**3GPP TSG-RAN WG1 #107-e R1-21xxxxx**

**eMeeting, Nov 11 – 19, 2021**

**Source: Moderator (Ericsson)**

**Title: Summary#2 of Email discussion [107-e-NR-DSS-01]**

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

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

# 1 Introduction

This document summarizes the discussions for email thread [107-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 [1-18] submitted for RAN1#107-e

### 2.1.1 PDCCH monitoring and BD/CCE limits

Following aspects were discussed related to PDCCH monitoring and BD/CCE limit handling when CCS from sSCell to PCell/PSCell is configured

#### 2.1.1.1 Type B BD/CCE limits

1. Option A BD/CCE limit handling
   * Issue related to UE is not required to monitor more than [ or ] PDCCH BD candidates per sSCell slot (in RAN1#106bis-e agreement for Option A)
     + - [3],[8],[9],[10],[11],[17]
       - [2],[4],[5],[6],[13],[15]
   * RRC parameter details for (in RAN1#106bis-e agreement for Option A)
     + Same vs. different values for BD and CCE limits
       - Same – [4],[8],[10],[13],
       - Different – [16],[17]? (but from same set of values)
     + Set of values
       - [0.1, 0.2, 0.3, 0.4, 0.5] – [2]
       - 1/6 or 1/8 granularity 3 bits – [10]
       - 0.1,0.2 ,…0.9 for BD; 1/14,2/14,…13/14 for CCE – [16]
       - [0.25 0.5 0.75] – [17]
   * Additional values for s1, s2
     + No additional values – [2],[3],[4],[8],[9],[13],[17]
     + Additional values – [1],[7],[10],[14]
       - s1=; s2=1- – [1]
       - scaling factor is additionally supported; ‘s1=, s2=0’ – [7]
       - s1=1; s2=1 for different SCS – [10]
       - s1=0.5; s2=0.5 – [14]
2. r16monitoringcapability
   * Can be supported using Option A – [2]
   * not configured on P(S)Cell and sSCell but can be on other SCells – [4], [10],
   * if configured for monitoring on sSCell but not configured for monitoring on P(S)Cell, Rel16 span based PDCCH monitoring limits applied for scheduling from sSCell but for (s-p) scheduling, the additional per P(S)Cell slot limit is still applied – [16]
3. Multiple CORESET pools
   * Can be supported using Option A – [2]
   * not configured on P(S)Cell and sSCell (but can be on other SCells) – [10]
   * When configured for P(S)Cell with multi-DCI-based multi-TRP, UE expects to be configured with CORESETPool on both P(S)Cell and sSCell – [13]

#### 2.1.1.2 Type A PDCCH monitoring and BD/CCE limits

1. PDCCH monitoring and BD/CCE limits for Type A UE
   * Based on Approach 1 (from Proposal 2v2-1 discussed in RAN1#106bis-e [19])
     + [1],[5],[7],[13],[16],[17]
     + Change ‘monitoring’ to ‘processing’ – [5]
     + BD/CCE with – [2]
   * Based on Approach 2 (from Proposal 2v2-1 discussed in RAN1#106bis-e [19])
     + [1],[4],[5],[6],[9],[10]?,[14],[18]
     + BD/CCE handling
       - Option B – [4]
       - Option D (from Proposal 2v2-1 discussed in RAN1#106bis-e [19]) – [6]
       - Option E (from Proposal 2v2-1 discussed in RAN1#106bis-e [19]) – [9]
       - Option D+E – [10]
   * UE capability to monitor PDCCH on only one of P(S)Cell and sSCell in a slot of the P(S)Cell – [10]
   * When a UE is configured to monitor PDCCH in a same slot of the P(S)Cell on P(S)Cell and sSCell, the UE monitors PDCCH only on P(S)Cell – [10]
   * Type A UE not specified
     + [3],[10]?
2. Same BD/CCE handling for Type A and Type B
   * + [7],[8],[13]
3. Clarification on [slot/symbol] in RAN1#105e agreement
   * per slot (of P(S)Cell) overlap is avoided – [4],[7],[8],[18]
4. non-fallback USS handling
   * Type A Supports non-fallback DCI format on PCell – [2],[7],[13]

#### 2.1.1.3 General

1. DCI Size matching
   * RAN1#106bis-e Working assumption on CIF bits on P(S)Cell for DCI size matching between (p-p) and (s-p) DCI formats
     + Confirm WA – [2],[10],[13],[15],[16]
     + Add a note to WA e.g., “CIF bits are reserved” or “CIF bits only used for self-scheduling” – [2],[16]
     + CIF bits on P(S)Cell set to same CIF value as used for sSCell to P(S)Cell scheduling – [7]
   * Other aspects related to DCI size matching
     + Other fields that may need alignment
       - SCell dormancy Indication field? -- [4],[5],[16]
       - TCI indication? -- [4],[5]
       - 1 bit Padding to avoid size confusion with non-fallback? – [4]
     + Change DCI size budget definition to per (scheduling cell, scheduled cell) pair from per scheduled cell in NR Rel-16 – [4]
     + Align total DCI size of non-fallback DCI formats on P(S)Cell as the corresponding non-fallback DCI formats on sSCell that are used for sSCell to P(S)Cell scheduling – [5]
2. Handling when sSCell is deactivated/dormant/not available
   * Additional mechanism -- [1], [2],[3],[4],[5],[7],[10],[12],[14],[15],[16]
     + Additional SS sets (with non-fallback DCI formats, or fallback USS etc.) activated when sSCell is deactivated -- [1], [2],[3],[4],[5],[12],[14],[15],[16]
     + Automatic recovery of BD/CCE budget when sSCell is deactivated – [2]
     + sSCell deactivation triggers SSSG switch on P(S)Cell – [3],[7]
     + Use Rel16 limits upon sSCell deactivation – [10],[14]?,
     + Use upon sSCell deactivation – [7]
     + Use new sSCell indicated via DCI when current sSCell is deactivated – [14]
   * No additional mechanism – [6]?, [17]
3. unaligned CA on sSCell
   * Supported – [16]
   * Not supported – [10]
4. SCS restrictions (discuss in UE features?)
   * 15/30/60kHz P(S)Cell SCS as UE capability – [4]
   * Only 15kHz SCS on P(S)Cell – [17]
5. Impact on #DL and UL unicast DCI per monitoring occasion/span – [2], [5], [11], [18] (discuss in UE features)
6. DCI format 2\_5 follows Rel16 – [9],[11],[14]

### 2.1.2 Search Space configuration

1. Handling of ‘linked search space sets’
   * Additional handling -- [3],[4],[9],[16]
     + new RRC IE in the PDCCH-Config of the PCell to identify the linked search space – [3]
     + ‘light config’ implies linked SS set which is not used for P(S)Cell self-scheduling – [4]
     + monitoringSlotPeriodicityAndOffset, duration, monitoringSymbolsWithinSlot can also be configured on P(S)Cell and can be monitored on P(S)Cell when sSCell is deactivated or dormant – [9]
     + Separate config of UL and DL DCI formats – [16]
   * No additional handling – [10]
     + Fully reuse Rel16 linking – [10]
2. SCell to PCell scheduling configured per USS set – [9],[14]

### 2.1.3 Other aspects

1. Dynamic activation/deactivation of sSCell to P(S)Cell scheduling – [2]
2. Whether sSCell can be unlicensed band? – [12] (No special handling specified for unlicensed, UE capability indication if any can be covered as part of UE features discussion?)
3. BFR/RLF enhancement? – [4]

### 2.1.4 TPs/ Spec text proposals

1. 38.214: clarify the definition of ‘symbol i’ in OOO handling when P(S)Cell and sSCell have different SCS – [7]
2. 38.213: Proposal to capture BD/CCE limits to result as integer values – [17]
3. 38.213: TP for overbooking handling – [18]

Below are some proposals for discussion

## 2.2 Proposals

### Proposal 1

* For Option A BD/CCE limit handling agreed in RAN1#106bis-e
  + On sSCell (for cross-carrier scheduling to P(S)Cell)
    - UE is not required to monitor more than ~~[~~ ~~or ]~~ PDCCH BD candidates per sSCell slot

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

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Support/Not support** | **Comments (Proposal 1)** |
| Moderator notes |  | Above proposal taking into account discussions so far and inputs from different companies summarized in point 1 of section 2.1.1.1. The issue has been discussed for previous two meetings. Lower of the two limits is proposed as starting point to attempt to reach agreement. |
| Nokia, NSB | Support |  |
| Apple | Support |  |
| Samsung |  | Support the proposal to re-use Re-16 limit, but this relates to “Discussion Point 4” below (s1, s2 values). This proposal is aligned with s1 = 1 and s2 = 1 for different SCS.  If s1 = 1 and s2 = 0 is adopted, is not a relevant limit. |
| Qualcomm | Support |  |
| MTK | Support | For Samsung’s comment:   * If s1 = 1 and s2 = 0 is adopted, is not a relevant limit.   Does it mean keeping in the min formula is still fine (no impact)? |
| Intel |  | Assuming s1=1 and s2=0, is calculated with considering s-p scheduling of sSCell, therefore, we think should not be a limit per sSCell slot.  As we commented several times, we think that and scaling factor should be considered, i.e. the limit per sSCell slot should be |
| vivo | Not support | If following current agreed s1 and s2 value, i.e. s1=1 and s2=0, we don’t understand the logic to use . Clearly sScell scheduling Pcell will be counted in the cell group with Pcell SCS. If using , sScell scheduling Pcell is additionally counted in the cell group with sScell SCS. If so, why using s2=0 to calculate the . As we discussed for many times, the total BD/CCE budget will be changed before and after sScell scheduling Pcell is configured, which violate the WID. Many companies mention that either of them works. Then why not select the one which follows current WID?  @Qualcomm: One clarification for your question in GTW online: which total limit is increased by selecting ? In our understanding, is not changed by using s1=1 and s2=0.  If s1=1 and s2=1 is introduced in “Discussion Point 4”, we agree to use in that case. |
| ZTE | Not support | First of all, both formulation works and in most cases, the result of these two formulation is the same. However, in some cases, e.g., the number of cells with the same SCS of sSCell, it may end up with . In this case, the BD/CCE budget on PCell and sSCell(for scheduling PCell) will be even smaller than the Rel-15 one.  On another aspect, the whole principle of Option A is to split the BD/CCE budget from PCell between PCell and sSCell, that’s why s1=1 and s2=0 is applied in the end. From this perspective, is not reasonable to be included in this formulation.  Finally, if is included in this formulation, it may imply that s-p scheduling should be counted in the limitation of . This is not reasonable since the BD/CCE for sSCell scheduling PCell is from PCell, which should not be counted under . |
| Xiaomi | Support |  |
| CMCC | Support | We think it is reasonable to maintain BD/CCE limit handling on sSCell per sSCell slot as in Rel-16 specification. |
| ETRI | Not support | In our understanding, the Option A principle we agreed implies that sSCell BD limit for cross-carrier scheduling belongs to the P(S)Cell BD capability. sSCell is even not counted for its own SCS u1 based on the agreed s1=1 and s2=0. Thus seems irrelevant to the sSCell limit, unless a non-zero s2 value is introduced. |
| OPPO | Conditional support | We see both sides of the argument have valid points. Meanwhile, because both choices can eventually work, we can support FL proposal if no extra spec impacts are introduced just due to selection of over . |
| Lenovo, Motorola Mobility | support | In our view if the condition “ PDCCH BD candidates per P(S)Cell slot” is not constraining the BD limit, we should be able to have BD limits same as Rel-16. In our view, S2=0 is for counting sSCell additionally, and hence, we can get Rel-16 limit if the per PCell condition is not constraining the sSCell budget (based on PCell BD parameters and ). |
| DOCOMO |  | For s1=1 and s2=0, we prefer . In some cases, , and it can provide better flexibility. was already taken into account per P(S)Cell slot, it seems redundant if is taken into account per sSCell slot. |
| Ericsson1 | Support | We are OK to support current proposal as compromise.  Below is our understanding   * With a) apply and b) s2=0 , for Ue implementation, sSCell to PCell scheduling BDs does not have to exceed i) total BD limit across all cells but can exceed ii) total BD limit computed across all cells with SCS same as sSCell. This is the extra flexibility cited by proponents of . The argument is since s2=0, the limit ii) need not apply. * By selecting a) to apply and b) s2=0 , for UE implementation, sSCell to PCell scheduling BDs does not have to exceed both i) total BD limit across all cells and also ii) total BD limit computed across all cells with SCS same as sSCell. This is the simplification that UE vendors seem to be insisting in our understanding.   For regularly expected scenarios, (e.g. the number of cells with PCell SCS is not significantly higher than number of cells with sSCell SCS), the does not actually seem to result in any practical constraint.  Overall, we do not see any inconsistency with either option. Instead, it is trade-off between flexibility (more BDs) vs. UE implementation (sSCell to PCell scheduling BDs do not exceed total BDs computed for the sSCell SCS) and both options work. |
| Samsung2 |  | For different SCS between PCell and sSCell, the issue is whether or not the BDs used for CCS from sSCell to PCell are counted towards . Use of s2=0 is intended to maintain the number of BDs on sSCell (and other scheduling cells with SCS configuration ) same as for no-DSS without consuming those BDs for DSS – PDCCH offloading from PCell to sSCell is only due to “. Therefore, is not a relevant limit for such BDs - only needs to be enforced. Also, spec clarification may be needed for the definition of in the current FL proposal.  If the intention is to consume some BDs on sSCell (and other scheduling cells with SCS configuration ) for CCS from sSCell to PCell and to count such BDs towards , this can be achieved by s1 = 1 and s2 = 1 which will actually offload some BDs from PCell to sSCell.  Arguments that has no real impact on UE’s BD/CCE budget basically suggest that the whole definition of is useless (and should not have been introduced in Rel-15).  For the case of same SCS between PCell and sSCell, there is clearly no issue with , because a more stringent limit (with scaling factor alpha) is already enforced by the PCell limit. |
| Huawei, HiSilicon | Support and | Support this proposal when the BD candidates On sSCell are included in which means, similar view with Samsung, is not a relevant limit when s1 = 1 and s2 = 0 is adopted and this is more consistent with UE implementation of other s1 and s2 values. |
| Moderator Notes2 |  | Suggest to continue discussion (using current Table) |
| ZTE |  | Based on the discussion above, it seems more and more companies acknowledge that shoud not be included if s2=0. But it may be useful if s2≠0. Then how about the following proposal. Proposal 1  * For Option A BD/CCE limit handling agreed in RAN1#106bis-e   + On sSCell (for cross-carrier scheduling to P(S)Cell)     - UE is not required to monitor more than ~~[ or~~ ~~]~~ PDCCH BD candidates per sSCell slot     - FFS if s2≠0 |
| Spreadtrum | Support | We are fine to support the proposal for progress. |

