**3GPP TSG RAN WG1 #102e R1-2007019**

**e-Meeting, August 17th – 28th, 2020**

**Source: Moderator (NTT DOCOMO, INC.)**

**Title: Summary on [102-e-NR-UEFeatures-CLI/RIM-01]**

**Agenda Item:** **7.2.11**

**Document for:** **Discussion and Decision**

1. Introduction

This contribution summarizes the following email discussion/approval in AI 7.2.11.

[102-e-NR-UEFeatures-CLI/RIM-01] Email discussion/approval on UE features for CLI/RIM (17th – 19th August), Hiroki (DCM)

·                 Whether the slot in FG17-2 component 3 is a slot using the SCS of UE’s active DL BWP or a slot in SCS = 15kHz.

1. FG17-2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 17. NR\_CLI\_RIM | 17-2 | SRS-RSRP measurement | 1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement within a slot |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {4, 8, 16, 32}.  Candidate values for component 3 are {2, 4, 8}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling |

In [2], following proposal is made.

|  |
| --- |
| During [101-e-Post-NR-UE-Features-14] email discussion/approval for potential editorial updates of Rel-16 UE features, it is identified that further clarification on FG 17-2 component 3 is needed. There was a proposal to change the per-slot constraint on the maximum SRS-RSRP measurements to a constraint of maximum SRS-RSRP measurements within a fixed time period, i.e., 1ms (a slot of SCS=15kHz).  In RAN1 #95 AH1901 [2], the following agreement has been made  *For SRS-RSRP:*   * *The number of SRS to be monitored by the UE should not exceed 8 within a slot*   In the original agreement, the limitation is clearly stated as per-slot, not within a fixed time period. Therefore, we propose to clarify that the slot in FG 17-2 component 3 is a slot assuming the SCS of UE’s active DL BWP.  **Proposal 18: Clarify that the slot in FG 17-2 component 3 is a slot using the SCS of UE’s active DL BWP.** |

In [3], following proposal is made.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| For CLI SRS-RSRP measurement resources, FG 17-2 has defined the maximum number of SRS resources within a slot. However, there is no associated SCS for determining the slot duration. We propose to clarify that in the FG 17-2 component 3 text the slot is a slot in SCS=15kHz.  Proposal: Clarify that in FG 17-2 component 3, a slot is a slot in SCS = 15kHz.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 17. NR\_CLI\_RIM | 17-2 | SRS-RSRP measurement | 1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement within a slot in SCS = 15kHz |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {4, 8, 16, 32}.  Candidate values for component 3 are {2, 4, 8}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling | |

Based on the above contributions, it is agreed to discuss following point in the email discussion [4].

**Discussion point#1**

* **Whether the slot in FG17-2 component 3 is a slot using the SCS of UE’s active DL BWP or a slot in SCS = 15kHz.**

During the preparation phase email discussion, following comment is provided [4].

|  |  |
| --- | --- |
| Company | Comment |
| Samsung | Given that it was agreed that UE is not required to measure SRS using different SCS compared to the downlink active BWP SCS of the same carrier, we believe that the slot using the SCS of UE’s active DL BWP is aligned with the agreement. |

## 2.1 Proposal and discussion

Based on the contributions and above input in the preparation phase, following proposal is made.

**FL proposal 1:**

* **Clarify that the slot in FG17-2 component 3 is a slot using the SCS of UE’s active DL BWP**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 17. NR\_CLI\_RIM | 17-2 | SRS-RSRP measurement | 1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement within a slot based on the SCS of UE’s active DL BWP |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {4, 8, 16, 32}.  Candidate values for component 3 are {2, 4, 8}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling |

Companies are encouraged to check above FL proposal and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

