**3GPP TSG-RAN WG4 Meeting # 97-e**  [**R4-2017013**](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 in which create test cases for measurement procedure and measurement performance requirements |

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** |
| Ericsson | Support Option 2, to distribute the work load |
| CATT | Support option 1. The test case can be discussed in parallel with accuracy requirements. |
| Huawei | Support option 1. Accuracy and test case can be discussed in parallel, and the same is done also for other WIs. |
| Intel | Regarding to the existing RAN plenary time target, the parallel approach make more sense to complete in time. |
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**Sub-topic#1-2 Specification structure for Test case**

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Disagree with the recommended WF. We need to have the entire picture of all scenarios we are going to cover in the test cases. We need test coverage for SA, NE-DC, and NR-DC deployments, but some applicability rules to reduce the number of test cases can be discussed. |
| CATT | The two options are quite similar. Slightly prefer option 1. For option 2, the exact section number should be coordinated with other RRM requirements like CSI-RS based L3 measurement. |
| Huawei | Support the Recommended WF. We do not think being configured with LTE or NR PSCell would impact the positioning measurement performance, so testing NR SA is sufficient. This is also aligned with testing scope of existing RRM test cases. |
| Intel | We can firstly agree on TC for SA only. Whether the test case beyond SA is necessary can be FFS. |
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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) | CATT:   * WI code is incorrect * The exact section number needs to be coordinated with other RRM measurement. * It is out of scope to include other RRM requirement in new section A.13. |
|  | Huawei: please refer to our comments for Sub-topic#1-2 |
|  | Intel: can be revised up to the conclusion of sub-topic 1-2 |
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## Summary for 1st round

### Open issues

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|  | **Status summary** |
| **Sub-topic#1-1** | **Work plan of performance part (e.g. test cases)**  *Tentative agreements:*  *Candidate options:*  *According to GTW agreements on the scenarios of test cases in Subtopic 5-2, could we agree the workplan for SA test in [*[**R4-2015567**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015567.zip)*]. If the perf part time line is extended in the future RAN plenary meeting, the WP can be updated to include other scopes if necessary.*  *And the tentative plan for CR splitting works can be:*   |  |  |  | | --- | --- | --- | | *CR title* | *Section* | *Responsible company* | | **Accuracy performance requirements:** | | | | *RSTD performance requirements* | *10.1.23* |  | | *PRS RSRP measurement accuracy requirements* | *10.1.24* |  | | *UE Rx-Tx time difference measurement accuracy requirements* | *10.1.25* |  | | **Test cases for UE core requirements** | | | | *PRS configuration patterns* | *A3.x* | *[Intel]* | | *TCs for RSTD in SA* | *A6.6.x, A7.6.x* | *[Intel]* | | *TCs for PRS RSRP in SA* | *A6.6.xx, A7.6.xx* |  | | *TCs for UE Rx-Tx time difference in SA* | *A6.6.xxx, A7.6.xxx* |  | | **Test cases for UE perf requirements** | | | | *TCs for RSTD in SA* | *A6.7.x, A7.7.x* |  | | *TCs for PRS RSRP in SA* | *A6.7.xx, A7.7.xx* |  | | *TCs for UE Rx-Tx time difference in SA* | *A6.7.xxx, A7.7.xxx* |  |   *Recommendations for 2nd round: Try to agree the option above.* |
| **Sub-topic#1-2** | **Specification structure for Test case**  *Tentative agreements:*  *According to GTW agreements on the scenarios of test cases in Subtopic 5-2, the specification structure for TC can be defined for SA scenario firstly.*  *Candidate options:*  *Recommendations for 2nd round: No need further discussion. The CRs based on* [*R4-2016400*](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016400.zip) *can be revised to include these agreements above* |

### CRs/TPs

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [**R4-2016400**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016400.zip) | Return to  Revision needed. |

## 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 splitting among companies in this meeting.*]

**Sub-topic#1-1 Work plan of performance part and CR splitting plan**

*[Moderator Notes: We can also discuss R4-2017158 directly. ]*

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| **Company** | **Comments** |
| Intel | Support the candidate option. In order to make progress in this meeting, we need to comply the current RAN-P time line to plan RAN4 discussion on performance requirements and test case. If the perf part time line is extended in the future RAN plenary meeting, the WP can be updated of course. |
| Ericsson | We provided comments in the work plan and work split document directly. No point to discuss this also here. |
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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.*  **Table 1: RSTD accuracy in FR1**   |  |  | | --- | --- | | **Accuracy [Tc]** | **PRS BW [PRB]** | | ±90 | TBD ≤ BW ≤ 48 | | ±50 | 48 < BW≤ 132 | | ±35 | BW >132 |   ***Proposal 7****: For FR2, the RSTD measurement accuracy is as in Table 2.*  **Table 2: RSTD accuracy in FR2**   |  |  | | --- | --- | | **Accuracy [Tc]** | **PRS BW [PRB]** | | ±80 | TBD ≤ BW ≤ 32 | | ±40 | 32 < BW≤ 64 | | ±30 | BW >64 | |
| [**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.**  **Proposal 9: If reference and neighbor PRS resources belong to different positioning frequency layers, the minimum PRS bandwidth across the positioning frequency layers should be used for applicability of accuracy requirements.**  **Proposal 10: The applicability of PRS-RTSD measurement accuracy requirements is not impacted by HO.**  **RSTD accuracy requirements for FR1 and FR2 with a single positioning frequency layer were proposed in Table 5‑1 and Table 6‑1, respectively.** |

## 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.*

*[Ericsson]: number of samples was agreed in RAN4#96-e, what was not agreed is for how many repetitions and which comb patterns the requirements apply.]*

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.
* Option 3 (Ericsson): The accuracy requirements shall apply for:
  + any number of repetitions >=1
  + any Lprs>=2 (related to comb size).

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

*[Moderator Notes: this subtopic can be discussed together with Sub-topic 2-9, 2-10]*

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

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

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. *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. For different antenna panels within the same RSTD measurement, a more relaxed RSTD measurement accuracy applies.* (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 intra-/inter-frequency 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, Qualcomm) Applicable accuracy requirements are not impacted by HO.
* Option 3 (Ericsson): 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.

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 other parameters (e.g. comb size, repetition)

* 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.
* Option 1b(Intel) Accuracy requirements should be defined at least regarding to PRS bandwidth and the number of comb size.
* 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. On BW dependency*:*

**Table 1: RSTD accuracy in FR1**

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

**Table 2: RSTD accuracy in FR2**

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

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*
* *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.

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

*[Moderator Notes: this subtopic can be discussed together with Sub-topic 2-9]*

### 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 |
| *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.* | |

* Option 2 (Qualcomm)

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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**

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

* Option 2 (Qualcomm)

