Option 2 (Ericsson). RAN4 will develop at least the following test cases for NR PRS-based positioning measurements in Rel-16:
  + *SA (FR1 and FR2) without CA,*
  + *NR-DC with FR1 PCell*

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

### Sub-topic 5-3 Test cases for DRX

* Option 1 (Intel, Huawei): NO DRX case will be tested only for NR positioning measurement requirements in Rel16

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

### Sub-topic 5-4 General PRS configuration for NR Positioning test case

**Sub-topic 5-4-1 PRS periodicity and offset**

* Option 1 (Huawei): PRS periodicity is 160ms with 10ms offset in all test cases.
* Option 2 (Intel): 2^u \*160ms，where was given by Table 4.2-1 in TS38.211

**Sub-topic 5-4-2 Combination of Comb size, number of symbol , slot repetition factor and PRS BW**

*[Moderator notes: In previous discussion, the PRS density in both time and frequency domain may introduce the performance diver. Therefore, these factors can be verified with several combinations.]*

* Option 1 (Huawei):
  + PRS comb size is 2 for all test cases
    - For measurement delay test, use symbol size 4, slot repetition 1, and PRS BW same as CH BW or
    - For measurement accuracy test, verify performance of different combinations with subtests
* Option 2 (Intel)：The following PRS configuration combinations are proposed:
* **Table 1: PRS configuration patterns for NR positioning measurement**

|  |  |  |  |
| --- | --- | --- | --- |
|  | PRS Pattern 1 | PRS Pattern 2 | PRS Pattern 3 |
| SCS | FR1, 15k | FR1, 30k | FR2, 120k |
| PRS periodicity | 160ms | 80ms | 20ms |
| PRS transmission bandwidth in RBs (System Bandwidth) | 52 (10MHz) | 132 (50MHz) | 128(200MHz) |
| Number of PRS symbol | 2 | 4 | 6 |
| Comb size | 2 | 4 | 6 |
| Repetition factor | 4 | 2 | 1 |

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

### Sub-topic 5-5 SRS configuration for NR Positioning test case

* Option 1 (Intel): SRS configuration pattern 1 for timing accuracy test in [2] can be reused for NR positioning measurements.

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

### Sub-topic 5-6 Number of cells/TRPs for NR Positioning test case

* Option 1a. (Ericsson)
  + *for RSTD measurement requirements, test cases with 3 cells are developed: NR PCell (cell 1) and two NR neighbor cells (cell 2, cell 3);*
  + *for RSTD measurement accuracy requirements, test cases with 2 cells can be sufficient, provided separate test cases are developed for measurements on the same and different frequency layers: NR PCell (cell 1) and one NR neighbor cell (cell 2)*
  + *for PRS-RSRP (DL-AoD) and UE Rx-Tx time difference measurement requirements and measurement accuracy requirements, the same test set-up as for RSTD can be used*
* Option 1b. (Intel)
  + *3 cells deployment scenarios (one is serving/reference cell, the other two neighbor cells) can be used for NR RSTD .*
  + *2 cells deployment scenarios (one is serving/reference cell, the other neighbor cell) can be used for UE Rx-Tx time difference, PRS RSRP*
* Option 2 (Huawei): two TRPs in the test case

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

### Sub-topic 5-7 Number of positioning frequency layers

* Option 1. (Intel): The number of positioning frequency layers measured cannot be larger than 2.
* Option 2 (Huawei): There are one PRS frequency layer

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

### Sub-topic 5-8 Synchronous/Asynchronous cells

* Option 1. (Intel): The synchronous cells will be tested for the measurement delay requirements test.

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

### Sub-topic 5-9 Muting pattern

* Option 1. (Intel, Huawei): only the non-muting PRS configuration will be used.

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

### Sub-topic 5-10 Test cases list

* Option 1. (Huawei)

Define measurement delay and measurement accuracy tests for the following cases (totally 12 test cases)

* Case 1: RSTD measurement delay test for FR1 SA
* Case 2: RSTD measurement delay test for FR2 SA
* Case 3: PRS-RSRP measurement delay test for FR1 SA
* Case 4: PRS-RSRP measurement delay test for FR2 SA
* Case 5: Rx-Tx measurement delay test for FR1 SA
* Case 6: Rx-Tx measurement delay test for FR2 SA
* Option 2. (Intel)

