**3GPP TSG-RAN WG4 Meeting # 96-e R4-200XXXX**

**Electronic Meeting, 17 – 28 Aug., 2020**

**Agenda item:** 7.14.1.1 & 7.14.1.2 & 7.14.1.5

**Source:** Moderator (CATT)

**Title:** Email discussion summary for [RAN4#96e][224] NR\_CSIRS\_L3meas\_RRM\_1

**Document for:** Information

# Introduction

The documents in agenda items 7.14.1.1 & 7.14.1.2 & 7.14.1.5 contain the following 2 main topics:

* Topic #1: CSI-RS measurement configuration
* Topic #2: Synchronization assumption for CSI-RS based L3 measurement.

# Topic #1: CSI-RS measurement configuration (AI 7.14.1.1)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009747 | Intel Corporation | Proposal 1: Don’t define requirement for CSI-RS configuration with {D=1 with PRBs ≥ 96} |
| R4-2009760 | Xiaomi | Proposal 1: The CSI-RS based L3 measurement requirements are not applied to {D=1 with PRBs ≥ 96} in Rel-16. |
| R4-2009839 | CATT | Proposal 1: Leave the discussion on {D=1 with PRBs ≥ 96} to Rel-17. |
| R4-2010052 | Apple | Proposal: Do not introduce additional CSI-RS configuration {D=1 with PRBs ≥ 96} for the requirements in Rel-16. |
| R4-2010385 | Nokia, Nokia Shanghai Bell | Observation#1: The accuracy performance under {D=1 with 96 PRBs} and {D=3 with 48 PRBs} are comparable irrespective of the SCS conditions.  Proposal1: It is proposed to define additional CSI-RS configuration {D=1 with PRBs ≥ 96} for the CSI-RS based measurement requirement. |
| R4-2010576 | NTT DOCOMO, INC. | Proposal 1: Taking the flexibility of the configuration patterns of CSI-RS resources, it is preferable to introduce multiple requirements.  Proposal 2: Specify requirements for {D=1 with PRBs ≥ 96}. |
| R4-2010760 | NEC | Proposal 1: RAN4 to introduce measurement requirements for CSI-RS configuration {D=1 with PRBs≥96} at least when CSI-RS BW is contained in active BWP.  Proposal 2: RAN4 to introduce single measurement requirement for {D=3 with PRBs≥48} and {D=1 with PRBs≥96} |
| R4-2011065 | Huawei, HiSilicon | Proposal 1: For CSI-RS based L3 measurements, it is suggest not to define CSI-RS measurement requirements for additional CSI-RS configuration with D=1 and PRBs≥96.  Proposal 2: For CSI-RS based L3 mobility, the side condition of CSI-RS measurement requirements can be defined as CSI-RS Es/Iot≥-6dB.  Proposal 3: The CSI-RS L3 measurement period requirements can be defined based on 5 available measurement samples, and the existing SSB L3 measurement period requirements can be used to derive the CSI-RS L3 measurement period requirements.  Proposal 4: For DRX cycle≤320ms, it is suggested not to introduce the sharing factor 1.5 for CSI-RS L3 measurement period requirements.  Proposal 5: It is suggested not to introduce the sharing factor Klayer1\_measurement for CSI-RS L3 measurement period requirements. |
| R4-2011314 | ZTE | Proposal 1: Define one set of requirements for both the cases of 48 PRBs with density 3 and 96 PRBs with density 1. |
| R4-2011338 | Qualcomm CDMA Technologies | Proposal1: Rel-16 doesnot introduce the CSI-RS configuration of {D=1 with PRBs ≥ 96}, or the topic can be deprioritized. |

## Open issues summary

### Sub-topic 1-1 CSI-RS measurement configuration

**Issue 1-1: Whether to define additional CSI-RS configuration {D=1 with PRBs ≥ 96} for the CSI-RS based measurement requirement in R16?**

* Proposals
  + Option 1: No (Intel, Xiaomi, CATT, Apple, HUAWEI, Qualcomm)
  + Option 2: Yes (Nokia, Docomo, NEC, ZTE)
    - Option 2a: RAN4 to introduce measurement requirements for CSI-RS configuration {D=1 with PRBs≥96} at least when CSI-RS BW is contained in active BWP ( NEC )
    - Option 2b: RAN4 to introduce requirements for CSI-RS configuration {D=1 with PRBs≥96} for intra frequency measurement in Rel-16
* Recommended WF
  + Need more discussion.