**Discussion Point 2 (RRC impact)**

* For Option A BD/CCE limit handling agreed in RAN1#106bis-e
  + Value of parameter for BD limit handling is configured via RRC from a set of
    - Alt 1: 4 possible values
    - Alt 2: 8 possible values
    - Alt 3: 16 possible values

Companies are requested to indicate their view on the above discussion point in the Table below

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Preferred Alternative(s)** | **Comments (Discussion Point 2)** |
| Moderator notes |  | Company inputs so far are summarized in point 1 of section 2.1.1.1. Please indicate your preferred alternative and (if any) specific preferred values for the possible set. |
| Nokia, NSB | Alt2 | Values e.g. 0,1, …, 0,9. |
| Apple |  | No strong preference |
| Samsung | Alt 2 | 8 values can provide sufficient flexibility to network configuration, with reasonable UE complexity. 4 values can also be acceptable – 16 is too much. |
| Qualcomm | Alt.1 | We should strive for finding minimum necessary set of values. Further, supporting very small value corresponding very small number of BDs or CCEs (e.g., 2 CCEs on sSCell and 54 CCEs on P(S)Cell) does not make sense. Having said that, we consider Alt.1 is sufficient.  If justified, we can consider extending the number of values as Alt.2. |
| MTK | Alt. 1 | Alt. 1 seems sufficient to us. Alt. 2 is also acceptable to us if that’s the majority view. |
| Intel | Alt 1 | It sounds reasonable to derive values considering CCE limit. The total number is 56, to allow 8 or 16 CCEs on PCell, it results in = 8/56=1/7 or 16/56=2/7. Taking =16/56 as minimum can work for all cases. We think should be allowed to define a unified solution with/without SCell scheduling PCell. |
| Vivo | Alt. 2 | We think Alt. 3 is too much. Alt. 1 may not provide enough flexibility. |
| ZTE | Alt.1/2 | No strong preference on this.  For the details value, the candidates value of α can be [0.1, 0.2, 0.3, 0.4, 0.5] (i.e., values smaller than 0.5) to allow more PDCCH offloading to sSCell. |
| Xiaomi | Alt 1 | We think alt 1 is sufficient and is our first preference. We can support 8 values at most. |
| CMCC | Alt 2 | We are fine with 8 values that can provide effective distribution of BD budget with flexibility for P(S)Cell and sSCell, and 4 values are also fine to us. |
| ETRI | Alt. 1 or Alt. 2 | No strong preference, but Alt. 1 seems sufficient. |
| OPPO | Alt1 | 4 values should be sufficient. |
| Lenovo, Motorola Mobility | Alt. 2 /Alt. 1 | Considering this is an RRC parameter, and overhead is not a major concern, we think Alt. 2 can provide sufficient flexibility, especially, when restricts the BD budget on Pcell. We are fine with Alt.1 too. |
| DOCOMO | Alt 2 | We think Alt 2 is reasonable choice. |
| Ericsson1 | Alt2 or Alt 3 | As discussed in our contribution, to cover cases with different #serving cells sufficient granularity is needed. |
| Huawei, HiSilicon | Alt 2 |  |

### Proposal 2v2 (RRC impact)

* For Option A BD/CCE limit handling agreed in RAN1#106bis-e
  + Value of parameter for BD limit handling is configured via RRC from a set of
    - ~~Alt 1: 4 possible values~~
    - Alt 2: 8 possible values
    - ~~Alt 3: 16 possible values~~

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

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Support/Not support** | **Comments (Proposal 2v2)** |
| Moderator notes2 |  | Based on company views from Discussion point 2. Alt 2 seems to be acceptable to most companies. |
| ZTE | Support | We also need to further determine the detailed candidate values for. |
| Spreadtrum | Support |  |
| MTK | Support |  |

**Discussion Point 3 (RRC impact)**

* For Option A BD/CCE limit handling agreed in RAN1#106bis-e
  + For CCE limit handling (i.e., scaling of maximum number of non-overlapping CCEs)
    - Alt 1: same parameter agreed for BD limit handling is used
    - Alt 2: Separate parameter can be configured. Possible set of values for and is same
    - Alt 3: Separate parameter can be configured. Possible set of values for and can be different

Companies are requested to indicate their view on the above discussion point in the Table below

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Preferred Alternative(s)** | **Comments (Discussion Point 3)** |
| Moderator notes |  | Company inputs so far are summarized in point 1 of section 2.1.1.1. Please indicate your preferred alternative and (if any) specific preferred values for the possible set. |
| Nokia, NSB | Alt1 | There is some merit in having different CCE and BD distribution, but due to simplicity we prefer having this the same. |
| Apple | Alt1 |  |
| Samsung | Alt-1 | The bottleneck is the number of CCEs. The network can select based on CCE requirement. Whether a somewhat smaller or somewhat larger is used for BDs would make no difference. |
| Qualcomm | Alt.1 or Alt.2 | On P(S)Cell, necessary number of CCEs are typically larger compared to that of BDs since common search space sets basically requires higher ALs. Therefore, we understand the motivation of having separate parameters for BD split and CCE split. We do not think Alt.2 brings issue if the number of values of the parameter is reasonably small (preferably 4 values, possibly 8 values) and the values are also reasonable. |
| MTK | Alt 1 | Due to simplicity we prefer having this the same, unless a clear performance gain is justified for other alternatives. |
| Intel | Alt1 |  |
| vivo | Alt. 1 |  |
| ZTE | Alt.1/2/3 | We are ok with all the three alternatives. Alt.1 can work while Alt.2/3 can provide more flexibility. |
| Xiaomi | Alt 1 | We share similar views with Samsung. Besides, whether or not the CCEs can be fully used highly depends on the search space configuration, e.g. the number of CCE, the distribution of AL. The benefits of alt 2 may be restricted. |
| LG Electronics | Alt 1 |  |
| CMCC | Alt 1 | We prefer to configure same scaling factor for BD and CCE limit handling to avoid additional network scheduling complexity. |
| ETRI | Alt. 1 |  |
| OPPO | Alt 1 |  |
| Lenovo, Motorola Mobility | Alt. 1 | We prefer Alt. 1 to avoid additional discussion on potential invalid/not useful combinations of , . |
| DOCOMO | Alt 1 |  |
| Ericsson1 | Alt 2 or Alt 3 | As discussed in our contribution, if e.g. 10MHz P(S)Cell then number of CCEs required for P(S)Cell would be 8 for which suitable alpha=8/56 and that translates to < 7 BDs (44\*(8/56)) left for P(S)Cell which is too small. Picking bigger alpha to accommodate more BDs would mean >8CCEs left for P(S)Cell if the parameters are linked which wastes precious CCE budget. Delinking the parameters is a simple way to avoid these trade-offs. |
| Huawei, HiSilicon | All acceptable | Same view as ZTE |

### Proposal 3v2 (RRC impact)

* For Option A BD/CCE limit handling agreed in RAN1#106bis-e
  + For CCE limit handling (i.e., scaling of maximum number of non-overlapping CCEs)
    - Alt 1: same parameter agreed for BD limit handling is used
    - ~~Alt 2: Separate parameter can be configured. Possible set of values for and is same~~
    - ~~Alt 3: Separate parameter can be configured. Possible set of values for and can be different~~

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

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Support/Not support** | **Comments (Proposal 3v2)** |
| Moderator notes2 |  | Based on company views for discussion point 3. Most companies seem to not see need for Alt 2/Alt3 |
| ZTE |  | We can accept Alt 1if this is the majority view. |
| Spreadtrum | Support |  |
| MTK | Support |  |

**Discussion Point 4 (RRC impact?)**

* For Option A BD/CCE limit handling agreed in RAN1#106bis-e
  + For determining and
    - Alt 1: Only (s1=1, s2=0) are used and additional values are not supported
    - Alt2: Values other than (s1=1, s2=0) can be used. Additional values for (s1, s2) are configured via RRC

Companies are requested to indicate their view on the above discussion point in the Table below

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Preferred Alternative(s)** | **Comments (Discussion Point 4)** |
| Moderator notes |  | Company inputs so far are summarized in point 1 of section 2.1.1.1. Please indicate your preferred alternative and if Alt 2 is preferred please provide (if any) specific preferred values. |
| Nokia, NSB | Alt1 | Slight preference in order to reduce cases to discuss when we haven’t identified a clear need for other values. |
| Apple | Alt1 |  |
| Samsung | Alt-2  (s1 = 1, s2 =1)  for different SCS | The agreed values of s1=1 and s2=0 are well suited for same SCS between P(S)Cell and sSCell. For different SCS, s1=1 and s2=1 is more appropriate because:   * The P(S)Cell is a scheduled cell for the sSCell as a scheduling cell – s2=0 does not reflect such operation; * Using s2=0 cancels having as a limit on the number of PDCCH candidates on the sSCell that are monitored for P(S)Cell scheduling (Proposal 1 in FL summary). It would be an unnecessary exception in the specifications to define as a new (non Rel-16) per-scheduled-cell limit. Using s2=1 keeps the Rel-16 per-scheduled-cell limit of . * Using s1=1 and s2=1 can realize the DSS goal for PDCCH offloading from P(S)Cell to sSCell: it decreases the number of BD/CCEs on Pcell ( /) and increases as the number of BD/CCEs on the sSCell () while the total BD/CCE remains the same (per WID). Using s1=1 and s2=0 keeps the same and as without DSS – no PDCCH offloading. * Using s1=1 and s2=1 for different SCS between P(S)Cell and sSCell allows a same definition for and for between Type-A and Type-B UEs. |
| Qualcomm | Alt.1 | First of all, the agreement is following. Even for different SCSs, (s1=1, s2=0) was already agreed.  **Agreement**  Option A is supported in Rel-17   * At least for Type B UE, when the UE is configured for CCS from sSCell to P(S)Cell and **when P(S)Cell SCS () is less than or equal to sSCell SCS ()**,[and at least when UE is not provided monitoringCapabilityConfig for any cell, ]   + Option A     - […]     - When determining and       * P(S)Cell self-scheduling is counted by applying scaling factor s1       * sSCell to P(S)Cell scheduling is counted additionally (assuming SCS of sSCell) by applying scaling factor s2       * **s1=1 and s2=0**, FFS other s1 and s2   Then, values other than (s1=1, s2=0) requires different per-SCS total BD/CCE limit for the same DL-CA configuration with the same value of *pdcch-BlindDetectionCA*. We do not think it can be simple RRC configuration (i.e., requires a new UE capability to enable it) and therefore, we prefer Alt.1. The best compromise is to support values other than (s1=1, s2=0) with a separate optional capability. However, we do not think the need is justified. |
| MTK | Alt1 | To our understanding, (s1 = 1, s2 =1) increases the BD limit compared to (s1 = 1, s2 =0), for both same/different SCS between PCell and sSCell. If there is a strong motivation to support (s1 = 1, s2 =1), we can accept to support that as another optional capability. |
| Intel |  | For s1=1 and s2=0, due to hard split of CCE limit to two cells, Pcell and sSCell, it causes much limitation on PDCCH transmission since channel estimation of CCE cannot be shared as legacy self-scheduling of Pcell. Therefore, we think it is beneficial to support other value pairs of (s1, s2). For example, s1 >1. On the other hand, s2>0 can be considered too, since it is not reasonable that PDCCH is transmitted on sSCell, however, s-p scheduling is not contributed to |
| vivo | Alt. 1 | We don’t see much motivation to have other values of s1 and s2.  If keeping current s1=1 and s2=0, is the natural choice in proposal 1 |
| ZTE |  | From our understanding, Alt.1 is aligned with Option A that has already agreed.  If other values is introduced, the Rel-16 budget will be anyway impacted. No matter s1=0.5 and s2=0.5, or s1=1 and s2=1, M\_total\_μ will be decreased, and M\_total\_μ1 will be increased. But from the motivation of Rel-17 DSS WI, this is beneficial for off-loading PCell PDCCH to sSCell.  So if other value are strongly preferred by companies, we can only accept s1+s2=1 (e.g. s1=0.5 and s2=0.5) because this at least maintains the number of PCell as 1. |
| Xiaomi | Alt1 | Same views as Qualcomm and MTK. When different SCS are configured for Pcell and sSCell, other combination like (s1=1,s2=1) increase the BD limit for sSCell group while reduce the BD limit for Pcell group. It will enlarge the imbalance between different numerology group. |
| LG Electronics | Alt2 | We share the view with Samsung. Considering PDCCH offloading to sSCell, we can support additional s1/s2 values (e.g., s1=0.5, s2=0.5) |
| CMCC | Alt 1 | We think s1=1 and s2=0 is enough and other values should not be supported. s1=1 and s2=0 can provide more scheduling opportunities and will not exceed Rel-16 UE capability, while other scaling factor combinations may cause unnecessary restriction to PDCCH monitoring on P(S)Cell for self-scheduling and sSCell for CCS due to the total budget decrease. |
| ETRI | Alt. 1 | Only s1=1 and s2=0 seems aligned to the principle of Option A. |
| OPPO | Alt 1. | Share the views from other companies. BTW, according to Samsung’s comment “Using s1=1 and s2=1 for different SCS between P(S)Cell and sSCell”, there seems no need to have “Additional values for (s1, s2) are configured via RRC” if the value setting is agreed to link to difference of SCS. |
| Lenovo, Motorola Mobility | Alt. 1 | S2>0 may increase BD/CCE limits on sSCell compared to that of Rel-16, depending on |
| DOCOMO | Alt 1 |  |
| Ericsson1 | OK with Alt 1 |  |
| Samsung2 |  | {s1=1, s2=1} is only for the case of different SCS - does not require RRC configuration or UE capability. As explained in our previous comment, this offloads some BD/CCEs from PCell to sSCell but maintains the total BD/CCE.{s1=1, s2=0} can be used for the case of same SCS. |
| Huawei, HiSilicon | Alt 2 | We support Alt-2, and propose additionally support s1=α. While the flexibility by configurable is not desirable, we are also ok with up to two sets of {s1, s2}.  As we said in the contribution, there are different UE implementations.  The main difference of Cap B-1 UE and Cap B-2 UE is the source of BDs/CCEs process capability for cross carrier scheduling from sSCell to PCell. Cap B-1 UE use BDs/CCEs for 15KHz CC group for ***both*** cross carrier scheduling from sSCell to PCell ***and*** self-scheduling of PCell. Cap B-2 UE uses BDs/CCEs for 15KHz CC group for self-scheduling of PCell and ***additionally/separately*** uses BDs/CCEs for 30KHz CC group for cross carrier scheduling from sSCell to PCell.  For Cap B-2 UE, (s1=1, s2=0) is not suitable.  **One example:**  Assume the scenario that the UE is configured with 5 CCs: 4 CCs with SCS 15KHz (including the PCell) and 1 CC with SCS 30KHz (sSCell) and the UE reports *pdcch-BlindDetectionCA* = 4. PCell and sSCell are configured to schedule PCell, and the sSCell and other sSCells are configured to self-schedule. The target PDCCH offloading ratio is 50%, which means the network aims to offload about 50% BD/CCEs for scheduling PCell by using sSCell. No cell is configured with M-TRP operation.    Figure 1. CA configuration with multiple CCs using SCS of 15KHz  When the factors s1=1 and s2=0 (i.e., Cap B-1 UE)   * , .   When the factors s1=0.5 and s2=0.5 (offloading ratio is 50%) (i.e., Cap B-2 UE)   * , .   As can be seen, when the self-scheduling of sSCell and the cross carrier scheduling from sSCell to PCell share 43 BDs, which significantly increases the gNB scheduling flexibility with Cap B-2 UE. On the other hand, when the current agreed factors s1=1 and s2=0 are used in line with Cap B-1 UE implementation, the BDs/CCEs for 30KHz CC group will be only 28, which is the same as legacy CA operation. This case does not really ‘offload’ any BD from PCell to the sSCell, rather, it utilize the existing sSCell PDCCH processing capability to carry the traffic load from PCell, which penalize the SCell self-scheduling (and potentially scheduling of other SCells from this sSCell).  **Another example**  Assume the scenario that the UE is configured with 5 CCs: 1 CCs with SCS 15KHz (the PCell) and 4 CC with SCS 30KHz (including the sSCell). Other conditions are the same as the previous example.    Figure 2. CA configuration with multiple CCs using SCS of 30KHz  When the factors s1=1 and s2=0 (i.e., Cap B-1 UE)   * , .   When the factors s1=0.5 and s2=0.5 (offloading ratio is 50%) (i.e., Cap B-2 UE)   * *, .*   As can be seen, with DSS enhancement as Cap B-2 UE implementation, it allows the UE to offload its PDCCH capability from PCell to SCell therefore that for PCell is reduced from 35 to 17 and that for SCell is increased. With Cap B-1 operation, the PCell PDCCH capability is not changed; however as those BDs cannot be scheduled efficiently anyway on a carrier shared with LTE due to e.g. LTE-CRS and/or spectrum limit, those BDs are likely wasted. |