**Table 3.1 Test cases for NR positioning core requirements**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Type of Test** | **Description** | **Test purpose** | **Responsible company** |
| 1-1 | FDD RSTD measurement reporting in FR1 | FDD,  PRS pattern 1  Gap#24  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  3 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.2.4 which is also rely on UE’s processing capability to be verified. UE reports RSTD within required delay for certain number of cells | Intel |
| 1-2 | TDD RSTD measurement reporting in FR1 | TDD,  PRS pattern 2  Gap#0  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  3 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.2.4 which is also rely on UE’s processing capability to be verified. UE reports RSTD within required delay for certain number of cells | Intel |
| 1-3 | TDD RSTD measurement reporting in FR2 | TDD,  PRS pattern 3  Gap#0  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  3 cells in total  Total measured positioning frequency layer is 4  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.2.4 which is also rely on UE’s processing capability to be verified. UE reports RSTD within required delay for certain number of cells | Intel |
| 2-1 | FDD UE Rx-Tx time difference measurement reporting in FR1 | FDD,  PRS pattern 1, SRSConf.1  Gap#24  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.4.4 which is also rely on UE’s processing capability to be verified. UE reports UE Rx-Tx time difference within required delay for certain number of cells |  |
| 2-2 | TDD UE Rx-Tx time difference measurement reporting in FR1 | TDD,  PRS pattern 2, SRSConf.1  Gap#0  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.4.4 which is also rely on UE’s processing capability to be verified. UE reports UE Rx-Tx time difference within required delay for certain number of cells |  |
| 2-3 | TDD UE Rx-Tx time difference measurement reporting in FR2 | TDD,  PRS pattern 3, SRSConf.1  Gap#0  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  3 cells in total  Total measured positioning frequency layer is 4  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.4.4 which is also rely on UE’s processing capability to be verified. UE reports UE Rx-Tx time difference within required delay for certain number of cells |  |
| 3-1 | FDD PRS RSRP measurement reporting in FR1 | FDD,  PRS pattern 1  Gap#24  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.3.4 which is also rely on UE’s processing capability to be verified. UE reports PRS RSRP within required delay for certain number of cells |  |
| 3-2 | TDD PRS RSRP measurement reporting in FR1 | TDD,  PRS pattern 2  Gap#0  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.3.4 which is also rely on UE’s processing capability to be verified. UE reports PRS RSRP within required delay for certain number of cells |  |
| 3-3 | TDD PRS RSRP measurement reporting in FR2 | TDD,  PRS pattern 3  Gap#0  Positioning period (T1,T2, T3) = (3,1.28,1.28) ms  No DRX cycle  Alignment b/w cells = synchronous  3 cells in total  Total measured positioning frequency layer is 4  DL-PRS-expectedRSTD is +/- 500us  TDL-A (30 ns delay spread, 5Hz) | Core requirements in section 9.9.3.4 which is also rely on UE’s processing capability to be verified. UE reports PRS RSRP within required delay for certain number of cells |  |

**Table 3.2 Test cases for NR positioning accuracy requirements**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Type of Test** | **Description** | **Test purpose** | **Responsible company** |
| 4-1 | FDD RSTD measurement accuracy in FR1 | FDD,  PRS pattern 1  Gap#24  Measurement positioning period :  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 1  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.23.2 is to be verified. UE reports RSTD within required measurement accuracy for certain number of cells | Intel |
| 4-2 | TDD RSTD measurement accuracy in FR1 | TDD,  PRS pattern 2  Gap#0  Measurement positioning period :  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 1  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.23.2 is to be verified. UE reports RSTD within required measurement accuracy for certain number of cells | Intel |
| 4-3 | TDD RSTD measurement accuracy in FR2 | TDD,  PRS pattern 3  Gap#0  Measurement positioning period :  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 1  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.23.2 is to be verified. UE reports RSTD within required measurement accuracy for certain number of cells | Intel |
| 5-1 | FDD UE Rx-Tx time difference measurement accuracy in FR1 | FDD,  PRS pattern 1, SRSConf.1  Gap#24  Measurement positioning period :  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.25.2 is to be verified. UE reports UE Rx-Tx time difference within required measurement accuracy for certain number of cells |  |
| 5-2 | TDD UE Rx-Tx time difference measurement accuracy in FR1 | TDD,  PRS pattern 2, SRSConf.1  Gap#0  Measurement positioning period :  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.25.2 is to be verified. UE reports UE Rx-Tx time difference within required measurement accuracy for certain number of cells |  |
| 5-3 | TDD UE Rx-Tx time difference measurement accuracy in FR2 | TDD,  PRS pattern 3, SRSConf.1  Gap#0  Measurement positioning period :  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.25.2 is to be verified. UE reports UE Rx-Tx time difference within required measurement accuracy for certain number of cells |  |
| 6-1 | FDD PRS RSRP measurement reporting in FR1 | FDD,  PRS pattern 1  Gap#24  Measurement period  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.24.2 is to be verified. UE reports PRS RSRP within required measurement accuracy for certain number of cells |  |
| 6-2 | TDD PRS RSRP measurement reporting in FR1 | TDD,  PRS pattern 2  Gap#0  Measurement period  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.24.2 is to be verified. UE reports PRS RSRP within required measurement accuracy for certain number of cells |  |
| 6-3 | TDD PRS RSRP measurement reporting in FR2 | TDD,  PRS pattern 3  Gap#0  Measurement period  No DRX cycle  Alignment b/w cells = synchronous  2 cells in total  Total measured positioning frequency layer is 2  DL-PRS-expectedRSTD is +/- 500us  AWGN | Accuracy requirements in section 10.1.24.2 is to be verified. UE reports PRS RSRP within required measurement accuracy for certain number of cells |  |
| Notes:   1. can be derived according to the RSTD measurement requirements specified in Clause 9.9.2.5. depending on UE capability 2. can be derived according to the RSTD measurement requirements specified in Clause 9.9.3.5. depending on UE capability 3. can be derived according to the RSTD measurement requirements specified in Clause 9.9.4.5. depending on UE capability | | | | |

