**3GPP TSG-RAN WG1 #103-e R1-20xxxxx**

**eMeeting, Oct 26th – Nov 13th, 2020**

**Source: Moderator (Ericsson)**

**Title: Summary of Email discussion [103-e-NR-DSS-01]**

**Agenda item:** **8.13.1**

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

# 1 Introduction

This document summarizes the discussions for email thread [103-e-NR-DSS-01] under agenda item 8.13.1 on Cross-carrier scheduling (from Scell to Pcell) for the Rel17 WI on NR Dynamic spectrum sharing (DSS).

# 2. Discussion

## 2.1 Moderator Summary

Below is a short moderator summary based on tdocs [1-19] submitted for RAN1#103-e

1. **Search Space and DCI format handling when CCS from an SCell (sSCell) to PCell/PSCell is configured**
   * Type 0/0A/1/2 CSS sets for any associated DCI formats
     + monitored only on PCell/PSCell – [1],[2],[4],[6],[7],[10],[11],[13],[14]
   * DCI formats 0\_0 and 1\_0 for scheduling PDSCH/PUSCH on PCell/PSCell in any associated SS set
     + monitored only on PCell/PSCell – [2],[3],[7],[10],[14],[16]
   * DCI formats 0\_1,1\_1,0\_2,1\_2 for scheduling PDSCH/PUSCH on PCell/PSCell in USS set(s)
     + Not monitored on PCell/PSCell and can be monitored only on sScell – [2],[3],[6?],[8],[11?],[19]
     + Can be monitored on both PCell/PSCell and the sSCell – [1],[7],[13],[14],[15],[16],[17?],[18]
     + Study further – [4],[5],[10]
   * DCI formats 2\_0, 2\_1, 2\_2, 2\_3, 2\_4 in Type 3 CSS set and DCI format 2\_5
     + monitored on PCell/PSCell/sSell according to existing specifications – [1?],[2],[4],[6],[10],[18]
     + applicable to PCell/PSCell even when monitored on PCell/PSCell in some cases – [14]
   * DCI format 2\_6 in type 3 CSS set
     + Monitored only on PCell/PSCell – [10]
     + Can be monitored on sSCell – [1],[6],
   * DCI formats 0\_1,1\_1 with SCell dormancy indication
     + Monitored only on PCell/PSCell –
     + Can be monitored on the sSCell – [1]
   * SS set overbooking and associated UE procedures
     + Applied only for PCell – [1],[6],[19]
     + Applied considering both PCell and sSCell – [14?]
2. **Scheduling framework when CCS from an SCell (sSCell) to PCell/PSCell is configured**
   * Activation/deactivation of sSCell
     + Discussed in [2],[4],[6],[7],[9],[18]
   * Dormancy/non-dormancy for sSCell
     + Discussed in [2],[4],[18]
   * No out of order scheduling between a) PDSCH/PUSCH on PCell/PSCell scheduled by PDCCH on PCell/PSCell and b) PDSCH/PUSCH on PCell/PSCell scheduled by PDCCH on sSCell
     + Discussed in [1],[18],[19]
   * No simultaneous rx/tx of unicast PDSCH/PUSCH on PCell/PSCell scheduled from PCell/PSCell and unicast PDSCH/PUSCH on PCell/PSCell scheduled from sSCell
     + Discussed in [18],[19]
   * Simultaneous rx of PDCCH on sSCell used for scheduling PCell/PCell and PDCCH for self-scheduling on PCell/PSCell
     + Discussed in [5]
   * PDCCH for initial transmission and retransmission can be on different cells for same TB
     + Discussed in [1],[5]
3. **BD/CCE limit handling when CCS from an SCell (sSCell) to PCell/PSCell is configured**
   * Use multi-TRP for BD/CCE handling as starting point – [1]
   * PCell is counted as a scheduled cell for both the PCell and sSCell – [6]
   * BD/CCE limits are counted over both scheduling cells (PCell and SCell) and determined for scheduled PCell, overbooking is allowed [14]
   * Both PCell self-scheduling and SCell to PCell are considered – [18]
   * Per-scheduling-CC limit is determined as (per-CC BD or CCE limit) – (max of the number of BDs or CCEs at a slot across all the slots on the PCell/PSCell) – [19]
   * Study further – [2],[10],[11],[13],
4. **Other aspects**
   * Further details on CCS configuration
     + *CrossCarrierSchedulingConfig* details – [2],[3],[10].[11]
   * Dynamic switching of PDCCH candidates/SS sets/SS groups between PCell/PSCell and sSCell – [13],[14],[15],[17]
   * Further details on search space handling
     + UE is not configured with complete USS in P(S)cell for self-scheduling/only parts of USS are moved – [2],[10]
     + Light SS linking – [2]
     + SS set linking between PCell/PSCell and sSCell by using same index – [4],[10]
     + Use n\_CI for SS hashing – [19]
     + Independent config. of parameters related to PDCCH monitoring occasions on sSCell for scheduling PCell/PSCell and for scheduling sSCell – [19]
     + Configuration of individual DCI format(s) (e.g. only DCI format 0-1, only DCI format 1-1) – [18]
     + CIF = 0 used for sSCell or PCell? – [11],[19]
   * sSCell can schedule dynamic and CG PDSCH/PUSCH – [2]
   * Multi/single-TRP operation should remain independent on the PCell and the SCell – [6]
   * Is SCell scheduling PCell configured per UE, per BWP or per SS? – [11]
   * Reuse Rel16 preparation time between sSCell PDCCH and PCell/PSCell PDSCH/PUSCH – [19]
   * Clarify whether PCell and/or sSCell can be unlicensed cell(s) – [16]
   * Clarify allowed #UL DCI and #DL DCI combination – [16]
   * DCI size alignment clarifications – [12]
   * Impact of BWP change on sScell on Scell to Pcell scheduling – [6]
   * SCell to PCell/PSCell scheduling has no impact on PUCCH – [6],[14]
   * Clarify that one sSCell per CG can be configured (in case wording in previous agreement is not clear) – [9]
   * BFR operations/mechanism for the sSCell should be studied – [9]