### Proposal 4v2 (for conclusion)

* For Option A BD/CCE limit handling agreed in RAN1#106bis-e
  + For determining and
    - Alt 1: Only (s1=1, s2=0) are used and additional values are not supported
    - ~~Alt2: Values other than (s1=1, s2=0) can be used. Additional values for (s1, s2) are configured via RRC~~

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

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Support/Not support** | **Comments (Proposal 4v2)** |
| Moderator notes2 |  | Based on company views for discussion point 4. Most companies seem to not see need to introduce additional (s1,s2) combinations |
| ZTE |  | We can accept Alt 1 if this is the majority. |
| Spreadtrum | Support |  |
| Huawei, HiSilicon | Not support | We still think the Alt 2 is the necessary. Alt 1 and Alt 2 are suitable for different UE implementations.  As we said in the contribution, it is worth noting a Cap B-2 UE needs to support cross carrier scheduling first, while a Cap B-1 UE does not need to support cross carrier scheduling. A UE san choose support only Cap B-1 or only Cap B-2 based on implementations. This is important as there are legacy UEs supporting cross-carrier scheduling already and implementation change to be minimized to those UEs for generalizing new devices is always highly preferable, even though the design of DSS enhancement based on Option A could optionally be built based on single cell BD/CCE budget. In a long term, having BD/CCE limit only in a manner of subjecting to single cell budget without compatibility with the implementation of existing designs enabling cross-carrier scheduling from PCell to SCell would significantly penalize the deployment of this feature, or make it non-future proof to be further evolved. |
| MTK | Support | We can accept to support additional (S1, S2) values as optional capability. |

### Proposal 5

* Down-select from following approaches for PDCCH monitoring and BD limit handling for Type A UE
  + Possible Approach 1
    - BD/CCE limits for Type B UEs are applicable for all Ues supporting cross-carrier scheduling from sSCell to P(S)Cell
    - Additional simplifications to PDCCH monitoring can be discussed during UE capabilities discussions including the following
      * Type A UE as per RAN1#105-e agreement and
        + simultaneous monitoring of ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell’
      * Type A UE as per RAN1#105-e agreement and
        + no simultaneous monitoring between ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’
        + simultaneous monitoring of ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC not scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’
  + Possible Approach 2
    - All Ues (supporting cross-carrier scheduling from Scell to Pcell) can be configured with Type 0/0A/1/2/CSS sets on P(S)Cell that overlap with sSCell USS sets (for P(S)Cell scheduling)
    - Type A Ues drop the USS set(s) on sSCell (for P(S)Cell scheduling) that overlap in same [symbol/slot] as Type 0/0A/1/2/CSS sets on P(S)Cell
      * Separate UE capability is introduced for the Type A Ues
    - BD/CCE limit for Type A UE is based on one of the following approaches (selected in RAN1#107-e)
      * Option B (discussed earlier for Type B Ues)
      * Option D
        + In a slot, if the PDCCH candidates are only configured on P(S)Cell, the BD/CCE limit on this slot is determined based on the P(S)Cell configurations
        + In a slot, if the PDCCH candidates are configured only on sSCell, the BD/CCE limit on this slot is determined based on the sSCell configurations
        + The limit of Rel-16 UE capability is applied without further restrictions
      * Option E
        + No per-slot change in and

Companies are requested to indicate their view on the above Proposal in the Table below

|  |  |
| --- | --- |
| **Company Name** | **Comments (Proposal 5)** |
| Moderator notes | Continuation of discussion from RAN1#106bis-e Proposal 2v2-1 [19]. Inputs to current meeting are summarized in section 2.1.1.2 point 1.  If possible, down-selection can be discussed in one of the GTW sessions. Please indicate if any further clarifications are needed |
| Nokia, NSB | If the Type B UE can be agreed to be the sole UE type, this discussion could be bypassed.  If we keep the Type A UE, then approach #1 should be selected. If we select approach #2, it opens up additional questions to resolve. |
| Apple | We prefer approach 1 |
| Samsung | It is clear by now that a UE based on Approach 1 is no different from Type-B UE.  Approach 2 re-uses Rel-16 implementation/specification (thereby a low-complexity solution), and retains the scheduling flexibility for DSS operation.  BD/CCE handling was raised as a concern for Type-A Ues per Approach 2. We support BD/CCE handling to be aligned for Type-A and Type-B Ues as follows:   * Same definition for and for both Type-A and Type-B Ues by re-using Rel-15/Rel-16 formulas and {s1,s2} values per Discussion Point 4. * Unified BD/CCE handling for both Type-A and Type-B Ues in P(S)Cell slots where the UE monitors PDCCH for P(S)Cell scheduling on only one of P(S)Cell and sSCell (but not both of them) using Option “D+E”. This will be Rel-16 requirements applied in each P(S)Cell slot based on the corresponding scheduling cell in that slot.   If a Type-A UE based on Approach 2 is not agreeable in RAN1, it is preferable to not have a Type-A UE defined in UE features, as there would be no benefit to UE implementation while a network will not have to support two UE types. |
| Qualcomm | **On possible approach 2:**  Samsung proposes above “BD/CCE handling to be aligned for Type-A and Type-B”. If we change the possible approach 2 as follows, the UE side concerns can be resolved. Not sure if this is acceptable to the network side.   * + Possible Approach 2     - All Ues (supporting cross-carrier scheduling from Scell to Pcell) can be configured with Type 0/0A/1/2/CSS sets on P(S)Cell that overlap with sSCell USS sets (for P(S)Cell scheduling)     - Type A Ues drop the USS set(s) on sSCell (for P(S)Cell scheduling) that overlap in same [symbol/slot] as Type 0/0A/1/2/CSS sets on P(S)Cell       * Separate UE capability is introduced for the Type A Ues     - BD/CCE limits for Type B Ues are applicable for all Ues supporting cross-carrier scheduling from sSCell to P(S)Cell (copied from possible approach 1)     - UE capability/incapability indication for below to be discussed as part of UE features discussion (copied from Type B)       * All search space configurations monitored on sSCell for cross-carrier scheduling to P(S)Cell are within a single span of [3] consecutive OFDM symbols within a duration spanning P(S)Cell slot     - Same approach as above is used for CCE limits (copied from Type B)       * FFS: Separate vs. same RRC configured scaling factors (corresponding to ) for BD and CCE limits.     - ~~BD/CCE limit for Type A UE is based on one of the following approaches (selected in RAN1#107-e)~~       * ~~Option B (discussed earlier for Type B Ues)~~       * ~~Option D~~         + ~~In a slot, if the PDCCH candidates are only configured on P(S)Cell, the BD/CCE limit on this slot is determined based on the P(S)Cell configurations~~         + ~~In a slot, if the PDCCH candidates are configured only on sSCell, the BD/CCE limit on this slot is determined based on the sSCell configurations~~         + ~~The limit of Rel-16 UE capability is applied without further restrictions~~       * ~~Option E~~         + ~~No per-slot change in and~~   If the above is not acceptable, we stay supporting the possible approach 1.  **On possible approach 1:**  The capabilities proposed under the possible approach 1 is “whether the UE can monitor unicast PDCCH on Type-0/0A/1/2 CSS sets that overlaps with sSCell USS set(s) in same [symbol/slot]”. We think disabling this from Type A is not harmful since there is sSCell USS set(s) that can carry unicast PDCCH in the slot anyway. Proponents of the capabilities under possible approach 1 can clarify if this is really essential. If having capabilities under possible approach 1 is not well justified, we suggest to update the possible approach 1 as follows.   * + Possible Approach 1     - BD/CCE limits for Type B Ues are applicable for all Ues supporting cross-carrier scheduling from sSCell to P(S)Cell     - Additional simplifications to PDCCH monitoring ~~can be discussed during UE capabilities discussions including the following~~       * ~~Type A UE as per RAN1#105-e agreement and~~         + ~~simultaneous monitoring of ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell’~~       * Type A UE as per RAN1#105-e agreement and         + no simultaneous monitoring between ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’         + simultaneous monitoring of ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC not scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’   Note that we made an agreement for supporting two types of Ues having the functionalities described below. It is FFS whether the differences are to be specified in 213 or can be part of UE features. We do not think Type-A and Type-B are the same, and we do not see any reason to revert the formal agreement.  **Agreement**  Two types of Ues (Type A and Type B) can support CCS from sSCell to P(S)Cell   * For Type A UE   + At least following search space sets on P(S)Cell and search space sets on sSCell are configured so that the UE does not monitor them in overlapping [slot/symbol] of P(S)Cell and sSCell     - search space sets on P(S)Cell       * USS sets for DCI formats 0\_1,1\_1,0\_2,1\_2 (if supported for Type A UE)       * USS sets for DCI formats 0\_0,1\_0       * Type3-CSS set(s) for DCI formats 1\_0/0\_0 with C-RNTI/CS-RNTI/MCS-C-RNTI     - search space sets on sSCell       * USS set(s) for scheduling P(S)Cell   + FFS: BD/CCE handling * For Type B UE   + Following search space sets on P(S)Cell and search space sets on sSCell can be configured so that the UE monitors them in overlapping [slot/symbol] of P(S)Cell and sSCell     - search space sets on P(S)Cell       * USS sets for DCI formats 0\_0,1\_0       * Type3-CSS set(s) for DCI formats 1\_0/0\_0 with C-RNTI/CS-RNTI/MCS-C-RNTI     - search space sets on sSCell       * USS set(s) for scheduling P(S)Cell   + For handling ‘USS sets for scheduling P(S)Cell’ on P(S)Cell and/or on sSCell for DCI formats 0\_1,1\_1,0\_2,1\_2     - Alt 2-1 is adopted   + There is no restriction on Type-0/0A/1/2-CSS sets configurations   + FFS: BD/CCE handling * For Type A and/or Type B UE   + FFS: switching to ‘normal’ PDCCH monitoring on P(S)Cell when sSCell is deactivated * FFS: Whether Type A is specified or is Type-B with restrictions (as part of UE features discussion) * FFS: Whether the UE can be configured with unaligned CA * FFS: Whether the above applies for multicast PDSCH |
| MTK | We support the **possible approach 2** mentioned by QC, followed by FL’s possible approach 2. Having said that, considering this is the last meeting for Rel-17, we have our preference between Approach1/Approach2, but we would keep our mind open if a clear majority prefers other flavor. |
| Intel | We support possible approach 1 which merges the early Alt 1 and 3. In particular, we still think the early Alt3 is the best.  We are also fine to remove Type A UE since there is no big difference between Type A and Type B. therefore, we prefer to define a single UE type based on Type B UE. Under such assumption, it is always to add some restriction to single UE type to approach Type A UE operation |
| vivo | We agree with Samsung that a UE based on approach 1 has no difference with Type B Ues.  If Type A UE is defined, we support approach 2.  If approach 2 can’t be agreed, we are fine not to define Type A Ues. |
| ZTE | We are ok to only have one type of UE, i.e., type-B UE if companies didn’t converge on either approach.  Similar view as Intel, our preference is Alt.3 in the possible approach 1, which has the least constraints from network perspective. If both type A and type B UE need to support monitoring PDCCHs on two Cells simultaneously, it seems not necessary to have a separate UE feature for type A UE. |
| Xiaomi | We prefer approach 1. We still don’t understand why approach 1 makes type A UE no different from type B UE. The original definition of type A UE is quoted by Qualcomm in the above, which is achieved in RAN1#105 meeting.  The possible approach 1 doesn’t revert the previous agreement and respect the definition of type A UE quite well. There is no restriction on whether type 0/0a/1/2 CSS can verlap or not overlap with USS on the sSCell. In the other words, our understanding is it is supported automatically as the current behaviour. Approach 1 is a much simpler solution and already completed. |
| LG Electronics | We prefer Approach 2 and Option D. |
| CMCC | We support Approach 2. Approach 1 allows simultaneous PDCCH monitoring on P(S)Cell and sSCell (for cross-carrier scheduling to P(S)Cell), or just restricts unicast PDCCH monitoring on P(S)Cell, which seems to make no difference from Type B UE capability, while we can distinguish the two types of UE by Possible Approach 2.  Since no simultaneous PDCCH monitoring on P(S)Cell and sSCell(for P(S)Cell scheduling) within a slot, there is no need to consider distribution of BD/CCE budget across different cells. Using Option “D+E” for Type A UE BD/CCE limit handling is acceptable to us, and  *,* do not need to vary per slot. |
| ETRI | We prefer Approach 1. Approach 1 may not be the best solution for Type A UE but some BD capability loss from Option A can be acceptable to achieve the simplicity assuming that Type A UE is the lower capability UE. |
| OPPO | We prefer Approach 2 with Option D. But with the observation that less effort is put on selection among Option {B,D,E}, we do not see a good chance to agree on Approach 2 in this very last meeting. For sake of progress, our next choice is “new Possible Approach 2” proposed by Qualcomm, followed by “Possible Approach 1”. We do not support removing Type-A from functionality perspective. |
| DOCOMO | We prefer Approach 1 updated by Qualcomm. But we are also fine with Approach 2 updated by Qualcomm. |
| Ericsson1 | Regarding Approach 2   * The main arguments cited for Approach 2 compared to Approach 1 seems to be – Approach 2 results in a Type A UE that is significantly different from Type B since simultaneous PDCCH monitoring is not required. * However, as we raised in RAN1#106bis-e all Ues (Approach 2) have to support ‘simultaneous monitoring of PDCCH on P(S)Cell and sSCell’ (i.e., there is no constraint on (p-p)+(s-s) scheduling). So, it is unclear how imposing a TDM constraint on just (p-p)+(s-p) results in difference in PDCCH monitoring. The proponents of Approach 2 are yet to clarify this.   + i.e., for blind decoding of PDCCH what is the significant difference between below if M1+M2+N <= M+N     - M candidates on Pcell (for p-p) + N candidates on Scell (for s-s) vs.     - M1 candidates on Pcell (for p-p) + M2 candidates on Scell (for s-p) + N candidates on Scell (for s-s) * We understand that there can be difference wrt. Processing of detected DCI formats (i.e., (s-p) vs. (s-s) but Approach 1 addresses this without impacting CSS on Pcell. Note – Ues already support simultaneous processing of broadcast and unicast so no need to have restrictions on CSS to avoid this from happening as proposed by Approach 2. * Also, from BD/CCE lmit perspective, with Options B/D/E above, Ues have to support more BDs than Option A (agreed for Type B). Given this, why is Approach 2 considered ‘simpler’? This is also not addressed by the proponents (it is mentioned that the mechanism is ‘similar to Rel16’ but Rel16 does not require slot by slot switching of BDs between different cells for scheduling a single cell) * Finally, while RAN1#105bie-e agreement spirit was to have a ‘simplified UE compared to Type B UE’ it should also be possible to utilize such Ues in practical networks. If the simplified Ues results in restriction/slowing down of RACH procedures or does not support simultaneous reception of broadcast and unicast is same slot (as it is case with Approach 2), then it is difficult to support such Ues and consequence is similar to having only having Type B Ues.   Therefore, in our view Possible Approach 1 is the appropriate way to realize simplified Type A UE in RAN1#105-e agreement.  Regarding QC proposal to modify Approach 2, it does not resolve the issue of CSS restrictions. Also, as discussed in RAN1#106bis-e the proposed combination results in most restrictions (among all options discussed) from scheduling flexibility perspective (full set of BDs can never be used in any slot for P(S)Cell scheduling as discussed in RAN1#106bis-e)  If progress beyond RAN1#105-e agreement is not possible using either Approach 1 or Approach 2, then given FFS from RAN1#105-e agreement (“•*FFS: Whether Type A is specified or is Type-B with restrictions (as part of UE features discussion*)”), we are also OK with below Approach n (it is consistent with RAN1 agreements and does not require further RAN1 work except UE capabilities).   * + Possible Approach n     - Separate Type A is not specified but ‘Type-B UE with restrictions’ is supported per RAN1#105-e agreement       * the restrictions agreed in RAN1#105-e for Type A UE are reflected in UE capability description of ‘Type-B UE with restrictions’     - Note: Option A (agreed for Type B Ues) is applicable for BD/CCE handling of ‘Type-B UE with restrictions’ |
| Samsung2 | We appreciate QC’s effort to progress the discussion towards a broadly acceptable Type-A UE. We think it is in a good direction, despite that some aspects are unnecessary and/or detrimental. For example, when the “a single span of [3] consecutive OFDM symbols” is considered as in the “possible approach 2” then, regardless of the SCS, there is no need to use BDs/CCEs for a Type-B UE – Rel-16 remains directly applicable.  We still believe that a NW can avoid (using Rel-15 means) any PDCCH monitoring conflict for non-Type3 CSS sets from the Pcell and USS/Type3 CSS sets from the sSCell (i.e., Type-A can be supported without specification impact – only requires a UE indication for DSS capability without a capability for Type-B PDCCH monitoring). That is clear for SI/paging and it is also the case for RAR as there is certainly no need for a DSS UE in RRC\_CONNECTED to monitor PDCCH for RAR in every slot (and the RA response window is large enough, and the PRACH can be retransmitted if any glitch without any impact – that would even have a smaller probability than for a typical incorrect RAR detection). There is never any impact on legacy Ues.  Even though “possible approach 2” avoids (actual) PDCCH monitoring conflict on the Pcell and the sSCell via specification, that is acceptable.  Finally, we would like to point out that, after more than half a year of discussions, there is still no justification for any potential benefit/need for having a “Type-B UE with restrictions”. |
| Huawei, HiSilicon | It turns to be the discussion point that what exactly is preferred to be the differing factor between Type A and Type B.  The previous discussion simply referred Type A/B w.r.t. the simultaneous monitoring capability, while now it further changes to the case of BD handing instead of simultaneous monitoring for proponents of Approach 1 concerning Approach 2. As said, RNTI does not bring clear different UE complexity in terms of BD budget or processing. Thus this approach is not consistent in spirit with having original Type A.  We would encourage to reconsider what is the fundamental difference that can achieve a simplified type of UE – in our view, this can be the Type B with s1=1 and s2=0 as R15 UE supporting basic CA, since all BD belongs to single cell limit. A real more advanced Type B UE can be achieved by allowing more BD based on other values of s1 and s2 based on R16 UE support cross-carrier scheduling. |
| Moderator Notes2 | Suggest to continue further discussion also considering below alternatives that were proposed in the discussion so far.  Proposed modification to Approach 2 from Qualcomm   * + Possible Approach 2-1(Qualcomm)     - All Ues (supporting cross-carrier scheduling from Scell to Pcell) can be configured with Type 0/0A/1/2/CSS sets on P(S)Cell that overlap with sSCell USS sets (for P(S)Cell scheduling)     - Type A Ues drop the USS set(s) on sSCell (for P(S)Cell scheduling) that overlap in same [symbol/slot] as Type 0/0A/1/2/CSS sets on P(S)Cell       * Separate UE capability is introduced for the Type A Ues     - BD/CCE limits for Type B Ues are applicable for all Ues supporting cross-carrier scheduling from sSCell to P(S)Cell (copied from possible approach 1)     - UE capability/incapability indication for below to be discussed as part of UE features discussion (copied from Type B)       * All search space configurations monitored on sSCell for cross-carrier scheduling to P(S)Cell are within a single span of [3] consecutive OFDM symbols within a duration spanning P(S)Cell slot     - Same approach as above is used for CCE limits (copied from Type B)       * FFS: Separate vs. same RRC configured scaling factors (corresponding to ) for BD and CCE limits.     - ~~BD/CCE limit for Type A UE is based on one of the following approaches (selected in RAN1#107-e)~~       * ~~Option B (discussed earlier for Type B Ues)~~       * ~~Option D~~         + ~~In a slot, if the PDCCH candidates are only configured on P(S)Cell, the BD/CCE limit on this slot is determined based on the P(S)Cell configurations~~         + ~~In a slot, if the PDCCH candidates are configured only on sSCell, the BD/CCE limit on this slot is determined based on the sSCell configurations~~         + ~~The limit of Rel-16 UE capability is applied without further restrictions~~       * ~~Option E~~         + ~~No per-slot change in and~~   Proposed modification to Approach 1 from Qualcomm   * + Possible Approach 1-1(Qualcomm)     - BD/CCE limits for Type B Ues are applicable for all Ues supporting cross-carrier scheduling from sSCell to P(S)Cell     - Additional simplifications to PDCCH monitoring ~~can be discussed during UE capabilities discussions including the following~~       * ~~Type A UE as per RAN1#105-e agreement and~~         + ~~simultaneous monitoring of ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell’~~       * Type A UE as per RAN1#105-e agreement and         + no simultaneous monitoring between ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’         + simultaneous monitoring of ‘USS sets (for P(S)Cell scheduling) on sSCell’ and ‘Type 0/0A/1/2/CSS sets on P(S)Cell for DCI formats with CRC not scrambled by C-RNTI/MCS-C-RNTI/CS-RNTI’   Proposal from Ericsson   * + Possible Approach n (Ericsson)     - Separate Type A is not specified but ‘Type-B UE with restrictions’ is supported per RAN1#105-e agreement       * the restrictions agreed in RAN1#105-e for Type A UE are reflected in UE capability description of ‘Type-B UE with restrictions’       * Note: Option A (agreed for Type B Ues) is applicable for BD/CCE handling of ‘Type-B UE with restrictions’ |
| ZTE | We can also accept the Possible Approach n from Ericsson. |
| Spreadtrum | Our first preference is Approach 2(from FL or QC), which is TDM PDCCH monitoring.  And we are willing to accept Approach 1-1, which allows broadcast DCI on Pcell and unicast DCI on sSCell, so UE do not need to process two unicast DCIs on Pcell and sSCell in one slot. We prefer to use processing instead of monitoring in approach 1-1 to align the description of PDCCH capability report in UE feature, and more accurate. |

