**3GPP TSG-RAN WG2 Meeting #112-e R2-200xxx**

Online, 2-13 November 2020

Agenda Item: 6.8.4

Source: CMCC

Title: Summary of email discussion [Post111-e][918][R16 DCCA] SCell SMTC window for Unaligned CA

Document for: Discussion and Decision

# 1 Introduction

This document is for the following offline discussion, particularly for topics in 6.8.4:

* [Post111-e][918][R16 DCCA] SCell SMTC window for Unaligned CA (CMCC)

Discuss the problem and attempt to come up with a solution.

 Intended outcome: Email discussion report + CR (if needed)

 Deadline: Long

In RAN2 #111 meeting, there is a hot discussion on one issue related to SCell slot slit for unaligned CA which had been identified and discussed in RAN1 and the potential RAN2 impact of the issue, triggered by [1]:

** Issue 1: Interpretation of slots indicated by the bitmap in measurementSlots in TS38.331 for unaligned CA case**

Moreover, in RAN# 89 meeting, the way forward in [2] as follows had been endorsed:

* How to handle the ambiguities, including SMTC window & DRX timing, for Case B is up to WGs

To progress the topic, this document provides questions with respect to the issue and potential RAN2 impact of the issue and companies are requested to provide their views on those.

# 2 Discussion

As descripted in [1] [3] [4], the issue comes from that when unaligned CA is applied, there will be slots partially overlapped with the SMTC window. For example, for Pcell=60kHz, SCell=15kHz, N = -1 (ca\_slot\_offset = -1), it is not clear whether slot 0 or slot 1 shown below (in red rectangle) should be the first slot in measurementSlots for the SCell. And in the below figure, SF means subframe, MO means measurement occasion; SMTC window is defined by PCell timing.



On the other hand, in TS 38.331 [3], the definition of “first slot in the SMTC window” is highlighted in yellow, then for unaligned CA case, it is not clear whether a partially overlapped slot with SMTC window should be treated as “a slot in the SMTC window”. Then to avoid ambiguity, some companies propose only complete slots inside the SMTC window are indicated by the bitmap in *measurementSlots.*



Regarding RSSI measurement, RSSI is a measured value not related to cell dimension, but rather an aggregated measured value from all cells in a specific frequency layer. Then, in the definition of SS reference signal received quality (SS-RSRQ) in TS38.215 [4], it is noted that:

***- For intra-frequency measurements, NR Carrier RSSI is measured with timing reference corresponding to the serving cell in the frequency layer***

This means a reference RSSI measurement timing based on one serving cell in this frequency layer needs to be determined. If there is only one SCell (no PCell) in this frequency layer, and the SCell has a slot offset compared to PCell, then this issue arises.

Additionally, with the definition of “*periodicityAndOffset”*in TS38.331 for SMTC configuration, the offset is subframe-based granularity, however, in the case of unaligned CA or slot-aligned CA, the offset between Pcell/PScell and Scellis is slot-based granularity, which will produce the case that [2] exemplified, however, even in non-CA case, such example may present between two TDD bands when their frame boundaries are not aligned, furtherly, it may present in asynchronized FDD system for inter-frequency measurement, therefore, RAN2 is required to handle this issue in a unified way.

Therefore, when unaligned CA is applied, there will be slots partially overlapped with the SMTC window.

**Question 1: For unaligned CA case, do you agree that it is not clear of the definition of “first slot in the SMTC window” in TS 38.331, i.e. whether a partially overlapped slot with SMTC window should not be treated as “a slot in the SMTC window” or not.**

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| **Company** | **Yes/No** | **Comment / alternative proposal** |
| CMCC | Yes | There is the ambiguity in the definition of the SMTC window requiring clarification. |
| ZTE | Partially agree | For intra-frequency measurement, we agree with rapporteur that the current description in TS 38.331 causes ambiguity issue when the UE is configured with unaligned CA. But we think the issue may also exist for inter-freqency measurement scenario, based on TS 38.215, RSSI measurement for inter-frequency is defined as below: - For inter-frequency measurements, NR Carrier RSSI is measured with timing reference corresponding to any cell in the target frequency layerNote that, the timing reference of RSSI measurement corresponding to any cell in the target frequency layer, while SMTC window is based on the timing reference of sPCell. Thus if target measured frequency is not sychronized with sPCell, there is also a misalignment of slot boundary even if async CA is not configured. |
| MediaTek | Yes | We also agree with ZTE that the problem already exist in inter-frequency case from Rel-15. |
| Qualcomm | Yes with comments | We agree that there is some ambiguity in the definition of the SMTC window on partially overlapping slot in async CA as rapporteur mentioned. However, we don’t think it is a big issue: * It can be resolved by proper Network implementation. For example, network can configure the SMTC window starting from slot boundary of SCell.
* It is possible that only a small part of slot is overlapped, e.g. 5% overlapping of a slot in SCell. Then, it seems not necessary to discard the full slot just because of the 5% loss, i.e. it seems like an overkill in some cases.