Cannot accept the proposals: QC, MTK

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | For carrier aggregation, CCs can have different SCS. Then active DL BWPs of different CCs can have different slot duration. In this case, it is still not clear how the per slot limit across all CCs is defined.  If the proposal is adopted, it may imply a change of the meaning of the component 3 from a per UE capbiltiy across CCs to a per CC capability. |
| Huawei, HiSilicon | Support FL proposal 1. We may not fully understand Qualcomm’s comment and concerns which seems to interpret component 3 as a capability across all CCs. Only component 1 is a UE capability across all CCs, the other two is the restriction for one CC. Otherwise, there is no difference between component 1 and component 2. |
| Nokia, NSB | Support FL proposal 1 |
| Qualcomm 2 | Components 2 and 3 should be the limit across CCs. This is because the actual hardware processing envelope is determined by max resource number across CCs but not a maximum number per CC. (This is also the way how maximum number of resources is defined for other cases such as beam management). As CA with multiple CCs is a typical to provide high eMBB throughput, defining a per CC maximum number is not useful as even with the lowest supported number for component 2, multiplying it with the number of CCs may result in a very large number or even exceed the max 32 resources across CCs. And CA is the case when complexity becomes critical. This should be clear when we discussed why component 2 is needed. Later when component 3 was added, it was the understanding that 1 is too low as the number of resources across CCs. Then the minimum number of 2 resources across CCs was agreed.  Maybe we can first clarify component 2 and 3 are limits across CCs as follows. For component 3, a reference SCS is left to FFS.  1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources across all CCs configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement across all CCs within a slot based on a SCS [FFS: value of the SCS] |
| MTK | We support to define that the slot in FG17-2 component 3 is a slot using the SCS of 15kHz. It simplifies the definition fits the original motivation of defining Component 3 better: avoid prohibitively high complexity in UE implementation for basic CLI measurement functions. We also share the understanding as QC that previous discussion of component 2 and component 3 is based on per UE (across all CCs) assumption. |
| Intel | We support the FL proposal.  If the slot is based on 15kHz in component 3, then we need to align the definition of “maximum number of measurement resources configured for SRS-RSRP measurement”. For component 1 and 2, it clearly refers to the number of different SRS-RSRP measurement RRC configurations. If we adopt the FL proposal, then the definition is clear and consistent in component 1, 2, and 3, since one configuration has at most one SRS measurement instance in one slot (based on SCS of UE’s active DL BWP). However, one configured SRS-RSRP measurement can have multiple measurement instances within a slot of 15kHz. For example, if the SRS is configured with SCS=60kHz and periodicity of 2 slots, then there are 2 instances, within a slot of 15kHz, the victim UE needs to measure the SRS-RSRP. Then how should we count the number of measurement resources within a slot? Is it based on the number of RRC configurations as in component 1 and 2? Or is it based on the number of measurement instances?  Moreover, we failed to see the contradiction between per UE capability and the FL proposal. UE indicates its capability for component 3, which is applied to each CCs. UE does not indicate its capability one by one for each individual CC. |
| Qualcomm | To address the concern of Intel’s about the counting of resources in the slot, we added the sub-bullet under 3  1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources across all CCs configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement across all CCs within a slot based on a SCS [FFS: value of the SCS]   * + A configured SRS resource is counted as one measurement resource in the number of measurement reources configured for SRS-RSRP measurement across all CCs if one or more symbols of the configured SRS resource is within the slot |
| ZTE | We support FL proposal 1. We don’t there is contradiction between the FL proposal and the per-UE capability of componenet 3. |
| Apple | * We support to clarify component 2 and 3 as across all CCs, even though this is not the ideal solution either. However, if it is clarified as per CC, it has potential UE capability under-reporting issues which has been identified in Rel-15 in the past. For a BC, it is agreed in RAN2 that all the fall-back configuration should be supported by the UE. Imagine if we support a BC of 16 CCs, and each CC we support 2 RSs, so total we support 32 RSs. But in practice, a particular operator may only have for example 4CCs, then NW can only configure total 8 RSs, i.e.,25% of the actual UE processing power. * After it is clarified as across all CCs. The next issue is how to define the reference SCS, which happens to be an identified issue for Rel-15 as well, for example, as part of FG2-24. This was discussed in the last meeting with the following CR R1-2004208 with the following conclusion. The conclusion is not preferable by almost all the companies, but it is a compromise reached after a lot of email exchange. We are fine with the FFS part from Qualcomm. This is just for reference purpose.   **Conclusion**  For UE features maxNumberSSB-CSI-RS-ResourceOneTx and maxNumberCSI-RS-ResourceTwoTx in feature group beamManagementSSB-CSI-RS,   * the total number of resources within a slot and across serving cells in FR1 is determined by x within 1 slot of subcarrier spacing of 15kHz * the total number of resources within a slot and across serving cells in FR2 is determined by y within 1 slot of the smallest subcarrier spacing configured for PDSCH in FR2 * the total number of resources within a slot and across FR1 and FR2 serving cells is determined by max (x, z\*y) within 1 slot of subcarrier spacing of 15 kHz,   where x is the reported value in FR1 and y is the reported value in FR2 and z is the ratio of the smallest subcarrier spacing configured in FR2 and 15kHz. |
| Moderator | Thank you very much for the inputs and discussion!  As I mentioned in the email based on checking for previous discussion, at least we should clarify that component 2 is max number across all CCs.  Then, for component 3, we should continue discuss on following points.   * Whether it is maximum number per CC or maximum number across all CCs * If it is maximum number across all CCs, what is the definition of “within a slot”   Since slightly larger number of companies seem to prefer to make component 3 as max number per CC, it is still proposed in the updated FL proposal. |