### Discussion Point 6

* For the handling of DCI formats 0\_1,1\_1,0\_2,1\_2 on P(S)Cell for Type A UE, please provide your view on Option 1 vs. Option 2 below
  + Option 1
    - Monitoring of USS sets for DCI formats 0\_1,1\_1,0\_2,1\_2 on P(S)Cell is supported for Type A UE (from RAN1#105-e agreement) configured for sSCell to P(S)Cell scheduling
  + Option 2
    - Monitoring of USS sets for DCI formats 0\_1,1\_1,0\_2,1\_2 on P(S)Cell is optionally supported for Type A UE (from RAN1#105-e agreement) configured for sSCell to P(S)Cell scheduling
      * Type A1: Type A Ues indicating support
      * Type A2: Type A Ues not indicating support

Companies are requested to indicate their view on the above discussion point in the Table below

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Preferred Option** | **Comments (Discussion Point 6)** |
| Moderator notes |  | Continuation of discussion from RAN1#106bis-e Proposal 2v3-2 [19]. Inputs to current meeting are summarized in section 2.1.1.2 point 4.  Please indicate your Option alternative and your view on WA from RAN1#104 wrt. Your preferred Option. |
| Nokia, NSB | Option 1 | This is a fairly single-dimensional feature and we strongly oppose making some sub-UE types. We can pre-empt this discussion by agreeing that there is no Type A UE at all. |
| Apple | Option 2 | Again, USS on P(S)Cell is supported for Type A UE.  The question is whether it is mandatory or not for Type A UE.  If the direction is to make this mandatory for the UE, this is trying to revert the previous WA which we object, |
| Samsung | Option 1 | It is up to gNB how to configure the USS sets on P(S)Cell.  With respect to a potential UE capability referred to as “Alt-1” in a WA from RAN1#104-e (i.e., non-fallback DCIs fully moved to sSCell), whether or not to confirm the WA, by also resolving the FFS for simultaneous monitoring, should be according to a definition of Type-A Ues, if any. Separate sub-types are not preferred. |
| Qualcomm |  | If we agree Type A design such that implementation complexity is reasonably relaxed, we are OK with Option 1.  If we really revert the formal RAN1#105-e agreement and remove Type-A from Rel-17 DSS at all, then we may need more relaxing options for Type-B Ues. Therefore, we suggest putting hold this until we fix the Proposal 5. |
| MTK | Option 2 | We prefer to follow the previous WA as mentioned by Apple. |
| Intel |  | Fine with defining UE capability for the limitation |
| vivo | Option 1 |  |
| ZTE | Option1 | From our perspective, no matter Approach 1 or Approach 2 is agreed, supporting Option 1 above will not increase any complexity since network can, for example, avoid overlapping PDCCH with non-fallback DCI on Pcell and USS on sSCell for scheduling Pcell. |
| Xiaomi | Option 2 | Same views as Apple and MTK. |
| LG Electronics | Option 1 |  |
| CMCC | Option 1 | There is no need to restrict monitoring of USS sets for DCI formats 0\_1,1\_1,0\_2,1\_2 on P(S)Cell. |
| ETRI | Option 1 |  |
| OPPO |  | This seems a UE capability discussion that could be put in another agenda. |
| DOCOMO | Option 1 |  |
| Ericsson1 | Option 1 |  |
| Huawei, HiSi | Option 2 | Fine with additional UE capability while this also equally motivates separate UE capabilities for Type B considering different BD handling capability. |
| Moderator Notes2 |  | Suggest to continue further discussion using current Table |
| Spreadtrum | Option 2 | We agree with Apple. |

### Proposal 7

* Confirm the WA from RAN1#106bis-e with addition of below Note (shown in blue)

***Working Assumption***

* *When CIF for sSCell to Pcell cross-carrier scheduling is configured,* *non-fallback DCI formats on P(S)Cell include same number of CIF bits as the corresponding non-fallback DCI formats on sSCell that are used for sSCell to P(S)Cell scheduling*
* Note: per RAN1#102-e agreement, when sSCell to P(S)Cell scheduling is configured for the UE, cross-carrier scheduling from P(S)Cell to another cell is not allowed. The CIF bits included in non-fallback DCI formats on P(S)Cell are considered reserved.