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **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**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 2. The RAN1 scenarios suggest the same coverage for FR1 and FR2. |
| CATT | Support option 2. No need to increase the side condition in FR2. |
| Huawei | Option 1, based on companies simulation results. |
| Intel | Support Option 2 |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | number of samples has been already agreed in RAN4#96-e [=4]. What was not agreed is for how many repetitions and which comb patterns the requirements apply.  We support option 2 where the requirements shall apply for:   * any number of repetitions >=1 * any Lprs>=2. |
| CATT | Support option 1. |
| Qualcomm | We support option 1: Single PRS sample which includes a number of PRS repetitions.  Option 2 is unclear. |
| Huawei | Option 1.  The number of repetitions needs to be discussed together with the PRS BW, i.e. enough repetitions should be provided (as side condition) so that UE can detect the first path with >90% detection rate. |
| OPPO | Option 1. |
| Intel | Option 1.  In our view, a single PRS sample includes all PRS symbols indicated by DL-PRS-ResourceRepetitionFactor and dl-PRS-NumSymbols jointly because form UE implementation perspective, all the PRS resource can be detected together which can benefit to improve the detection performance especially in lower SINR. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We propose Option 3:  The accuracy requirements shall apply for:   * any number of repetitions >=1 * any Lprs>=2 (related to comb size). |
| CATT | Support option 1. Note that comb size is not equal to comb pattern. Comb size and the number of PRS symbols have no binding relation. What matters for accuracy is the PRS bandwidth and symbol number (resource repetition) rather than the comb size. |
| Qualcomm | We believe options 1, 1a and 1b are all saying the same thing. It can be clarified, if needed. Again, this question is a matter of choice. By using the comb pattern (comb\_size = num PRS symbols) as a building block we can reduce the number of degrees of freedom when defining accuracy requirements. We think this would simplify the definition of requirements. |
| Huawei | Option 1. On option 1b, it is better to address in sub-topic 2-9 and 2-10. |
| OPPO | Option 1. |
| Intel | The parameters which could impact the performance can be discussed jointly. Then the number of groups for which the different requirements applied can be minimized. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Unclear: is it over all PRS frequency layers or only those PRS frequency layers involved in the measurement (reference and neighbor cell on 1 or max 2 frequency layers in total). The latter approach is used in LTE. Furthermore, it may also depend on UE measurement capability, etc. And what is the PRS\_BWi exactly, e.g., when multiple PRSs are configured and/or not all PRSs are covered by MGs? |
| CATT | Support the recommended WF. |
| Qualcomm | We support option 1: min {PRS\_BWi} of the positioning frequency layers should be used for applicability of accuracy requirements. |
| Huawei | Support the Recommended WF |
| OPPO | Support the recommended WF. |
| Intel | The recommended WF can be agreed. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We think the requirements shall be defined based on the assumption of using the same antenna panel for receiving both reference and neighbor PRS. If the UE can meet the same requirement also with different antenna panels, good enough. Alternatively, a more relaxed accuracy can be allowed (FFS: whether to specify or not the exact values for this relaxed accuracy). |
| CATT | Support option 1. |
| Qualcomm | We support option 1: RAN4 not to define separate accuracy requirements for RSTD measured with same panel and with different panels. |
| Huawei | Option 1.  The requirements should be defined for worst case (different panels used for different TRPs). In real world, how panels are deployed and which panel is used to take a measurement from a certain TRP are up to UE implementation, so it is not possible to define when UE should use same or different antenna panels for the reference and neighbour cell. |
| Intel | Support Option 1. RAN4 needs not to define induvial requirements regarding to UE antenna implementation. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 1 |
| CATT | Support option 1. |
| Qualcomm | We think that it is OK to add TRS settings to the test cases but that by itself should not have a significant impact on accuracy requirements (it can be discussed further during test case definition).  However, proximity conditions between PRS resources to need to be considered (option 2a). |
| Huawei | Option 1.  PRS measurement itself is a timing measurement, so we do not see the need to define conditions on TRS presence or PRS resource proximity. |
| OPPO | Support option 1. |
| Intel | Support Option 1. As a compromise, the test case with specific TRS configuration can be defined if necessary. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We do not have intra- or inter-frequency RSTD requirements, so the same RSTD accuracy requirements shall apply for intra- and inter-frequency HO and regardless of the type of the serving cell (PCell, PSCell, or SCell) being changed change. |
| CATT | We can agree on option 2. And option 2 and option 3 is same in our understanding. |
| Qualcomm | We support option 2: Applicable accuracy requirements are not impacted by HO. |
| Huawei | Option 2. |
| OPPO | Support option 2. |
| Intel | Support Option 2. In our view, Option 3 is quite same as Option 2. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We do not need to define any applicability in the requirements, but discussing the relevance of NLOS channel models at all for timing measurements based positioning and deriving the accuracy requirements could be useful. |
| CATT | Support option 1. |
|  |  |
| Qualcomm | We support option 2: 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.) |
| Huawei | Support option 2, and we agree with Ericsson comments above. Another question is whether and how the applicability or consideration of NLOS should be captured in the spec. |
| Intel | Support Option 1. For Option 2, how will UE know which types of propagation channel in the realistic testing?  We can agree Ericsson’s proposal/observations above: RAN4 could NOT define any applicability depending on channel propagation condition (e.g. NLOS/LOS). |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We support the approach in Option 2 i.e. the requirements shall depend on the BW but can be derived to apply for any Lprs and any number of repetitions. |
| CATT | Support option 1. The accuracy requirements should be impacted by PRS BW and repetition factors in one sample. |
| Qualcomm | We support option 1a: Accuracy requirements would be specified as a function of PRS bandwidth and the total number of comb pattern repetitions contained in one PRS sample.  If companies agree on this, then we can move on to discuss the specific combinations of PRS bandwidth and repetitions. |
| Huawei | Support option 1, and we are open to study option 1a  More specifically, we propose to define different accuracy requirements based on PRS BW in RB and SCS, and define number of repetitions as side conditions (enough repetitions to ensure the detection rate). |
| Intel | Option 1,1a,1b can be accepted for us. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | To avoid restrictions on the network, our preference is to base the requirements on the smallest number of repetitions so that the requirements become applicable for any repetition factor configuration. |
| CATT | Not very clear the intention of *PRS\_TotalRepetition*. The accuracy requirements can be related on the number of samples and the repetition factor which is indicated by high layer parameter. |
| Qualcomm | We support option 1. |
| Huawei | Option 1 looks reasonable, but we need a bit more time to check as this is brought up first time. |
| OPPO | Option 1 may lead to cross-slot combination and we are not sure whether it is practical for UE implementation especially when the PRS resource gap is large. |
| Intel | In our view, Option 1 is to define some normalized PRS density over the time domain. So we can figure out the proper way to do it. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| CATT | Fine with option 1. |
| Qualcomm | Support option 1: 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   Agree that group delay calibration margin should be part of the accuracy requirements. We can agree with the sub-clause (zero margin) ***for RSTD accuracy requirements*** when PRS resources are in the same frequency layer. |
| Huawei | Support option 1 at least for FR1, and we understand the same is assumed in LTE.  For FR2 and the case where reference and neighbouring resources are on different frequency layers, we can further discuss the margin. |
| Intel | Support Option 1 and FFS the possible group delay calibration error. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 1, but the exact accuracy numbers (in Tc) can be further discussed or can be in square brackets. |
| CATT | Agree with moderator’s suggestion to define exact accuracy requirement after the principle is decided. |
| Qualcomm | Accuracy requirements are dependent on PRS BW in Hz. What is the SCS in Table 1 provided by Ericsson? |
| Huawei | Support option 2, but exact numbers need to be discussed further |
| OPPO | Agree that accuracy should depend on the PRS BW and repetition, but how to define repetition need further discussion in sub-topic 2-10. |
| Intel | Up to how to define the different sets of requirements |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 1, but the exact accuracy numbers (in Tc) can be further discussed or can be in square brackets. |
| CATT | Agree with moderator’s suggestion to define exact accuracy requirement after the principle is decided. |
| Qualcomm | Accuracy requirements are dependent on PRS BW in Hz. What is the SCS in Table 1 provided by Ericsson? |
| Huawei | Support option 2, but exact numbers need to be discussed further. In addition, the UE Rx delay calibration error needs to be discussed, since different resources may be measured with different antenna panels. |
| OPPO | Same as sub-topic 2-12 |
| Intel | Up to how to define the different sets of requirements |

### CRs/TPs

[*Moderator notes: suggest take one of these CR drafts as the baseline which can be revised in 2nd round discussion*.]

