

[98e-15-R18-Multicarrier] - Version 0.0.5

RAN

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3GPP TSG-RAN Meeting #98-e RP-223455

Electronic Meeting, December 12 - 16, 2022

Agenda item: 9.3.1.2

Source: Moderator (NTT DOCOMO, INC.)

Title: Moderator's summary for discussion [98e-15-R18-Multicarrier]

Document for: report

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## 1 Introduction

This contribution summarizes the following email discussion in AI 9.3.1.2 regarding Multi-carrier enhancements for NR.

Table 1:

[98e-15-R18-MultiCarrier]	RP-222921, 3037, 3083, 3148, 3164, 3165, 3192, 3201, 3259	Hiroki Harada, DoCoMO	9.3.1.2	Yes	RP-223455
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## 2 References

- [1] RP-222921 Clarifying Multi-Carrier Enhancements objectives Qualcomm Incorporated
- [2] RP-223037 Discussion on Rel-18 Multi-carrier enhancements Spreadtrum Communications
- [3] RP-223083 On extension of Rel-18 WI on multi-carrier enhancements Samsung
- [4] RP-223148 Remaining open issues of Rel-18 multi-carrier enhancements for NR CATT
- [5] RP-223164 Status report for WI: Multi-carrier enhancements for NR NTT DOCOMO, INC.
- [6] RP-223165 Discussion on remaining RAN1 work for Multi-carrier enhancements WI NTT DOCOMO,

INC.

[7] RP-223192 Discussion on remaining issues for Rel-18 multi-carrier enhancement xiaomi

[8] RP-223201 On remaining aspects for multi-carrier enhancements in NR Rel-18 Apple

[9] RP-223259 Views on progress of Rel-18 multi-carrier enhancements WI ZTE, Sanechips

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### 3 Discussion on RAN1 work extension for Q1 2023

In [5], the rapporteur proposed to request 1 additional RAN1 TU for Q1 2023, i.e., RAN1#112 meeting. The reason for requesting additional RAN1 TU is described as below.

**Table 2: [5]**

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

The total amount of RAN1 TU was 3 TU in the agreed TU excel sheet, and RAN1 plan is to complete their work for this WI at RAN#98-e. However, although many agreements and progress were made at RAN1#110bis-e and RAN1#111 meetings, there are number of remaining RAN1 discussion points to complete this WI in RAN1. Therefore, it is requested in this status report to have an additional RAN1 TU for RAN1#112 meeting (1 TU).

In [6], the rapporteur clarified remaining RAN1 works on each of two objectives (Multi-cell PUSCH/PDSCH scheduling with a single DCI and Multi-carrier UL Tx switching scheme).

**Table 3: [6]**

**Proposal 1:**

**RAN1 should discuss and decide following remaining points for multi-cell PUSCH/PDSCH scheduling with a single DCI in Q1 2023.**

**Details on DCI fields in DCI format 0\_X/1\_X, including TDRA, ChannelAccess-CPext, FDRA, indicator of co-scheduled cells, UL/SUL indicator, Priority indicator, beta-offset indicator and CSI request fields**

**Whether/how to support multiple sets of cells for multi-cell scheduling**

**Details on HARQ, such as reference PDSCH for HARQ-ACK feedback timing determination, last DCI format for PUCCH resource determination, reference PDSCH to determine DAI counting and support of Type-1 HARQ-ACK codebook**

**Proposal 2:**

**RAN1 can discuss following remaining points for multi-carrier UL Tx switching scheme.**

**Details on solution for potential ambiguity issue on switching period location**

**Details on potential issues related to timeline for UL Tx switching**

In [1], it is proposed that additional RAN1 work is necessary while no further scope reduction is necessary.