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

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Support/Not support** | **Comments (Proposal 7)** |
| Moderator notes |  | Inputs from different companies summarized in point 1 of section 2.1.1.3. |
| Nokia, NSB | Support | This would seem to be needed to align the DCI sizes. |
| Apple | Support |  |
| Samsung |  | We are OK to confirm the WA, but in view of Discussion Point 8, we prefer to support a generic solution for DCI size alignment which is agnostic to the DCI fields. If the DCI on the Pcell includes X bits and the DCI on the sSCell includes Y bits, |X-Y| bits are padded to the DCI with the smaller size. The reason can be CIF, Scell dormancy indication, TCI state, and so on, but the specs don’t need to outline each possible combination. That is also a forward compatible approach. |
| Qualcomm | Support | No differentiation of field sizes/positions for the same DCI format for the same scheduled cell should be the simple approach. |
| MTK | Support | Also support Samsung’s approach. |
| Intel | Support | Since it is all targeted to Pcell, we prefer to define a same field with a same size for the DCI formats on Pcell and sSCell. |
| Vivo |  | This is related to discussion point 8.  The main motivation of this WA is to align DCI size from different scheduling cells (i.e. sScell and Pcell) for the same scheduled cell (i.e. Pcell). However, other fields may not be aligned as indicated in discussion point 8. There are the following alternatives that could be considered as proposed in our contribution:  Alt. 1: Change the definition of DCI size budget to (scheduling cell, scheduled cell) pair;  Alt. 2: Align the size of DCI from different scheduling cells for the same scheduled cell  Alt. 2.1: Align the size for each field  Alt. 2.2: Align the total size |
| ZTE | Support | We support this proposal. From our perspective, the same DCI fields can be copied from Pcell self-scheduling to sSCell-scheduling-Pcell. |
| Xiaomi | Support | Also fine with the generic solution as proposed by Samsung. |
| LG Electronics |  | Same view with Samsung |
| CMCC | Support | Agree with Qualcomm’s comment. |
| ETRI | Support | This proposal is related to discussion point 8. We prefer to confirm the working assumption and do the same thing to each identified field. |
| OPPO |  | Share the view from Samsung. |
| Lenovo, Motorola Mobility |  | Same view as Samsung |
| DOCOMO | Support |  |
| Ericsson1 | Support |  |
| Huawei, HiSilicon |  | We share the same view of Samsung. This restriction is simply not necessary and prevent to have flexibility of scheduling of different configurations. Up to gNB to handle the total DCI size is more general and simpler and no additional complexity for UE as long as DCI size/BD budget is kept. |
| Moderator Notes2 |  | Several companies commented on generic approach and Discussion point 8v2 below attempts to address this.  Is it OK to confirm the CIF WA and continue discussion on the general approach (since alignment of CIF is anyway needed)? |
| Spreadtrum |  | We are fine with either solution, but prefer to include all the possible fields.   1. Align bit length of every field 2. Align total DCI size |

**Discussion Point 8**

* What clarifications (if any) are needed for below bit-fields to align size between ‘non-fallback DCI formats used for P(S)Cell self-scheduling’ and ‘non-fallback DCI formats used for P(S)Cell scheduling via CCS from sSCell’
  + Scell dormancy Indication
  + Transmission configuration indication
  + “1 bit padding bit in DCI 0\_1 and DCI 1\_1 according to DCI size alignment procedure step 2 when the size of DCI 0\_1 or DCI 1\_1 in a USS is equal to the size of DCI 0\_0/1\_0 in another USS” (discussed in [4])
* What clarifications (if any) are needed for DCI size matching procedures in the specs?

Companies are requested to indicate their comments on above discussion point in the Table below

|  |  |
| --- | --- |
| **Company Name** | **Comments (Discussion Point 8)** |
| Moderator notes | Inputs from different companies summarized in point 1 of section 2.1.1.3. |
| Samsung | As commented above, we prefer to support a DCI size alignment that is agnostic to the DCI fields. If the DCI on the Pcell includes X bits and the DCI on the sSCell includes Y bits, |X-Y| bits are padded to the DCI with the smaller size. The reason can be CIF, Scell dormancy indication, TCI state, and so on, but the specs don’t need to outline each possible combination. That is also a forward compatible approach. |
| Qualcomm | We think Proposal 7 for CIF should be extended to the other fields. |
| MTK | Same view as Samsung. |
| Intel | As commented in proposal 7, we prefer to define a same field with a same size for the DCI formats on Pcell and sSCell. |
| Vivo | As commented above, there are the following alternatives that could be considered as proposed in our contribution:  Alt. 1: Change the definition of DCI size budget to (scheduling cell, scheduled cell) pair;  Alt. 2: Align the size of DCI from different scheduling cells for the same scheduled cell  Alt. 2.1: Align the size for each field  Alt. 2.2: Align the total size  We are open to discuss the above alternatives to solve the problem. |
| ZTE | Our understanding is that the same DCI fields for Pcell self-scheduling can be copied to sSCell-scheduling-Pcell. The logic is that, the DCI is generated from Pcell, it’s just moved to sSCell for transmission.  Also, if the DCI size of Pcell self-scheduling and sSCell-scheduling-Pcell is always aligned, there is no issue with the third bullet at all. |
| Xiaomi | Same view as Samsung. |
| ETRI | Please see the comment on Proposal 7. |
| OPPO | Same view as Samsung |
| Lenovo, Motorola Mobility | Same view as Samsung |
| Ericsson1 | For Scell dormancy indication, it should be clarified that Scell dormancy indication field is present when the corresponding DCI format is carried by PDCCH on for the primary cell. Others it is in rinciple possible to handle by implementation.  Regarding Proposal from Samsung – the implication would be DCI field positions of DCI formats for scheduling the P(S)Cell will be different for P(S)Cell self-scheduling and sSCell to P(S)Cell scheduling. Our preference is to avoid this.  We are However OK to consider generic approach e.g. something like – When sSCell to P(S)Cell scheduling is configured for the UE, the DCI format on Pcell has 3 extra bits for CIF (already covered by WA) and this DCI format is also used for scheduling Pcell from sSCell |
| Samsung2 | Just to clarify that there is no change in field positions in any DCI format (and the CIF does not necessarily have 3 bits, it can have 1 or 2 bits) – the positions are same as when there is no DSS – making them different because of DSS is actually what should not happen.  It will be more complicated, and unjustified, to define a new UE procedure for separately handling each possible field (and with configurable size) that may exist for the Pcell but not for the sSCell or the reverse. That is also not forward compatible when it is practically certain that more fields will be introduced in DCIs, especially for the Pcell, even in Rel-17. A generic statement such as “the UE adds bits to the DCI format with smaller size to match the DCI format with larger size” is enough. |
| Huawei, HiSi | Same view as Samsung and “Minimum applicable scheduling offset indicator” field can also be different for more flexibility. |

### Discussion Point 8v2

* Please provide your view on which of the below ‘generic’ approaches for size matching is preferred
  + Option 1
    - If the DCI on the Pcell includes X bits and the DCI on the sSCell includes Y bits, |X-Y| bits are padded to the DCI with the smaller size.
  + Option 2
    - When sSCell to P(S)Cell scheduling is configured for the UE, for a given non-fallback DCI format, the DCI fields and field sizes used for P(S)Cell self-scheduling are used also for sSCell to P(S)Cell cross-carrier scheduling
      * Note: per RAN1#106bis WA – “*DCI formats on P(S)Cell include same number of CIF bits as the corresponding non-fallback DCI formats on sSCell that are used for sSCell to P(S)Cell scheduling*”
  + Option 3
    - Change the definition of DCI size budget to (scheduling cell, scheduled cell) pair

Companies are requested to indicate their comments on above discussion point in the Table below

|  |  |
| --- | --- |
| **Company Name** | **Comments (Discussion Point 8v2)** |
| Moderator notes2 | Option 1 based on input from Samsung.  Option 2 based on comments from QC, ZTE, vivo (Alt 2 in their comments), Ericsson.  Option 3 based on input from vivo (similar to Option 1?) |
| ZTE | We support Option 2.  Option 3 seems to contradict with the WI objective since the WI requires not to increase the DCI budget.  Option 1 can also work. However, it may end up with some functions can only be indicated by PDCCH on Pcell but not on sSCell, e.g., Scell dormancy Indication, although both PDCCHs are scheduling PDSCH/PUSCH on Pcell. |
| Spreadtrum | We support Option 1 or Option 2. Also want some clarifications:   * For Dormancy indication, when a DCI on sSCell to schedule Pcell, does Dormancy indication field can be included in this DCI? From our understanding, the bit length of every field for Pcell depends on RRC configuration for Pcell, so it is nature to have this field. But we are open to exclude it from a DCI format on sSCell when it is used for cross carrier scheduling PCell. |
| MTK | Option 1 or Option 2 |

### Discussion Point 9 (RRC impact?)

* For UEs configured for cross-carrier scheduling from sSCell to P(S)Cell, please indicate your view on whether a mechanism to enable monitoring of additional PDCCH monitoring candidates/DCI formats on P(S)Cell when sSCell is deactivated should be supported for the following cases
  + Case 1: Supported for Type A Ues
  + Case 2: Supported for Type A and Type B Ues
  + Case ~~1~~3: Supported only for Type A2 Ues (as described in discussion point 6)
* Note: The additional PDCCH monitoring candidates/DCI formats are not monitored on P(S)Cell when sSCell is activated
* Also, please indicate your preference for the detailed mechanism
  + M1: Additional SS sets monitored on P(S)Cell when sSCell is deactivated and not monitored when sSCell is activated
  + M2: SSSG switch on P(S)Cell triggered when sSCell is deactivated/activated
  + M3: Scaling factor not applied for BD limit computation and overbooking handling on P(S)Cell, when sSCell is deactivated

Companies are requested to indicate their comments on above discussion point in the Table below

|  |  |
| --- | --- |
| **Company Name** | **Comments (Discussion Point 9)** |
| Moderator notes | Continuation of discussion from RAN1#106bis-e Proposal 6 [19]. Inputs from different companies summarized in point 2 of section 2.1.1.3. |
| Nokia, NSB | This should be supported by all UE types.  Prefer M1, M2 could be considered. M3 would not work if the BDs are not allowed to overlap when sSCell is active, and in this case scaling would not introduce new monitoring occasions freed from sSCell.  To enable M1 a framework similar to SSG switching is required in our view, since the UE needs to be aware that this SS is additional and in what circumstances to monitor it.  In addition this mechanism should also be considered for dormant SCell to maximize power efficiency and sSCell RLF scenarios to minimize interruption times. |
| Apple | The WI is created to address the DSS issue in which the CRS persistently exits in LTE cell  Towards the end of this WI, people start to design a system assuming there is no scheduling restriction on NR P(S)Cell due to LTE CRS.  We are wondering which part is to address to true deployment concern. We prefer to minized any effort on sSCell dormancy and deactivation and make it UE optional feature. We do not want to implement a complicate feature, but in the end, NW just turns it on and off and not sure whether there is a need for the feature or not. |
| Samsung | There is no need for such enhancements. If the sSCell is deactivated and another sSCell is not activated, existing means (RRC configuration, if needed) are sufficient as the UE buffer is expected to be empty and immediate scheduling for high data rates is unnecessary. Also, depending on whether or not a UE monitors PDCCH for DCI format 1\_1 (e.g. Type-B UE or Type-A UE for approach 2), SSSG can apply based on Rel-17 means for the UE-PS WI.  The note “M3” needs to be separated from this Discussion Point, and discussed independently.   * When the intention of sSCell deactivation is to not have a new sSCell but to switch to non-DSS operation for scheduling on the P(S)Cell, the UE should fall-back to operating with the Rel-16, single-scheduling cell, PDCCH monitoring limits for the P(S)Cell. Otherwise, PCell scheduling is unnecessarily penalized (due to alpha scaling factor). |
| Qualcomm | So far, RAN4 does not have a requirement on the exact timing when to start PDCCH monitoring on a SCell when the SCell is activated. When a SCell is deactivated, all the procedures are expected to be end at slot n+k, but this is not really very important requirement, since the SCell is being deactivated due to less/no traffic for the UE. **If we discuss this topic, first of all, we propose to clarify that RAN1 does not change any of the RAN4 requirements regarding the PDCCH monitoring on sSCell for sSCell activation/deactivation.**  Then, for the discussion here, we should keep in mind that the options (even if supported) should not have the timing requirement based on the above.  Regarding the need of the solution, we tend to agree with Apple and Samsung that the sSCell can be actived as long as there is a traffic for the UE and can be deactived otherwise. As long as SCell activation/deactivation command is available on P(S)Cell, network can simply control the activation/deactivation of the sSCell and hence the proposal here is not really essential.  However, we understand that if non-fallback DCI formats are not supported on P(S)Cell (depending on the consequence of discussion point 6), that will be a restriction for the network to operate sSCell activation/deactivation. Therefore, we are OK to discuss this if we confirm that some UEs do not support non-fallback DCI formats on P(S)Cell when CCS from sSCell to P(S)Cell is configured, **subject to the condition that the solution does not have the exact timing requirement on turning/switching on/off**.  As for the comparison among M1 – M3, for Type B, M3 should be sufficient. The UE performs PDCCH overbooking based on {alpha x limit} or {1 x limit} on P(S)Cell depending on whether the sSCell is active/deactive. Some SS sets that are dropped by {alpha x limit} can be monitored if the limit becomes {1 x limit}. |
| MTK | No strong view here. |
| Intel | We think an enhancement is necessary especially considering the case that all USS sets are configured on sSCell for maximum PDCCH offloading. Then, when sSCell goes to sleep, some mechanism relying on PDCCH monitoring PCell should be discussed.  For the 3 options M1/M2/M3, we think M3 is a basis. Unless the max BD/CCE is increased on PCell, there is no real benefit to reconfigure USS sets or switch SSSG for PCell. So, it is clear that M3 should be supported. We are open to further discuss M1/M3. |
| vivo | We support case 2. It should apply to all UE types.  As for comparison among M1-M3, at least M3 should be supported. When sScell is deactivated, there is no reason to apply alpha in that case and should fallback to legacy case. We also support M1 since it could avoid frequency RRC re-configuration. |
| ZTE | We think this enhancement is necessary and it should be applicable to both type A and type B UE.  Besides, it should be applied to the same when sSCell is in dormant BWP.  Regarding M1, M2 and M3, we think M3 is the basic solution which should be supported. UE just remove the limitation of BD/CCE in this case and reuse the limits we defined in Rel-15/16.  In the end, if this enhancement is not supported, basically it means network won’t deactivate sSCell even if there is no traffic on sSCell. Because, otherwise, even the basic unicast scheduling on PCell is pretty limited especially for type A UE. This is not beneficial for UE power saving. |
| Xiaomi | Share the same views with Samsung and Apple. Whether the SCell is deactivated or not is up to gNB. We should keep in mind that the motivation of the whole feature is to facilitate the mitigation from PCell to SCell. gNB should make a wise decision on activate or deactivate a SCell corresponding to CCS from SCell to PCell. |
| CMCC | Both Type A UE and Type B UE should support additional PDCCH monitoring on P(S)Cell when sSCell is deactivated.  We support M1 as the supplementary mechanism for additional PDCCH monitoring on P(S)Cell. Since both USS sets for P(S)Cell self-scheduling when sSCell is activated (CCS is enabled) and additional USS sets for “fallback” self-scheduling monitoring when sSCell is deactivated/dormant (CCS is disabled) need to be configured on P(S)Cell for this mechanism, cross-carrier scheduling configuration can be configured per USS set for P(S)Cell to differentiate these USS sets.  As for M2, our understanding is that if the new SSSG is configured to support P(S)Cell self-scheduling when sSCell is deactivated or dormant, this mechanism seems similar to M1. |
| ETRI | If Option 1 of discussion point 6 is agreeable, there seems no need of additional spec effort to handle the sSCell deactivation case. |
| OPPO | We share the view from Samsung. Unless there is RAN4 requirement on the timing for such a specific case, the existing solutions should work. |
| Lenovo, Motorola Mobility | We think sSCell is not available (e.g., due to deactivation/dormancy), the UE should fallback to Rel-16 operation (excluding what is prohibited in Rel-17 DSS such as PCell cross-carrier scheduling another sCell).  We are wondering if M3 essentially implying the same view as ours? |
| DOCOMO | It should be applied for both Type A UE and Type B UE. We support M1 or M2. If this mechanism is not supported, in some cases the network might not be able to indicate sSCell deactivation and it has impact on UE power consumption. The network may indicate sSCell activation in case of low traffic. |
| Ericsson1 | We think additional mechanism is required at least for Type A2 as described in discussion point 6.  Regarding mechanisms we prefer M1. |
| Huawei, HiSi | This is a separate UE capability not necessary to be tied with Type A or Type B.  Prefer M1. |
| Moderator Notes2 | Discussion for M1 and M2 is somewhat linked to Type A UE (although also can be used for Type B) and it appears converging on Proposal 5, Discussion point 6 can perhaps make it easier to progress the discussion on these.  Proposal 9v2-1 added below to separate the discussion for M3.  Please continue using current table to further discuss M1, M2. |
| Spreadtrum | We support the enhancement, for both type A and Type B.  According to M1/2/3, we think M1 and M2 can work well. Our first preference is M2. |