## 2.1 Proposals for discussion

Below are some proposals for discussion

### Proposal 1

* When CCS from an SCell (sSCell) to PCell/PSCell is configured, UE monitors Type 0/0A/1/2 CSS sets (for the DCI formats associated with those SS sets) only on the PCell/PSCell and not on the sSCell

Companies are requested to indicate their view about the above proposal in the Table below

|  |  |  |
| --- | --- | --- |
| **Company Name** | **support/not support** | **Comments (Proposal 1)** |
| Intel | support | Type0/0A/1/2 CSS sets are necessary for UE with single cell operation on ‘PCell’. Specifically, they are used before a CA UE enters CA mode.  It is possible ‘SCell’ has its own Type0/0A/1/2 CSS sets, since ‘SCell’ can be PCell for some other UEs. However, this is not related to ‘SCell scheduling PCell’ under current scope of WI. |
| Qualcomm | Support |  |
| CATT | Support |  |
| vivo | support | Type0/0A/1/2 CSS sets remains on PCell/PSCell as NR Rel-15/16 |

### Proposal 2

* When CCS from an SCell (sSCell) to PCell/PSCell is configured, UE monitors DCI formats 0\_0 and 1\_0 for scheduling PDSCH/PUSCH on PCell/PSCell (in any associated SS set(s)) only on the PCell/PSCell and not on the sSCell

Companies are requested to indicate their view about the above proposal in the Table below.

|  |  |  |
| --- | --- | --- |
| **Company Name** | **support/not support** | **Comments (Proposal 2)** |
| Intel | Support | We are considering two sources of DCI 0\_0/1\_0 on PCell/PSCell:   1. a DCI format in CSS, which has same DCI size as DCI 0\_0/1\_0 can be used for unicast scheduling 2. a USS containing only DCI 0\_0/1\_0 may be configured on PCell |
| Qualcomm | Not support | We do not see the need of supporting a USS set on the PCell/PSCell when the UE is configured to monitor USS set(s) on the SCell for cross-carrier scheduling from the SCell to the PCell/PSCell. Therefore, we propose the following.   * When CCS from an SCell (sSCell) to PCell/PSCell is configured, UE monitors DCI formats 0\_0 and 1\_0 for scheduling PDSCH/PUSCH on PCell/PSCell (in ~~any associated~~ CSS set(s)) only on the PCell/PSCell and not on the sSCell |
| CATT | Not support | We support Qualcomm’s update.  The motivation of supporting a USS on the scheduled P(s)Cell is far from being justified. The intention of supporting CCS from Scell to PCell is to offload the PDCCH overhead on the scheduled PCell. If a USS can be configured on the PCell for self-scheduling, there is no reason to further configure CCS from SCell to PCell. |
| vivo |  | We understand the key point of this proposal is not to allow DCI 0\_0 and 1\_0 from sScell to PCell/PSCell scheduling. If this is the correct understanding, we support it; otherwise we agree with QC’s update. |