**Updated FL proposal 1:**

* **Clarify that component 2 is the maximum number of measurement resources across all CCs configured for SRS-RSRP measurement**
* **Clarify that the slot in FG17-2 component 3 is maximum number of measurement resources per CC within a slot using the SCS of UE’s active DL BWP**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 17. NR\_CLI\_RIM | 17-2 | SRS-RSRP measurement | 1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources across all CCs configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement per CC within a slot based on the SCS of UE’s active DL BWP |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {4, 8, 16, 32}.  Candidate values for component 3 are {2, 4, 8}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling |

Companies are encouraged to check above FL proposal and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

Cannot accept the proposals:

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | For the early FL proposal based on SCS of UE’s active DL BWP below, the understanding can be component 3 is a maximum number of configured SRS resoureces across CCs but the number is counted in every slot on each cell rather than in a reference slot as we proposed. We think our proposal is cleaner by defining a reference slot duration of 1ms. However, if the reference slot duration is not agreed, we can revert back to the original feature description without any update and component still means a maximum number of configured SRS resources across CCs within a slot duration on each CC of the CCs. The slot duration is fixed or varying depending on whether active DL BWPs of all CCs have the same numerology.   * **Clarify that the slot in FG17-2 component 3 is a slot using the SCS of UE’s active DL BWP**   To further explain this, we believe the following bullets are equivalent to the original feature description.  1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources across all CCs configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement across all CCs within a slot based on the SCS of UE’s active DL BWP on each CC   * + A SRS resource configured on any CC is counted as one measurement resource in the number of measurement reources configured for SRS-RSRP measurement across all CCs if the configured SRS resource overlaps with the slot |
|  |  |
|  |  |

Based on the email discussion, following agreement was made.