## Companies views’ collection for 1st round

### Open issues

**Issue 1-1: Whether to define additional CSI-RS configuration {D=1 with PRBs ≥ 96} for the CSI-RS based measurement requirement in R16?**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | Support Option 1: No.  BTW, this is a low priority issue according to approved exception sheet RP-201340 in last RAN plenary meeting. RAN4 should focus on other more urgent issues. |
| ZTE | To move forward, a compromise proposal (Option 2b) is provided that requirements for {D=1, PRB=96} CSI-RS configuration are defined intra frequency measurement in Rel-16. Since the requirements for intra frequency measurement are defined without gaps, UE is capable of receiving CSI-RS resources together with serving cell data. So UE complexity is not a concern in this special case. |
| Qualcomm | Agree with Option 1.  Option2b compromises with limiting the configuration to intra-frequency. But a larger number of intra-frequency resources on a single intra-frequency layer may still be concerning for UE. Thus, we prefer to revisit this when other higher priority open issues settle. |

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
|  | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

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

*Recommendations 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 provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **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”* |

# Topic #2: Others (AI 7.14.1.5)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009747 | Intel Corporation | Proposal 2: For CSI-RS measurement with associated SSB, RAN4 addresses the issue of timing difference between the arrival of the CSI-RS and UE’s FFT timing in the performance part. |
| R4-2010054 | Apple | Proposal 1: The timing of CSI-RS resource should be assumed the same as the associatedSSB.  Proposal 2: No single FFT is assumed to measure CSI-RS resources from different cells.  Proposal 3: Strive to complete measurement opportunity sharing between CSI-RS and SSB based L3 measurement in R16  Proposal 4: Postpone the other open issues in table 1 to Rel-17 |
| R4-2010072 | CMCC | Proposal 1: for the CSI-RS resource with associatedSSB, basing the timing on the cell given by the cellId of the CSI-RS resource configuration is preferred. However, to move forward, compromise can be considered.  Proposal 2: the compromised solution could be the combination of introducing UE capability and specifying different requirements for different arrival timing difference. For example, normal requirements are specified for arrival timing difference no larger than CP, relaxed requirements are specified for arrival timing difference larger than CP. UE capability is introduced to differentiate different types of UEs. For the UE supporting using only single timing for CSI-RS measurement per frequency layer, if the arrival timing difference is no larger than CP, normal requirements are followed, if the arrival timing difference is larger than CP, relaxed requirements are followed. For the UE supporting using timing of associated SSB for respective CSI-RS measurement, normal requirements are always followed. |
| R4-2010315 | MediaTek Inc. | Observation 1: According to WID, UE is required to use single FFT window to measure all cells in one frequency layer.  Observation 2: The cell phase synchronization error is already larger than the CP length of SCS 30KHz, 60KHz and 120KHz, even without considering the difference due to propagation delay.  Observation 3: Inter-gNB distance and the cell phase synchronization requirement were determined in R15 and will not be further reduced due to the introduction of CSI-RS for L3 measurement.  Observation 4: The receive timing difference is only visible at UE side. Network has no knowledge about which measurement report is more reliable than the others  Observation 5: Even with the new UE capability introduced, practical UE implementation with limited number of FFT engines still need to handle the measurement on the CSI-RS signal with misaligned receive timing.  Proposal 1: RAN4 to address the issue of timing difference between the arrival of the CSI-RS and UE’s FFT timing in the performance part with different measurement accuracy requirements. |
| R4-2010334 | vivo | Proposal 1: UE should be able to obtain timing from SSBs from multiple cells without the constraint of single FFT. No need for specifying any further constraint on network synchronisation assumption beyond R15 and no need for different UE capability. The performance degradation due to interfered neighbour cell CSI-RS measurement should be further discussed in performance part.  Proposal 2: Requirement for asynchronous deployment can be delayed to R17.  Proposal 3: Requirement for FR2 is not significantly impacted by the synchronization assumption and should be specified in R16. |
| R4-2010388 | Nokia, Nokia Shanghai Bell | Observation#1: If associatedSSB is configured, tight cell synchronization is not always assumed between the cell to be measured and the serving cell.  Observation#2: There may be timing difference between the CSI-RS resources to be measured and the timing of single FFT.  Proposal#1: The impact due to the timing difference needs to be considered under the single FFT assumption when defining the requirements in Rel16.  Observation#3: The CSI-RS based measurement result makes sense only when the timing difference is within the CP length.  Proposal2: UE capability can be defined to indicate whether single FFT is applied when performing the CSI-RS based measurement on one frequency layer. |
| R4-2010577 | NTT DOCOMO, INC. | Observation 1: It is obviously described in TS38.331 that UE assumes the timing of the CSI-RS resources follows that of the cell indicated by cellId.  Observation 2: UE is assumed to acquire the timing of the target cell which is indicated by cellId with reading the associated SSB.  Proposal 1: Option 2 should be supported, i.e., the timing of the CSI-RS resources should follow that of the cell given by cellId. |
| R4-2010716 | OPPO | Proposal 1: If a new capability for UE supporting different SCS in source and target cells is defined in Rel-16 NR mobility measurement, reuse it for CSI-RS L3 measurement.  Otherwise, introduce a dedicated new capability of simultaneous reception of CSI-RS of neighbor cell and SSB of serving cell for CSI-RS L3 measurement.  Proposal 2: Do not introduce UE capability for minimum separation between two slots in Rel-16. |
| R4-2010761 | NEC | Proposal 1: RAN4 to introduce scheduling restriction such that gNB may schedule neighbour cells CSI-RS resources, whose timing is within the same Timing advance group (TAG).  Proposal 2: RAN4 to further study this problem in Rel-17 for single FFT UE implementation. |
| R4-2011173 | Huawei, HiSilicon | Observation 1: According to RAN1 specification, the timing of CSI-RS measurement with associated SSB should be based on the associated SSB.  Observation 2: If UE uses a single timing for CSI-RS measurement with associated SSB, the function of the associated SSB as timing reference for the CSI-RS measurement is completely wasted.  Observation 3: If UE uses a single timing for CSI-RS measurement with associated SSB, it will unnecessarily require network synchronization, and some use cases cannot be supported.  Observation 4: If UE uses a single timing for CSI-RS measurement with associated SSB, even in synchronous network, the accuracy performance will be degraded a lot for large SCS.  Proposal 1: When CSI-RS measurement is configured with associated SSB, UE is assumed to use the timing of the detected SSB, and the CSI-RS measurement requirements is not conditioned on network synchronization.  Proposal 2: If Proposal 1 is not acceptable, RAN4 should define a UE capability to indicate if UE supports CSI-RS measurement based on timing of each individual associated SSB or a single timing per MO. |
| R4-2011338 | Qualcomm CDMA Technologies | Proposal15: The collision between L1 measurement and CSI-RS L3 measurement shall be resolved by introducing the time-domain restrictions on the CSI-RS resources configuration.  Proposal18: RAN4 shall consider requirements only defined if the timing difference between serving and neighbor cell including cell phase synchronization is guaranteed to be less than half CP length.  Observation7: NW’s measurement configuration could be restricted to avoid different cells’ resources at the same time. The limitation is UE can ONLY follow one alternative timing other than the serving cell timing due to single FFT constraint and serving cell is subject to interruptions on CSI-RS symbols. |