|  |  |
| --- | --- |
| **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) | Ericsson: need basic agreements first |
| Company B |
|  |
| [**R4-2014450**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014450.zip)  (CATT) | Ericsson: need basic agreements first. There are no intra-/inter-frequency PRS measurements. |
| Company B |
|  |
| R4-2016405 (Ericsson) | CATT: pending on the conclusion of open issues above. |
| Huawei: for change 1, do we need 60kHz SCS for FR1 table? Change 3 needs to be based on technical agreements. |
| Intel: the parameters combination to define RSTD accuracy requirements shall be agreed firstly. |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#2-1** | **SINR side condition for FR2**  *Tentative agreements:*  *Agreements (From GTW on Thu):*   * SINR side condition for FR2:   -6dB for reference TRP and -13 dB for neighbor TRP  *Candidate options:*  *Recommendations for 2nd round: No further discussion needed* |
| **Sub-topic#2-2** | **Number of samples for accuracy requirements**  *Agreements (From GTW on Thu):*  Agreements:  Define the requirements at least for the cases without repetition and multiple repetitions (within the slot and across the slots within one PRS period (i.e. TPRS)) can be considered for small BW  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: No need further discussion separately.* |
| **Sub-topic#2-3** | **Whether accuracy requirements are agnostic to comb size**  *Tentative agreements: None*  *Candidate options:*  *Recommendations for 2nd round: No further discussion needed. This issue can be discussed in Sub-topic#2-9* |
| **Sub-topic#2-4** | **Applicable PRS BW for defining accuracy**  *Tentative agreements: None*  *Candidate options:*  *Recommendations for 2nd round: No further discussion needed. This issue can be discussed in Sub-topic#2-9* |
| **Sub-topic#2-5** | **Antenna panel assumption**  *Tentative agreements: None.*  *Candidate options:*   * Option 1. RAN4 not to define separate accuracy requirements for RSTD measured with same panel and with different panels. (Intel, Huawei, Qualcomm, CATT) * Option2. The requirements relaxed for the UE using different antenna panel for receiving both reference and neighbor PRS. (Ericsson)   *Recommendations for 2nd round: Can be FFS* |
| **Sub-topic#2-6** | **Assumption on TRS setting for defining accuracy and test**  *Tentative agreements: None*  *Candidate options:*   * Option 1 (Intel, Huawei, CATT, OPPO, Ericsson): 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   *Recommendations for 2nd round: Can be FFS* |
| **Sub-topic#2-7** | **Applicable accuracy requirement in case of HO**  *Tentative agreements: None*  *Candidate options:*   * Option 2. (Huawei, Intel, Qualcomm, CATT) Applicable accuracy requirements are not impacted by HO. * Option 3 (Ericsson): 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.   *Recommendations for 2nd round: Can be FFS* |
| **Sub-topic#2-8** | **Applicable propagation channel for accuracy requirement**  *Tentative agreements:*  *Candidate options:*   * Option 1 (Intel, CATT, Ericsson). 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.)   *Recommendations for 2nd round: Can be FFS* |
| **Sub-topic#2-9** | **How to define the accuracy requirements with the combinations of PRS BW, repetitions and others**  *Tentative agreements:*  GTW Agreements:  Define the requirements at least for the cases without repetition and multiple repetitions (within the slot and across the slots within one PRS period (i.e. TPRS)) can be considered for small BW  *Candidate options:*  *The tables below including the parameters which impact the performance can be used to define the different accuracy requirements in the future.*  **Table 1: RSTD accuracy in FR1**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  |   **Table 2: RSTD accuracy in FR2**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  |   *Recommendations for 2nd round: Companies are encouraged to input the proper sets of these parameters combination.* |
| **Sub-topic#2-10** | **How to define the accuracy requirements with the repetitions factor**  *Tentative agreements:.*  *Candidate options:*  *Recommendations for 2nd round: Can be discussed in sub topic 2-9. No need further discussion.* |
| **Sub-topic#2-11** | **Group delay calibration margin**  *Tentative agreements:*  RAN4 needs 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   *Candidate options:*  *Recommendations for 2nd round: No further discussion needed* |
| **Sub-topic#2-12** | **RSTD accuracy requirements for FR1**  *Moderator Notes: The principle (e.g. the parameters used to define the different requirements) can be agreed firstly. Then we can define the specific accurate requirements.*  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: The exact requirements can be deferred to the next meeting.* |
| **Sub-topic#2-13** | **RSTD accuracy requirements for FR2**  *Moderator Notes: The principle (e.g. the parameters used to define the different requirements) can be agreed firstly. Then we can define the specific accurate requirements.*  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: The exact requirements can be deferred to the next meeting.* |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [**R4-2015760**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015760.zip) (Huawei, Hi Silicon) | Return to.  Revision is needed |
| [**R4-2014450**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014450.zip)  (CATT) | Merged with [**R4-**[**R4-2015760**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015760.zip)](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip) |
| R4-2016405 (Ericsson) | Merged with [**R4-**[**R4-2015760**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015760.zip)](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip) |

## Discussion on 2nd round

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

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1. |
| Ericsson | Support Option 2 |
| Qualcomm | Support Option 1. |
| Huawei | Support option 1. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option1. Can compromise to define the TRS settings in the test case only. |
| Ericsson | Option 1. Whether and what we need in test cases is a separate discussion. |
| Qualcomm | Repeating our position from 1st round: We think that it is OK to add TRS settings to the test cases but that by itself should not have a significant impact on accuracy requirements (it can be discussed further during test case definition).  So option 1 is OK. We don’t need to specify TRS settings explicitly in the accuracy requirements.  However, error due timing drift should be considered in the definition of RSTD accuracy requirements. This can be addressed by specifying proximity conditions between PRS resources (option 2a). |
| Huawei | Support option 1. TRS should be added in the test cases as in existing RRM test cases, but no need to have it in the accuracy requirements. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Both options are fine. |
| Ericsson | Support Option 3. Option 3 is more explicit. Furthermore, Option 3 also covers any serving cell change in general, which is not solved by Option 2. |
| Qualcomm | Option 2 |
| Huawei | We support option 2. Actually based on either option 2 or option 3, there seems to be no need to capture anything in the spec, so we are not sure if we still need to discuss this issue anymore. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1. |
| Ericsson | Option 1 |
| Qualcomm | Option 2. Furthermore we propose defining separate measurement accuracy requirements for AWGN and fading/NLOS channels. |
| Huawei | This needs to be further discussed. The timing measurement accuracy is quite dependent on the propagation channel, so we suggest to explicitly capture in the spec under which channels the requirements are derived, as otherwise the requirement may be misleading in terms of what kind of accuracy performance can be expected in real deployment. If this is agreeable, we have no strong view whether to include results from TDL-C for FR1 accuracy. |

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

[*Moderator notes:*

*The tables below is used to collect companies view on proper setting of the parameters which can be used to define the different accuracy requirements.*

*The possible candidate parameters setting are listed in these tables. But which combination can be used to define the different requirements can be down-selected after the companies provided the simulation results*.

*]*

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Table 1: RSTD accuracy in FR1**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  |   **Table 2: RSTD accuracy in FR2**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |
| Intel | **Table 1: RSTD accuracy in FR1**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  | 52 (10MHz) /  104 (20MHz)/  268 (50MHz) | 15k | 1/2/4 | 2/4/6 | |  | 48 (20MHz)/  132 (50MHz),/  272 (100MHz) | 30k | 1/2/4 | 2/4/6 | |  |  |  |  |  |   **Table 2: RSTD accuracy in FR2**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  | 52 (10MHz) /  104 (20MHz)/  268 (50MHz) | 15k | 1/2/4 | 2/4/6 | |  | 32(50MHz),64(100MHz), 128 (200MHz) | 120k | 1/2/4 | 2/4/6 | |  |  |  |  |  |   Notes:   1. the parameters set shall avoid the cross-slot combination. E.g. repetition=4, comb size=4 or 6 |
| Ericsson | The same accuracy shall apply regardless of the repetitions and comb size for BW>=XRSTD. XRSTD=TBD. FFS: For BW<XRSTD, two or more slot repetitions and/or more PRS symbols within the slot.  [*Moderator: as we agree in GTW, the tables above can be used to collect companies view on the possible parameters which can impact the accuracy requirement sets. Then companies can provided more simulation results or observations on the proper combination (e.g. same as your proposal here, two sets can be defined regarding the BW and repetition.)]* |
| Qualcomm | **Table 1: RSTD accuracy in FR1**   |  |  |  |  | | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **PRS-TotalRepetition** | |  |  |  |  | |  |  |  |  | |  |  |  |  |   **Table 2: RSTD accuracy in FR2**   |  |  |  |  | | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **PRS-TotalRepetition** | |  |  |  |  | |  |  |  |  | |  |  |  |  |   In our view it does not make sense to consider comb size by itself in the accuracy requirements. If we consider comb size then number of PRS symbols should also be specified. This can be avoided by specifying the number of repetitions of the comb pattern (PRS-TotalRepetition) instead.  [*Moderator: Does “PRS total repetition” depend on repetition , comb size or other parameter? If so, the table provided above can be assumed as the baseline to differeniate the requirements set as a first step? How will we down-select or combine these parameters can be FFS*] |
| Huawei | On BW, our tentative suggestion is given in the table below in MHz,  On repetition, we are fine to take the approach suggested by QC to define repetitions based on comb patterns. The number of repetitions should be defined as the minimum value that can lead to reasonable accuracy for a certain BW, this can be further checked with simulations.  **Table 1: RSTD accuracy in FR1**   |  |  |  |  | | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **PRS-TotalRepetition** | |  | 20/50 | 15 |  | |  | 50/100 | 30 |  |   **Table 2: RSTD accuracy in FR2**   |  |  |  |  | | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **PRS-TotalRepetition** | |  | 50/100/200 | 120 |  | |

