**3GPP TSG-RAN WG4 Meeting # 98-e R4-21XXXX**

**Electronic Meeting, 25 Jan. – 5 Feb., 2021**

**Agenda item:** 7.14.1, 7.14.2.1

**Source:** Moderator (CATT)

**Title:** Email discussion summary for [98e][221] NR\_CSIRS\_L3meas\_RRM\_1

**Document for:** Information

# Introduction

The documents in agenda items 7.14.1 & 7.14.2.1 contain the following 2 main topics:

* Topic #1: CSI-RS RRM core requirements maintenance
* Topic #2: CSI-RS RRM performance requirements.
  + Topic #2.1 CSI-RSRP requirements
  + Topic #2.2 CSI-RSRQ requirements
  + Topic #2.3 CSI-SINR requirements

*Moderator’s note:*

*Proposal 4, 5 in R4-2101203 which are related to test cases are included in [98e][222] NR\_CSIRS\_L3meas\_RRM\_2.*

*Proposal 3, 4 in R4-2101532 which are related to test cases are included in [98e][222] NR\_CSIRS\_L3meas\_RRM\_2.*

# Topic #1: CSI-RS RRM core requirements maintenance

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100243 | Apple | **Proposal 1: Define the starting point of the 5ms window as the slot boundary of the first configured L3 CSI-RS resource is located.**  **Proposal 2: The *refFreqCSI-RS* shall be configured as the lower boundary of CRB #0 for the L3 CSI-RS MO.** |
| R4-2100421 | CATT | **Observation 1: Case 2 (different resources fall in different windows) can occur when the resource offsets of CSI-RS in one layer are different.**  **Proposal 1: When UE performs CSI-RS intra-frequency measurements in a TDD band, UE is not expected to transmit on data OFDM symbols overlapped by CSI-RS resource symbols to be measured, and 1 OFDM symbols before and after each consecutive CSI-RS symbols, where the serving cell is taken as the symbol level timing reference.**  **Proposal 2: For intra-band carrier aggregation, the scheduling restriction due to a given serving cell should also apply to all other serving cells in the same band. For inter-band carrier aggregation, there are no scheduling restrictions on the serving cells in the bands due to CSI-RS based measurement in different bands.**  **Proposal 3: Only case 1 (all CSI-RS resources are confined in the same window duration) is included in Rel-16.** |
| R4-2100422 | CATT | **CR on CSI-RS based L3 measurement** |
| R4-2100716 | Xiaomi | **Proposal 1: When UE performs CSI-RS intra-frequency measurements in a TDD band, UE is not expected to transmit on data OFDM symbols overlapped by CSI-RS resource symbols to be measured, and 1 OFDM symbols before and after each consecutive CSI-RS symbols, where the serving cell is taken as the symbol level timing reference.**  **Proposal 2: All CSI-RS resources in the same MO have the same periodicity and offset.**  **Proposal 3: The measurement gap length should greater than not only the SMTC duration for SSB based measurement but also the length of CSI-RS resources.**  **Proposal 4: the measurement gap sharing scheme defined in section 9.1.2 can be applied when UE requires measurement gaps to identify and measure on SSB based frequency layers and on CSI-RS based frequency layers.** |
| R4-2100718 | Xiaomi | **CR on core requirement for CSI-RS L3 measurement** |
| R4-2101150 | MTK | **Maintenance CR for CSI-RS based L3 measurement requirements R16** |
| R4-2101185 | Qualcomm CDMA Technologies | **Propose1: When the UE performs intra-frequency CSI-RS L3 measurements in a TDD band, the following restrictions apply**  **- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive CSI-RS symbol to be measured and 1 data symbol after each consecutive CSI-RS symbol to be measured within the CSI-RS measurement window duration.**  **Observation1: Option2 leads to multiple CSI-RS measurement windows due to “different periodicities and/or offset”.**  **Proposal2: RAN4 to discuss and agree whether it is expected to have multiple window periodicities that lead to multiple configured windows per MO.** |
| R4-2101393 | Nokia, Nokia Shanghai Bell | **Proposal1: Introduce a scheduling restriction when UE performs CSI-RS intra-frequency measurements in a TDD band:**   * **When UE performs CSI-RS intra-frequency measurements in a TDD band, UE is not expected to transmit PUCCH/PUSCH/SRS on CSI-RS resource symbols to be measured, and on 1 OFDM symbol before and after each consecutive CSI-RS symbols to be measured.**   **Proposal2: Do not further restrict the time domain configuration for CSI-RS resources i.e. Option 2 is preferred.** |
| R4-2101394 | Nokia, Nokia Shanghai Bell | **38.133 CR on the CSI-RS based measurement requirements** |
| R4-2101413 | Intel Corporation | **Proposal 1: all CSI-RS resources in the same MO have the same periodicity.**  **Observation 1: the timing offset between the reference measurement timing and the target CSI-RS in one layer is equal to 1 CP, 0.8dB performance degradation is observed.**  **Observation 2: the timing offset between the reference measurement timing and the target CSI-RS in one layer is equal to 2 CP, 1.5dB performance degradation is observed.**  **Observation 3: the timing offset between the reference measurement timing and the target CSI-RS in one layer is equal to 3us, 3dB performance degradation for SCS=120KHz is observed.**  **Proposal 2: Define CSI-RS accuracy performance requirement based on 2CP timing offset, if the timing offset is larger than 2CP, 1.5dB performance degradation is expected.**  **Proposal 3: Define 5 samples for CSI-RSRP measurement accuracy requirements.** |
| R4-2101767 | vivo | ***Proposal 1: When UE performs CSI-RS intra-frequency measurements in a TDD band, UE is not expected to transmit on data OFDM symbols overlapped by CSI-RS resource symbols to be measured, where the serving cell is taken as the symbol level timing reference.***  ***Proposal 2: Scheduling restriction only apply if intra-frequency CSI-RS measurement requirements apply according to the applicability rules defined 9.10.1 and 9.10.2.2.***  ***Proposal 3: Measurements requirements apply when all CSI-RS resources in the same MO are configured with the same periodicity.***  ***Proposal 4: No restriction on offset for CSI-RS resources in one MO as long as all the CSI-RS resources are contained in 5ms window.*** |
| R4-2101837 | Huawei, HiSilicon | **Proposal 1: as there are some possible understanding of uplink scheduling restriction, there are two options of defining uplink scheduling restrictions in TDD band in FR1:**  **- Option 1: If we regard the guard period before UL symbols as the scheduling restriction, the uplink scheduling restriction is: CSI-RS resource symbols to be measured, and 1 OFDM symbol (for 15kHz/30kHz SCS) or 2 OFDM symbols (for 60kHz) before CSI-RS resource symbols to be measured,** **and 1 OFDM symbol after CSI-RS resource symbols to be measured.**  **- Option 2: without considering GP, the uplink scheduling restriction is: CSI-RS resource symbols to be measured, and 1 OFDM symbol before and after CSI-RS resource symbols to be measured.**  **Proposal2: Support CSI-RS resources in the same MO with different offsets, i.e. different CSI-RS resources may fall in different 5ms window occasions.** |
| R4-2101838 | Huawei, HiSilicon | **CR on UL scheduling restriction for CSI-RS intra-frequency measurements** |
| R4-2101840 | Huawei, HiSilicon | **Correction on CSSFoutsidegap for CSI-RS measurement** |
| R4-2101842 | Huawei, HiSilicon | **CR on CSI-RS measurement window and intra-frequency measurements** |