**Table 4: [1]**

**Observation 1:**

**For multi-cell PUSCH/PDSCH scheduling with a single DCI, additional RAN1 discussion is necessary to make it complete.**

**RAN plenary discussion on scope reduction is not necessary. RAN1 can focus on essential remaining aspects with a minimum workload.**

**Observation 2:**

**For UL Tx switching of inter-band CA without SUL, and Inter-band CA Option1 with SUL, RAN1 discussed and specified the technical solution. There are only minor leftover issues summarized in rapporteur's status report.**

In [2], several potential approaches to complete the remaining RAN1 works are provided.

**Table 5: [2]**

***Proposal: One or more of the following potential methods can be adopted to handle the open issues of Rel-18 multi-carrier enhancements:***

***Assign 1/0.5 TU at RAN1#112 for Rel-18 MC***

***Trigger 1-2 weeks email discussion before RAN1#112***

***Set up additional 1/2 days e-meeting for Rel-18 MC at Jan. or Feb. 2023***

***Others***

In [3], same as the status report, additional 1 TU allocation for Q1-2023 (RAN1#112) is proposed.

**Table 6: [3]**

**Proposal 1: Extend the Rel-18 WI on multi-carrier enhancement to Q1-2023 with 1 TU allocation for RAN1#112.**

**Proposal 2: RAN to provide guideline of high priority issues to complete the RAN1 work in RAN1#112 which include:**

- Multi-cell DCI design**
- DCI size alignment to accommodate multi-cell DCI**
- Type 1 and 2 HARQ-ACK codebooks for multi-cell scheduling**
- Configuration of switching period location**

In [4], it is proposed to address remaining RAN1 issues if additional TU request is agreed.

**Table 7: [4]**

**Proposal 1: RAN1 is tasked to address the following remaining open issues on Rel-18 multi-carrier enhancement for NR if additional TU is agreed:**

**On HARQ enhancements issues**

**Reference PDSCH for HARQ-ACK feedback timing determination**

**Last DCI for PUCCH resource determination**

**DAI counting for DCI format 1\_X**

**Type-1 HARQ-ACK codebook generation for DCI format 1\_X**

**On DCI format 0\_X/1\_X field design**

**Details on indicator of co-scheduled cells**

**Details on FDRA field**

**UL/SUL indicator**

**Details on Type-1B types fields**

**BWP indicator**

**Rate matching indicator**

**ZP CSI-RS trigger**

**TCI**

**SRS request**

**SRS offset indicator**

**On Multi-carrier UL TX switching scheme**

**Switching period location determination**

**Minimum separation time between two UL Tx switching**

In [7], same as the status report, additional 1 TU allocation for Q1-2023 (RAN1#112) is proposed.

**Table 8: [7]**

**Proposal: For Rel-18 Multi-carrier enhancement, one additional TU is requested for RAN1#112 meeting.**

In [8], the remaining essential issues for completion of this WI are shown.

**Table 9: [8]**

**Proposal 1: For completion of the NR Rel-18 WI on multi-carrier enhancements, following open issues can be considered for multi-cell scheduling:**

**DCI fields in DCI format 0\_X/1\_X:**

**FDRA compression design**

**TDRA table design**

**UL/SUL indicator (if agreed to be included)**

**Antenna port indication (for type 1A field type configuration)**

**HARQ Aspects**

**Timing for PUCCH with HARQ-ACK**

**Scheduling Aspects**

**Number of sets of cells and corresponding scheduling cell(s)**

**Signaling for indication of co-scheduled cells from a set of cells**

In [9], additional 0.5 or 1 TU allocation for Q1-2023 (RAN1#112) is proposed.

**Table 10: [9]**

**Proposal 1:** *The target completion date of RAN1 for Rel-18 MC WI is extended to March of 2023 with additional 0.5~1 RAN1 TU for multi-cell scheduling only.*

In summary, all companies submitting contributions seem to be fine/requesting the additional RAN1 TU for Q1 2023 i.e., RAN1#112 meeting. Although several alternatives (e.g., email discussion before RAN1#112, additional 1 or 2 days e-meeting) are provided in [2], it seems adding 1 TU for RAN1#112 meeting is acceptable for many companies and it should be applied if it is accepted by RAN1 chair.