## Summary on 2nd round

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

# Topic #3: Measurement Accuracy Requirements for PRS RSRP

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **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  **Observation 1: There is performance gain when PRS RSTD measurement BW is increased. But such gap becomes smaller if the PRS density in the time domain is high enough (e.g. larger combsize and repetition).**  **Observation 2: There is obvious performance gap when PRS resource number and comb size is different especially for the neighbor cell with SINR>-13dB.**  ***Proposal 1: Multiple PRS measurement performance requirements shall be defined at least regarding to:***   * ***Different PRS measurement bandwidth (e.g. <=52RBs and >52RBs)*** * ***Different PRS comb size (e.g. <=comb2 and >comb2)*** |
| [**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:*  **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 |   ***Proposal 8****: For FR2, the PRS-RSRP measurement accuracy is as in Table 2.*  **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 | |
| [**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 PRS-RSRP SINR side condition for DL-AoD

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.*

*[Ericsson] – the number of samples was agreed (=4) in RAN4#96-e, but what was not agreed is for how many repetitions/comb patterns etc the requirements apply.]*

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

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

* Option 1. (Intel, Huawei, Qualcomm, ZTE) Define ONLY relative accuracy requirements for PRS-RSRP
* Option 2. (Intel, Huawei, ZTE) Define both absolute and relative accuracy requirements for PRS-RSRP
* Option 2a. (Ericsson)
  + 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 other parameters (e.g.comb size, repetition)

* 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
* Opton 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 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. Dependency on BW is in the tables:*

**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 |

Recommended WF: Follow the same principle as for RSTD accuracy requirements (Sub-topic 2.9).

### 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**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Support Option 2. Unlike PRS-RSTD measurements, in PRS-RSRP measurements for DL-AoD positioning there is no reference cell. |
| Ericsson | The reference TRP has nothing to do with the PRS-RSRP measurement. But we can agree on defining two levels in side conditions for the *target* (no need to call “serving” or “neighbor”) measured PRS-RSRP: [-3 dB or -6 dB] and [-13 dB]. The corresponding PRS-RSRP measurement accuracy is to be met depending on the condition. |
| CATT | Support option 1b. We are also fine to follow the conclusion of UE Rx-Tx time difference side condition. |
| Huawei | Support option 2. We can also agree to option 3. |
| OPPO | Support option 2 and can comprise to option 3. |
| Intel | Option 2 and 3 can be acceptable for us. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 2. Same comment as for RSTD: the number of samples has been already agreed. We need to agree on the number of repetitions, comb, etc. |
| CATT | Support option 1b. We don’t think the number of samples agreed (=4) in last meeting is the number of samples used to define accuracy requirements. |
| Qualcomm | Propose we follow the same conclusion as in sub-topic 2-2. |
| Huawei | We support option 1, and we are open to study option 1a and 1b. |
| Intel | Can follow the same conclusion of RSTD (sub-topic 2-2) |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Our view was not correclty captured thus I modified the summary to reflect our view. Our view is to define requirements for relative accuracy at least. Thus I put ZTE as one of the companies supporting Option 1 and Option 2. |
| Ericsson | Prefer Option 3. We do not agree on Option 1, but could compromise to Option 2 or 2a. |
| CATT | We are fine with option 1 and option 2. |
| Qualcomm | Support option 1. |
| Huawei | Option 1 or option 2. |
| OPPO | Support option 1 and can comprise to option 2. |
| Intel | Prefer Option 2 as a compromise for all companies |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 2. Accuracy requirements are defined depending on the BW, but apply for all repetition factor configurations and all comb sizes (number of PRS symbols). |
| CATT | Support option 1. The accuracy requirements should be impacted by PRS BW and repetition factors in one sample. |
| Qualcomm | Propose we follow the same conclusion as in sub-topic 2-9. |
| Huawei | Suggest to follow same conclusion as sub-topic 2-9. |
| Intel | follow same conclusion as sub-topic 2-9. |

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

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

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We support the principle shown in Option 1, but the exact numbers can be further discussed and can be in square brackets. |
| CATT | Agree with moderator’s suggestion to define exact accuracy requirement after the principle is decided. |
| Huawei | We suggest to also include resource repetition as side condition, which is not included in option 1. |
| Intel | Can be discussed up to the conclusions for the principle to define these accuracy requirements |

### CRs/TPs

[Moderator notes: suggest take one of these CR drafts as the baseline which can be revised in 2nd round discussion.]

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2014451**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip)  **(CATT)** | Ericsson: need basic agreements first. There are no intra-/inter-frequency for PRS measurements. |
| Intel: the parameters combination to define accuracy requirements shall be agreed firstly |
|  |
|  |
| [**R4-2015762**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015762.zip)  **(Huawei)** | We need basic agreements first. |
| Intel: the parameters combination to define accuracy requirements shall be agreed firstly |
| **R4-2016403**  **(Ericsson)** | CATT:   * WI code is incorrect. * pending on the conclusion of open issues above. |
| Intel: the parameters combination to define accuracy requirements shall be agreed firstly |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#3-1** | **SINR side condition**  *Tentative agreements :None*  *Candidate options:*   * Option 1a (Ericsson): -3dB for serving TRP * Option 1b (CATT): -6dB for serving TRP * Option 1c (Ericsson): defining two levels in side conditions for the target (no need to call “serving” or “neighbor”) measured PRS-RSRP: [-3 dB or -6 dB] and [-13 dB]. * Option 2 (Intel, Huawei, ZTE, OPPO): for neighbor cell/TRPs ONLY * Option 3 (Qualcomm, Intel, OPPO): For the reference cell/TRPs and neighbour cell/TRPs   + Same as that for the reference cell in PRS-RSTD   *Recommendations for 2nd round:* Can be FFS. |
| **Sub-topic#3-2** | **Number of samples for PRS RSRP accuracy requirements**  *Tentative agreements:*  *Follow the same principle for that of RSTD measurement.*  *Candidate options:*  *Recommendations for 2nd round: No further discussion needed.* |
| **Sub-topic#3-3** | **Type of requirements**  *Tentative agreements: None*  *Candidate options:*   * Option 1. (Intel, Huawei, Qualcomm, ZTE) Define ONLY relative accuracy requirements for PRS-RSRP * Option 2. (Intel, Huawei, ZTE) Define both absolute and relative accuracy requirements for PRS-RSRP * Option 2a. (Ericsson)   + 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)  *Recommendations for 2nd round: can be FFS. Try to compromise to Option 2.* |
| **Sub-topic#3-4** | **How to define the accuracy requirements with the combinations of PRS BW and repetitions** *Tentative agreements:*  *Follow the same principle for that of RSTD measurement.*  *Candidate options:*  *Recommendations for 2nd round: No further discussion needed* |
| **Sub-topic#3-6** | **PRS RSRP accuracy requirements**  *Moderator Notes: The principle (e.g. the parameters used to define the different requirements) can follow the conclusion of RSTD (sub topic 2-9). Then we can define the specific accurate requirements.*  *Tentative agreements: None.*  *Candidate options:*  *Recommendations for 2nd round: The tables as for Sub-topic#2-9 is used to collect companies view on proper setting of the parameters which can be used to define the different PRS RSRP accuracy requirements. The exact requirements can be deferred to the next meeting.* |
|  |  |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [**R4-2014451**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip)  **(CATT)** | Return to.  Revision is needed |
| [**R4-2015762**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015762.zip)  **(Huawei)** | Can merged with [**R4-2014451**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip) |
| **R4-2016403**  **(Ericsson)** | Can merged with [**R4-2014451**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip) |

## Discussion on 2nd round

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

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Prefer Option 3 |
| Ericsson | Option 1c. Option 3 has no technical justification for AoD, since RSRP is not based on two cells unlike RSTD. |
| Qualcomm | Option 2 or 3. |
| Huawei | Option 2 or 3. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Prefer Option 2 |
| Ericsson | Option 2a |
| Qualcomm | Prefer option 1. |
| Huawei | Option 1 or 2. |