## Open issues summary

### Sub-topic 1-1 Time domain restriction for CSI-RS resources

*Background:*

*In RAN4#96-e, it is agreed [WF R4-2012178] that*

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| * *Introduce the same time domain restriction for intra-frequency measurement and inter-frequency measurement in Rel-16.*    + *Do not associate CSI-RS location with SMTC*   + *CSI-RS resources per frequency layers are configured within 5 ms window at any location*   + *CSI-RS periodicities for L3 measurement: 10, 20, 40 ms*   + *Up to 1 CSI-RS periodicity can be configured per CSI-RS intra-frequency layer*   + *Up to 1 CSI-RS periodicity can be configured per CSI-RS inter-frequency layer*   + *The exact relative location between CSI-RS and SMTC can be decided by NW to make sure a single MG pattern can cover both CSI-RS and SMTC for inter-frequency layer.*   + *Note: the restrictions above are the conditions to apply the requirements for both Core and Performance part* |

*In moderator’s understanding, the agreements in RAN4#96e meeting have indicated that all the CSI-RS resources in the same MO have the same periodicity since only one MO corresponding to one frequency layer is considered in R16. So in issue 1-1-1, whether the CSI-RS resources offset in the same MO can be different needs to be discussed only.*

**Issue 1-1-1: Whether the CSI-RS resources in the same MO can have different offset?**

* Proposals
  + Option 1a: (CATT, vivo)
    - Yes, but all CSI-RS resources in the same MO are configured in the same 5ms window.
  + Option 1b: (Nokia, Huawei)
    - Yes, and different CSI-RS resources may fall in different 5ms window.
  + Option 2: (Xiaomi)
    - No, all CSI-RS resources in the same MO have the same periodicity and offset.
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-1-1: Whether the CSI-RS resources in the same MO can have different offset?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 1-1-2: How to define the starting point of 5ms time window?**

* Proposals
  + Option 1: (Apple)
    - Define the starting point of the 5ms window as the slot boundary of the first configured L3 CSI-RS resource is located
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-1-2: How to define the starting point of 5ms time window?** | |
| **Company** | **Comments** |
| XXX |  |
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### Sub-topic 1-2 Frequency offset for CSI-RS resource

**Issue 1-2-1: How to define the frequency offset for CSI-RS resource?**

* Proposals
  + Option 1: (Apple)
    - The *refFreqCSI-RS* shall be configured as the lower boundary of CRB #0 for the L3 CSI-RS MO
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-2-1: How to define the frequency offset for CSI-RS resource?** | |
| **Company** | **Comments** |
| XXX |  |
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### Sub-topic 1-3 Scheduling restriction for TDD band