### 3.1 Initial round discussion

The moderator would like to ask companies to provide feedback if any on the above summary and following question.

**Question 3-1: Are you fine with requesting additional 1 RAN1 TU for RAN1#112 meeting? If it is not fine, what is your proposed way to complete RAN1 work for Rel-18 MC enh.?**

**Feedback Form 1: 1st round Feedback form for Question 3-1**

<b>1 – Nokia Corporation</b> We are fine with requesting additional 1 RAN1 TU for RAN1#112 meeting.
<b>2 – Samsung Electronics Co.</b> We are fine.
<b>3 – Fujitsu Limited</b> We are fine with the moderator’s proposal
<b>4 – Spreadtrum Communications</b> We support addition one RAN1 TU.
<b>5 – VODAFONE Group Plc</b> Support
<b>6 – OPPO</b> We are fine with allocating one TU in RAN1 #112 for Multi-carrier enhancement.

BTW, the Question from moderator seems to ask to increase the overall TU budget (the budget for all RAN1 discussion topics) by one for RAN1 #112, which may not be the intention here. We suppose some other RAN1 discussion area may see the decrease of 1 TU if MC-Enh consumes 1 TU, unless there is spare TU already. Clarification is desirable.

**7 – Apple France**

We are fine

**8 – ZTE Corporation.**

We are fine to request additional RAN1 TU for RAN1#112 meeting. Regarding how many TUs should be allocated, it may depend on the discussion in Section 5 and also the overall available TU budget in RAN1#112 as commented by OPPO.

When discussing the SR submitted in this RAN plenary, it was clarified by rapporteur that the requested additional RAN1 TU is not due to the minor issues left for UL Tx switching. In other words, the additional TU if allocated is for multi-cell scheduling. So, we suggest making it clear regarding how to use the additional TU, and our preference is to focus on multi-cell scheduling only in RAN1#112 and leave the minor issues of UL Tx switching to be addressed in maintenance phase.

**9 – Qualcomm Incorporated**

We are fine to request additional RAN1 TU for RAN1#112 meeting with the understanding that most of that time will be spent on multi-CC scheduling, and not on UL Tx switching since the latter has very little left for discussion.

**10 – NTT DOCOMO INC.**

Let me try to clarify the intension as reply to some comments.

Based on the initial round feedback, if majority is ok to request additional RAN1 TU for RAN1#112 meeting, the rapporteur will ask RAN1 chair whether/how many TUs can/should be allocated. Based on RP-213469 where RAN1 TUs during Rel-18 timeframe are summarized, there are some reserved TU for RAN1#112 meeting (2 TUs). On the other hand, in our experiences in previous meetings, almost all available TUs in RAN1 were fully utilized. So, we should ask RAN1 chair guidance.

Regarding the topics to be discussed at RAN1#112 meeting, as also summarized in section 4, it seems common understanding among companies that main remaining issues are on multi-cell scheduling objective and hence most of the time would be used for the discussion on the multi-cell scheduling objective at RAN1#112 meeting. However, there is no need to have limitation on topics to be discussed at this plenary. As commented in section 4, it should be based on the contributions and FL summary at RAN1#112 meeting as usual.

**11 – CATT**

We are fine with additional 1 RAN1 TU for RAN1#112 meeting to complete R18 MC enh.

**12 – Beijing Xiaomi Electronics**

We are fine with requesting 1 TU for RAN1#112 meeting. We agree with moderator that a generic guidance on extended RAN1 TU is sufficient. The allocation of TU for MC scheduling and UL Tx switching can be handled in WG level based on the common understanding.