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

**Moderator notes:**

*The tables below is used to collect companies view on proper setting of the parameters which can be used to define the different accuracy requirements.*

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Table 1: PRS RSRP accuracy in FR1**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  |   **Table 2: PRS RSRP accuracy in FR2**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |
| Intel | Can follow the same principle of RSTD. |
| Ericsson | The same accuracy shall apply regardless of the repetitions and comb size for BW>=XPRS-RSRP. XPRS-RSRP=TBD. FFS: For BW<XPRS-RSRP, two or more slot repetitions and/or more PRS symbols within the slot. XPRS-RSRP and XRSTD can be different.  [*Moderator: in GTW, the agreement below achieved*:  “3-4: How to define the accuracy requirements with the combinations of PRS BW and repetitions  Agreement: Follow the same principle for that of RSTD measurement”  ] |
| Qualcomm | Same format as RSTD |
| Huawei | We can follow RSTD, but need to further discuss if the PRS BW should be defined in MHz or PRB. In our view, for PRS-RSRP, the number of PRBs matters. |

## Summary on 2nd round

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

# Topic #4: Measurement Accuracy Requirements for UE Rx-Tx Time Difference

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **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.*  **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 |   **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 | |
| [**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 side conditions 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 4-5a 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).

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

### Sub-topic 4-5b Applicability of accuracy requirements in the case of cell change which is different from HO

* Option 1: The same UE Rx-Tx measurement accuracy requirements shall apply before and after the cell change (not HO) 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 |
| *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.* | | |

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 |
| *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.* | | |

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** |
| Ericsson | We prefer to define two levels in the side conditions for UE Rx-Tx for the target TRP, could compromise to [-3 dB or -6 dB] and [-13 dB]. |
| CATT | Our view is to define one set of accuracy requirement for both serving cell and neighbor cell but with separate side condition.  So we add option 1a as below:   * Option 1a.   + Define separate side condition i.e. -13dB for neighbour cell and -6dB for serving cell. |
| Huawei | Option 2. not sure why serving cell condition is needed, while it is not the limiting factor of the positioning performance. |
| Intel | Option 2. UE Rx-Tx time difference measurements is independent on the serving cell or non-serving cells. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Same comment as for RSTD, but applies for the same/different antenna panels for rx and tx for the same measurement. The requirements are defined under the assumption for the “same” case. For the “different” case, a relaxed accuracy is allowed but it can be FFS with to specify or not its exact values. |
| CATT | Agree moderator to follow the conclusion of RSTD measurement. |
| Qualcomm | Propose we follow the outcome of sub-topic 2-5. |
| Huawei | Suggest to follow conclusion from 2-5. |
| Intel | Suggest to follow conclusion from 2-5. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | We can also agree on Option 2 and to discuss this for gNB separately. |
| Ericsson | We need to focus on the UE side since this is the UE measurement to be tested. Errors in gNB can be further discussed separately. |
| Huawei | Option 2. We do not see clear technical base of option 1, the calibration error for gNB can be larger or smaller than UE. The errors need to be checked by UE vendors and Infra vendors respectively. |
| Intel | Option 2 can be acceptable for us as majority companies agree the margin for gNB’s calibration error can be discussed later. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 2. By default, i.e., with Option 1, the same requirements will apply with or without change but that is not feasible and not what the UE vendors can guarantee, so the current requirements are wrong with Option 1. |
| CATT | Support option 1. |
| Qualcomm | This topic is being discussed in email thread [97e][213]. Suggest we discuss it in one place.  [Moderator: this is accuracy requirements ] |
| Huawei | Option 1. This is a rather corner case and can be covered by RAN4#95-e agreement:  UE Rx-Tx time difference accuracy requirements do not apply under TA change during the measurement period |
| Intel | Prefer Option 2 since NTA\_offset will impact UE Rx-Tx timing. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | 4-5a: option 1  4-5b: option 1 (RAN4 has already agreed earlier that such cases exist, as discussed in our contribution) |
| CATT | Sub-topic 4-5a  Support option 1.  Sub-topic 4-5b  Technically fine with option 1, but prefer to clarify the scenario. |
| Huawei | Option 1, which is same as the case for UL timing change |
| Intel | Sub-topic 4-5a  Support option 1.  Sub-topic 4-5b  Support option 1 |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 1 |
| CATT | Technically fine with option 1. |
| Qualcomm | This topic is being discussed in email thread [97e][213]. Suggest we discuss it in one place. |
| Huawei | We have RAN4#95-e agreement:  UE Rx-Tx time difference accuracy requirements do not apply under TA change during the measurement period  So the focus should be on autonomous adjustment, which we need more time to check. |
| Intel | Share same view as Huawei. We can focus on autonomous adjustment only |

**Sub-topic 4-7 link level simulation results**

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

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We propose to agree on the principle used in Option 2, but the exact numbers can be further discussed and can be in square brackets. |
| CATT | Same as RSTD and PRS-RSRP, the exact accuracy requirements should be discussed after the principle is decided. |
| Qualcomm | Questions about Table 1 from Ericsson.   * 1. What’s the SCS?   2. For Es/Iot = -13 dB, Accuracy = ±90 for BW = 48 and Accuracy = ±50 for BW = 49 ? |
| Huawei | Support option 1, but exact numbers need to be discussed further |
| Intel: | the parameters combination to define accuracy requirements shall be agreed firstly. Then the requirements can be defined with the simulation results provided by companies. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | We propose to agree on the principle used in Option 2, but the exact numbers can be further discussed and can be in square brackets. |
| CATT | Same as RSTD and PRS-RSRP, the exact accuracy requirements should be discussed after the principle is decided. |
| Qualcomm | Similar questions as for FR1. |
| Huawei | Support option 1, but exact numbers need to be discussed further |
| Intel: | the parameters combination to define accuracy requirements shall be agreed firstly. Then the requirements can be defined with the simulation results provided by companies. |

### 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)** | Ericsson: need basic agreements |
| Intel: the parameters combination to define accuracy requirements shall be agreed firstly. Then the requirements can be defined with the simulation results provided by companies. |
|  |
|  |
| [**R4-2016407**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016407.zip)  **(Ericsson)** | CATT:   * WI code is incorrect. * pending on the conclusion of open issues above. |
| Intel: the parameters combination to define accuracy requirements shall be agreed firstly. Then the requirements can be defined with the simulation results provided by companies. |
| [**R4-2014452**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014452.zip)  **(CATT)** | Ericsson: need basic agreements. There are no intra-/inter-frequency PRS measurements. |
| Intel: the parameters combination to define accuracy requirements shall be agreed firstly. Then the requirements can be defined with the simulation results provided by companies. |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#4-1** | **Whether to define separate measurement accuracy requirements for serving and neighbor cells**  *Tentative agreements: None.*  *Candidate options:*   * 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)   *Recommendations for 2nd round: Can be FFS. Try to agree Option 2 based on the majority view.* |
| **Sub-topic#4-2** | **Antenna panel assumption**  *Tentative agreements:*  *Can following same conclusion for RSTD requirements*  *Candidate options:*  *Recommendations for 2nd round: No further discussion needed* |
| **Sub-topic#4-3** | **Rx-Tx calibration error budget at UE and gNB**  *Tentative agreements:*  RAN4 to decide on the margin to account for the group delay calibration error for both UE Rx and Tx. The same margin for gNB can be FFS separately  *Candidate options:*  *Recommendations for 2nd round: No further discussion needed* |
| **Sub-topic#4-4** | **Applicability of accuracy requirements in the case of NTA\_offset change**  *Tentative agreements:*  *Candidate options:*   * 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)   *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#4-5a** | **Applicability of accuracy requirements in the case of HO**  *Tentative agreements:*  UE Rx-Tx time difference accuracy requirements do NOT apply with HO during the measurement period  *Candidate options:*  *Recommendations for 2nd round: No need further discussion* |
| **Sub-topic#4-5b** | **Applicability of accuracy requirements in the case of serving cell change which is different from HO**  *Tentative agreements:*  *Candidate options:*  -Option 1. The same UE Rx-Tx measurement accuracy requirements shall apply before and after the serving cell change (not HO) which does not impact SRS configuration, when the UE continues the measurement  *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#4-6** | **Applicability of accuracy requirements under TA adjustment**  *Tentative agreements: None*  *Candidate options:*   * 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   *Recommendations for 2nd round: Can be FFS* |
| **Sub-topic#4-8** | **UE Rx-Tx time difference measurement accuracy requirements for FR1**  The principle on how to define the different accuracy requirements depending on multiple PRS parameters(e.g.PRS BW , repetitions) can follow that of RSTD. The exact requirements can be FFS.  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: The tables as for Sub-topic#2-9 is used to collect companies view on proper setting of the parameters which can be used to define the different PRS RSRP accuracy requirements. The exact requirements can be deferred to the next meeting.* |
| **Sub-topic#4-9** | **UE Rx-Tx time difference measurement accuracy requirements for FR2**  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: The tables as for Sub-topic#2-9 is used to collect companies view on proper setting of the parameters which can be used to define the different PRS RSRP accuracy requirements. The exact requirements can be defered to the next meeting.* |
|  |  |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [**R4-2015764**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015764.zip)  **(Huawei)** | Can be merged into [**R4-2016407**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016407.zip). |
| [**R4-2016407**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016407.zip)  **(Ericsson)** | Return to.  Revision is need. |
| [**R4-2014452**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014452.zip)  **(CATT)** | Can be merged into [**R4-2016407**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016407.zip). |