**Issue 1-3-1: How to define the intra-frequency measurement scheduling restriction for TDD band?**

* Proposals
  + Option 1: (CATT, Xiaomi, Qualcomm, Huawei)
    - When UE performs CSI-RS intra-frequency measurements in a TDD band, UE is not expected to transmit on data OFDM symbols overlapped by CSI-RS resource symbols to be measured, and 1 OFDM symbols before and after each consecutive CSI-RS symbols, where the serving cell is taken as the symbol level timing reference.
  + Option 2: (Nokia)
    - When UE performs CSI-RS intra-frequency measurements in a TDD band, UE is not expected to transmit PUCCH/PUSCH/SRS on CSI-RS resource symbols to be measured, and on 1 OFDM symbol before and after each consecutive CSI-RS symbols to be measured.
  + Option 3: (vivo)
    - When UE performs CSI-RS intra-frequency measurements in a TDD band, UE is not expected to transmit on data OFDM symbols overlapped by CSI-RS resource symbols to be measured, where the serving cell is taken as the symbol level timing reference.
  + Option 4: (Huawei)
    - If we regard the guard period before UL symbols as the scheduling restriction, the uplink scheduling restriction is: CSI-RS resource symbols to be measured, and 1 OFDM symbol (for 15kHz/30kHz SCS) or 2 OFDM symbols (for 60kHz) before CSI-RS resource symbols to be measured, and 1 OFDM symbol after CSI-RS resource symbols to be measured.
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-3-1: How to define the intra-frequency measurement scheduling restriction for TDD band?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 1-3-2: The scheduling restriction for intra-band and inter-band CA?**

* Proposals
  + Option 1: (CATT)
    - For intra-band carrier aggregation, the scheduling restriction due to a given serving cell should also apply to all other serving cells in the same band. For inter-band carrier aggregation, there are no scheduling restrictions on the serving cells in the bands due to CSI-RS based measurement in different bands.
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-3-2: The scheduling restriction for intra-band and inter-band CA?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 1-3-3: Applicability of scheduling restricitons?**

* Proposals
  + Option 1: (vivo)
    - Scheduling restriction only apply if intra-frequency CSI-RS measurement requirements apply according to the applicability rules defined 9.10.1 and 9.10.2.2.
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-3-3: Applicability of scheduling restricitons?** | |
| **Company** | **Comments** |
| XXX |  |
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### Sub-topic 1-4 Gap configuration and sharing for SSB and CSI-RS based measurement

**Issue 1-4-1: MG configuration for SSB based and CSI-RS based measurement?**

* Proposals
  + Option 1: (Xiaomi)
    - The measurement gap length should greater than not only the SMTC duration for SSB based measurement but also the length of CSI-RS resources.
      * When UE is configured with measurement object including CSI-RS measurement and the UE requires measurement gaps for performing such measurements, only 6ms and 5.5ms of measurement gap length can be configured.
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-4-1: MG configuration for SSB based and CSI-RS based measurement?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 1-4-2: MG sharing mechanism between SSB based and CSI-RS based measurement?**

* Proposals
  + Option 1: (Xiaomi)
    - The measurement gap sharing scheme defined in section 9.1.2 can be applied when UE requires measurement gaps to identify and measure on SSB based frequency layers and on CSI-RS based frequency layers.
* Recommended WF
  + *Need more discussion.*

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| **Issue 1-4-2: MG sharing mechanism between SSB based and CSI-RS based measurement?** | |
| **Company** | **Comments** |
| XXX |  |
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## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

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| --- | --- | --- |
| **CR/TP number** | **Title** | **Comments collection** |
| R4-2100422 (CATT) | CR on CSI-RS based L3 measurement | Company A |
| Company B |
|  |
| R4-2100718 (Xiaomi) | CR on core requirement for CSI-RS L3 measurement | Company A |
| Company B |
|  |
| R4-2101150 (MTK) | Maintenance CR for CSI-RS based L3 measurement requirements R16 |  |
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| R4-2101394 (Nokia) | 38.133 CR on the CSI-RS based measurement requirements |  |
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| R4-2101838 (Huawei) | CR on CSI-RS based intra-frequency scheduling restriction |  |
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| R4-2101840 (Huawei) | Correction on CSSFoutsidegap |  |
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| R4-2101842 (Huawei) | CR on CSI-RS measurement window and intra-frequency measurements |  |
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## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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

*Recommendations on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: CSI-RS RRM performance requirements