### Proposal 9v2-1

* Scaling factor (from RAN1#106bis-e agreement) is not applied for PDCCH monitoring on P(S)Cell when sSCell is deactivated

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Support/Not support** | **Comments (Proposal 9v2-1)** |
| Moderator Notes2 |  | Proposal related to M3 in Discussion point 9 |
| ZTE |  | We support this proposal.  As we commented in the first round of discussion, in the end, if this enhancement is not supported, basically it means network won’t deactivate sSCell even if there is no traffic on sSCell. Because, otherwise, even the basic unicast scheduling on PCell is pretty limited especially for type A UE. This is not beneficial for UE power saving. |
| MTK |  | We are generally fine with the FL proposal. Suggest to add a note for potential timeline issue:   * FFS: Application delay, e.g. to follow search space switching delay |

### Discussion Point 10

* Please indicate your preference from below alternatives related to *ca-SlotOffset* for sSCell
  + Alt1: case when sSCell is configured with non-zero ca-SlotOffset is supported as UE capability
  + Alt2: case when sSCell is configured with non-zero ca-SlotOffset is not supported

Companies are requested to indicate their comments on above discussion point in the Table below

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Preferred Alternative** | **Comments (Discussion Point 10)** |
| Moderator notes |  | Continuation of discussion from below conclusion in RAN1#106bis-e  ***Conclusion***   * *A UE configured for cross-carrier scheduling from SCell to P(S)Cell can also be configured with unaligned CA (i.e., using  ca-SlotOffset ), and a non-zero value for ca-SlotOffset can be configured at least for Scells other than the sSCell*   + *FFS: Whether case when sSCell is configured with non-zero ca-SlotOffset is supported and any associated capability signalling* * *Note: No additional L1 spec impact related to ca-SlotOffset had been identified* |
| Nokia, NSB |  | Support for *ca-SlotOffset* UE capability already exists. We do not see any need for a new UE capability to support the feature when sSCell is the scheduling cell. |
| Apple | Alt2 |  |
| Samsung | Alt 2 | We prefer Alt-2 since DSS-UE behaviour depends on overlap or no-overlap of PDCCH monitoring occasions between P(S)Cell and sSCell for P(S)Cell scheduling, and therefore sSCell needs to be aligned with P(S)Cell.  A separate UE capability is not preferred. |
| Qualcomm | Alt.2 | We suggest to adopt Alt.2 in Rel-17 DSS unless real demand is identified. |
| MTK | Alt. 2 | Same view as Samsung |
| Intel |  | Though we don’t see a problem for Alt 1, but fine with Alt 2 if it is majority view |
| vivo | Alt. 2 |  |
| ZTE |  | We don’t think any of the two alternatives is needed.  Currently, there has been a UE capability for unaligned CA, i.e., FG 18-7 “CA with non-aligned frame boundaries” can be used to indicate the support of aligned/unaligned frame boundary already. Also, the prerequisite of FG18-7 is also FG6-5 (basic DL CA).  Together with FG 18-7 and FG for sSCell scheduling Pcell (FG34-1/34-2), the following combinations can be supported:  1. UE indicates support for FG18-7 and FG 34-1/34-2 for the same BC, then UE can support unaligned CA together with sSCell scheduling Pcell for this BC;  2. UE only indicates FG 34-1/34-2 for the BC but not indicate FG18-7, then UE can NOT support unaligned CA together with sSCell scheduling Pcell for this BC.  We don’t see any issue with the above mechanism.  Regarding companies’ comments “behaviour depends on overlap or no-overlap of PDCCH monitoring occasions between P(S)Cell and sSCell for P(S)Cell scheduling,”, we think the overlapping or not can be well derived by the RRC configuration and CA offset, no new issue identified in this case. |
| Xiaomi | Alt. 2 |  |
| CMCC | Alt 1 | We think there is no need to exclude the UE capability for the case when sSCell is configured with non-zero ca-SlotOffset. Alt 1 has potential in some CCS application scenarios, unaligned CA of 2.6 GHz(Pcell) and 4.9 GHz (sSCell) is also DSS with LTE, and sSCell configured with non-zero ca-SlotOffset is supported.  Since PDCCH monitoring and BD/CCE limit handling for UE are determined by slot level(per P(S)Cell slot or per sSCell slot), we don’t see there is any additional spec impact on monitoring behavior when sSCell is unaligned with P(S)Cell. |
| OPPO | Alt 2. |  |
| Ericsson1 | OK with Alt1 | We have similar view as Nokia and ZTE but also OK with Alt1 as compromise. |
| Huawei, HiSi | Ok with Alt 2 | We agree with ZTE while can accept Alt 2. A separate UE capability is not worthwhile. |
| Moderator Notes2 |  | Suggest to continue discussion using current table. At this stage the impact seems to be limited to UE capability description as no additional L1 spec impact related to *ca-SlotOffset* had been identified so far. |
| ZTE |  | We propose to discuss this issue in UE feature session. As Moderator clarified, there seems to be no L1 spec impact. |
| Spreadtrum | Alt 2 | We want a simple method unless enough justification is provided. |

### Discussion Point 11

* Please indicate your preference from below alternatives related to *r16monitoringcapability*
  + Alt1: When CCS from sSCell to P(S)Cell is configured for the UE,
    - r16monitoringcapability is not configured for PDCCH monitoring on P(S)Cell and not configured for PDCCH monitoring on sSCell;
    - r16monitoringcapability can be configured for PDCCH monitoring on Scells other than sSCell
  + Alt2: When CCS from sSCell to P(S)Cell is configured for the UE,
    - r16monitoringcapability is not configured for PDCCH monitoring on P(S)Cell; but can be configured for PDCCH monitoring on sSCell
      * Rel16 span based PDCCH monitoring limits are applied for scheduling from sSCell but for sSCell to P(S)Cell scheduling, the additional per P(S)Cell slot limit is still applied
    - r16monitoringcapability can be configured for PDCCH monitoring on Scells other than sSCell

Companies are requested to indicate their comments on above discussion point in the Table below

|  |  |
| --- | --- |
| **Company Name** | **Comments (Discussion Point 11)** |
| Moderator notes | Company inputs are summarized in point 2 of section 2.1.1.1. |
| Apple | We prefer Alt 1. |
| Samsung. | We prefer Alt-1.  There is no reason to support span-based PDCCH monitoring for P(S)Cell and sSCell as the two scheduling cells for P(S)Cell, because DSS with LTE-NR coexistence is not geared towards URLLC services and joint DSS/URLLC is not an objectives of the DSS WI. However, this should not preclude URLLC operation on other serving cells in different carriers/bands as that has no impact on DSS operation or specification and is Rel-16 operation. |
| Nokia, NSB | We prefer Alt2: Our understanding is that the limitation on r16monitoringcpability only needs to apply to the P(S)Cell. For type B UE we limit the monitoring to 3symbols within the P(S)Cell slot hence no further restriction is required for sSCell. |
| Qualcomm | We prefer Alt.1. Agree with Samsung. |
| MTK | We prefer Alt.1. Agree with Samsung. |
| Intel | We think both alternative works. Since legacy SS set linking is reused, the SS set on sSCell that schedules a Pcell transmission should already follow the span pattern if r16monitoringcapability is configured on sSCell. So there is no additional complexity of Alt 2. We are fine to Alt 1 too. |
| Vivo | We prefer Alt. 1. |
| ZTE | We prefer Alt.1. Span-based PDCCH should NOT be precluded on other Cells. |
| Xiaomi | We prefer Alt.1. Agree with Samsung. |
| LG Electronics | We prefer Alt 1. |
| ETRI | We prefer Alt. 1. |
| OPPO | Alt 1. |
| Lenovo, Motorola Mobility | We prefer Alt. 1. If s2>0 is agreed, BD/CCE budget could be impacted for Scells in Alt. 2. For Alt.2 wondering if different set of values needed to be configured compared to the case that sSCell is not configured with *r16monitoringcapability.* |
| DOCOMO | We are fine with Alt 1. |
| Ericsson1 | Support Alt 2. Note intention of Alt 2 is avoid unnecessary restriction on r16monitoringcpability for sSCell self-scheduling. Alt 2 does not imply larger BD limits (provided by r16monitoringcpability) for sSCell to P(S)Cell scheduling. |
| Huawei, HiSi | Alt 1. It has been the common understanding when we agreed to adopt Option A/C. |
| Moderator Notes2 | Discussion seems to be converging towards Alt1.  One question for clarification before drafting a proposal for this (as e.g. “*no reason to support span-based PDCCH monitoring for P(S)Cell and sSCell as the two scheduling cells for P(S)Cell*” was a bit unclear). Is it correct understanding that companies supporting Alt1 (“*r16monitoringcapability is not configured for PDCCH monitoring on P(S)Cell and not configured for PDCCH monitoring on sSCell*”) prefer to preclude sSCell self-scheduling using *r16monitoringcpability* based BD/CCE limits when sSCell to P(S)Cell CCS is configured for the UE? |
| ZTE | Our understanding is aligned with “*r16monitoringcapability is not configured for PDCCH monitoring on P(S)Cell and not configured for PDCCH monitoring on sSCell*. ” If we allow sSCell-scheduling-Pcell to use slot-based PDCCH budget and sSCell-self-scheduling to use span-based PDCCH budget, we are not sure about the spec impact and implementation impact yet. Maybe the proponents can further clarify the potential impact. |
| Spreadtrum | We support Alt 1.  If r16monitoringcapability is configured on sSCell and not configured on Pcell, it leads to Rel15+Rel-16 combination PDCCH monitoring on sSCell which UE may not support, e.g. UE only support Rel-16 PDCCH monitoring on sSCell.  According to Moderator Notes2, it is same as our understanding. |

**Discussion Point 12**

* Please indicate your preference from below alternatives related to multiple CORESET pools
  + Alt1: When CCS from sSCell to P(S)Cell is configured for the UE,
    - Multiple CORESET pools are not configured for PDCCH monitoring on P(S)Cell and not configured for PDCCH monitoring on sSCell;
    - Other Scells can be configured with multiple CORESET pools
  + Alt2: When CCS from sSCell to P(S)Cell is configured for the UE, and when UE is configured for P(S)Cell with multi-DCI-based multi-TRP PDSCH scheme, UE expects to be configured with CORESETPool on both P(S)Cell and sSCell.

Companies are requested to indicate their comments on above discussion point in the Table below

|  |  |
| --- | --- |
| **Company Name** | **Comments (Discussion Point 12)** |
| Moderator notes | Company inputs are summarized in point 3 of section 2.1.1.1. |
| Apple | Alt 1 |
| Samsung | Alt-1.  Since PDCCH monitoring limits for the case of cross-carrier scheduling are not specified (at least for the case of multi-DCI multi-TRP, cross-carrier scheduling is not supported), Rel-17 DSS can disregard the multi-TRP case. Also, DSS is not for FR2 operation (LTE-NR) nor is scheduling from FR2 to FR1 meaningful for coverage or robustness. It is still possible to support multi-TRP operation for serving cells other than P(S)Cell and sSCell. |
| Nokia, NSB | Prefer Alt2 so that we are not specifying mutually exclusive features. |
| Qualcomm | We prefer Alt.1. Agree with Samsung. |
| MTK | We prefer Alt.1. Agree with Samsung. |
| Intel | We prefer Alt.1. |
| vivo | Prefer Alt. 1 |
| ZTE | Similar as Nokia, sSCell-scheduling-Pcell and MTRP are not specified to be mutually exclusive.  For simplicity, we can also accept Alt.1. |
| Xiaomi | We prefer Alt.1. Agree with Samsung. |
| LG Electronics | We prefer Alt 1. |
| ETRI | We prefer Alt. 2, but we can accept Alt. 1 if majority supports it. |
| OPPO | Alt 1. |
| Lenovo, Motorola Mobility | Alt. 1. Agree with Samsung. |
| DOCOMO | We are fine with Alt 1. |
| Ericsson1 | OK with Alt1 |
| Huawei, HiSi | Alt 1. |

### Proposal 12v2

* Alt1: When CCS from sSCell to P(S)Cell is configured for the UE,
  + Multiple CORESET pools are not configured for PDCCH monitoring on P(S)Cell and not configured for PDCCH monitoring on sSCell;
  + Other Scells can be configured with multiple CORESET pools

Companies are requested to indicate their comments on above Proposal in the Table below

|  |  |  |
| --- | --- | --- |
| **Company Name** | **Support/Not support** | **Comments (Proposal 12v2)** |
| Moderator Notes2 |  | Based on inputs received for Discussion point 12 |
| Spreadtrum | Support |  |
| Huawei, HiSilicon | Support |  |
| MTK | Support |  |

### Discussion Point 13 (RRC impact?)

* Please provide your views on below proposed enhancements
  + P1: Introduce a new RRC IE in the PDCCH-Config of the PCell to identify the linked search space when CCS from sSCell to PCell is configured – [3]
  + P2: monitoringSlotPeriodicityAndOffset, duration, monitoringSymbolsWithinSlot can also be configured on P(S)Cell and can be monitored on P(S)Cell when sSCell is deactivated or dormant – [9]
  + P3: whether a P(S)cell search space is cross-carrier linked to another (scheduling) search space having the same searchSpaceId in sScell, is implicitly determined by whether a light configuration (including only searchSpaceId and nrofCandidates) is provided to the P(S)cell search space – [4]
  + P4: For CCS from sSCell to P(S)Cell, configuration of individual UL/DL DCI format(s) (e.g., only DCI format 0-1, only DCI format 1-1) is supported as part of the corresponding search space set configuration – [16]
  + P5: CCS from sSCell to PCell is configured per USS set – [9],[14]
  + P6: Dynamic activation/deactivation of sSCell to P(S)Cell scheduling – [2]