## Open issues summary

### Sub-topic 2-1 Synchronization assumption for CSI-RS based measurement

**Issue 2-1: Synchronization assumption for CSI-RS based measurement**

* Proposals
  + Option 1: (Intel, MTK)
    - RAN4 to address the issue of timing difference between the arrival of the CSI-RS and UE’s FFT timing in the performance part.
  + Option 2: (Apple, CMCC, vivo, Docomo, HUAWEI, ZTE)
    - the corresponding timing of CSI-RS resources should be assume the same as the timing of the cell given by the cellId of the CSI-RS resource configuration.
  + Option 3: (CMCC, Nokia, HUAWEI)
    - introduce the UE capability to differentiate the following 2 types of UEs.
      * Type 1: UE supporting using only single timing for CSI-RS measurement per frequency layer
        + Type1.1: UE supporting using only single timing for CSI-RS measurement per frequency layer based on the serving cell timing
        + Type1.2: UE supporting using only single timing for CSI-RS measurement per frequency layer based on ONE of the associated neighbor cell SSBs
      * Type 2: UE supporting using timing of associated SSB for respective CSI-RS measurement
  + Option 4: (NEC)
    - RAN4 to introduce scheduling restriction such that gNB may schedule neighbour cells CSI-RS resources, whose timing is within the same Timing Advance Group (TAG)
    - RAN4 to further study this problem in Rel-17 for single FFT UE implementation
  + Option 5: (Qualcomm)
    - RAN4 shall consider requirements only defined if the timing difference between serving and neighbor cell including cell phase synchronization is guaranteed to be less than half CP length.
    - A baseline WID compliant UE features single FFT based on the same timing and/or same Rx beam for the serving cell. Such a baseline UE shall be assumed for defining the minimal requirements and test cases by RAN4.
* Recommended WF
  + Option 2 is recommended.