## Discussion on 2nd round

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

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 2 because for UE Rx-Tx time difference measurement the serving cell can be absent. |
| Ericsson | Option 1. Actually there is no “serving” or “neighbor” in our proposal, we are just proposing two levels for the target TRP, to allow for PRS flexible configurations and deployments. |
| Qualcomm | Option 2 |
| Huawei | Option 2 |
|  |  |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Prefer Option 2. |
| Ericsson | Option 2. Otherwise, by default, the same requirement applies when the NTA\_offset changes, which means the requirement is broken. |
| Qualcomm | Prefer option 1 |
| Huawei | Option 1 |

**Sub-topic#4-5b Applicability of accuracy requirements in the case of cell change which is different from HO**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1 |
| Ericsson | Option 1, it is based on the earlier RAN4 agreement. |
| Qualcomm | This issue needs to be looked at carefully. Potentially there could be many corner cases in which it may not make sense or be possible for the UE Rx-Tx measurement to continue without interruption. E.g. if PCell changes and the SCell configured with SRS is deactivated. |
| Huawei | Similar comment as for the core part discussion in sub-topic 3-13 of email 213, i.e. we see no need to capture this in the spec. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Can be FFS. We can focus on autonomous adjustment only |
| Ericsson | Option 1. |
| Qualcomm | These issues are already being discussed in NR\_pos\_RRM\_1 thread sub-topics 3-10 and 3-11. Suggest we follow the same conclusion. |
| Huawei | We should focus on autonomous adjustment, which we need more time to check.  To QC, what is discussed in email 213 is the applicability of the measurement period requirements, while here the discussion is about the measurement accuracy requirements. |

**Sub-topic 4-8&4-9 UE Rx-Tx time difference measurement accuracy requirements**

**Moderator notes:**

*The tables below is used to collect companies view on proper setting of the parameters which can be used to define the different accuracy requirements.*

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A | **Table 1: UE Rx-Tx time difference accuracy in FR1**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  |   **Table 2: UE Rx-Tx time difference accuracy in FR2**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Accuracy [Tc]** | **PRS BW, MHz (or PRBs)** | **SCS, kHz** | **Repetition factor** | **Comb size** | |  |  |  |  |  | |  |  |  |  |  | |  |  |  |  |  | |
| Intel | Can follow the same principle for RSTD |
| Ericsson | The same accuracy shall apply regardless of the repetitions and comb size for BW>=XUERxTx. XUERxTx=TBD. FFS: For BW<XUERxTx, two or more slot repetitions and/or more PRS symbols within the slot. XUERxTx and XPRS-RSRP and XRSTD can all be different. |
| Qualcomm | Same format as RSTD |
| Huawei | Same as RSTD |

## 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.*   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **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 |  |   ***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* * ***Proposal 6****: In SA,*    + *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.* * ***Proposal 7****: In NR-DC,*   + *for RSTD measurement and RSTD measurement accuracy requirements, test cases with 3 cells are developed: NR PCell (cell 1), NR PSCell (cell 2), and NR neighbor cell;*   + *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.* * ***Proposal 8****: For UE capable to support PRS-RSRP reporting together with RSTD and UE Rx-Tx, the PRS-RSRP measurements are also configured and verified in the test for TDOA and multi-RTT, respectively.* |
| [**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: Agree on Option 1.

### 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: Agree on Option 1.

### 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): 1/2^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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 1 |
| Huawei | Support the Recommended WF |
| Intel | The recommended WF can be agreed. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 2 |
| Huawei | Option 1, same issue as sub-topic 1-2 |
| Intel | Support Option 1. In our view, the requirements applied to SA are definitely same as these for PCell in CA. That is the test cases proposed by Option 2 are redundant. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Ok with DRX OFF in test cases, as a baseline. |
| Huawei | Support the Recommended WF |
| Intel | the Recommended WF can be agreed. |

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

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Further discussion is needed, difficult to agree in this meeting. |
| Huawei | Does option 2 mean that for 120k SCS the PRS periodicity is 256\*160ms?  [Intel: shall be 1/2^u \*160ms] |
| Intel | Support Option 2. The test cases for the different numerologies are necessary. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Further discussion is needed, difficult to agree in this meeting. Need to agree the requirements first. |
| Huawei | Support the principle of option 1, and exact numbers for PRS RMC can be further discussed. |
| Intel | Support Option 2. The other proposals which can balance the testing efforts and coverage are also fine to us. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Further discussion is needed, difficult to agree in this meeting. |
| Huawei | Not sure why SRS needs to be configured in the test cases?  [Intel: SRS configuration is needed for UE Rx-Tx time difference measurement] |
| Intel | Option 1 |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 1a |
| Huawei | Option 2, it’s not clear why 2 neighbor cells are needed for RSTD test since there is no PRS-PRS interference.  [Intel: LPP need two RSTDs at least to estimate the location. But for the accuracy requirements test case, 1 RSTD which needs 2 cells/TRPs (one is for reference, the other neighbor cell)] |
| Intel | Both 1a and 1b are fine for us. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Need to first agree on the scenarios, number of cells, etc. |
| Huawei | Option 2, to simplify the test, and also considering not all UEs support multiple PRS layers. |
| Intel | Both options are fine for us. Slightly prefer Option 1 to cover the multiple positioning frequency layers. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Further discussion is needed |
| Huawei | Option 1 is fine |
| Intel | Option 1 |

**Sub-topic#5-9 Muting pattern**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Not so obvious, Further discussion is needed, depends on how the test is set up. |
| Huawei | Option 1, the PRS resources can be made orthogonal without muting. |
| Intel | Option 1 |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Option 3 |
| Huawei | Need to be further discussed. The number of test cases is too high in option 2 or option 3. We should focus on the basic scenario only. |
| Intel | In principle, we need trade-off between the test case number and the testing coverage. |