Companies are requested to indicate their comments on above discussion point in the Table below

|  |  |
| --- | --- |
| **Company Name** | **Comments (Discussion Point 13)** |
| Moderator notes |  |
| Nokia, NSB | Support P1  Support the intention of P2 but it would cleaner, less prone to config errors to have a separate SS for the fallback. In addition, the number of candidates which may be configured for the linked search space may not be adequate for the P(S)Cell  Would be OK with P4  Support P6.  P2 and P6 should be part of Discussion Point 9 |
| Samsung | We don’t support any of the enhancements.  Search space linking has been discussed (and concluded) in several meetings. RAN1 didn’t agree to a full separation of SS sets on scheduled cell vs scheduling cell. We don’t prefer to have partial solutions. The existing Rel-15/16 (although inefficient) can be retained. |
| Qualcomm | Related to P1, P3, P5, we would need to clarify whether a search space set configured on the DL BWP of the P(S)Cell is for self-scheduling (and actually monitored on P(S)Cell) or for providing parameters for cross-carrier scheduling from sSCell to P(S)Cell (hence not monitored on P(S)Cell). We think this can be enabled without RRC signalling, e.g., a SS set on P(S)Cell linked to a SS set on sSCell is not monitored. |
| MTK | This seems like a detailed scheme design of Discussion point 9. Suggest to conclude Discussion 9 first. |
| Intel | We are supportive to P3. Depending on whether parameters other than nrofCandidates is configured or not, UE can know the SS set is for self-scheduling or CCS. |
| Vivo | For P3, we are not proposing an enhancement but a clarification on existing SS linking rules.  According to existing SS linking rules in TS 38.331 that “In case of cross carrier scheduling, search spaces with the same *searchSpaceId* in scheduled cell and scheduling cell are linked to each other”, There is the following question:  **Question**: How to handle/interpret the following configuration as illustrated in the figure, i.e. a search space in P(S)cell with full configuration (i.e. including fields such as *monitoringSlotPeriodicityAndOffset* besides *searchSpaceId* and *nrofCandidates*) has the same ID as a search space in sScell with full configuration?    Our proposal on P3 is not to link them for the above case by updating the linkage rule a little, i.e. a search space in P(S)cell with light configuration (including only *searchSpaceId* and *nrofCandidates*) and a search space in sScell with full configuration with the same *searchSpaceId* are linked to each other in case of sScell scheduling P(S)cell |
| ZTE | Regarding “Dynamic activation/deactivation of sSCell to P(S)Cell scheduling”, we think it is beneficial to accommodate the dynamic channel conditions. |
| Xiaomi | We don’t think any of the above enhancement is needed. |
| LG Electronics | Support P5.  Question to Samsung and Qualcomm: How can UE determine whether a USS set configured for PCell is monitored on PCell or sSCell, without change from Rel-15/16 specifications?  Could the following example be aligned with what you have in mind?   1. For PCell, USS set indexes #3/4/5/6 are configured. 2. For sSCell USS set indexes #3/4 are configured. 3. After sSCell-to-PCell cross-carrier scheduling is configured, USS set indexes #5/6 are monitored on PCell while USS set indexes #3/4 are not monitored on PCell but monitored on sSCell. |
| CMCC | Support P2 and P5.  P2 method is proposed to avoid unnecessary RRC reconfiguration for both CCS enabled and disabled scenarios. According to the conclusion of RAN1#106b-e meeting, Rel-16 SS linking approach is reused for CCS USS set(s) from sSCell to P(S)Cell, if additional USS sets can be monitored according to the condition whether CCS is disabled/enabled, complete parameters including nrofcandidates and monitoringSlotPeriodicityAndOffset, duration, monitoringSymbolsWithinSlot can be configured for the linked SS set in P(S)Cell. And these additional USS sets can be monitored directly after sSCell is deactivated without RRC reconfiguration signalling.  And with configuration of P5, we can use this information to clearly indicate UE the usage of USS set configured on P(S)Cell, e.g.,whether this USS set is used for self-scheduling regardless sSCell is activated or deactivated, or used as linkage USS sets for CCS but can also be monitored on P(S)Cell only when sSCell is deactivated/dormant. |
| ETRI | We support P3, but it may not have a specification impact.  We support P6. |
| OPPO | Support P1. |
| Ericsson1 | Support P4  We are OK to consider P1+P2 as reduces SS index restrictions  Do not prefer P5 (prefer to keep current framework)  P6 is somewhat similar functionality as Discussion point 9 so not needed. |
| Moderator Notes2 | Suggest to continue further discussion on P1-P6 using current Table |

### Discussion Point 14

Please use table below to provide any general/additional comments

|  |  |
| --- | --- |
| **Company Name** | **General/additional Comments** |
| Samsung | We prefer to have a separate item for note “M3” in Discussion Point 10.  The current BD/CCE handling for PCell when sSCell is deactivated, penalized the P(S)Cell, and needs to be discussed separately. |
|  |  |

# 3 Conclusions

TBD

# 4 References

1. R1-2110796 Discussion on SCell PDCCH scheduling P(S)Cell PDSCH or PUSCH Huawei, HiSilicon
2. R1-2110924 Discussion on Cross-Carrier Scheduling from SCell to PCell ZTE
3. R1-2110944 On cross-carrier scheduling from SCell to Pcell Nokia, Nokia Shanghai Bell
4. R1-2111043 Remaining issues on Scell scheduling Pcell vivo
5. R1-2111116 Discussion on cross-carrier scheduling from SCell to Pcell Spreadtrum Communications
6. R1-2111346 Discussion on cross-carrier scheduling from Scell to Pcell OPPO
7. R1-2111519 On SCell scheduling PCell transmissions Intel Corporation
8. R1-2111553 Discussion on cross-carrier scheduling from SCell to PCell Xiaomi
9. R1-2111631 Discussion on cross-carrier scheduling from SCell to PCell CMCC
10. R1-2111764 Cross-carrier scheduling from SCell to PCell Samsung
11. R1-2111900 Views on Rel-17 DSS SCell scheduling Pcell Apple
12. R1-2111954 Cross-carrier scheduling (from Scell to Pcell) Lenovo, Motorola Mobility
13. R1-2111999 Remaining issues on cross-carrier scheduling from SCell to Pcell ETRI
14. R1-2112067 Discussion on cross-carrier scheduling from SCell to Pcell LG Electronics
15. R1-2112131 Discussion on cross-carrier scheduling enhancements for NR DSS NTT DOCOMO, INC.
16. R1-2112154 Enhanced cross-carrier scheduling for DSS Ericsson
17. R1-2112242 Cross-carrier scheduling from an SCell to the PCell/PSCell Qualcomm Incorporated
18. R1-2112295 On Cross-Carrier Scheduling from sSCell to P(S)Cell MediaTek Inc.
19. R1-2110664 Summary#4 of Email discussion [106bis-e-NR-DSS-01], Moderator (Ericsson), RAN1#106bis-e, October 2021.

# 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

## Agreements from RAN1#103-e

**Conclusion**

* When CCS from sSCell to PCell/PSCell is configured, the configuration of Type 3 CSS set for DCI formats 2\_0, 2\_1, 2\_2, 2\_3, 2\_4 and applicability of the information in the DCI formats are the same as in Rel-15/Rel-16
  + FFS: DCI format 2\_5 and DCI Format 2\_6 handling
* Note: The SCell configured with CCS to Pcell/PSCell is referred to as ‘sSCell’

**Conclusion**

* When the PCell/PSCell and sSCell use different numerologies, the PDSCH reception preparation time between the PDCCH on the sSCell and the PDSCH on the PCell/PSCell is applied (i.e., as specified in TS38.214 Section 5.5).

Agreements:

* 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
  + Note: UE monitors Type 0/0A/2 CSS only on PCell while Type 1 CSS can be monitored on PCell/PSCell

Agreements:

* Discuss in RAN1#104-e how to handle ‘DCI formats 0\_1,1\_1,0\_2,1\_2 scheduling PDSCH/PUSCH on PCell/PSCell’ from USS set(s), when CCS from sSCell to PCell/PSCell is configured.. Below alternatives can be considered in the discussion (other alternatives are not precluded)
* ~~Below alternatives can be considered in the discussion (other alternatives are not precluded)~~
  + Alt 1: ~~When CCS from sSCell to PCell/PSCell is configured,~~ UE cannot be configured to monitor DCI formats 0\_1,1\_1,0\_2,1\_2 on PCell/PSCell USS set(s), and can be configured to monitor them only on the sSCell USS set(s)
  + Alt 2: ~~When CCS from sSCell to PCell/PSCell is configured,~~ UE can be configured to monitor DCI formats 0\_1/1\_1/0\_2/1\_2 on PCell/PSCell USS set(s), and/or on sSCell USS set(s). The PDCCH monitoring is based on following alternatives (other alternatives are not precluded)
    - Alt 2-1:
      * UE can monitor DCI formats 0\_1,1\_1,0\_2,1\_2 on both PCell USS set(s) and sSCell USS sets simultaneously
        + ~~FFS activation/deactivation of scheduling from sSCell to PCell/PSCell~~
    - Alt 2-2:
      * Dynamic switching of PDCCH monitoring of DCI formats 0\_1,1\_1,0\_2,1\_2 between monitoring on PCell/PSCell USS sets and monitoring on sSCell USS sets is supported
        + FFS: Details of switching mechanism (~~e.g. based on SS group switching, based on BWP switching,…~~)
      * UE does not monitor DCI formats 0\_1,1\_1,0\_2,1\_2 on both PCell USS set(s) and sSCell USS sets simultaneously
    - Alt 2-3:
      * UE does not monitor the same DCI format on both PCell USS set(s) and sSCell USS sets simultaneously. UE can monitor some DCI formats on sSCell USS sets and other DCI formats on PCell/PSCell USS sets simultaneously
    - Alt 2-4:
      * The USS set(s) on PSCell/PCell and the USS set(s) on sSCell are configured such that UE does not monitor DCI formats 0\_1,1\_1,0\_2,1\_2 on both PCell USS set(s) and sSCell USS set(s) simultaneously
* FFS following aspects
  + Impact of sSCell activation/deactivation and sSCell dormancy
  + Impact on BD/CCE limit handling ~~including considering PDCCH monitoring on CSS sets and PDCCH monitoring of ‘DCI formats 0\_0, 1\_0 scheduling PUSCH/PDSCH on PCell/PSCell’~~
  + Whether PDCCH overbooking on sSCell is supported or not supported and impact (if any) on overbooking handling on PCell/PSCell
  + Impact from different numerologies between PDCCH on the PCell/PSCell and that on the sSCell
  + Whether or not to have mechanism for activation/deactivation of scheduling from sSCell to PCell/PSCell
  + USS configuration details (e.g. handling of USS type (self-scheduling, cross carrier scheduling) for a ~~configured~~ USS set configured for scheduling of ~~in~~ PCell/PSCell)

## Agreements from RAN1#104-e

**Agreement**

When CCS from sSCell to PCell/PSCell is configured,

* Out of order scheduling is not allowed between a) PDSCH on PCell/PSCell scheduled by PDCCH on PCell/PSCell and b) PDSCH on PCell/PSCell scheduled by PDCCH on sSCell
* Out of order scheduling is not allowed between a) PUSCH on PCell/PSCell scheduled by PDCCH on PCell/PSCell and b) PUSCH on PCell/PSCell scheduled by PDCCH on sSCell

FFS: Whether this agreement requires RAN1 specification impact.

**Agreement**

When CCS from sSCell to PCell/PSCell is configured,

* Simultaneous reception of a) unicast PDSCH on PCell/PSCell scheduled from PCell/PSCell and b) unicast PDSCH on PCell/PSCell scheduled from sSCell is not allowed
* Simultaneous transmission of a) PUSCH on PCell/PSCell scheduled from PCell/PSCell and b) PUSCH on PCell/PSCell scheduled from sSCell is not allowed
* Note: Simultaneous implies full/partial time overlapping

FFS: Whether this agreement requires RAN1 specification impact.

**Agreement**

* When CCS from sSCell to PCell/PSCell is configured, CA activation/deactivation operation for the sSCell is supported

**Working Assumption**

* When CCS from sSCell to PCell/PSCell is configured, UE can be configured to monitor DCI formats 0\_1/1\_1/0\_2/1\_2 that schedule PDSCH/PUSCH on PCell/PSCell on PCell/PSCell USS set(s), and/or on sSCell USS set(s)
* The WA to be confirmed after agreements are made on PDCCH BD/CCE handling and PDCCH overbooking handling for CCS from sSCell to PCell/PSCell
* Specs also allow UEs supporting functionality of only Alt-1. Capability signaling details, if any, can be handled during the UE capability discussion for Rel17
* FFS: Whether the UE can monitor PDCCH from both cells in the same slot.