## Companies views’ collection for 1st round

### Open issues

**Issue 2-1: Synchronization assumption for CSI-RS based measurement**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| MTK | Support Option 1.  Regarding Option 2, we understand previous RAN1 design assumes UE to follow the timing of associated SSB, but it is later RAN Plenary’s decision to allow UE to implement single FFT. Procedure-wise, RAN Plenary should have the right to override RAN1 decision.  Regarding Option 3, we have provided our view in our paper R4-2010315. Even with the new UE capability introduced, practical UE implementation with limited number of FFT engines still has the chance to handle the measurement on the CSI-RS signal with misaligned receive timing. In this case, it is inevitable to define different accuracy requirements in performance part. So this still goes back to Option 1. |
| ZTE | Though single FFT is the assumption in the WID, it is not workable in the practical network for many cases. For example in FR1 the time difference of any two cells for a UE could be anywhere between 0 ~33 us. It is half symbols for 15kHz SCS and one symbol for 30kHz SCS. It is not possible to specify reasonable performance requirements to address such large time difference. If the time difference is small enough, e.g. within half CP, it is more like co-location deployment.  If reasonable relaxed (reduced) performance requirements cannot be specified, then some neighbor cells may never be measured as long as time difference to serving cell is too large. So the feature cannot work in a performance assured manner.  Option 2 is aligned with procedures specified by RAN1. It should be followed.  UE capability proposed by option 3 would make the feature too complicated. Two set of requirements would be specified. NW has to handle different UEs which increase NW complexity. Type 2 UE may not be useful in practical network. So it is not preferable.  Option 4 puts too much restriction at NW side. Besides the scenarios to use this feature is highly compromised. |
| Qualcomm | Our option5 can be merged with option3-type1.1.  Then both Option3-type1.1 and Option3-type1.2 are agreeable. And option1 is reasonable to discuss performance impact for these two types of UEs.  Option2 and option3 type2 are not complied with the WID assumption **potentially**. Thus, they are NOT agreeable.  Suggestion to companies and moderator,  Can we please merge option1, option3-type1.1 and option3-type1.2 and option 5? I.e.  “  *Introduce the UE capability to differentiate the following 2 types of UEs both of which are WID compliant. I.e. UE supporting using only single timing for CSI-RS measurement per frequency layer*  *Type1: UE supporting using only single timing for CSI-RS measurement per frequency layer based on the serving cell timing*  *Type2: UE supporting using only single timing for CSI-RS measurement per frequency layer based on one and only one of the associated neighbor cell SSBs*  *RAN4 to address the impact of timing difference between the arrival of the CSI-RS and UE’s FFT timing for type1 or both types of UEs in the performance part.*  ” |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2009763 (Xiaomi) | Company A |
| Company B |
|  |
| R4-2010390  (Nokia) | MTK:   * This CR should be treated in [225], where the technical discussion about the requirement takes place * (9.x.1) FFT # is UE implementation issue, we can address this in the accuracy, but not in core part. * (9.x.2.1) Do not need transition requirement for CSI-RS because intra-freq measurement is always gap-less and inter-freq measurement is always gap-assisted. There is no transition between outside gap and within gap. * (9.x.2.1) "even if no explicit neighbour list with physical layer cell identities is provided" should be removed. CSI-RS measurement always needs cell ID configured by network * (9.x.2.2) the associated SSB also needs to be detectable, not just the cell |
| Company B |
|  |
| R4-2010392  (Nokia) | MTK: This is a performance part requirement. Suggest to postpone this to performance part. |
| Company B |
|  |
| R4-2011174 (HUAWEI) | Company A |
| Company B |
|  |
| R4-2011416 (Qualcomm) | MTK:   * This CR is better to be handled in [225], where the technical discussion about the requirement takes place. * There is no track change. * The technical contents are pending on the discussion in [225] * Maybe typo? “UE shall be capable of measuring without measurement gap for the intra-frequency measurements based on” * The last sentence “If the associated SSB is not configured, above restriction is not needed” is misleading. If associated SSB, UE will even not measure the CSI-RS, rather than measuring it without restriction. |
| Qualcomm: Thanks MTK for comments. Sure, let’s wait agreements in [225] and we can update accordingly. |
|  |

## 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*

|  |  |
| --- | --- |
| **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”* |