### CRs/TPs

|  |  |
| --- | --- |
| **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) | Ericsson: further discussion is needed |
|  |
|  |
|  |
| [**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) | Ericsson: Overlaps with Change #1 in CR R4-2016405 from Ericsson. There are no intra-/inter-frequency. Better to have generic for PRS measurements. |
|  |
|  |
| [**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) | Ericsson: further discussion is needed |
| Intel: some overlap with [**R4-2014572**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014572.zip)**. Can be merged these two.** |
|  |
| [**R4-2016400**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016400.zip)  **(Ericsson)** | Discussed under Topic #1 |
|  |
|  |
|  |  |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#5-1** | **Test cases for the different positioning method**  *Tentative agreements:*  No need to define separated E-CID test case in Rel16  *Candidate options:*  *Recommendations for 2nd round: No need further discussion* |
| **Sub-topic#5-2** | **Test cases for the different deployment scenarios**  *Tentative agreements:*  Agreement:  Define test cases for  SA FR1 without CA  SA FR2 without CA  FFS: NR-DC with FR1 PCell and FR2 PSCell  *Candidate options:*  *Recommendations for 2nd round: NR-DC cases can be FFS in the next meeting. No need further discussion in this meeting* |
| **Sub-topic#5-3** | **Test cases for DRX**  *Tentative agreements:* NO DRX case will be tested only for NR positioning measurement requirements in Rel16  *Candidate options:*  *Recommendations for 2nd round: No need further discussion* |
| **Sub-topic#5-4** | **General PRS configuration for NR Positioning test case**  *Tentative agreements: None.*  *Candidate options:*   * 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  |  |  |  |  | | --- | --- | --- | --- | |  | 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 |  * Option 2 (Intel)：The following PRS configuration combinations are proposed: * **Table 1: PRS configuration patterns for NR positioning measurement**   *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#5-5** | **SRS configuration for NR Positioning test case**  *Tentative agreements: None*  *Candidate options:*   * Option 1 (Intel): SRS configuration pattern 1 for timing accuracy test in [2] can be reused for NR positioning measurements.   *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#5-6** | **Number of cells/TRPs for NR Positioning test case**  *Tentative agreements:None.*  *Candidate options:*   * Option 1a. (Ericsson, Intel)   + *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 2 (Huawei): two TRPs in the test case   *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#5-7** | **Number of positioning frequency layers**  *Tentative agreements: None.*  *Candidate options:*   * Option 1. (Intel): The number of positioning frequency layers measured cannot be larger than 2. * Option 2 (Huawei): There are one PRS frequency layer   *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#5-8** | **Synchronous/Asynchronous cells**  *Tentative agreements: None*  *Candidate options:*   * Option 1. (Intel, Huawei): The synchronous cells will be tested for the measurement delay requirements test.   *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#5-9** | **Muting pattern**  *Tentative agreements: None*  *Candidate options:*  Option 1. (Intel, Huawei): only the non-muting PRS configuration will be used  *Recommendations for 2nd round: Can be FFS.* |
| **Sub-topic#5-10** | **Test cases list**  *Tentative agreements: None.*  *Candidate options:*  *According to GTW agreements of 5-2, the following test cases for SA can be:*   * 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   [*Moderator notes: for Option 1, is there any sub test cases which is defined by “test configurations”? If yes, the test cases list from these three options are similar]*   * Option 2. (Intel)  |  |  | | --- | --- | | TC-Config index | Test cases for SA without CA | | 1-1 | RSTD measurement reporting for FDD in FR1 | | 1-2 | RSTD measurement reporting for TDD in FR1 | | 1-3 | RSTD measurement reporting for TDD in FR2 | | 2-1 | UE Rx-Tx time difference measurement reporting for FDD in FR1 | | 2-2 | UE Rx-Tx time difference measurement reporting for TDD in FR1 | | 2-3 | UE Rx-Tx time difference measurement reporting for TDD in FR2 | | 3-1 | PRS RSRP measurement reporting for FDD in FR1 | | 3-2 | PRS RSRP measurement reporting for TDD in FR1 | | 3-3 | PRS RSRP measurement reporting for TDD in FR2 | | 4-1 | RSTD measurement accuracy for FDD in FR1 | | 4-2 | RSTD measurement accuracy for TDD in FR1 | | 4-3 | RSTD measurement accuracy for TDD in FR2 | | 5-1 | UE Rx-Tx time difference measurement accuracy for FDD in FR1 | | 5-2 | UE Rx-Tx time difference measurement accuracy for TDD in FR1 | | 5-3 | UE Rx-Tx time difference measurement accuracy for TDD in FR2 | | 6-1 | PRS RSRP measurement reporting for FDD in FR1 | | 6-2 | PRS RSRP measurement reporting for TDD in FR1 | | 6-3 | PRS RSRP measurement reporting for TDD in FR2 |  * Option 3( Ericsson)  |  |  | | --- | --- | | TC-Config index | Test cases for SA without CA | | 1-1 | RSTD measurement requirements in FR1 on the same frequency layer | | 1-2 | RSTD measurement requirements in FR1 on 2 different frequency layers | | 1-3 | RSTD measurement requirements in FR2 on the same frequency layer | | 1-4 | RSTD measurement requirements in FR2 on 2 different frequency layers | | 2-1 | PRS RSRP measurement requirements in FR1 on the same frequency layer | | 2-2 | PRS RSRP measurement requirements in FR1 on 2 different frequency layers | | 2-3 | PRS RSRP measurement requirements in FR2 on the same frequency layer | | 2-4 | PRS RSRP measurement requirements in FR2 on 2 different frequency layers | | 3-1 | UE Rx-Tx time difference measurement requirements in FR1 on the same frequency layer | | 3-2 | UE Rx-Tx time difference measurement requirements in FR1 on 2 different frequency layers | | 3-3 | UE Rx-Tx time difference measurement requirements in FR2 on the same frequency layer | | 3-4 | UE Rx-Tx time difference measurement requirements in FR2 on 2 different frequency layers | | 4-1 | RSTD measurement accuracy requirements in FR1 on the same frequency layer | | 4-2 | RSTD measurement accuracy requirements in FR1 on 2 different frequency layers | | 4-3 | RSTD measurement accuracy requirements in FR2 on the same frequency layer | | 4-4 | RSTD measurement accuracy requirements in FR2 on 2 different frequency layers | | 5-1 | PRS RSRP measurement accuracy requirements in FR1 on the same frequency layer | | 5-2 | PRS RSRP measurement accuracy requirements in FR1 on 2 different frequency layers | | 5-3 | PRS RSRP measurement accuracy requirements in FR2 on the same frequency layer | | 5-4 | PRS RSRP measurement accuracy requirements in FR2 on 2 different frequency layers | | 6-1 | UE Rx-Tx time difference accuracy measurement requirements in FR1 on the same frequency layer | | 6-2 | UE Rx-Tx time difference measurement accuracy requirements in FR1 on 2 different frequency layers | | 6-3 | UE Rx-Tx time difference measurement accuracy requirements in FR2 on the same frequency layer | | 6-4 | UE Rx-Tx time difference measurement accuracy requirements in FR2 on 2 different frequency layers |   *Recommendations for 2nd round:*  *In the 2nd round discussion, companies are also encouraged to provide their views on the following question to converge the test cases list.*  *Q1: whether are the different test cases necessary regarding to FR1/FR2?*   * *Yes(Intel, Huawei, Ericsson)* * *No ()*   *Q2: whether are the different test cases necessary regarding to TDD/FDD?*   * *Yes(Intel, Ericsson)* * *No (Huawei)*   *Q3: whether are the different test cases necessary regarding to different positioning frequency layers?*   * *Yes(Ericsson, Intel)* * *No ( Huawei,)*   *Q4: Shall the more detailed test configurations within a single test case (e.g. the table below in TS38.133) be defined?*  *“*Table A.6.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations   |  |  | | --- | --- | | Config | Description | | 1 | NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode | | 2 | NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode | | 3 | NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode | | Note: The UE is only required to be tested in one of the supported test configurations in each supported band | |   *“*   * *Yes()* * *No ( )* |
|  |  |

### CRs/TPs

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| [**R4-2014572**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014572.zip)  **(Intel)** | Return to  Revision needed |
| [**R4-2015370**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015370.zip)  **(CATT)** | Return to  Revision needed |
| [**R4-2015766**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015766.zip)  **(Huawei)** | Merged |

## Discussion on 2nd round

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

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Beside the parameters included in Option 1, other general PRS parameter can be included. (e.g. Slot offset). Can discuss CR [R4-2017156] directly. |
| Ericsson | Depends on the accuracy discussion, since we may test e.g. different BWs. We need more analysis until the next meeting for PRS configurations. |
| Qualcomm | Option 2 seems to be reasonable as a baseline. This can be further discussed in the next meeting. |
| Huawei | We are fine to further discuss in next meeting. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1 |
| Ericsson | FFS in this meeting |
| Qualcomm | Discuss in the next meeting. |
| Huawei | Not sure if SRS is needed for the TC |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1 for reasonable testing coverage. |
| Ericsson | Option 1 |
| R&S | Option 2  We strongly encourage max 2 NR cells for the test cases to keep an affordable system complexity, which is in fact sufficient for all other TCs. In the past, TCs with 3 LTE cells were mostly complex, didn’t bring much value and were thus finally not widely supported by the industry. |
| Qualcomm | 3 cells for RSTD. Two positioning frequency layers (PFL). PFL 1 would have reference cell + neighbor 1. PFL 2 would have neighbor 2.  2 cells for UE Rx-Tx. One PFL only and SRS in the same band as PRS.  Tests should be configured such that. PRS resources are orthogonal.  Tests should cover synchronous and asynchronous cells. |
| Huawei | Option 2.  What network is likely to do is to coordinate the PRS transmission e.g. with comb offset, symbol/slot offset and muting, the PRS resources from neighbour TRPs are orthogonal with each other. In this case, the measurement performance of different neighbour TRPs are no different, and modelling more than one neighbour TRP in the test is not necessary. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1 |
| Ericsson | Option 1 is Ok |
| Qualcomm | Option 1 |
| Huawei | OK with option 1, but we do not need to have 2 PRS layers in each test, also no need to duplicate the test just for different number of PRS layers. |