For the Inter-frequency issue mentioned by ZTE, we think no clarification is required because it will impact Rel-15 sync CA. In addition, for sync CA, the max time difference is like half a symbol, i.e. less than 5% of a slot if the example showed by rapporteur. We don’t think it is necessary to discard the full slot because of such small overlapping. Based on above reason, we show some preference to keep the spec for async CA, i.e. the partially overlapped slot of SCell is still regarded as “a slot in SMTC window”. Please note that Network can set such slot as “0” in *measurementSlots* if Network identified a large part of this slot is overlapped and should be discarded by the UE. We think it also provides some flexibility for different cases.As we mentioned before, we don’t think it is a big issue. So, if majority prefer to clarify in rapporteur’s solution (i.e. UE always discards the partially overlapped slot), it is also acceptable to us. However, in this case, we will insist that such clarification should be only for intra-frequency RSSI measurement of Rel-16 async CA.  |
| Nokia | Yes with comments | There is ambiguity in case the PCell SCS is higher than the SCell SCS in case of unaligned CA. Whether this ambiquity causes any actual problem is not that clear. Maybe one could even consider it to be up to UE to decide which non-complete slots to apply as long as performance requirements are met. In case of regular (aligned CA) in rel-15 is minimal and does not require any changes. |
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Regarding RSSI measurement, a reference RSSI measurement timing based on one serving cell in this frequency layer needs to be determined.

**Question 2: Do you agree that the issue will arise if there is only one SCell (no PCell) in this frequency layer, and the SCell has a slot offset compared to PCell?**

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| **Company** | **Yes/No** | **Comment / alternative proposal** |
| CMCC | Yes |  |
| ZTE | See comments | The question is a bit unclear because intra-frequency must be performed on serving frequency. As we responsed to Q1, we think the issue not only appears in intra-frequency measurement, for normal inter-frequency measurement (since Rel-15), as long as the measured target frequency/cell is not sychronized with sPCell, the ambiguity issue also exists. In summary, we think the issue appears in the following cases:1. Intra-frequency measurement, when UE is configured with async CA, and the subframe boundary of sPCell is not aligned with the slot boudary of SCell.
2. Inter-frequency measurement when the subframe boundary of sPCell is not aligned with the slot boudary of target measured cell.
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| MediaTek | Yes for intra-frequency case | For intra-frequency measurement, this issue arises due to async CA. For inter-frequency measurement, there is already some ambiguity started from Rel-15. |
| Qualcomm  | See comments | As we commented in Q1: * For intra-frequency case, we don’t think it is a big issue, and we prefer to keep the spec for async CA, i.e. the partially overlapped slot of SCell is still regarded as “a slot in SMTC window”. if majority prefer to clarify in rapporteur’s solution (i.e. UE always discards the partially overlapped slot), it is also acceptable to us. But it is only needed for async CA of Rel-16
* For inter-frequency case, we think no clarification is needed because it may impact Rel-15 sync CA. And as we analyzed, the loss in sync CA will be small and not worth for the UE to discard the full slot.
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| Nokia | Likely yes - See response to clarify the question | Using “frequency layer” may not be ambiguous, but in our understanding there can be just **one** cell on a given frequency layer in a CA setup, not several cells . Hence the question would reduce to “*Do you agree that the issue will arise if* ***an SCell*** *has a slot offset to PCell*” - so quite similar to first question. In this case, this is maybe a similar SMTC window issue here with regard to the measurement timing. |
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If you confirm the above issues, then please provide your answer the question 3:

**Question 3: Do you agree the following proposal:**

**For the IE *measurementSlots* defined in 38.331, only complete slots inside the SMTC window are indicated by the bitmap in *measurementSlots* in case of both intra- frequency measurement and inter-frequency measurement, and add the corresponding clarification for the slot bitmap interpretation of *measurementSlots* in TS38.331.**

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| **Company** | **Yes/No** | **Comment / alternative proposal** |
| CMCC | Yes | The clarification for the ambiguity is needed.  |
| ZTE | Yes | We are ok with the proposal and it covers both “intra-frequency measurement” and “inter-frequency measurement” cases. As we responsed to Q1, we understand the issue (for inter-frequency measurement) has existed since Rel-15, so it would be good to confirm whether all Rel-15 UEs have already implemented as the proposed way. Otherwise, we need to find another solution.  |
| MediaTek | Yes | At least for intra-frequency case in Rel-16, we support this clarification. We could further discuss on whether we want to clarify this also for inter-frequency measurement. And if yes, do we want to clarify this from Rel-15 or from Rel-16?  |
| Qualcomm  | See comments | As we commented in Q1: * For intra-frequency case, we don’t think it is a big issue, and we prefer to keep the spec for async CA, i.e. the partially overlapped slot of SCell is still regarded as “a slot in SMTC window”. if majority prefer to clarify in rapporteur’s solution (i.e. UE always discards the partially overlapped slot), it is also acceptable to us. But the clarification is only needed for async CA of Rel-16
* For inter-frequency case, we think no clarification is needed because it may impact Rel-15 sync CA. And as we analyzed, the loss in sync CA will be small and not worth for the UE to discard the full slot.
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| Nokia | Maybe | Definition of “complete slot” is not that clear as this is already now existing due to timing inaccuracies between serving cells in case of aligned CA. So it is not fully clear what is the proposal but we agree that ambiquity should be removed if it causes performance issues but if the impact is minimal it would not really justify specification impacts.  |
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# **3 Conclusion**

TBD

# 4 References

1. R2-2001627 Impact of CG/SPS with periodicities non dividing HF length Sequans Communications[R2-2008365](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_111-e/Docs/R2-2008365.zip) Issue on SCell Slot Slit for Unaligned CA CMCC
2. RP-202030 Moderator’s Summary for Email Discussion [89E][12][R16\_DCCA\_unaligned\_frames], MediaTek

1. **R1-2007008** FL summary on support of unaligned frame boundary for R16 NR inter-band, CMCC
2. R1-2005626, Remaining issues on Rel-16 carrier aggregation, MediaTek Inc..
3. 3GPP TS 38.331 V16.0.0, ”NR; Radio Resource Control (RRC) protocol specification”
4. 3GPP TS 38.215 V16.2.0, ”NR; Physical layer measurements”

# **6 Proposals in summary contribution**