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-20xxxxx | Company A | Proposal 1:  Observation 1: |
| R4-2100423 | CATT | **Observation 1: When the sample number is 5, the absolute measurement error can be within ±1.5dB for the Es/Iot = -5.97dB and within ±1dB for Es/Iot = -3.97dB in FR1.**  **Observation 2: When the sample number is 5, the absolute measurement error can be within ±2.5dB for the Es/Iot = -5.97dB and within ±2dB for Es/Iot = -3.97dB in FR2.**  **Observation 3: When the sample number is 5, the relative measurement error can be within ±1.5dB for the Es/Iot = -5.97dB and within ±1dB for Es/Iot = -3.97dB in FR1.**  **Observation 4: When the sample number is 5, the relative measurement error can be within ±2dB for the Es/Iot = -5.97dB and within ±1.5dB for Es/Iot = -3.97dB in FR2.** |
| R4-2100424 | CATT | **Observation 1: When the sample number is 5, the absolute measurement error can be within ±1.5dB for the Es/Iot = -5.97dB and within ±1dB for Es/Iot = -3.97dB in FR1.**  **Observation 2: When the sample number is 5, the absolute measurement error can be within ±2.5dB for the Es/Iot = -5.97dB and within ±2dB for Es/Iot = -3.97dB in FR2.**  For relative accuracy:  **Observation 3: When the sample number is 5, the relative measurement error can be within ±1.5dB for the Es/Iot = -5.97dB and within ±1dB for Es/Iot = -3.97dB in FR1.**  **Observation 4: When the sample number is 5, the relative measurement error can be within ±2dB for the Es/Iot = -5.97dB and within ±1.5dB for Es/Iot = -3.97dB in FR2.** |
| R4-2100425 | CATT | **Observation 1: When the sample number is 5, the absolute measurement error can be within ±1.5dB for the Es/Iot = -5.97dB and Es/Iot = -3.97dB in FR1.**  **Observation 2: When the sample number is 5, the absolute measurement error can be within ±2.5dB for the Es/Iot = -5.97dB and within ±2dB for Es/Iot = -3.97dB in FR2.**  **Observation 3: When the sample number is 5, the relative measurement error can be within ±1.5dB for the Es/Iot = -5.97dB and within ±1dB for Es/Iot = -3.97dB in FR1.**  **Observation 4: When the sample number is 5, the relative measurement error can be within ±2dB for the Es/Iot = -5.97dB and within ±1.5dB for Es/Iot = -3.97dB in FR2.**  **Observation 5：When the Es/Iot of CSI-RS resources reach to a certain value, the accuracy of CSI-SINR measurement will degrade as the value of Es/Iot increase.**  **Observation 6：The CSI-SINR measurement error indicated by delta SINR will reach to almost 3dB when the Es/Iot = 10dB.** |
| R4-2100426 | CATT | **Proposal 1: For the case 1 (the timing offset between the reference measurement timing and the target CSI-RS in one layer is smaller or equal to CP), reuse the accuracy requirements of SS-RSRP measurement.**  **Proposal 2: Do not define CSI-RS based measurement requirements for case 2 in R16.** |
| R4-2100428 | CATT | **Proposal 1: For the case 1 (the timing offset between the reference measurement timing and the target CSI-RS in one layer is smaller or equal to CP), reuse the accuracy requirements of SS-SINR measurement.**  **Proposal 2: Do not define CSI-RS based measurement requirements for case 2 in R16.**  **Proposal 3: The upper limit of Es/Iot for CSI-SINR measurement is defined as 10dB for case 1.** |
| R4-2100429 | CATT | **CR on performance requirement for CSI-RSRP** |
| R4-2100430 | CATT | **CR on performance requirement for CSI-RSRQ** |
| R4-2100431 | CATT | **CR on performance requirement for CSI-SINR** |
| R4-2100717 | Xiaomi | **Proposal 1: When the timing offset between the reference measurement timing and the target CSI-RS in one layer is smaller or equal to CP, the accuracy requirement defined for SSB L3 measurement can be reused for CSI-RS L3 measurement.**  **Proposal 2: The CSI-RS L3 accuracy requirement are defined with 5 measurement samples.**  **Proposal 3: When the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than CP length but smaller or equal to 2\*CP length, additional 1dB in FR1 and 2dB in FR2 relaxed accuracy requirement is considered on the basis of the CSI-RS L3 accuracy requirement defined for case 1.**  **Proposal 4: If the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than 2\*CP length, no CSI-RS L3 accuracy requirement is defined.**  **Proposal 5: Introduce the feedback signaling of timing offset information to inform the gNB whether the timing offset is larger than the CP length or not.** |
| R4-2100719 | Xiaomi | **CR on CSI-RSRP performance requirement for CSI-RS L3 measurement** |
| R4-2100720 | Xiaomi | **CR on CSI-RSRQ performance requirement for CSI-RS L3 measurement** |
| R4-2100721 | Xiaomi | **CR on CSI-SINR performance requirement for CSI-RS L3 measurement** |
| R4-2100861 | CMCC | ***Proposal 1: it is proposed to specify two sets of L3 CSI-RSRP/CSI-RSRQ/CSI-SINR measurement accuracy requirements:***  ***• Specify one set of requirements for the case that timing offset <= CP***  ***• Specify another set of requirements for CP < timing offset <= Y, Y could be 2\*CP or other value***  ***Proposal 2: To move forward, we are OK to define CSI-RSRP/CSI-RSRQ/CSI-SINR measurement accuracy requirements with 5 samples.***  ***Proposal 3: To move forward, we are also fine to reuse the accuracy requirements of SS-RSRP/ SS-RSRQ/ SS-SINR for the case of CSI-RS measurement with timing offset within CP.*** |
| R4-2100862 | CMCC | **Simulation results of CSI-RSRP** |