### Proposal 3

* When CCS from an SCell (sSCell) to PCell/PSCell is configured, UE monitors DCI formats 2\_0, 2\_1, 2\_2, 2\_3, 2\_4 in Type 3 CSS set configured on PCell/PSCell/sSell, and applicability of the information in the DCI formats is as per Rel15/Rel6 framework

Companies are requested to indicate their view about the above proposal in the Table below.

|  |  |  |
| --- | --- | --- |
| **Company Name** | **support/not support** | **Comments (Proposal 3)** |
| Intel | Support | Our understanding is the support of DCI formats 2\_0, 2\_1, 2\_2, 2\_3, 2\_4 on a SCell is already supported in Rel-15. Therefore, it can be used on sSCell |
| Qualcomm | Need a clarification | It is better to clarify that a UE monitors DCI formats 2\_0, 2\_1, 2\_2, 2\_3, 2\_4 in Type 3 CSS set configured on either of PCell/PSCell or sSell. |
| CATT | Support |  |
| vivo | Need updates | It seems 2\_5 introduced in NR Rel-16 is missed in the proposal. Besides, 2\_6 is already supported in PCell/PSCell and whether to extend to sScell can be FFS. Combined with QC’s update, we suggest the proposal updated below:   * When CCS from an SCell (sSCell) to PCell/PSCell is configured, UE monitors DCI formats 2\_0, 2\_1, 2\_2, 2\_3, 2\_4, 2\_5 in Type 3 CSS set configured on either of PCell/PSCell or sSell and 2\_6 in PCell/PSCell, and applicability of the information in the DCI formats is as per Rel15/Rel6 framework * FFS: whether/how to support DCI 2\_6 in sScell |

### Discussion point 4

* For USS handling, below options should be further discussed
  + Option 1
    - When CCS from an SCell (sSCell) to PCell/PSCell is configured, regarding DCI formats 0\_1,1\_1,0\_2,1\_2 that schedule PDSCH/PUSCH on PCell/PSCell, UE does not monitor them on PCell/PSCell USS set(s), and monitors them only on the sSCell USS set(s)
  + Option 2
    - When CCS from an SCell (sSCell) to PCell/PSCell is configured, regarding DCI formats 0\_1,1\_1,0\_2,1\_2 that schedule PDSCH/PUSCH on PCell/PSCell, UE can monitor them on both PCell/PSCell USS set(s) and sSCell USS set(s)

Companies are requested to indicate their view about the above options in the Table below. If companies prefer to study further, please indicate FFS and the aspects to be considered.

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Preferred option** | **Comments (Discussion point 4)** |
| Intel | Option 2 | We prefer to allow the flexibility to configure a USS on PCell/PSCell or sSCell. By this way, operator can select a most proper configuration based for a deployment.  Configuration of a USS on PCell/PSCell or sSCell could be per BWP. In fact, it is possible that the NR BW and LTE BW are only partially overlapped. In this case, it is possible that, a first BWP is overlapped with LTE hence coordination is needed, while a second BWP is not overlapped with LTE. For the latter case, it is preferable to allow USS configured on PCell.  Even for the overlap case, it doesn’t mean that PCell cannot transmit PDCCH. In fact, UE anyway needs to monitor DCI 0\_0/1\_0 and DCI 2\_x on PCell. Therefore, it doesn’t introduce new behavior to monitor a USS on PCell. The choice of configuration of a USS or not on PCell can be left to implementation. |
| Qualcomm | Option 1 | So far, for a given scheduled cell, there was only one scheduling cell that is configured by higher-layer signalling semi-statically. We do not think we need to change this principle. The reason why a UE configured with cross-carrier scheduling from an SCell to the PCell/PSCell has to monitor PDCCH on the PCell/PSCell is because of UE-common functions and fallback operation using CSS set(s). This does not mean we should enable USS on the PCell/PSCell.  Allowing USS on the PCell/PSCell will cause further trouble if the subcarrier-spacings are different between PDCCH on the PCell/PSCell and PDCCH on the scheduling SCell. |
| CATT | Option 1 | We don’t see the necessity of supporting USS configuration on the scheduled P(S)Cell.  The case here is similar to the current cross carrier scheduling scheme in some regard, wherein UE only monitoring USS on the scheduling cell. gNB has the freedom to configure the combination of scheduling cell and scheduled cell, and any proper search space on the scheduling cell. The flexibility is already fully respected from the current mechanism.  As we commented on proposal 2, it doesn’t make sense to configure USS on the scheduled cell considering it can already been scheduled by a USS on the scheduling cell. It will cause more efforts of monitoring PDCCH on different cells in vain. |
| Vivo | Option 1 | In our view, there is no use case to monitor USS simultaneously from Pcell/PScell and sScell. It makes the handling of DCI size budget, BD/CCE budget more complicated. |