* Option 3(Ericsson)

**Table 1: NR positioning test cases list**

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| **Group of requirements** | **Requirements section** | **Test cases** | **Top section for test cases** | **Phase** | **Volunteer company** |
| RSTD measurement requirements | 9.9.2.5 | SA (cell 1: NR PCell; cells 2/3: NR neighbor cells):   1. All 3 cells are in FR1 on the same frequency layer 2. All 3 cells are in FR1 on 2 different frequency layers 3. All 3 cells are in FR2 on the same frequency layer 4. All 3 cells are in FR2 on 2 different frequency layers 5. PCell is in FR1 and 2 neighbor cells are in FR2 on different frequency layers 6. PCell is in FR2 and 2 neighbor cells are in FR1 on different frequency layers | A.6.6.7 RSTD measurements,  A.7.6.5 RSTD measurements | I | Ericsson |
| NR-DC (cell 1: NR PCell; cell 2: NR PSCell; cell 3: NR neighbor cell), where:   1. All 3 cells are in FR1, cell 2 and cell 3 are on the same frequency layer 2. All 3 cells are in FR1, cell 2 and cell 3 are on different frequency layers 3. All 3 cells are in FR2, cell 2 and cell 3 are on the same frequency layer 4. All 3 cells are in FR2, cell 2 and cell 3 are on different frequency layers 5. Cell 1 is in FR1, cell 2 is in FR2, cell 3 is in FR2 and different frequency layer than cell 2 6. Cell 1 is in FR2, cell 2 is in FR1, cell 3 is in FR1 and different frequency layer than cell 2 | A new section A.X is needed for NR-DC test cases | I |  |
| PRS-RSRP measurement requirements | 9.9.3.5 | SA (cell 1: NR PCell; cells 2/3: NR neighbor cells):   * Same cases as for RSTD measurements in SA | A.6.6.8 PRS-RSRP measurements,  A.7.6.6 PRS-RSRP measurements | I |  |
| NR-DC (cell 1: NR PCell; cell 2: NR PSCell; cell 3: NR neighbor cell), where:   * Same cases as for RSTD measurements in NR-DC | A new section A.X is needed for NR-DC test cases | I |  |
| UE Rx-Tx measurement requirements | 9.9.4.5 | SA (cell 1: NR PCell; cells 2/3: NR neighbor cells):   * Same cases as for RSTD measurements in SA | A.6.6.9 UE Rx-Tx time difference measurements,  A.7.6.7 UE Rx-Tx time difference measurements | I | Ericsson |
| NR-DC (cell 1: NR PCell; cell 2: NR PSCell; cell 3: NR neighbor cell), where:   * Same cases as for RSTD measurements in NR-DC | A new section A.X is needed for NR-DC test cases | I |  |
| RSTD measurement accuracy requirements | 10.1.23 | SA (cell 1: NR PCell; cells 2: NR neighbor cell):   1. All cells are in FR1 on the same frequency layer 2. All cells are in FR1 on different frequency layers 3. All cells are in FR2 on the same frequency layer 4. All cells are in FR2 on different frequency layers 5. PCell is in FR1 and cell 2 is in FR2 6. PCell is in FR2 and cell 2 is in FR1 | A.6.7.9 RSTD measurements,  A.7.7.6 RSTD measurements | II | Ericsson |
| NR-DC (cell 1: NR PCell; cell 2: NR PSCell; cell 3: NR neighbor cell), where:   1. All 3 cells are in FR1, cell 2 and cell 3 are on the same frequency layer 2. All 3 cells are in FR1, cell 2 and cell 3 are on different frequency layers 3. All 3 cells are in FR2, cell 2 and cell 3 are on the same frequency layer 4. All 3 cells are in FR2, cell 2 and cell 3 are on different frequency layers 5. Cell 1 is in FR1, cell 2 is in FR2, cell 3 is in FR2 and different frequency layer than cell 2 6. Cell 1 is in FR2, cell 2 is in FR1, cell 3 is in FR1 and different frequency layer than cell 2 | A new section A.X is needed for NR-DC test cases | II |  |
| PRS-RSRP measurement accuracy requirements | 10.1.24 | SA (cell 1: NR PCell; cells 2: NR neighbor cell):   * Same cases as for RSTD accuracy in SA | A.6.7.10 PRS-RSRP measurements,  A.7.7.7 PRS-RSRP measurements | II |  |
| NR-DC (cell 1: NR PCell; cell 2: NR PSCell; cell 3: NR neighbor cell), where:   * Same cases as for RSTD accuracy in NR-DC | A new section A.X is needed for NR-DC test cases | II |  |
| UE Rx-Tx measurement accuracy requirements | 10.1.25 | SA (cell 1: NR PCell; cells 2: NR neighbor cell):   * Same cases as for RSTD accuracy in SA | A.6.7.11 UE Rx-Tx time difference measurements,  A.7.7.8 UE Rx-Tx time difference measurements | II |  |
| NR-DC (cell 1: NR PCell; cell 2: NR PSCell; cell 3: NR neighbor cell), where:   * Same cases as for RSTD accuracy in NR-DC | A new section A.X is needed for NR-DC test cases | II |  |

