**3GPP TSG-RAN WG1 #106-e R1-21xxxxx**

**eMeeting, Aug 16 – 27, 2021**

**Source: Moderator (Ericsson)**

**Title: Summary of Email discussion [Post-106-e-Rel17-RRC-13]**

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

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

# 1 Introduction

This document summarizes the discussion for email thread [Post-106-e-Rel17-RRC-13] under agenda item 8.13.1 on Cross-carrier scheduling (from SCell to PCell) for the Rel17 WI on NR Dynamic spectrum sharing (DSS).

Objective of discussion is to prepare a draft list of RRC parameters based on agreements so far. The draft list would be used for further discussion on RRC parameters in subsequent RAN1 meetings.

Related guidance from RAN1 chairman is given below

….

As announced during RAN1#106-e, there will be a number of email threads on Rel-17 RRC parameters. For each Rel-17 work item, the work item rapporteur will kick off the email thread. The email discussions on RRC parameters will start from September 1 until September 10 (of course excluding the weekend). The purpose of these email discussions is to initiate our preparations to send the first LS to RAN2 on Rel-17 RRC parameters in October (e.g. tabulate agreed RRC parameters so far and identify ones that RAN1 should discuss whether or not to define).

Please note that RAN1 will NOT be making any decision with regards to the Rel-17 RRC parameters during the email discussions. Intention is to have the work item rapporteurs provide their initial assessment and collect company views if there are any. I am hoping that this discussion will help companies better prepare for RAN1#106bis-e. For each email thread, the rapporteur is to provide a tdoc collecting company views along with a draft list of RRC parameter at the end of the email discussion.

The email threads and moderators are as follows:

…

* [Post-106-e-Rel17-RRC-13] DSS – to be moderated by Ravi (Ericsson)

….

# 2. Discussion

### Comments for v00

v00 of RRC parameter spreadsheet is in drafts folder for A.I. 8.13.1.

Companies are requested to provide comments for this version in below Table preferably by Sep 06 5PM UTC

|  |  |
| --- | --- |
| **Company Name** | **Comments (for v00)** |
| Moderator notes | Please check the spreadsheet and provide comments on any potential modifications to v00. Moderator will provide updated version(s) of the spreadsheet based on the comments. |
| OPPO | First, we agree there is something in 38.331 that has to be updated, e.g., the text saying “The network configures this field [i.e., field of “other”] only for SCells” should be removed or modified.  On the other hand, we do not see a real necessity to change the ASN code for CrossCarrierSchedulingConfig IE, because:   1. CrossCarrierSchedulingConfig is configured per cell, while CCS from sSCell to PCell only applies to one specific cell. It seems a over-tune to change ASN code that may apply to all cells under cross-carrier scheduling. 2. The motivation to change the RRC configuration for CCS from sSCell to PCell is that PCell will have two scheduling cells. However, PCell always has itself as one scheduling cell (at least for CSS), no matter what CrossCarrierSchedulingConfig says. So this is something that can live outside of RRC configuration.   So our preference is to keep the ASN definition for CrossCarrierSchedulingConfig as is, and to use plain text in RAN1/RAN2 spec to describe that PCell can have another scheduling cell --- itself, besides what CrossCarrierSchedulingConfig says. |

**Comments for v01**

TBU

# 3 Conclusions

TBU

# 4 References

1. RP-211345 Revised WID on NR Dynamic spectrum sharing (DSS), Ericsson, RAN#92e, June 2021, eMeeting.

# 5 Annex A – Agreements from the RAN1 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