<p><b>13 – New H3C Technologies Co.</b></p> <p>we are fine with additional RAN1 TU for RAN1#112 meeting</p>
<p><b>14 – Intel Deutschland GmbH</b></p> <p>We are fine with the moderator’s proposal</p>
<p><b>15 – HUAWEI TECHNOLOGIES Co. Ltd.</b></p> <p>We are fine with additional 1 RAN1 TU to complete the WI.</p>
<p><b>16 – LG Electronics France</b></p> <p>We are ok with adding RAN1 TU as the proposal</p>
<p><b>17 – MediaTek Inc.</b></p> <p>Support 1 additional TU for RAN1#112.</p> <p>On the other hand, additional RAN1 discussion on UL TX switching is <b>not</b> necessary. Further handling in maintenance phase will be sufficient.</p>
<p><b>18 – vivo Communication Technology</b></p> <p>OK</p>
<p><b>19 – Esurfing IoT</b></p> <p>China Telecom</p> <p>We are fine to have additional TU in RAN1 and agree with moderator no need to have limitation on topics to be discussed at this plenary.</p>
<p><b>20 – Lenovo (Beijing) Ltd</b></p> <p>We are fine to have additional 1 TU in RAN1#112 and agree with moderator that no need to limit the discussed topics. It is up to RAN1 chair.</p>
<p><b>21 – Ericsson LM</b></p> <p>We are fine to have additional 1 TU in RAN1#112. Also, we agree with Moderator’s comment that all companies are aware of the remaining issues, specially on single DCI scheduling multiple cells. We can assess in the next plenary the status and see how to proceed. At this plenary, no need from RAN to guide RAN1 how to design DCI as RAN1 knows the best.</p>
<p><b>22 – China Mobile Com. Corporation</b></p> <p>We are fine to have additional 1 TU, and also agree that no RAN guidance is needed for further RAN1 discussion, especially the detailed design.</p>

## 3.2 Initial round summary

Based on the initial round discussion, there is no objection to request additional RAN1 TU for RAN1#112 meeting to complete RAN1 work on this WI. There are two companies commenting that only multi-cell scheduling should be discussed in RAN1#112 meeting and remaining issues on UL Tx switching should be discussed in maintenance phase, while there are six companies commenting that such limitation on topics to be discussed in RAN1#112 meeting is not necessary at this plenary. In addition, according to the discussion in section 4, almost all companies are fine to have no RAN guidance on RAN1 work scope for Q1 2023.

Therefore, the moderator will ask RAN1 chair's guidance/confirmation on additional RAN1 TU allocation for RAN1#112 meeting, and then the moderator would like to close this discussion.

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## 4 Discussion on possible RAN guidance on RAN1 work scope for Q1 2023 if additional TU request is agreed

As summarized in section 3, several contributions provided a list of remaining RAN1 works on each of two objectives (Multi-cell PUSCH/PDSCH scheduling with a single DCI and Multi-carrier UL Tx switching scheme) [1, 2, 3, 4, 6, 7, 8, 9]. Basically, companies' views on the remaining RAN1 works are aligned and following are the list of potential remaining RAN1 works based on contributions.

- For Multi-cell PUSCH/PDSCH scheduling with a single DCI
  - Details on DCI fields in DCI format 0\_X/1\_X
    - Details on TDRA, ChannelAccess-CPext, FDRA, indicator of co-scheduled cells, UL/SUL indicator, Priority indicator, beta-offset indicator, CSI request, antenna port indication fields and some other Type-1B fields
    - Whether/how to support additional fields e.g., Enhanced Type 3 codebook indicator, HARQ-ACK retransmission indicator, Minimum applicable scheduling offset indicator, SCell dormancy indication, PDCCH monitoring adaptation indication, PUCCH Cell indicator, DFI flag, HARQ-ACK bitmap, Invalid symbol pattern indicator, ChannelAccess-CPext-CAPC and so on
  - Whether/how to support multiple sets of cells for multi-cell scheduling
  - Whether MC-DCI and legacy SC-DCI can be from different scheduling cells for a scheduled cell
  - DCI size alignment
  - Details on HARQ, such as reference PDSCH for HARQ-ACK feedback timing determination, last DCI format for PUCCH resource determination, reference PDSCH to determine DAI counting and support of Type-1 HARQ-ACK codebook enhancements
- For Multi-carrier UL Tx switching scheme
  - Details on solution for potential ambiguity issue on switching period location
  - Details on potential issues related to timeline for UL Tx switching