**Agreements:**

* **Clarify that component 2 is the maximum number of measurement resources across all CCs configured for SRS-RSRP measurement**
* **Clarify that component 3 is the maximum number of measurement resources across all CCs configured for SRS-RSRP measurement within a slot**
  + **RAN1 continues discussion on the definition of "within a slot" and counting rule**

### **Updated FL proposal 1:**

* **For component 3 of FG17-2**
  + **A slot is based on minimum SCS among active BWPs across all CCs configured for SRS-RSRP measurement**
  + **A SRS resource occasion that UE needs to be processed is counted as one measurement resource**

Companies are encouraged to check above FL proposal and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

Cannot accept the proposals:

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | There are a few options for defining the slot duration   * The reference slot in SCS=15kHz * Slot based on the minimum SCS among active BWPs across all CCs * Slot based on the minimum SCS among active BWPs across al CCs configured for SRS-RSRP measurement   The first option has the lowest requirement and the third option has the highest requirements for UE implementation for the same component 3 value reported by the UE. To make this issue concluded sooner, we can take the third option as suggested by FL proposal.  Besides, we tried to clarify the counting of SRS resources in second sub-bullet with following updates.   * **For component 3 of FG17-2**   + **A slot is based on minimum SCS among active BWPs across all CCs configured for SRS-RSRP measurement**   + **A SRS resource occasion that overlaps with the slot is counted as one measurement resource in the slot** |
|  |  |
|  |  |

1. Conclusion

**Agreements:**

* **Clarify that component 2 is the maximum number of measurement resources across all CCs configured for SRS-RSRP measurement**
* **Clarify that component 3 is the maximum number of measurement resources across all CCs configured for SRS-RSRP measurement within a slot**
  + **RAN1 continues discussion on the definition of "within a slot" and counting rule**

**Update FL proposal 1:**

* **For component 3 of FG17-2**
  + **A slot is based on minimum SCS among active BWPs across all CCs configured for SRS-RSRP measurement**
  + **A SRS resource occasion that UE needs to be processed is counted as one measurement resource**

Reference

[1] R1-2006462 Updated RAN1 UE features list for Rel-16 NR Moderators (AT&T, NTT DOCOMO, INC.)

[2] R1-2005857 Rel-16 UE feature Intel Corporation

[3] R1-2006788 Discussion on NR Rel-16 UE features Qualcomm Incorporated

[4] R1-2006713 Summary on UE features for CLI/RIM Moderator (NTT DOCOMO, INC.)

Appendix: UE features list for CLI/RIM in [1]

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type**  **( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 17. NR\_CLI\_RIM | 17-1 | CLI-RSSI measurement | 1. Support CLI-RSSI measurement. The max number of resources across all CCs configured to measure RSSI shall not exceed 64.  2. Maximum number of measurement resources configured for CLI-RSSI measurement |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {8, 16, 32, 64}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling |
| 17. NR\_CLI\_RIM | 17-2 | SRS-RSRP measurement | 1. Support SRS-RSRP measurement. The max number of SRS resources across all CCs configured to measure SRS-RSRP shall not exceed 32.  2. Maximum number of measurement resources configured for SRS-RSRP measurement  3. Maximum number of measurement resources configured for SRS-RSRP measurement within a slot |  | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | Candidate values for component 2 are {4, 8, 16, 32}.  Candidate values for component 3 are {2, 4, 8}.  CLI measurement is not supported in unlicensed bands in Rel-16 | Optional with capability signalling |
| 17. NR\_CLI\_RIM | 17-3 | Simultaneous reception of DL signals/channels and CLI-RSSI measurement resource | Support simultaneous reception of DL signals/channels and CLI-RSSI measurement resource | 17-1 | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | UE shall prioritize CLI-RSSI measurement when simultaneous reception of DL signals/channels and CLI-RSSI measurement resource is not supported.  How to capture this sentence is up to RAN2 | Optional with capability signalling |
| 17. NR\_CLI\_RIM | 17-4 | Simultaneous reception of DL signals/channels and SRS-RSRP measurement resource | Support simultaneous reception of DL signals/channels and SRS-RSRP measurement resource | 17-2 | Yes | N/A |  | Per UE | No (TDD only) | Yes | N/A | UE shall prioritize SRS-RSRP measurement when simultaneous reception of DL signals/channels and SRS-RSRP measurement resource is not supported.  How to capture this sentence is up to RAN2 | Optional with capability signalling |