| R4-2100863 | CMCC | **Simulation results of CSI-RSRQ** |
| R4-2100864 | CMCC | **Simulation results of CSI-SINR** |
| R4-2100865 | CMCC | ***Proposal 1: for the case that timing offset is within CP, the upper limit of Ês/Iot to apply the CSI-SINR requirements is proposed to reuse the upper bound of SS-SINR, which is 25dB.***  ***Proposal 2: for the case that timing offset is larger than CP, the upper limit of Ês/Iot to apply the relaxed requirements can be further discussed.*** |
| R4-2101152 | MediaTek Inc. | **Proposal 1: Specify CSI-RSRP accuracy requirement with the absolute timing offset between UE’s FFT window and the target CSI-RS no larger than 0.9\*CP.**  **Proposal 2: Do not specify CSI-RSRP accuracy requirements for other timing offset values.**  Proposal 3: The absolute CSI-RSRP accuracy requirements with the absolute timing offset between UE’s FFT window and the target CSI-RS no larger than 0.9\*CP are the same as SSB, i.e.,   * FR1 intra-frequency: ±4.5dB @ Es/Iot≥-6dB * FR2 intra-frequency: ±6dB @ Es/Iot≥-6dB * FR1 inter-frequency: ±4.5dB @ Es/Iot≥-6dB * FR2 inter-frequency: ±6dB @ Es/Iot≥-4dB   Proposal 4: The relative CSI-RSRP accuracy requirements with the absolute timing offset between UE’s FFT window and the target CSI-RS no larger than 0.9\*CP are the same as SSB, i.e.,   * FR1 intra-frequency: ±3dB @ Es/Iot≥-6dB * FR2 intra-frequency: ±6dB @ Es/Iot≥-6dB * FR1 inter-frequency: ±4.5dB @ Es/Iot≥-6dB * FR2 inter-frequency: ±6dB @ Es/Iot≥-4dB |
| R4-2101153 | MediaTek Inc. | **Proposal 1: Specify CSI-SINR accuracy requirement based on one of the following 2 options**   * **Option 1: 0 ≤ TΔ ≤CP/2 with Es/Iot ≤ 25dB** * **Option 2: |TΔ |≤CP/2 with Es/Iot ≤ X dB, where X is within the range of 0 to 10dB**   Proposal 2: Do not specify a 2nd CSI-RSRP accuracy requirement for other timing offset values.  Proposal 3: The absolute CSI-SINR accuracy requirements with the timing offset between UE’s FFT window and the target CSI-RS within [TBD] are the same as SSB, i.e.,   * FR1 intra-frequency: ±3.5dB @ Es/Iot≥-6dB * FR2 intra-frequency: ±3.5dB @ Es/Iot≥-6dB * FR1 inter-frequency: ±3.5dB @ Es/Iot≥-6dB * FR2 inter-frequency: ±3.5dB @ Es/Iot≥-4dB   Proposal 4: The relative CSI-SINR accuracy requirements with the timing offset between UE’s FFT window and the target CSI-RS within [TBD] are the same as SSB, i.e.,   * FR1 inter-frequency: ±4dB @ Es/Iot≥-6dB * FR2 inter-frequency: ±4dB @ Es/Iot≥-6dB |
| R4- 2101203 | Qualcomm CDMA Technologies | Observation1: if the timing offset is within a [CP], baseband accuracy of CSI-RSRP can be chosen to be within +/-2.0dB assuming 5 sample average for both FR1 and FR2. For FR2 with cell timing offset up to 3us, the RSRP baseband accuracy is up to +/-4.0dB.  **Proposal1: Reuse the accuracy requirements of SS-RSRP for CSI-RSRP assuming 5-sample average for smaller cell timing offset within a CP, i.e. +/-4.5dB for FR1 and +/-6.0dB for FR2 combining both baseband and RF margins.**  **Proposal1.1: RAN4 to discuss if the FR2 RSRP accuracy requirement shall be relaxed to +/-8.0dB for 3us cell timing offset.**  **Proposal1.2: It is up to NW implementation for determining the validity of CSI-RSRP or pruning the CSI-RSRP reports with less confidence.**  Observation2: For FR1, if the cell timing error is within a CP, baseband SNR accuracy is shown to be +/-2.5dB assuming 5 sample averaging. For FR2, simulations show +/-1.5dB for cell timing error within a CP and +/-4dB for the timing error up to 3us.  **Proposal2: assuming 1dB implementation margin, the FR1 and FR2 CSI-SINR accuracy can be +/-3.5dB for cell timing offset within a CP.**  **Proposal2.1: RAN4 to discuss if FR2 CSI-SINR accuracy requirement can be relaxed to +/-5.0dB for larger cell timing offset at 3us.**  **Proposal3: CSI-RSRQ accuracy is +/-3.5dB for both FR1 and FR2 at -6dB Es/Iot assuming 5-sample average for smaller timing offset within [CP].**  **Proposal4: new test cases for CSI-RS based L3 measurement performance requirements shall NOT be defined for FR1, FDD, intra-frequency measurements.**  **Proposal5: new test cases for CSI-RS based L3 measurement performance requirements shall NOT be defined for FR2 intra-frequency measurements with larger cell timing offset beyond [CP] unless the performance requirements can be relaxed correspondingly.** |
| R4-2101395 | Nokia, Nokia Shanghai Bell | **Observation#1: The CSI-RS based measurement with large timing difference does not provide qualified measurement results.**  **Proposal1: In Rel16, the UE is not required to measure the CSI-RS resource if the timing difference exceeds a threshold.**  **Proposal2: The CSI-RS based measurement performance shall be defined when the timing offset is within one or twice of the CP length.**  **Proposal3: The accuracy performance is defined according to either of the following options:**   * **Option1: Adopt the same number of samples as SSB-based measurement i.e. 5 samples, and define a better accuracy performance based on the simulation results.** * **Option2: Adopt a smaller number of samples i.e. 3 samples, and define the accuracy performance comparable with the performance of SSB-based measurement.** |
| R4-2101396 | Nokia, Nokia Shanghai Bell | **38.133 draftCR on the CSI-RSRP accuracy requirements** |
| R4-2101397 | Nokia, Nokia Shanghai Bell | **Simulation results of CSI-RSRP** |