- Working assumption on minimum separation time between two UL Tx switching

It is rapporteur's view that no RAN guidance on RAN1 work scope for Q1 2023 is necessary. Anyway, companies' understandings on remaining RAN1 works for RAN1 completion are basically aligned, and what to be discussed at RAN1#112 meeting should be based on RAN1 contributions and FL's summary at the meeting.

## 4.1 Initial round discussion

The moderator would like to ask companies to provide feedback if any on the above summary and following question.

**Question 4-1: Are you fine with above rapporteur's summary that no RAN guidance on RAN1 work scope for Q1 2023 is necessary?**

### **Feedback Form 2: 1st round Feedback form for Question 4-1**

#### **1 – Nokia Corporation**

We are fine with the WI rapporteur's proposal that no RAN guidance on the scope is necessary. RAN1 can continue working on the known open issues without attempting to detail them out in the RAN meeting.

If a RAN guidance is to be provided, it should be about what to NOT work on (a list of things to down-scope) rather than about what to work on. The motivation behind this view is that if we provide a list of things to work on, there is a significant risk of missing some fundamental aspect, leading to RAN1 debating on whether or not such an aspect can be worked on, when not on the RAN list of things.

#### **2 – Samsung Electronics Co.**

Fine.

#### **3 – OPPO**

We think that RANP guidance should be kept on high level instead of containing a long list of what RAN1 should do. From this point, we agree with moderator that RANP guidance like what is summarized from contributions is NOT necessary. On the other hand, if certain RANP guidance is indeed desirable by the companies, a simple version such as "RAN1 strives to complete basic functionalities for MC-Enh WI in 2023Q1" should be sufficient, which delivers a message that RAN1 may need to consider dropping some "enhancement rather than basic" aspects from WI in RAN1 discussion and do not rely on getting further TU in Q2 to complete the whole WI.

**4 – Apple France**

We are also fine with moderator’s proposal that RAN guidance maybe needed on specific topics. But, if majority desires, we’ll be okay also if high level guidance on essential topics necessary for completion of WI can be provided.

**5 – ZTE Corporation.**

One main reason of this WI not being able to be completed in time is because some controversial issues have consumed lots of RAN1 time, e.g., defining the field type for each of the DCI fields in DCI 0\_X/1\_X. Although we spent almost all RAN1 time on this issue in RAN1#111, the filed type for many of the fields are still not resolved. If no RAN guidance on this issue, it’s our view that RAN1 may still have a risk on completing the objective for multi-cell scheduling within one RAN1 meeting.

It would be good if RAN can make decisions on the filed type for the remaining fields. If not possible, at least some high-level RAN guidance is needed in case no RAN1 consensus can be made.

**6 – Qualcomm Incorporated**

We have made a proposal to make a Plenary agreement on the number of SUL indicator bits in the multi-CC DCI. The reason is that this seemed to be controversial at the last RAN1 meeting. But other than this, we don’t think Plenary guidance is needed.

In addition, we have a proposal on clarifying the supported SUL scenarios, but this would have no impact to the WG work in the next quarter.

**7 – CATT**

We are fine with moderator’s proposal that no RAN guidance on RAN1 work scope for Q1 2023 is necessary at this point.

**8 – Spreadtrum Communications**

We support that no RAN guidance on RAN1 scope is necessary.

**9 – NTT DOCOMO INC.**

The question 4-1 is about whether RAN guidance on RAN1 work scope for Q1 2023 (e.g., what can/should be discussed or what can/should not be discussed) is necessary or not. We think it is not necessary.

Regarding potential RAN guidance on specific issues, it can be discussed in question 5-1.