**Agreement**

* When CCS from sSCell to PCell/PSCell is configured, UE monitors ‘DCI formats 0\_0 and 1\_0 in CSS that schedule PDSCH/PUSCH on PCell/PSCell’ only on the PCell/PSCell and not on the sSCell

## Agreements from RAN1#104b-e

**Agreement**

* When CCS from sSCell to PCell/PSCell is configured
  + CIF=0 used for sSCell self-scheduling, and CIF for sSCell to PCell cross-carrier scheduling is explicitly configured using RRC signalling

**Agreement**

PDCCH overbooking on sSCell USS set(s) is not allowed

Following was captured in RAN1 Chairman notes

**For RAN1#105-e, companies are encouraged to consider:**

* Further discuss PDCCH monitoring and BD/CCE limit handling in RAN1#105e considering below BD/CCE limit handling options
  + Option A
    - At least when P(S)Cell SCS is not higher than sSCell SCS, PDCCH monitoring candidates on P(S)Cell and/or sSCell are configured such that max of (x1(m1)+x2(m1))+max of y(m2) corresponding to any P(S)Cell slots m1 and m2 is less than or equal to Z1
    - At least the case of Z1 = 44 is supported for P(S)Cell SCS 15kHz
      * FFS if Z1 larger than above can also be supported based on UE capability (e.g. similar to *BDFactorR* in Rel16)
    - FFS signalling details on how the limit Z1 is realized, e.g.
      * RRC configured BD limit/scaling factor-based limit for max(x1(m)+x2(m))
      * Separate RRC configured BD limits/scaling factor-based limits for max(x1(m)+x2(m)) and max(y(m))
      * separate BdfactorR for P(S)Cell and sSCell
      * SS configuration-based BD limit for max(x1(m)+x2(m)) and max(y(m))
      * RRC configured BD limit/scaling factor-based limit for max(x1(m)+x2(m))+ max(y(m))
      * Counting ‘sSCell-to-P(S)Cell’ scheduling as an additional scheduling cell with numerology given by sSCell numerology in determining the BD/CCE limits
    - FFS reference SCS to use when P(S)Cell has higher SCS than sSCell (if supported)
    - For sSCell scheduling P(S)Cell, the UE is not required to monitor on the active DL BWP with SCS configuration of the sSCell more than PDCCH candidates per slot of sSCell.
      * FFS how limit is computed and applied when CCS from sSCell to P(S)Cell is configured
  + Option B
    - At least when P(S)Cell SCS is not higher than sSCell SCS, For P(S)Cell slot m, PDCCH monitoring candidates on P(S)Cell and/or sSCell are configured such that x1(m)+x2(m)+y(m) is less than or equal to BD limit Z2
    - At least the case of Z2 = 44 is supported for P(S)Cell SCS 15kHz
      * FFS if Z2 larger than above can also be supported based on UE capability (e.g. similar to *BDFactorR* in Rel16)
    - max of (x1(m1)+x2(m1)) + max of y(m2) corresponding to any P(S)Cell slots m1 and m2 ~~can~~ is allowed to be larger than BD limit Z2
    - FFS signalling details on how the limit Z2 is realized
    - FFS reference SCS to use when P(S)Cell has higher SCS than sSCell (if supported)
    - For sSCell scheduling P(S)Cell, the UE is not required to monitor on the active DL BWP with SCS configuration of the sSCell more than PDCCH candidates per slot of sSCell.
      * FFS how limit is computed and applied when CCS from sSCell to P(S)Cell is configured
  + Option C
    - PDCCH monitoring candidates on P(S)Cell are configured such that max of (x1(m1)+x2(m1)) is less than or equal to Z3
      * Z3 is derived by the PDCCH monitoring capability of PCell
    - PDCCH monitoring candidates on sSCell are configured such that max of y(m2) is less than or equal to Z4
      * Z4 is derived by the PDCCH monitoring capability of sSCell
    - FFS details to define Z3 and Z4, e.g.
      * Separate RRC configured BD limits/scaling factor-based limits for max(x1(m)+x2(m)) and max(y(m))
    - For sSCell scheduling P(S)Cell, the UE is not required to monitor on the active DL BWP with SCS configuration of the sSCell more than Z4 PDCCH candidates per slot of sSCell
  + Note
    - x1(m) is #BDs for PDCCH CSS(s) candidates monitored on P(S)Cell slot m
    - x2(m) is #BDs for PDCCH USS(s) candidates monitored on P(S)Cell slot m
    - y(m) is #BDs for PDCCH USS(s) candidates monitored on sSCell in all sSCell slot(s) that overlap slot m of P(S)Cell
    - USS(s) => USS(s) that can schedule PDSCH/PUSCH on P(S)Cell)

## Agreements from RAN1#105-e

**Agreement**

Two types of UEs (Type A and Type B) can support CCS from sSCell to P(S)Cell

* For Type A UE
  + At least following search space sets on P(S)Cell and search space sets on sSCell are configured so that the UE does not monitor them in overlapping [slot/symbol] of P(S)Cell and sSCell
    - search space sets on P(S)Cell
      * USS sets for DCI formats 0\_1,1\_1,0\_2,1\_2 (if supported for Type A UE)
      * USS sets for DCI formats 0\_0,1\_0
      * Type3-CSS set(s) for DCI formats 1\_0/0\_0 with C-RNTI/CS-RNTI/MCS-C-RNTI
    - search space sets on sSCell
      * USS set(s) for scheduling P(S)Cell
  + FFS: BD/CCE handling
* For Type B UE
  + Following search space sets on P(S)Cell and search space sets on sSCell can be configured so that the UE monitors them in overlapping [slot/symbol] of P(S)Cell and sSCell
    - search space sets on P(S)Cell
      * USS sets for DCI formats 0\_0,1\_0
      * Type3-CSS set(s) for DCI formats 1\_0/0\_0 with C-RNTI/CS-RNTI/MCS-C-RNTI
    - search space sets on sSCell
      * USS set(s) for scheduling P(S)Cell
  + For handling ‘USS sets for scheduling P(S)Cell’ on P(S)Cell and/or on sSCell for DCI formats 0\_1,1\_1,0\_2,1\_2
    - Alt 2-1 is adopted
  + There is no restriction on Type-0/0A/1/2-CSS sets configurations
  + FFS: BD/CCE handling
* For Type A and/or Type B UE
  + FFS: switching to ‘normal’ PDCCH monitoring on P(S)Cell when sSCell is deactivated
* FFS: Whether Type A is specified or is Type-B with restrictions (as part of UE features discussion)
* FFS: Whether the UE can be configured with unaligned CA
* FFS: Whether the above applies for multicast PDSCH

**Discuss further in RAN1#106-e:**

* For at least Type B UE, downselect from one of the BD/CCE limit handling options below
  + [based on Option A/C] When UE is configured for CCS from sSCell to P(S)Cell and when P(S)Cell SCS () is less than or equal to sSCell SCS ()
    - On P(S)Cell (for self-scheduling)
      * UE is not required to monitor more than PDCCH BD candidates per P(S)Cell slot
      * UE is not required to monitor more than
        + Alt1

PDCCH BD candidates per P(S)Cell slot

* + - * + Alt2

PDCCH BD candidates per P(S)Cell slot

* + - On sSCell (for cross-carrier scheduling to P(S)Cell)
      * UE is not required to monitor more than PDCCH BD candidates per slot of sSCell
      * UE is not required to monitor more than
        + Alt1

PDCCH BD candidates per P(S)Cell slot

* + - * + Alt2:

PDCCH BD candidates per P(S)Cell slot

* + - At least case of is supported.
      * FFS case of
      * FFS multi-TRP case
    - FFS following
      * Selection between Alt1 vs. Alt2 above
      * Whether separate and are configured by RRC or if and only is configured
      * How the PDCCH BD candidates are distributed between multiple sSCell slots overlapping a P(S)Cell slot when and whether the BD limits for sSCell are specified per sSCell slot or per P(S)Cell slot
  + [based on Option B] When UE is configured for CCS from sSCell to P(S)Cell and when when P(S)Cell SCS () is less than or equal to sSCell SCS ()
    - On P(S)Cell (for self-scheduling)
      * UE is not required to monitor more than PDCCH BD candidates per slot of P(S)Cell
    - On sSCell (for cross-carrier scheduling to P(S)Cell)
      * UE is not required to monitor more than PDCCH BD candidates per slot of sSCell
    - Considering both PDCCH BD candidates for P(S)Cell self-scheduling on P(S)Cell and PDCCH BD candidates for sSCell to P(S)SCell cross-carrier scheduling on sSCell
      * UE is not required to monitor more than
        + Alt 1

PDCCH BD candidates per P(S)Cell slot

* + - * + Alt 2

PDCCH BD candidates per P(S)Cell slot

* + - FFS: selection between Alt-1 and Alt-2
  + FFS: whether/how the definition of or is modified compared to Rel16 when UE is configured with CCS from sSCell to P(S)Cell

## Agreements from RAN1#106-e

**Agreement**

Specification supports dormant BWP operation on sSCell for a UE is configured CCS from sSCell to P(S)Cell.

Agreement

* When CCS from sSCell to P(S)Cell is configured for a UE
  + at least the number of PDCCH monitoring candidates monitored on sSCell (for scheduling P(S)Cell) is indicated to the UE using the SS set linking approach as in Rel16
  + ~~FFS: If any modifications to Rel16 approach are introduced for~~ *~~monitoringSlotPeriodicityAndOffset, monitoringSymbolsWithinSlot, duration~~* ~~for the PDCCH monitoring candidates monitored on sSCell (for scheduling P(S)Cell)~~

Agreement

* At least for Type B UE, when the UE is configured for CCS from sSCell to P(S)Cell and when P(S)Cell SCS () is less than or equal to sSCell SCS (), and at least when UE is not provided monitoringCapabilityConfig for any cell, down select one from [based on Option A/C] or [based Option C] below
  + [based on Option A/C]
    - On P(S)Cell (for self-scheduling)
      * UE is not required to monitor more than PDCCH BD candidates per P(S)Cell slot
    - On sSCell (for cross-carrier scheduling to P(S)Cell)
      * UE is not required to monitor more than [ or ] PDCCH BD candidates per sSCell slot (Note: this is assumed per Rel16)
      * UE is additionally not required to monitor more than PDCCH BD candidates per P(S)Cell slot
    - and are based on RRC configuration and at least cases o~~f~~ are supported
    - FFS the following for [based on Option A/C]
      * Distribution of PDCCH BD candidates between multiple sSCell slots overlapping a P(S)Cell slot including whether the above additional BD limitation is defined per sSCell slot or per P(S)Cell slot.
        + Discuss further using following alternatives as starting point (other alternatives/further refinement of alternatives not precluded)

Alt1

The additional BD limitation is per sSCell slot with further limitation that UE is not required to monitor more than PDCCH BD candidates per sSCell slot

Alt 2

The additional BD limitation is per P(S)Cell slot and no further restrictions

Alt 3

The additional BD limitation is per P(S)SCell slot with below further limitation

All search space configurations monitored on sSCell for cross-carrier scheduling to P(S)Cell are within a single span of 3 consecutive OFDM symbols within a duration spanning P(S)Cell slot

* + - * Whether/how the definition of or is modified compared to Rel16 when UE is configured with CCS from sSCell to P(S)Cell
      * Whether separate and are configured by RRC or if and only is configured
  + [based on Option C]
    - On P(S)Cell (for self-scheduling)
      * UE is not required to monitor more than PDCCH BD candidates per P(S)Cell slot
    - On sSCell (for cross-carrier scheduling to P(S)Cell)
      * UE is not required to monitor more than PDCCH BD candidates per sSCell slot
    - When determining and
      * P(S)Cell self-scheduling is counted by applying scaling factor s1,
      * sSCell to PCell scheduling is counted additionally (assuming SCS of sSCell) by applying scaling factor s2
    - and
    - FFS the following
      * + Allowed combinations of s1 and s2 , and whether they are fixed or configured via RRC
        + Whether/how the definition of or is modified compared to Rel16 when UE is configured with CCS from sSCell to P(S)Cell
* FFS the following
  + Multi-TRP handling
  + PDCCH BD handling when monitoringCapabilityConfig = r16monitoringcapability is configured for any cell

**Agreement**

* Endorse below TP to 38.300 from RAN1 perspective
* Send LS to RAN2 with the TP and list of RAN1 agreements, to update Stage 2 spec are needed to reflect the RAN1 agreements

----------------------------------------- start TP1 for 38.300 v.xyz -------------------------------------------

10.8 Cross Carrier Scheduling

Cross-carrier scheduling with the Carrier Indicator Field (CIF) allows the PDCCH of a serving cell to schedule resources on another serving cell but with the following restrictions:

- ~~Cross-carrier scheduling does not apply to Pcell i.e~~. When cross-carrier scheduling from an SCell to Pcell is not configured, Pcell can only be ~~is always~~ scheduled via its PDCCH;

- When cross-carrier scheduling from an SCell to Pcell is configured, PDCCH on that SCell can schedule Pcell’s PDSCH and PUSCH, and PDCCH on the Pcell can also schedule Pcell’s PDSCH and PUSCH, and PDCCH on Pcell cannot schedule PDSCH and PUSCH on any other cell. Only one SCell can be configured to be used for cross-carrier scheduling to Pcell;

- When an SCell is configured with a PDCCH, that cell’s PDSCH and PUSCH are always scheduled by the PDCCH on this SCell;

- When an SCell is not configured with a PDCCH, that SCell’s PDSCH and PUSCH are always scheduled by a PDCCH on another serving cell;

- The scheduling PDCCH and the scheduled PDSCH/PUSCH can use the same or different numerologies.

--------------------------------------------------- end TP1 -----------------------------------------------

Draft LS [R1-2108576](file:///C:\Users\Docs\R1-2108576.zip) is endorsed in principle

Final LS [R1-2108662](file:///C:\Users\Docs\R1-2108662.zip) is endorsed

## Agreements from RAN1#106b-e

**Agreement**

Option A is supported in Rel-17

* At least for Type B UE, when the UE is configured for CCS from sSCell to P(S)Cell and when P(S)Cell SCS () is less than or equal to sSCell SCS (),[and at least when UE is not provided monitoringCapabilityConfig for any cell, ]
  + Option A
    - On P(S)Cell (for self-scheduling)
      * UE is not required to monitor more than PDCCH BD candidates per P(S)Cell slot
    - On sSCell (for cross-carrier scheduling to P(S)Cell)
      * UE is not required to monitor more than [ or ] PDCCH BD candidates per sSCell slot
      * UE is additionally not required to monitor more than PDCCH BD candidates per P(S)Cell slot
    - is based on RRC configuration
    - is used for P(S)Cell overbooking procedure
    - When determining and
      * P(S)Cell self-scheduling is counted by applying scaling factor s1
      * sSCell to P(S)Cell scheduling is counted additionally (assuming SCS of sSCell) by applying scaling factor s2
      * s1=1 and s2=0, FFS other s1 and s2
      * ~~and are based on RRC configuration~~
        + ~~FFS: additional constraints on s1 and s2 e.g., 1 ≤ s1+s2 ≤ 2 or s1 + s2 1~~
      * ~~Note: is as in Rel16~~
    - UE capability/incapability indication for below to be discussed as part of UE features discussion
      * All search space configurations monitored on sSCell for cross-carrier scheduling to P(S)Cell are within a single span of [3] consecutive OFDM symbols within a duration spanning P(S)Cell slot
    - Same approach as above is used for CCE limits
      * FFS: Separate vs. same RRC configured scaling factors (corresponding to ) for BD and CCE limits.
* When P(S)Cell SCS () is larger than sSCell SCS (), for CCS from sSCell to P(S)Cell and, it is not supported Rel-17 DSS.

**Conclusion**

* When sSCell to PCell cross-carrier scheduling is configured, DCI format 2\_6 (if configured) is monitored only on P(S)Cell

**Working Assumption**

* When CIF for sSCell to PCell cross-carrier scheduling is configured, non-fallback DCI formats on P(S)Cell include same number of CIF bits as the corresponding non-fallback DCI formats on sSCell that are used for sSCell to P(S)Cell scheduling

**Conclusion**

* A UE configured for cross-carrier scheduling from SCell to P(S)Cell can also be configured with unaligned CA (i.e., using  *ca-SlotOffset*), and a non-zero value for *ca-SlotOffset*can be configured at least for SCells other than the sSCell
  + FFS: Whether case when sSCell is configured with non-zero *ca-SlotOffset*is supported and any associated capability signalling
* Note: No additional L1 spec impact related to *ca-SlotOffset* had been identified

**Conclusion**

* When CCS from sSCell to P(S)Cell is configured for a UE
  + monitoringSlotPeriodicityAndOffset, monitoringSymbolsWithinSlot, duration for the PDCCH monitoring candidates monitored on sSCell as determined per Rel16 SS linking approach

Agreements from “UE features for DSS” Agenda Item

**Agreement**

The agreements listed in Section 6 of R1-2109917 are endorsed.