| R4-2101413 | Intel Corporation | **Proposal 1: all CSI-RS resources in the same MO have the same periodicity.**  **Observation 1: the timing offset between the reference measurement timing and the target CSI-RS in one layer is equal to 1 CP, 0.8dB performance degradation is observed.**  **Observation 2: the timing offset between the reference measurement timing and the target CSI-RS in one layer is equal to 2 CP, 1.5dB performance degradation is observed.**  **Observation 3: the timing offset between the reference measurement timing and the target CSI-RS in one layer is equal to 3us, 3dB performance degradation for SCS=120KHz is observed.**  **Proposal 2: Define CSI-RS accuracy performance requirement based on 2CP timing offset, if the timing offset is larger than 2CP, 1.5dB performance degradation is expected.**  **Proposal 3: Define 5 samples for CSI-RSRP measurement accuracy requirements.** |
| R4-2101532 | OPPO | **Proposal 1: Two options are recommended for accuracy requirements for FR1 and FR2:**   * Option 1: Define 1 set of relaxed accuracy requirements with the timing offset smaller or equal to 3us   + E.g., relax the requirement of CSI-RSRP accuracy by ~1.0dB for FR1 and ~3.0dB for FR2 compared to SSB-RSRP’s. * Option 2: Define 2 sets of accuracy requirements with 2 timing offset limit, * Case 1: Reuse the accuracy requirements with timing offset smaller or equal to CP * Case 2: Relax the requirement of CSI-RSRP with timing offset from Cp to 2\*CP   + E.g., relax the requirement of CSI-RSRP accuracy by ~1.0dB for FR1 and ~3.0dB for FR2 compared to SSB-RSRP’s.   **Proposal 2: The principle of defining CSI-RSRP accuracy requirements shall apply for measurement accuracy requirements for CSI-RSRQ and CSI-SINR.**  **Proposal 3: One test configuration is recommended for each test case even if 2 sets of accuracy requirements were defined.**  **Proposal 4: RAN4 test configurations shall exclude FDD duplex mode at least for intra-frequency measurement test cases.** |
| R4-2101768 | vivo | **Simulation results of CSI-RSRP** |
| R4-2101769 | vivo | **Proposal 1: Defining one set of accuracy requirements for CSI-RSRP measurement.**  **Proposal 2: The accuracy requirements of CSI-RSRP measurement is to reuse SS-RSRP measurement accuracy requirements in both FR1 and FR2.**  **Proposal 3: The timing offset between between the reference measurement timing and the target CSI-RS in one layer, within which CSI-RSRP accuracy requirements apply, is smaller or equal to CP.**  **Proposal 4: Number of samples for defining CSI-RSRP measurement accuracy requirements is 5.**  **Proposal 5: RAN4 to further discuss whether UE is required/necessary to report the CSI-RSRP measurement results when actual timing offset is beyond the timing offset threshold CP.** |
| R4-2101770 | vivo | **Simulation results of CSI-RSRQ** |
| R4-2101771 | vivo | **Proposal 1: Defining one set of accuracy requirements for CSI-RSRQ measurement.**  **Proposal 2: The accuracy requirements of CSI-RSRQ measurement are to reuse SS-RSRQ measurement accuracy requirements in both FR1 and FR2.**  **Proposal 3: The timing offset between between the reference measurement timing and the target CSI-RS in one layer, within which CSI-RSRQ accraucy requirements shall apply, is smaller or equal to CP.**  **Proposal 4: Number of samples for defining CSI-RSRQ measurement accuracy requirements is 5.**  **Proposal 5: RAN4 to further discuss whether UE is required/necessary to report the CSI-RSRQ measurement results when actual timing offset is beyond the timing offset threshold CP.** |
| R4-2101772 | vivo | **Simulation results of CSI-SINR** |
| R4-2101773 | vivo | **Proposal 1: Defining one set of accuracy requirements for CSI-SINR measurement.**  **Proposal 2: The accuracy requirements of CSI-SINR measurement requirements are to reuse SS-SINR measurement accuracy requirement in both FR1 and FR2.**  **Proposal 3: The timing offset between between the reference measurement timing and the target CSI-RS in one layer, within which CSI-SINR accraucy requirements apply, is smaller or equal to CP.**  **Proposal 4: Number of samples for defining CSI-SINR measurement accuracy requirements is 5.**  **Proposal 5: RAN4 to further discuss whether UE is required/necessary to report the CSI-SINR measurement results when actual timing offset is beyond the timing offset threshold CP.**  **Proposal 6: The upper limit of Ês/Iot for CSI-SINR accuracy can be set as 25dB.** |
| R4-2102799 | Huawei, HiSilicon | **Proposal 1: Update the threshold in Case 1 from CP to CP/2, and re-use the SS-RSRP accuracy.**  **Proposal 2: Define requirements for Case 2 with timing error between CP/2 and 1.5\*CP.**  **Proposal 3: No need for NW to know whether the timing offset is <= CP (or other threshold) for a CSI-RS resource.**  **Proposal 4: Use 5 samples as assumption for defining CSI-RSRP measurement accuracy requirements.** |
| R4-2102800 | Huawei, HiSilicon | **Proposal 1: define two sets of accuracy requirements for CSI-SINR:**   * **Case 1: timing error is <= CP/2, and the upper limit of Es/Iot condition is 25dB (same as SS-SINR), and the accuracy is [7.5]dB** * **Case 2: timing error is <= 1.5\*CP, and the upper limit of Es/Iot condition is 12dB, and the accuracy is also [7.5]dB** |
| R4-2102801 | Huawei, HiSilicon | **draftCR on CSI-SINR accuracy requirements** |