**10 – Beijing Xiaomi Electronics**

We support moderator’s proposal. RAN guidance on RAN1 work scope is not necessary. The leftovers actually has been extensively discussed and can be handled properly in WG.

**11 – New H3C Technologies Co.**

we are finew with FL ’s proposal

**12 – Intel Deutschland GmbH**

We are fine with moderator’s proposal. The list of open issues in rapporteur’s summary should be part of normative work in RAN1. RAN1 can continue to work on these issues as usual without RAN intervention if 1 additional TU is approved in Q1 2023.

**13 – HUAWEI TECHNOLOGIES Co. Ltd.**

We agree that no RAN guidance on RAN1 work scope for Q1 2023 is necessary.

**14 – LG Electronics France**

We are ok with the proposal and agree with Nokia/OPPO that RAN guidance (if necessary) should not be on detailed list of RAN1 works to avoid risk of missing essential issues

**15 – MediaTek Inc.**

We support rapporteur’s summary that **no** RAN guidance on RAN1 work scope for Q1 2023 is necessary. For ”Whether MC-DCI and legacy SC-DCI can be from different scheduling cells for a scheduled cell”, we think this is currently not allowed from RAN1 agreement.

**16 – vivo Communication Technology**

OK with rapporteur’s suggestion.

**17 – Esurfing IoT**

China Telecom

We are fine no RAN guidance on RAN1 work scope for Q1 2023 is necessary.

**18 – Lenovo (Beijing) Ltd**

We agree with moderator’ proposal that no RAN guidance is needed for the remaining issues of multi-cell scheduling in Q1 2023.

In addition, if RAN can reach consensus on field type of SUL indicator, it will be good to save the time of RAN1#112 as this issue is quite controversial and better to be discussed in RAN plenary.

**19 – Ericsson LM**

We agree with Moderator. Our reasons are similar to our input in section 3.1.

**20 – China Mobile Com. Corporation**

We agree with moderator proposal. No RAN guidance is needed.

## 4.2 Initial round summary

Based on the initial round discussion, almost all companies are fine to have no RAN guidance on RAN1 work scope for Q1 2023. Although some companies commented that RAN guidance on specific issue is necessary/helpful, it can be discussed in section 5.

Therefore, the moderator would like to close this discussion without any RAN guidance on RAN1 work scope for Q1 2023.

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# 5 Discussion on possible RAN guidance on specific discussion points

In [1], following proposals were made.

**Table 11: [1]**

<p><b>Proposal 1:</b> UL/SUL indicator in a DCI format 0_X for multi-cell PUSCH scheduling is 1 bit (when it is present), which is for one serving cell within the set of co-scheduled cells.</p> <p><b>Observation 2:</b> For UL Tx switching of inter-band CA without SUL, and Inter-band CA Option1 with SUL, RAN1 discussed and specified the technical solution. There are only minor leftover issues summarized in rapporteur's status report. For UL Tx switching of inter-band CA Option 2 with SUL, 2 SUL + 2 NUL cases, RAN1 didn't have any technical discussion yet.</p> <p><b>Proposal 2:</b> Take the above observation into account during the UE capability discussion in WGs.</p>
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In [9], following proposals were made.

**Table 12: [9]**

<p><i>Proposal 2: RAN plenary decision should be needed at least on DCI field for multi-cell scheduling to accelerate RAN1 progress, including at least classifying the field type for some remaining fields.</i></p>
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**Table 13: [9]**