### Proposal 5

* When CCS from an SCell (sSCell) to PCell/PSCell is configured, CA activation/deactivation of the sSCell is supported

Companies are requested to indicate their view about the above proposal in the Table below.

|  |  |  |
| --- | --- | --- |
| **Company Name** | **support/not support** | **Comments (Proposal 5)** |
| Intel |  | We are fine with the proposal. However, it seems the proposal is not as basic as the other 4 proposals. It is fine to leave this issue for further study. |
| Qualcomm |  | Agree with Intel. |
| CATT |  | Share similar views with Intel. |
| vivo |  | Agree with Intel. In addition, dormancy behavior of sSCell should also be discussed for future study. |

# 3 Conclusions

TBD

# 4 References

1. R1-2007579 Discussion on SCell PDCCH scheduling P(S)Cell PDSCH or PUSCH Huawei, HiSilicon
2. R1-2007695 Discussion on Scell scheduling Pcell vivo
3. R1-2007839 Disucssion on cross-carrier scheduling from Scell to Pcell CATT
4. R1-2008062 Discussion on cross-carrier scheduling from SCell to Pcell LG Electronics
5. R1-2008110 Discussion on cross-carrier scheduling from SCell to Pcell Spreadtrum Communications
6. R1-2008195 Cross carrier scheduling from SCell to Pcell Samsung
7. R1-2008284 Discussion on cross-carrier scheduling from Scell to Pcell OPPO
8. R1-2008451 Views on Rel-17 DSS SCell scheduling PCell Apple
9. R1-2008695 Discussion on cross-carrier scheduling from SCell to PCell ASUSTeK
10. R1-2008830 Discussion on Cross-Carrier Scheduling from SCell to PCell ZTE
11. R1-2009003 On SCell scheduling PCell transmissions Intel Corporation
12. R1-2009023 Cross-carrier scheduling from SCell to Pcell ETRI
13. R1-2009040 Discussion on Cross-carrier scheduling from SCell to Pcell Xiaomi
14. R1-2009046 Cross-carrier scheduling from SCell to Pcell Nokia, Nokia Shanghai Bell
15. R1-2009085 Search space monitoring to support SCell scheduling PCell InterDigital, Inc.
16. R1-2009110 Cross-carrier scheduling (from Scell to Pcell) Lenovo, Motorola Mobility
17. R1-2009195 Discussion on cross-carrier scheduling enhancements for NR DSS NTT DOCOMO, INC.
18. R1-2009206 Enhanced cross-carrier scheduling for DSS Ericsson
19. R1-2009277 Views on cross-carrier scheduling from an SCell to the PCell/PSCell Qualcomm Incorporated

# 5 Annex A – Agreements from previous meetings

## Agreements from RAN1#102-e

Agreements:

* Following scheduling combinations are allowed/not allowed when cross-carrier scheduling from an SCell to PCell/PSCell is configured  
  1. self-scheduling on PCell/PSCell is allowed
  2. cross-carrier scheduling from PCell/PSCell to another SCell is not allowed
  3. self-scheduling on the ‘SCell used for scheduling PCell/PSCell’ is allowed
  4. cross-carrier scheduling from the ‘SCell used for scheduling PCell/PSCell’ to another serving cell is allowed
  5. cross-carrier scheduling from another serving cell to the ‘SCell used for scheduling PCell/PSCell’ is not allowed
* FFS: Search space and DCI format handling for the allowed cases above

Agreements:

* Configuring 2 or more Scells to schedule the PCell/PSCell is not allowed