## Open issues summary

### Sub-topic 2-1 CSI-RSRP measurement accuracy requirements

*Bachground:*

*In RAN4#97e meeting, it was agreed [WF R4-2017367] that:*

|  |
| --- |
| *Specify the following L3 CSI-RSRP measurement accuracy requirements*   * *Case 1: the timing offset between the reference measurement timing and the target CSI-RS in one layer is smaller or equal to [CP]*   + *FFS: Reuse the accuracy requirements of SS-RSRP*   + *FFS on whether gNB needs to know that the timing offset is smaller or equal to CP and how to provide such information if needed* * *FFS: Case 2: the timing offset between the reference measurement timing and the target CSI-RS in one layer is larger than [CP]* * *Reference measurement timing for one layer is the*    + *Intra-frequency case: Serving cell timing*   + *Inter-frequency case: Up to UE implementation and shall be based on the timing of one of the target cells*     - *Note: UE may use a single or multiple reference measurement timings for different measurements on different symbols* |

**Issue 2-1-1: The upper bound of timing offset for case 1?**

* Proposals
  + Option 1: (CATT, Xiaomi, CMCC, Nokia, OPPO, vivo)
    - CP.
  + Option 2: (MTK)
    - 0.9\*CP.
  + Option 3: (Nokia, Intel)
    - 2\*CP.
  + Option 4: (Huawei)
    - CP/2.
* Recommended WF
  + *Option 1 is recommended as majority view.*

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| --- | --- |
| **Issue 2-1-1: The upper bound of timing offset for case 1?** | |
| **Company** | **Comments** |
| XXX |  |
|  |  |

**Issue 2-1-2: The CSI-RSRP measurement accuracy requirements for case 1?**

* Proposals
  + Option 1: (CATT, Xiaomi, CMCC, MTK, Qualcomm, OPPO, vivo, Huawei)
    - Reuse the accuracy requirements of SS-RSRP measurement.
  + Option 2: (Intel)
    - 1.5dB performance degradation than SS-RSRP measurement.
  + Option 3: (Nokia)
    - A better accuracy than SS-RSRP measurement if using 5 samples.
    - Reuse the accuracy of SS-RSRP measurement if using 3 samples.
* Recommended WF
  + *Option 1 is recommended as majority view.*

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| **Issue 2-1-2: The CSI-RSRP measurement accuracy requirements for case 1?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 2-1-3: Whether to define CSI-RS measurement accuracy requirements for case 2?**

* Proposals
  + Option 1: (CATT, MTK)
    - No.
  + Option 2: (Xiaomi, CMCC, Huawei, OPPO)
    - Yes.
  + Option 3: (Qualcomm)
    - RAN4 to discuss if the FR2 RSRP accuracy requirement shall be relaxed to +/-8.0dB for 3us cell timing offset.
    - It is up to NW implementation for determining the validity of CSI-RSRP or pruning the CSI-RSRP reports with less confidence.
* Recommended WF
  + *Need more discussion.*

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| **Issue 2-1-3: Whether to define CSI-RS measurement accuracy requirements for case 2?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 2-1-4: If the answer of issue 2-1-3 is yes, the accuracy requirements for case 2?**

* Proposals
  + Option 1: (Xiaomi)
    - Additional 1dB in FR1 and 2dB in FR2 on the basis of the requirements of case 1.
  + Option 2: (OPPO)
    - Additional 1dB in FR1 and 3dB in FR2 on the basis of the requirements of case 1.
* Recommended WF
  + *Need more discussion.*

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| **Issue 2-1-4: If the answer of issue 2-1-3 is yes, the accuracy requirements for case 2?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 2-1-5: If the answer of issue 2-1-3 is yes, the upper bound of timing offset for case 2?**

* Proposals
  + Option 1: (Xiaomi, CMCC, OPPO)
    - 2\*CP.
  + Option 2: (Huawei)
    - 1.5\*CP.
* Recommended WF
  + *Need more discussion.*