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

## Companies views’ collection for 1st round

### Open issues

**Sub-topic#5-1 Test cases for the different positioning method**

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| **Company** | **Comments** |
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**Sub-topic#5-2 Test cases for the different deployment scenarios**

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| **Company** | **Comments** |
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**Sub-topic#5-3 Test cases for DRX**

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| **Company** | **Comments** |
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**Sub-topic#5-4 General PRS configuration for NR Positioning test case**

**Sub-topic 5-4-1 PRS periodicity and offset**

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| **Company** | **Comments** |
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**Sub-topic 5-4-2 Combination of Comb size, number of symbol , slot repetition factor and PRS BW**

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| **Company** | **Comments** |
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**Sub-topic#5-5 SRS configuration for NR Positioning test case**

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| **Company** | **Comments** |
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**Sub-topic#5-6 Number of cells/TRPs for NR Positioning test case**

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| **Company** | **Comments** |
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**Sub-topic#5-7 Number of positioning frequency layers**

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| **Company** | **Comments** |
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**Sub-topic#5-8 Synchronous/Asynchronous cells**

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| **Company** | **Comments** |
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**Sub-topic#5-9 Muting pattern**

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| **Company** | **Comments** |
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**Sub-topic#5-10 Test cases list**

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

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| **CR/TP number** | **Comments collection** |
| [**R4-2014572**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014572.zip) Draft CR to TS 38.133: PRS configurations for NR Pos RRM tests (Intel) |  |
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| [**R4-2015370**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015370.zip) CR on condition for NR RSTD measurement  (CATT) |  |
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| [**R4-2015766**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015766.zip)  draftCR on PRS RMC for positioning test cases  (Huawei, HiSilicon) |  |
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| [**R4-2016400**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016400.zip)  **(Ericsson)** |  |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#5-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |
| **Sub-topic#5-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |
| **Sub-topic#5-3** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: can be FFS* |
| **Sub-topic#5-4** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
| **Sub-topic#5-5** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
| **Sub-topic#5-6** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
| **Sub-topic#5-7** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
| **Sub-topic#5-8** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
| **Sub-topic#5-9** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
| **Sub-topic#5-10** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
| **Sub-topic#5-11** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Defer to the performance part in the next meeting.* |
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### 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#5-1**

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| **Company** | **Comments** |
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**Sub-topic#5-2**

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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 #6: Others

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2016401**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016401.zip) | Ericsson | CT for correction to UE Rx-Tx measurement report mapping |
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## Open issues summary

## 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** |
| [**R4-2016401**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016401.zip) (Ericsson) | Company A |
| Company B |
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## Summary for 1st round

### Open issues

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### CRs/TPs

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

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