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

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1 |
| Ericsson | FFS in this meeting |
| Qualcomm | Tests should cover synchronous and asynchronous cells. |
| Huawei | Option 1, not sure if async case is needed since the PRS from different TRPs are orthogonal and the side condition need to be ensured, so there is no difference performance wise between sync and async. |

**Sub-topic#5-9 Muting pattern**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | Support Option 1 |
| Ericsson | FFS in this meeting |
| Qualcomm | FFS. Note that current measurement period requirement does not account for muting. |
| Huawei | Option 1, PRS from different TRPs can be made orthogonal without muting, so we see no need to have muting in the test. |

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

*Moderator notes: in order converge this issue clearly, companies are also encouraged to provide their views on the following question to converge the test cases list.*

*Q1: whether are the different test cases necessary regarding to FR1/FR2?*

* *Yes(Intel, Huawei, Ericsson)*
* *No ()*

*Q2: whether are the different test cases necessary regarding to TDD/FDD?*

* *Yes(Intel, Ericsson)*
* *No (Huawei)*

*Q3: whether are the different test cases necessary regarding to different positioning frequency layers?*

* *Yes(Ericsson, Intel)*
* *No ( Huawei,)*

*Q4: Shall the more detailed test configurations within a single test case (e.g. the table below in TS38.133) be defined?*

Table A.6.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode |
| 3 | NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations in each supported band | |

* *Yes()*
* *No ( )*

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Intel | *Q1: whether are the different test cases necessary regarding to FR1/FR2? - yes*  *Q2: whether are the different test cases necessary regarding to TDD/FDD? – Yes. But these tests for FDD/TDD can be defined by the different configurations in each test cases.*  *Q3: whether are the different test cases necessary regarding to different positioning frequency layers?*  *Yes. But in order to minimize the test cases number, part of configuatition in each test case can cover single layer others for >1 layers.*  *Q4: yes. It is better to achieve the consensus in this meeting.*  *Base on the understanding on test case list above, we can propose the test case lists for NR Pos are:*   |  |  |  |  | | --- | --- | --- | --- | | *Index* | *Test case* | *Tentative Clause* | *Test configurations* | | 1 | RSTD measurement requirements for FR1 in SA | *A6.6.x* | *FDD,* 2 positioning frequency layer | | *TDD, 1* positioning frequency layer | | 2 | RSTD measurement requirements for FR2 in SA | *A7.6.x* | *TDD, 1* positioning frequency layer | | 3 | PRS RSRP measurement requirements for FR1 in SA | *A6.6.xx* | *FDD,* 2 positioning frequency layer | | *TDD, 1* positioning frequency layer | | 4 | PRS RSRP measurement requirements for FR2 in SA | *A7.6.xx* | *TDD, 1* positioning frequency layer | | 5 | UE Rx-Tx time difference measurement requirements for FR1 in SA | *A6.6.xxx* | *FDD,* 2 positioning frequency layer | | *TDD, 1* positioning frequency layer | | 6 | UE Rx-Tx time difference measurement requirements for FR2 in SA | *A7.6.xxx* | *TDD, 1* positioning frequency layer | | 7 | RSTD measurement accuracy for FR1 in SA | *A6.6.x* | *FDD,* 2 positioning frequency layer | | *TDD, 1* positioning frequency layer | | 8 | RSTD measurement accuracy for in FR2 SA | *A7.6.x* | *TDD, 1* positioning frequency layer | | 9 | PRS RSRP measurement accuracy for FR1 in SA | *A6.6.xx* | *FDD,* 2 positioning frequency layer | | *TDD, 1* positioning frequency layer | | 10 | PRS RSRP measurement accuracy for FR2 in SA | *A7.6.xx* | *TDD, 1* positioning frequency layer | | 11 | UE Rx-Tx time difference measurement accuracy for FR1 in SA | *A6.6.xxx* | *FDD,* 2 positioning frequency layer | | *TDD, 1* positioning frequency layer | | 12 | UE Rx-Tx time difference measurement accuracy for FR2 in SA | *A7.6.xxx* | *TDD, 1* positioning frequency layer | |
| Ericsson | The list of test cases is being discussed directly in the work plan document.  Q2: the channel configuration is indeed duplex dependent  Q3: PRS measured on different frequency layers shall also be tested.  Q4: FFS in this meeting |
| Qualcomm | Yes to Q1, Q2 and Q3.  Q4 FFS |
| Huawei | *Q1: whether are the different test cases necessary regarding to FR1/FR2?*  *yes*  *Q2: whether are the different test cases necessary regarding to TDD/FDD?*  *Same comment as Intel. FDD and TDD can be tested in the same TC as in existing RRM TCs*  *Q3: whether are the different test cases necessary regarding to different positioning frequency layers?*  *Yes, but no need to duplicate the test just for different number of PRS layers*  *Q4: Shall the more detailed test configurations within a single test case (e.g. the table below in TS38.133) be defined?*  *This can be FSS for next meeting* |

## Summary on 2nd round

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

# Topic #6: Others

## Companies’ contributions summary

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

## Open issues summary

## Companies views’ collection for 1st round

### Open issues

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

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2016401**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016401.zip) (Ericsson) | Huawei: OK |
| Intel: can be agreed. |
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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** |
| [**R4-2016401**](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016401.zip) | Approved |

## Discussion on 2nd round

# Recommendation for Tdocs

After first round:

|  |  |  |  |
| --- | --- | --- | --- |
| Tdoc No. | Source company | Recommendation | Remarks |
| **CR on spec orgnai requirements** | | | |
| [R4-2016400](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016400.zip) | Ericsson | Revised to **R4-2017152** |  |
| **CR on RSTD accuracy requirements** | | | |
| [R4-2014450](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014450.zip) | CATT | Merged |  |
| [R4-2015760](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015760.zip) | Huawei | Revised to **R4-2017153** |  |
| R4-2016405 | Ericsson | Merged | The part of RSTD requirements can be merged with [R4-2015760](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015760.zip), others with [R4-2015370](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015370.zip) |
| **CR on PRS-RSRP accuracy requirements** | | | |
| [R4-2014451](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014451.zip) | CATT | Revised to **R4-2017154** |  |
| [R4-2015762](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015762.zip) | Huawei | Merged |  |
| R4-2016403 | Ericsson | Merged |  |
|  |  |  |  |
| **CR on UE Rx-Tx accuracy requirements** | | | |
| [R4-2015764](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015764.zip) | Huawei, HiSilicon | Merged |  |
| [R4-2014452](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014452.zip) | CATT | Merged |  |
| [R4-2016407](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016407.zip) | Ericsson | Revised to **R4-2017155** |  |
| **CR on TC** | | | |
| [R4-2014572](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2014572.zip) | Intel | Revised to **R4-2017156** |  |
| [R4-2015370](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015370.zip) | CATT | Revised to **R4-2017157** | Please co-work with Ericsson to include the CR R4-2016405 |
| [R4-2015766](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015766.zip) | Huawei | Merged |  |
| Others | | | |
| [R4-2016401](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2016401.zip) | Ericsson | Approved |  |
| [R4-2015567](file:///C:\Users\rhuang5\Documents\my_work\LTE_A\RAN4\97e\Docs\R4-2015567.zip) | Intel | Revised to **R4-2017158** | Work plan and CR splitting assignments |
| NewTdoc | | | |
| XXXX | Intel | Return to | Title: WF on UE PRS performance requirements  To capture technical agreements and remaining open issues |