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| **Issue 2-1-5: If the answer of issue 2-1-3 is yes, the upper bound of timing offset for case 2?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 2-1-6: Whether gNB need to know the timing offset?**

* Proposals
  + Option 1: (Xiaomi, Nokia)
    - Yes.
  + Option 2: (Huawei)
    - No
* Recommended WF
  + *Need more discussion.*

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| **Issue 2-1-6: Whether gNB need to know the timing offset?** | |
| **Company** | **Comments** |
| XXX |  |
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**Issue 2-1-7: If the answer of issue 2-1-6 is yes, how to provide the timing offset information to the gNB?**

* Proposals
  + Option 1: (Xiaomi)
    - Introduce the feedback signaling of timing offset information.
  + Other options not precluded
* Recommended WF
  + *Need more discussion.*

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| --- | --- |
| **Issue 2-1-7: If the answer of issue 2-1-6 is yes, how to provide the timing offset information to the gNB?** | |
| **Company** | **Comments** |
| XXX |  |
|  |  |

**Issue 2-1-8: UE behaviour when the timing offset is beyond the threshold defined above?**

* Proposals
  + Option 1: (Nokia)
    - The UE is not required to measure the CSI-RS resource if the timing difference exceeds a threshold.
  + Option 2: (vivo)
    - RAN4 to further discuss whether UE is required/necessary to report the CSI-RSRP measurement results when actual timing offset is beyond the timing offset threshold CP.
  + Other options not precluded.
* Recommended WF
  + *Need more discussion.*

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| **Issue 2-1-8: UE behaviour when the timing offset is beyond the threshold defined above?** | |
| **Company** | **Comments** |
| XXX |  |
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### Sub-topic 2-2 CSI-RSRQ measurement accuracy requirements

*Moderator: For defining CSI-RSRQ measurement requirements, it was agreed in last meeting to follow the same principle of CSI-RSRP measurement. So the conclusions of the issues in sub-topic 2-1 will be reused for CSI-RSRQ measurement unless there are technical issues realized.*

### Sub-topic 2-3 CSI-SINR measurement accuracy requirements

**Issue 2-3-1: The upper limit of Es/Iot for CSI-SINR measurement with timing offset(T△)?**

* Proposals
  + Option 1: (CATT)
    - Specify CSI-SINR requirements for 0 ≤T△ ≤CP with Es/Iot ≤ 10dB.
  + Option 2: (CMCC, vivo)
    - Specify CSI-SINR requirements for 0 ≤T△ ≤CP with Es/Iot ≤ 25dB.
  + Option 3: (MTK)
    - Specify CSI-SINR requirements for 0 ≤T△ ≤CP/2 with Es/Iot ≤ 25dB.
  + Option 4: (MTK)
    - Specify CSI-SINR requirements for |T△| ≤CP/2 with Es/Iot ≤ X dB, where X is within the range of 0 to 10dB.
  + Option 5: (Huawei)
    - Specify two set of CSI-SINR accuracy requirements
      * Case 1: 0 ≤T△ ≤CP/2 with Es/Iot ≤ 25dB
      * Case 2: CP/2 ＜T△ ≤1.5\*CP with Es/Iot ≤ 12dB
* Recommended WF
  + *Need more discussion.*

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| --- | --- |
| **Issue 2-3-1: The upper limit of Es/Iot for CSI-SINR measurement with timing offset(T△)?** | |
| **Company** | **Comments** |
| XXX |  |
|  |  |

**Issue 2-3-2: The CSI-SINR measurement accuracy requirements under the condition in issue 2-3-1?**

* Proposals
  + Option 1: (CATT, CMCC, MTK, Qualcomm, vivo)
    - Reuse the accuracy requirements of SS-SINR measurement.
  + Option 2: (Huawei)
    - [7.5]dB for case 1 and case 2.
* Recommended WF
  + *Need more discussion.*

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| **Issue 2-3-2: The CSI-SINR measurement accuracy requirements under the condition in issue 2-3-1?** | |
| **Company** | **Comments** |
| XXX |  |
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## Companies views’ collection for 1st round

### Open issues

### CRs/TPs comments collection

|  |  |  |
| --- | --- | --- |
| **CR/TP number** | **Title** | **Comments collection** |
| R4-2100429 (CATT) | CR on performance requirement for CSI-RSRP | Company A |
| Company B |
|  |
| R4-2100430 (CATT) | CR on performance requirement for CSI-RSRQ | Company A |
| Company B |
|  |
| R4-2100431 (CATT) | CR on performance requirement for CSI-SINR |  |
|  |
| R4-2100719 (Xiaomi) | CR on CSI-RSRP performance requirement |  |
|  |
| R4-2100720 (Xiaomi) | CR on CSI-RSRQ performance requirement |  |
|  |
| R4-2100721 (Xiaomi) | CR on CSI-SINR performance requirement |  |
|  |
| R4-2101396 (Nokia) | 38.133 draftCR on the CSI-RSRP accuracy requirements |  |
|  |
| R4-2102801 (Huawei) | draftCR on CSI-SINR accuracy requirements |  |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

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

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| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |