**3GPP TSG-RAN WG2 #109bis-e R2-20xxxx**

E-meeting: 20th – 30th, April, 2020

Agenda Item: 6.7.2.2

Source: CMCC

Title: Summary of offline discussion-026- Scheduling Enhancements, Part 1

Document for: Discussion and Decision

# 1 Introduction

This document is for the following offline discussion, particularly for topics in 6.7.2.2:

* [AT109bis-e][026][IIOT] Scheduling Enhancements (CMCC)

Status: Not yet Started, will be started after on-line session April 21

Scope: Treat topics in 6.7.2.2, open issues and corrections, in particular parts of [R2-2003497](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003497.zip) that are not treated on-line.

Part 1: Determine which issues that need resolution, find agreeable proposals. Deadline: April 24 0700 UTC. Result to be merged into CRs in other email discussions (e.g. RRC, possibly MAC).

The offline discussion has been conducted. The target is aiming to identify the agreeable proposals listed in the email discussion (026). The identified agreements have been listed in **Section 3 Conclusion**.

The pervious summary of contributions submitted to Agenda Item 6.7.2.2 related to Scheduling Enhancements for IIOT WI sections are copied in the **Section Annex** for reference.

# 2 Discussion

## 2.1 Potential easy agreements

The following agreements are proposed as potential easy agreements based on the summary in [13].

Proposal 1: Not to introduce restrictions of how many SPS configurations are supported, e.g. per cell/ per UE (SPS/CG).

**Question 1: Do you agree with Proposal 1?**

|  |  |  |
| --- | --- | --- |
| Company | YES/NO | Comment / alternative proposal |
| Nokia | YES |  |
| Ericsson | Yes |  |
| LG | YES |  |
| ZTE | Yes |  |
| Samsung | Yes |  |
| Qualcomm | Conditional yes | Assuming proposal 3 is also agreed |
| OPPO | Yes |  |
| CATT | Yes |  |
| vivo | Yes |  |
| Sony | Yes |  |
| Huawei | Yes |  |
| Intel | Yes |  |
| CMCC | Yes |  |

**Conclusion:**

All companies agreed Proposal 1, so we can have the following agreement:

* **Not to introduce restrictions of how many SPS configurations are supported, e.g. per cell/ per UE (SPS/CG).**

Proposal 2: No need to capture limitation of maximum CG/SPS configurations per MAC entity in TS 38.300.

**Question 2: Do you agree with Proposal 2?**

|  |  |  |
| --- | --- | --- |
| Company | YES/NO | Comment / alternative proposal |
| Nokia | YES |  |
| Ericsson | Yes |  |
| LG | YES |  |
| ZTE | Have no strong point of view |  |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| vivo | Yes |  |
| Sony | Yes |  |
| Huawei | Yes |  |
| Intel | Yes |  |
| CMCC | Yes |  |

**Conclusion:**

All companies agreed or didn’t object Proposal 2, so we can have the following agreement:

* **No need to capture limitation of maximum CG/SPS configurations per MAC entity in TS 38.300.**

Proposal 3: Support up to 32 SPS configurations per MAC entity.

**Question 3: Do you agree with Proposal 3?**

|  |  |  |
| --- | --- | --- |
| Company | YES/NO | Comment / alternative proposal |
| Nokia | YES |  |
| Ericsson | Yes |  |
| LG | YES |  |
| ZTE | Yes |  |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| vivo | Yes |  |
| Sony | Yes |  |
| Huawei | Yes |  |
| Intel | Yes |  |
| CMCC | Yes |  |

**Conclusion:**

All companies agreed Proposal 3, so we can have the following agreement:

* **Support up to 32 SPS configurations per MAC entity.**

**Proposal 4: Support CG periodicities of multiple of 2/7 symbols in IIoT.**

**Question 4: Do you agree with Proposal 4?**

|  |  |  |
| --- | --- | --- |
| Company | YES/NO | Comment / alternative proposal |
| Nokia | YES | Considering this has no impact to RAN1, we see no reason not to support it. It can be a UE capability which is separate from the slot level periodicities. |
| Ericsson | Yes | Agree with Nokia |
| LG | NO | We think that the main use case of CG periodicities of multiple of 2/7 symbols is to align between IIoT traffic pattern and CG. But, RAN2 already agreed to support additional periodicity and multiple active CG and these two new features would be sufficient for this same purpose. Maybe this may be considered in the next release. |
| ZTE | Yes | The periodicity with multiple of 2/7 symbol can excellent support the various service periods. |
| Samsung | No (no strong view) | Agree with LG. But, if majority wants, we are ok. |
| Qualcomm | No | We are not aware of a use-case that IIoT work item was targeting that demands this. Even if needed, equivalent functionality can be obtained by configuring two CG with offsets. The function is complex for the UE to support because different CG occurrences will see different collisions with SRS that is only present in specific symbols of a slot. |
| OPPO | Yes, but | There should be a UE capability to indicate whether UE support such periodicity. |
| CATT | Yes | This feature allows configuring CG periods of e.g. 1.5 slots (N=3 with 7-symb granularity) which provides more flexibility in aligning CG and the traffic pattern. |
| vivo | No | There is no clear use case for the very short SPS periodicity. |
| Sony | Yes | From latency reduction perspective, it is useful to support. |
| Huawei | No | Maybe more discussion could be done. |
| Intel | No | Agree with LG. Rel-15 already supports 2 and 7 symbol periodicities for CG. Rel-16 further introduces slot granularity periodicity of up to 640 ms for CG. Additional support of CG periodicities of multiple of 2/7 symbols does not bring much gain of alignment between TSN periodicity and SPS/CG periodicity. |
| CMCC | Yes | We prefer to support CG periodicities of multiple of 2/7 symbols, which is defined as a separate UE capability. |

**Conclusion:**

7 companies agree with Proposal 3, one company indicated can follow majorities’ view, but 5 companies disagree. We tend to achieve the following agreement that requires a short period for approval in 2rd offline discussion:

* **Support CG periodicities of multiple of 2/7 symbols in IIoT. And whether the UE support such periodicity** **will be** **defined as a separate UE capability.**

**Proposal 6. SPS-Config and SPS-ConfigList in BWP-DownlinkDedicated cannot be configured simultaneously at a given time.**

**Question 5: Do you agree with Proposal 6 ?**

|  |  |  |
| --- | --- | --- |
| Company | YES/NO | Comment / alternative proposal |
| Nokia | YES | We may run into some issues if we do otherwise, e.g. ambiguity in activation/release commands. |
| Ericsson | Yes | There is a typo in the question, and we support proposal 6.  The intention to introduce the “sps-ConfigList” is to support one or more SPS configurations per BWP. It would be a wrong configuration if the network configures the two fields together.  We think it does not hurt to clarify. In addition, a clarification in this WI can help the discussion of the related ASN.1 class 2 RIL issues (flagged as DiscMail6). |
| LG | YES, but | It seems network configuration. This proposal is whether to confirm network restriction. |
| ZTE | Yes |  |
| Samsung | Yes | Without such restriction, there might be an interoperability issue in the future. |
| Qualcomm | Yes |  |
| OPPO | Yes | Agree with Ericsson. |
| CATT | Yes | Aligned with configured grants, for which it is required, see below. |
| Vivo | Yes |  |
| Sony | Yes |  |
| Huawei | Yes |  |
| Intel | Yes |  |
| CMCC | Yes |  |

**Conclusion:**

All companies agreed Proposal 6, so we can have the following agreement:

* **SPS-Config and SPS-ConfigList in BWP-DownlinkDedicated cannot be configured simultaneously at a given time.**

**Proposal 7. ConfiguredGrantConfig and ConfiguredGrantConfigList in BWP-UplinkDedicated cannot be configured simultaneously at a given time.**

**Question 6: Do you agree with Proposal 7?**

|  |  |  |
| --- | --- | --- |
| Company | YES/NO | Comment / alternative proposal |
| Nokia | YES | We may run into some issues if we do otherwise, e.g. ambiguity in activation/release commands, CG confirmation MAC CE etc. |
| Ericsson | Yes | The same argument as above. |
| LG | YES, but | It seems network configuration. This proposal is whether to confirm network restriction. |
| ZTE | Yes |  |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| OPPO | Yes |  |
| CATT | Yes | It is necessary because MAC selects which type of confirmation MAC CE to send based which of Rel-15 or Rel-16 IE is configured. |
| vivo | Yes |  |
| Sony | Yes |  |
| Huawei | Yes |  |
| Intel | Yes |  |
| CMCC | Yes |  |

**Conclusion:**

All companies agreed Proposal 6, so we can have the following agreement:

* **ConfiguredGrantConfig and ConfiguredGrantConfigList in BWP-UplinkDedicated cannot be configured simultaneously at a given time.**

## 2.2 Proposal may require more discussion

**Proposal 5: it is proposed that the step of determining the closest N needs to be added.**

**Question 7-a: Do you agree with that the step of determining the closest N needs to be added.?**

|  |  |  |
| --- | --- | --- |
| **Company** | **YES/NO** | **Comment / alternative proposal** |
| Nokia |  | Yes, we need to progress as there is a pending FFS in the specifications. Should we discuss a Text Proposal for this? We had our own proposal for a simple TP in [9], but we also think there was a good proposal in [6], i.e. clarify for Type 1 CG formula that:  “where N >= 0 and N is the smallest value corresponding to the closest available CG occasion after configured grant Type 1 configuration.” |
| Ericsson |  | We agree with Nokia this should be resolved and we prefer an email discussion over candidate TPs. |
| LG |  | Not clear the proposal, but we think that this can be resolved by implementation. |
| ZTE |  | In our understanding, we have already explained the parameter timeReferenceSFN in 38.321 as well as RRC specification. It can imply that UE need to deduct the closest N based on the timeReferenceSFN and periodicity. Therefore , there is no need for us to clarify this again in the specification. It can be left to UE implementation for how to deduct the closest N |
| Samsung | Yes | UE implementation could resolve it. But we have an agreement, it’s better to capture it with a simple way |
| Qualcomm | No | Can be handled by implementation at UE. We have not seen any interoperability concern in the current spec. |
| OPPO |  | From our perspective, it can be resolved by implementation. But we are also fine to have a NOTE if majority want something clarified in the spec. |
| CATT | Yes | For example [6] proposes a clear and non-ambiguous TP. |
| Vivo |  | This seems to be an UE implementation. It is not clear why this should be clarified. |
| Huawei |  | We think this is UE implementation issue and no need to specify. |
| Intel |  | We also think this can be handled by UE implementation. |
| Sequans | No (no need for a precise determination of closest N). | Actually, we think the current text is fine.  MAC formula describes CG occurrences indexed by N>=0; the timeReferenceSFN from which the formula applies occurs in the past compared to when the configuration is received (as already clearly specified). See figure below:  C:\Users\omarco\Pictures\Screenpresso\2020-04-24_14h41_43.png  The UE cannot obviously use the CG occasions occurring in the past; it will start by N=m.  It seems some companies want to define exactly what is this value N=m, however we think it might be overkill.  Also we should be careful to not introduce new issues. Regarding CATT TP proposal “where N >= 0 and N is the smallest value corresponding to the closest available CG occasion after configured grant Type 1 configuration”, for us it means N has a fixed value, so only one CG occasion is defined, so we don’t agree with this TP.  However, we are ok with a NOTE or short TP to clarify above understanding, if it is not clear enough. |
| CMCC | No | To our understanding, it can be resolved by implementation. |

4 companies agree with Proposal 5 (Nokia, Ericson, Samsung and CATT), but 9 companies disagree. The rapporteur would suggest to achieve the following agreement:

* **Not to specify the step of determining the closest N in MAC spec, which can be handled by UE implementation.**

**Question 7-b: If you support to add a text for description of the step of determining the closest N, please provide corresponding informal candidate TP in the table.**

|  |  |
| --- | --- |
| **Company** | **Candidate TP** |
| CATT | After an uplink grant is configured for a configured grant Type 1, the MAC entity shall consider sequentially that the Nth uplink grant occurs in the symbol for which:  [(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  (*timeReferenceSFN* × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot + timeDomainOffset* × *numberOfSymbolsPerSlot* + *S* + N × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*).  Where N >= 0 and N is the smallest value corresponding to the closest available CG occasion after configured grant Type 1 configuration. |
|  |  |
|  |  |
|  |  |

## 2.3 Possible postpone Issues

### ***2.2.1 Issue #7 Configure grant type 1 resources calculation during BWP switch***

R2-2003586 [11] raised an issue that in rel-16, not similar with R-15, the occasion of configured grant type 1 is no longer solid in one SFN cycle due to the enhanced periodic can have a non-integer multiple time relationship with 10240ms. Thus UE need to deduct the occasion sequentially from the first occasion. Thus the understanding of ‘suspend’ and ‘initialize/reinitialize’ shall be clarified in Rel-16. Thus it proposed:

**Proposal 8: RAN 2 is kindly asked to clarify the ‘suspending’ and ‘(re)-initializing’ configured gran type 1 resources for the case of BWP switch:**

**The understanding of suspending:**

* **Option 1: UE still keep calculating the occasion of the suspended configured grant type 1 even when the related UL BWP is deactivated**
* **Option 2: UE stop calculating the occasion of the suspended configured grant type 1 when the related UL BWP is deactivated.**

**Correspondingly, the understanding of ‘initialize/reinitialize’**

* **Option 1: UE continue to use the occasion of the suspended configured grant type 1 when the related UL BWP is activated**
* **Option 2: UE recalculate the occasion of the configured grant type 1 based on the r*eferenceSFNnumber , timeDomainOffset, and S* and the SFN number when the switch on is occurred.**

**Question 8: Do you think this issue need to be addressed in Rel-16? If yes, do you agree the proposal?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | YES/NO- Addressed in Rel-16 | YES/NO- Do you agree the proposal | Comment / alternative proposal |
| Nokia | Yes |  | We are not sure we understand the options really. In any case, we think UE needs to continue to calculate the occasions even when not operating in a BWP. Otherwise, there might be misalignment between the occasion it will use when it switches back to the BWP and the one it should be using. |
| Ericsson | Yes |  | This is an implementation related question in the UE, i.e. how UE keeps track of CG occasions when CG is suspended. For the occasion calculation the UE must relate back to the start of the CG, which it can do whether CG is suspended or not (e.g. during BWP switch). This calculation is simple. It seems that this is the option 1, which does not require spec change.  For option 2, as pointed out in the paper R2-2003586, there might be a misalignment between network and UE when UE performs an automatic BWP switch. |
| LG | NO | NO | In our understanding, the current behavior is option 2 in both “suspending” and “initialize/reinitialize” and there is no issue. |
| ZTE | Yes |  | Option 1 is our preference, the detail can refer to our contribution R2-2003586.  For now, we suggest to capture a clarification in the chairman note or specification for fear that this issue will be raised again. |
| Samsung | No |  | Our understanding is “suspend”. MAC specification does not differentiate whether the CG is on active BWP or not. Current text is clear |
| Qualcomm | No |  | Agree with Samsung |
| OPPO | Yes |  | What we really need is the correct calculation results of the CG occasions when the BWP is activated again. But how to achieve that is up to UE implementation, which do not need to be standardized. |
| CATT | Yes | Yes | But we don’t think this necessarily implies a specification update as option 2 is what the above formula specifies. |
| Vivo | Yes |  | The UE could have autonomous BWP switching. The occasion should be aligned between the gNB and UE regardless of the BWP switching. |
| Huawei | No |  | No sure there is issue to solve. |
| Intel | Yes |  | Our understanding is that UE needs to keep track of the CG occasions even if BWP is deactivated, so that CG occasion is aligned with traffic pattern. Maybe this is option 1. |
| Sequans | Yes |  | Agree with Ericsson  “For the occasion calculation the UE must relate back to the start of the CG, which it can do whether CG is suspended or not (e.g. during BWP switch).”  We agree with Option 1 behavior. |
| CMCC | Yes |  | But in our understanding, this is an implementation related question in the UE. |

* 9 companies agree with that this issue need to be addressed in Rel-16, but it is an UE implementation, which does not require spec change.
* 4 companies think there is no such issue at all.

Hence, the rapporteur would suggest to achieve the following agreement:

* **No need to clarify the ‘suspending’ and ‘(re)-initializing’ configured gran type 1 resources for the case of BWP switch.**

**Proposal 9: When an UL BWP is deactivated, UE still need to calculate the resources sequentially for each configured grant type 1. When an UL BWP is activated, UE continue to use the occasion of the suspended configured grant type 1 resources when the related UL BWP is activated.**

**Question 9: Do you this issue need to be addressed in Rel-16? If yes, do you agree the proposal?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | YES/NO- Addressed in Rel-16 | YES/NO- Do you agree the proposal | Comment / alternative proposal |
| Nokia | Yes | Yes | It seems this is a proposal related to P8 as well. This is how we think it should work, so we support the proposal. |
| Ericsson | Yes | Yes | This seems to be the option 1 in the proposal 8 |
| LG | No | No |  |
| ZTE | Yes | Yes |  |
| Samsung | No |  | TS38.321 clearly specify that suspend any configured uplink grant of configured grant Type 1 on the inactive BWP. No need to clarify. |
| Qualcomm | No |  | Agree with Samsung. |
| OPPO | Yes | No | As explained in the previous question. |
| CATT | Yes | Yes | Same comment as above. |
| Vivo | Yes | Yes |  |
| Huawei | No |  |  |
| Intel | Yes | Yes | This might be option 1 in proposal 8. |
| Sequans | Yes | Yes |  |
| CMCC | Yes | Yes | Same comment as above. |

Majority think this proposal is related to P8 as well. Hence, same agreement as indicated in Proposal 8.

### ***2.2.2 Issue #7 Measurement gaps***

R2-2002657[1] proposes UE to transmit during the measurement gaps, since UE cannot transmit/receive during the measurement gap and it impacts the latency performance. However, there were other proposals before this meeting that even if allowing UE to send during measurement gap, it does not solve the issue for DL traffic and one simpler solution is to allow UE to be equipped with two radios. Therefore, we expect this topic to be contentious and unlikely to converge at e-Meeting.

**Proposal 10: The TSN transmission should be allowed when TSN transmission collides with measurement gap, and Network can configure UE which types of TSN traffic can be transmitted during measurement gaps.**

**Question 10: Do you this issue need to be addressed in Rel-16? If yes, do you agree the proposal?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | YES/NO- Addressed in Rel-16 | YES/NO- Do you agree the proposal | Comment / alternative proposal |
| Nokia | No | No | This has been discussed and we agreed this should not be treated in Rel-16. |
| Ericsson | No | No | As we pointed out in our previous paper that even if we allow UE to send during measurement gap, it does not solve the latency issue for DL traffic when UE is in a measurement gap. The simple approach is to allow UE to be equipped with two radios. |
| LG |  |  | We have sympathy with transmission during measurement gap, but it seems too late to discuss at this late stage. We may be handled in the next release. |
| ZTE | No | No | Agree with Nokia |
| Samsung | No | No |  |
| Qualcomm | No |  |  |
| OPPO | No | No |  |
| CATT | No |  | This issue was already brought up without conclusion. |
| vivo |  |  | Due to the very limited time, it seems difficult to resolve the measurement gap issue in Rel-16. |
| Huawei |  |  | OK to postpone this discussion. |
| Intel | No | No |  |
| CMCC | No | No |  |

**Conclusion:**

All companies agreed that this should not be treated in Rel-16., so we can have the following agreement:

* **Not to address the issue that the TSN transmission should be allowed when TSN transmission collides with measurement gap, and Network can configure UE which types of TSN traffic can be transmitted during measurement gaps in Rel-16.**

### ***2.2.3 Issue #8 Burst arrival time***

R2-2002708 [3] proposes a clarification of the burst arrival time defined in SA2 TS 23.501. It raised an issue that the aggregation process results in the 5G network identifying TSCAI information (e.g. Burst Arrival time) and QoS flow characteristics that are representative of the aggregated set of TSN flows. The gNB uses this information to allocate periodic resource in support of the corresponding TSN streams. Currently, the burst arrival time is defined as the beginning of the burst. Since it is more beneficial for RAN to get the knowledge of a burst arrival time that refers to the end of the burst, it is proposed that RAN2 send SA2 an LS stating “It is beneficial for RAN to obtain from TSCAI a burst arrival time that refers to the end of the burst rather than the beginning of the burst” [4].

**Proposal 11: It is beneficial for RAN to obtain from TSCAI a burst arrival time that refers to the end of the burst rather than the beginning of the burst. And RAN2 can send SA2 an LS stating “It is beneficial for RAN to obtain from TSCAI a burst arrival time that refers to the end of the burst rather than the beginning of the burst”.**

**Question 11: Do you this issue need to be addressed in Rel-16? If yes, do you agree the proposal?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | YES/NO- Addressed in Rel-16 | YES/NO- Do you agree the proposal | Comment / alternative proposal |
| Nokia | No | No | We do not have a strong view, but we think determining the end of the burst may not be trivial at this stage. This could be left for implementation in Rel-16 and addressed in Rel-17 where SA2 is already working on defining additional parameters such as burst spread. |
| Ericsson | Yes | Yes | The purpose of this paper is to reach a common understanding in RAN2 that a reference to the end of the burst (which is missing from TSCAI) is needed.  With this information, gNB knows when all the payload within a burst arrives at UE/gNB and so can correctly allocate the starting position of the periodic resources (i.e., CG/SPS) after the end of the burst. To facilitate resource allocation at gNB is the motivation to introduce the TSC AI, and we consider this an essential correction.  This would be a Rel-16 correction in SA2, but we acknowledge the detailed timeline and how to correct in TS 23.501 should be left for SA2 to decide. |
| LG | No | No |  |
| ZTE | No | No for Rel-16 | The NW implementation can resolve such issue (i.e: relay on the experience derived from the first burst) |
| Samsung | No | No |  |
| Qualcomm | No | No | Agree with the Nokia view. There is no need to send Rel-16 LS to SA2. |
| OPPO | No | No for Rel-16 | We have sympathy on this issue, but maybe it is hard to have a consensus at this stage. We can resolve it by UE implementation in Rel-16, and have more discussion in Rel-17. |
| CATT | No |  | The TimeIntervalValue of a GateControlEntry of an IEEE 802.1Qbv schedule specifies the time interval during which the burst may occur. Therefore considering the end of this interval always applies the worst-case delay even if the burst comes at the beginning of the interval. We acknowledge providing the beginning of the burst only is not ideal as both the beginning and the end of the interval should be provided (hopefully this is solved in Rel-17). But only providing the end of the burst is worse in our view. |
| vivo | No | No | We agree with the issue. However using only the end time seems not correctly reflecting the burst arrival time, which includes a start time and an end time. |
| Huawei | No |  | Prefer to postpone this discussion |
| Intel | No | No |  |
| Sequans | No |  | Similar view as vivo, we think both start/end should be required (or start/duration). |
| CMCC | No |  | Prefer to address this issue in Rel-17 |

**Conclusion:**

12 companies agreed that this should not be treated in Rel-16., but one company prefer to address this issue now. Hence, we tend to achieve the following agreement:

* **Not to address the issue for RAN to obtain from TSCAI a burst arrival time that refers to the end of the burst rather than the beginning of the burst in Rel-16.**

# 3 Conclusion

For the remaining issues on scheduling enhancement, the discussion identifies the following agreeable. If no objection was received within the period of 2nr discussion, all the following proposals are marked as to be agreeable.

* **Not to introduce restrictions of how many SPS configurations are supported, e.g. per cell/ per UE (SPS/CG).**
* **No need to capture limitation of maximum CG/SPS configurations per MAC entity in TS 38.300.**
* **SPS-Config and SPS-ConfigList in BWP-DownlinkDedicated cannot be configured simultaneously at a given time.**
* **ConfiguredGrantConfig and ConfiguredGrantConfigList in BWP-UplinkDedicated cannot be configured simultaneously at a given time.**
* **Not to specify the step of determining the closest N in MAC spec, which can be handled by UE implementation.**
* **No need to clarify the ‘suspending’ and ‘(re)-initializing’ configured gran type 1 resources for the case of BWP switch.**
* **Not to address the issue that the TSN transmission should be allowed when TSN transmission collides with measurement gap, and Network can configure UE which types of TSN traffic can be transmitted during measurement gaps in Rel-16.**
* **Not to address the issue for RAN to obtain from TSCAI a burst arrival time that refers to the end of the burst rather than the beginning of the burst in Rel-16.**

Since there are 7 companies agree with Proposal 3, one company indicated can follow majorities’ view, but 5 companies disagree. The following controversial issue needs further discussion, e.g. online, email or next meeting.

* **Support CG periodicities of multiple of 2/7 symbols in IIoT. And whether the UE support such periodicity will be defined as a separate UE capability.**

# 4 References

1. R2-2001627 Impact of CG/SPS with periodicities non dividing HF length Sequans CommunicationsR2-2002657 Handling of collision between TSN transmission and measurement gap Spreadtrum Communications discussion
2. R2-2002707 SPS CG remaining issues Ericsson discussion NR\_IIOT-Core
3. R2-2002708 TSC AI clarifications: meaning of arrival time Ericsson discussion NR\_IIOT-Core R2-2000790
4. R2-2002709 Draft LS: TSC AI clarifications for arrival time Ericsson LS out NR\_IIOT-Core R2-2000791 To:SA2
5. R2-2002663 Discussion about open issues for CG and SPS Huawei, HiSilicon discussion Rel-16 NR\_IIOT-Core
6. R2-2002753 Remaining issues for multiple SPS and CG configurations CATT discussion NR\_IIOT-Core
7. R2-2002946 Configuration of Configured Grant and Semi-Persistent Scheduling Samsung discussion Rel-16 NR\_IIOT-Core
8. R2-2003168 Periodicities of multiple of 2 or 7 symbols for CG Nokia, Nokia Shanghai Bell, Ericsson, NTT Docomo discussion Rel-16 NR\_IIOT
9. R2-2003169 Determining the ‘closest N’ for CG Type-1 initialization Nokia, Nokia Shanghai Bell draftCR Rel-16 38.321 16.0.0 NR\_IIOT
10. R2-2003504 RRC Open Issues for Scheduling Enhancements CMCC discussion Rel-16 NR\_IIOT-Core
11. R2-2003586 Remaining issues on configured grant type 1 resources calculation ZTE, Sanechips discussion Rel-16 NR\_IIOT-Core
12. R2-2003322 Remaining issues in IIoT UE capability Intel Corporation discussion Rel-16 NR\_IIOT-Core

# 5 Annex

## 5.1 Remaining Issue

### ***5.1.1 Issue #1: 38.300 FFS whether there are other restrictions of how many SPS configurations are supported, e.g. per cell / per UE***

|  |  |  |
| --- | --- | --- |
| ***Company/Tdoc*** | ***Yes/No*** | ***Related proposal*** |
| Ericsson [2] | No | The same number of 32 seems appropriate. The definition should be per MAC entity, not per UE, as MAC entity/module is responsible for scheduling. By this definition the maximum supported number can also be flexibly used among BWPs and cells. |
| Huawei [5] | No | As for the restriction of the number of SPS configurations in other levels, e.g. per cell or per UE level, we don’t see any necessities there. No need to introduce per cell or per UE level’s restriction of the maximum number of supported SPS configurations. |
| CATT [6] | No | Not to introduce restrictions of how many SPS configurations are supported, e.g. per cell/ per UE (SPS/CG). |
| CMCC[10] | No | It is proposed to not to specify additional the maximum number of SPS configurations per UE. |

**4 companies expressed an opinion on this issue and none supported that it is necessary to introduce per cell or per UE level’s restriction of the maximum number of supported SPS configurations.**

Proposal 1: Not to introduce restrictions of how many SPS configurations are supported, e.g. per cell/ per UE (SPS/CG).

### ***5.1.2 Issue #2: 38.300: Editor’s note: The limitation of maximum of 32 CGs per MAC entity needs to be captured in TS 38.300***

|  |  |  |
| --- | --- | --- |
| ***Company/Tdoc*** | ***Yes/No*** | ***Related proposal*** |
| Ericsson [2] | No | No need to capture limitation of maximum CG/SPS configurations per MAC entity in TS 38.300. |

**Only one company expressed an opinion on this issue and there is no impact on current spec. or running CR.**

Proposal 2: No need to capture limitation of maximum CG/SPS configurations per MAC entity in TS 38.300.

### ***5.1.3 Issue #3: Whether a limitation on maximum number per MAC entity should be defined? If needed, what is the number?***

|  |  |  |
| --- | --- | --- |
| ***Company/Tdoc*** | ***Yes/No*** | ***Related proposal*** |
| Ericsson [2] | Yes | Support up to 32 SPS configurations per MAC entity. |
| Huawei [5] | Yes | Introduce a restriction that maximum 32 SPS configurations per MAC entity can be configured for a UE. |
| Samsung [7] | Yes | Max 32 SPS configurations per MAC entity are supported. |

**3 companies expressed an opinion on this issue and all supported that Max 32 SPS configurations per MAC entity.**

Proposal 3: Support up to 32 SPS configurations per MAC entity.

### ***5.1.4 Issue #4: FFS whether to support allowing CG periodicities of multiple of 2/7 symbols as a separate capability with a cross-slot boundary capability as a pre-requisite.***

|  |  |  |
| --- | --- | --- |
| ***Company/Tdoc*** | ***Yes/No*** | ***Related proposal*** |
| Huawei [5] | No | * It should be noted that such issue has not been discussed explicitly in either RAN1 or RAN2. We doubt this as suitable to support this feature and further introduce a cross-slot boundary capability without any formal input from RAN1 at this late stage. * We prefer hence not to support CG periodicities of multiple of 2/7 symbols in this release. |
| CATT [6] | Yes | * it has been agreed that PUSCH repetition type B, i.e. cross slot boundary scheduling, is supported in RAN1. Hence, technically, there is no obstacle to support CG periodicities of multiple of 2/7 symbols. * Furthermore, this feature allows configuring CG periods of e.g. 1.5 slots (N=3 with 7-symb granularity) which provides more flexibility in aligning CG and the traffic pattern, i.e. the CG occasion can be tailored to traffic. * It also solves the mismatch issue between CG and traffic pattern issue when time elapses. * Support CG periodicities of multiple of 2/7 symbols in IIoT. |
| Nokia, Ericsson, NTT Docomo [8] | Yes | * RAN1 specifications allow a UE to transmit a PUSCH that overlaps with the slot boundary if it supports and it is configured with “PUSCH repetition Type B” as part of the CG configuration. Otherwise, it does not transmit those PUSCHs that overlap with the slot boundary. * Support CG periodicities of multiple of 2/7 symbols as a separate UE capability.   • PUSCHs that overlap with the slot boundary are handled according to RAN1 specifications (i.e. no RAN1 impact) |
| Intel [12] | No | Support of CG periodicities of multiple of 2/7 symbols is not defined in Rel-16. |
| CMCC[10] | Yes | It is proposed to support CG periodicities of multiple of 2/7 symbols as a separate capability with a cross-slot boundary capability. |

7 companies expressed opinions on this issue.

* 5 companies (CATT, Nokia, Ericsson, NTT Docomo and CMCC) prefer to support CG periodicities of multiple of 2/7 symbols as a separate UE capability.
* 2 companies (Huawei, Intel) prefer not to support of CG periodicities of multiple of 2/7 symbols as a separate UE capability.

Proposal 4: Support CG periodicities of multiple of 2/7 symbols in IIoT.

### ***5.1.5 Issue #5: 38.321 Editor’s Note: The step of determining the closest N needs to be added.***

|  |  |  |
| --- | --- | --- |
| ***Company/Tdoc*** | ***Yes/No*** | ***Related proposal*** |
| Huawei [5] | No | Add a note to clarify that the UE can determine the value of N for the first available CG occasion, the step of determination is up to UE implementation. |
| CATT [6] | Yes | The step of determining the closest N for CG type 1 is captured in MAC running CR. |
| Samsung [7] | Yes | The intention of the “lowest N” is that some CG occasions before the reception of the RRC reconfiguration may not be actually used. So, only CG occasions after the reception of the RRC reconfiguration can be used. |
| Nokia [9] | Yes | Description of how the UE determines the closest CG occasion when CG Type 1 is initialized needs to be added into TS38.321. |
| ZTE [11] | No | It is up to UE implementation to determine the closest value of N from the first N which is calculated based on the received referenceSFNnumber, timeDomainOffset and S. |

5 companies expressed an opinion on this issue.

* 3 companies (CATT, Nokia, and Samsung) prefer to descript the step of determining the closest N for CG type 1 is captured in MAC running CR.
* 2 companies (Huawei, ZTE) prefer that the step of determination is up to UE implementation.

The number of Companies from two camps are too close, hence it is proposed.

Proposal 5: Progress further the issue of the step of determining the closest N needs to be added.by email discussion or on line discussion.

### ***5.1.6 Issue #6 regarding the configuration design of SPS/CG***

R2-2002946 [7] raised the issue about the configuration design of SPS. The issue it that if a single SPS per BWP is configured, both SPS-Config and SPS-ConfigList in BWP-DownlinkDedicated are possible for multiple SPS configurations per UE. Similarly, if a single CG per BWP is configured, both ConfiguredGrantConfig and ConfiguredGrantConfigList in BWP-UplinkDedicated are possible for multiple CG configurations per UE. Hence, the determination of whether to allow the both ways of configuration and leave up to NW implementation is needed. And it proposed that both configurations are possible, but only one configuration should be used at a given time. And it proposed that

**Proposal 6. SPS-Config and SPS-ConfigList in BWP-DownlinkDedicated cannot be configured simultaneously at a given time.**

**Proposal 7. ConfiguredGrantConfig and ConfiguredGrantConfigList in BWP-UplinkDedicated cannot be configured simultaneously at a given time.**

## 5.2 Other open issues with little/no discussion before

### ***5.2.1 Issue #7 Configure grant type 1 resources calculation during BWP switch***

R2-2003586 [11] raised an issue that in rel-16, not similar with R-15, the occasion of configured grant type 1 is no longer solid in one SFN cycle due to the enhanced periodic can have a non-integer multiple time relationship with 10240ms. Thus UE need to deduct the occasion sequentially from the first occasion. Thus the understanding of ‘suspend’ and ‘initialize/reinitialize’ shall be clarified in Rel-16. Thus it proposed that RAN 2 is kindly asked to clarify the ‘suspending’ and ‘(re)-initializing’ configured gran type 1 resources for the case of BWP switch:

The understanding of suspending:

* Option 1: UE still keep calculating the occasion of the suspended configured grant type 1 even when the related UL BWP is deactivated
* Option 2: UE stop calculating the occasion of the suspended configured grant type 1 when the related UL BWP is deactivated.

Correspondingly, the understanding of ‘initialize/reinitialize’

* Option 1: UE continue to use the occasion of the suspended configured grant type 1 when the related UL BWP is activated
* Option 2: UE recalculate the occasion of the configured grant type 1 based on the r*eferenceSFNnumber , timeDomainOffset, and S* and the SFN number when the switch on is occurred.

If the above proposal is taken into account, it proposed that When an UL BWP is deactivated, UE still need to calculate the resources sequentially for each configured grant type 1. When an UL BWP is activated, UE continue to use the occasion of the suspended configured grant type 1 resources when the related UL BWP is activated.

It could be treated if the issues in the section 2.1 can be addressed in the meeting.

### ***5.2.2 Issue #7 Measurement gaps***

R2-2002657[1] proposes UE to transmit during the measurement gaps, since UE cannot transmit/receive during the measurement gap and it impacts the latency performance. However, there were other proposals before this meeting that even if allowing UE to send during measurement gap, it does not solve the issue for DL traffic and one simpler solution is to allow UE to be equipped with two radios. Therefore, we expect this topic to be contentious and unlikely to converge at e-Meeting.

It could be treated if the issues in the section 2.1 can be addressed in the meeting.

### ***5.2.3 Issue #8 Burst arrival time***

R2-2002708 [3] proposes a clarification of the burst arrival time defined in SA2 TS 23.501. It raised an issue that the aggregation process results in the 5G network identifying TSCAI information (e.g. Burst Arrival time) and QoS flow characteristics that are representative of the aggregated set of TSN flows. The gNB uses this information to allocate periodic resource in support of the corresponding TSN streams. Currently, the burst arrival time is defined as the beginning of the burst. Since it is more beneficial for RAN to get the knowledge of a burst arrival time that refers to the end of the burst, it is proposed that RAN2 send SA2 an LS stating “It is beneficial for RAN to obtain from TSCAI a burst arrival time that refers to the end of the burst rather than the beginning of the burst” [4].

It could be treated if the issues in the section 2.1 can be addressed in the meeting.

# **6 Proposals in summary contribution**

This contribution summarized the contributions posted in the Agenda Item 6.7.2.2 related to scheduling enhancement and the proposals in these contributions related to UE capabilities moved into the Summary of 6.7.6 UE capabilities in the Agenda Item 6.7.6. Handling of scheduling enhancement, at this e-meeting, and suggested some possible agreements / way forward as follows:

Proposal 1: Not to introduce restrictions of how many SPS configurations are supported, e.g. per cell/ per UE (SPS/CG).

Proposal 2: No need to capture limitation of maximum CG/SPS configurations per MAC entity in TS 38.300.

Proposal 3: Support up to 32 SPS configurations per MAC entity.

**Proposal 4: Support CG periodicities of multiple of 2/7 symbols in IIoT.**

**Proposal 5: Progress further the issue of the step of determining the closest N needs to be added.by email discussion or on line discussion.**

**Proposal 6. SPS-Config and SPS-ConfigList in BWP-DownlinkDedicated cannot be configured simultaneously at a given time.**

**Proposal 7. ConfiguredGrantConfig and ConfiguredGrantConfigList in BWP-UplinkDedicated cannot be configured simultaneously at a given time.**

And for other open issues with little/no discussion listed in section 2.2 in the previous meetings, we propose that these issues could be treated if the above issues in the section 2.1 can be addressed in the meeting.