<i>DCI</i>	<i>DCI fields</i>
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<p><i>DL DCI</i></p>	<p><i>Fields to be decided about whether omitted or not, and which field type if not omitted:</i>  <i>Enhanced Type 3 codebook indicator, HARQ-ACK retransmission indicator, Minimum applicable scheduling offset indicator, SCell dormancy indication, PDCCH monitoring adaptation indication, PUCCH Cell indicator.</i>  <i>Fields have been categorized as Type-1 filed, while need further determine whether it is Type-1A, Type-1B or Type-1C:</i>  <i>TDRA, ChannelAccess-Cpext, Priority indicator.</i></p>
<p><i>UL DCI</i></p>	<p><i>Fields to be decided about whether omitted or not, and which field type if not omitted:</i>  <i>DFI flag, HARQ-ACK bitmap, Invalid symbol pattern indicator, ChannelAccess-CPext-CAPC, Minimum applicable scheduling offset indicator, SCell dormancy, PDCCH monitoring adaptation indication, UL/SUL indicator.</i>  <i>Fields have been categorized as Type-1 filed, while need further determine whether it is Type-1A, Type-1B or Type-1C:</i>  <i>TDRA, ChannelAccess-Cpext, Priority indicator, Beta offset indicator, CSI request, UL-SCH indicator.</i></p>

Above contributions proposed to have some discussion at this RAN#98-e meeting to solve some part of remaining RAN1 issues as below.

- Whether/how to support UL/SUL indicator field in DCI format 0\_X
- Whether/how to support additional fields e.g., Enhanced Type 3 codebook indicator, HARQ-ACK retransmission indicator, Minimum applicable scheduling offset indicator, SCell dormancy indication, PDCCH monitoring adaptation indication, PUCCH Cell indicator, DFI flag, HARQ-ACK bitmap, Invalid symbol pattern indicator, ChannelAccess-CPext-CAPC and so on
- Further details on the field type of some fields, including TDRA, ChannelAccess-CPext, Priority indicator, Beta offset indicator, CSI request and UL-SCH indicator

## 5.1 Initial round discussion

The moderator would like to ask companies to provide feedback if any on the above summary and following question.

**Question 5-1: Do you agree to discuss above specific points proposed in [1] and/or [9] at RAN#98-e? If you agree, what is your views on the proposals?**

**Feedback Form 3: 1st round Feedback form for Question 5-1**

**1 – Nokia Corporation**

Wrt. the proposal 1 of [1]: We are supportive of proposal 1 of [1]. The UL Tx Switching should not lead to a redesign of SUL. Due to this, there should not be a need to debate on how multiple SUL carriers of a cell can be addressed. Thus, the RAN guidance on this matter might be helpful, although strictly speaking not necessary and should be understood already the RAN1 scope of work.

Wrt. the proposal 2 of [1]: We agree with the observation, but would have a general preference (not just related to this particular question) to address the issues within the WI TU allocations rather than push the issues to the UE capability discussions.

Wrt. the proposal 2 of [9], as indicated in our response to Question 4-1: no discussion in RAN is needed.

**2 – Samsung Electronics Co.**

Proposal 2 of [1]: We share the Nokia's view, i.e., to address the issues within the WI TU.

Proposal 2 of [9]: Discussion in RAN1 would be more appropriate.

**3 – OPPO**

Proposal 2 of [9]: This proposal is too RAN1-specific, and should be handled in RAN1.

**4 – Apple France**

Details under proposal 2 of [9] would be more appropriate for WG discussion.

**5 – ZTE Corporation.**

For the proposals/observations of [1], it seems RAN could have some discussion and clarify the understandings of these issues.

For our proposal 2 in [9], as we commented in Section 4, we think it's better to have some RAN guidance to avoid the risk of not completing the WI even with one additional RAN1 meeting.

**6 – Qualcomm Incorporated**

Obviously, we support the proposals in [1].

As to [9], we are open to discussing it, but if the majority view is that we should move the discussion to the WGs, we are ok with that as well.

**7 – Spreadtrum Communications**

Proposal 2 of [9] can be addressed in WGs.

**8 – CATT**

We are fine to discuss the issues/proposals in [1] in RAN while proposal in [9] can be discussed in WGs.

**9 – NTT DOCOMO INC.**

We think proposal 1 of [1], about UL/SUL indicator, was extensively discussed at RAN1 but no consensus could be achieved. Hence, RAN plenary guidance would be helpful to resolve such situation.

The proposals in [9] can be discussed and decided in WGs. Although it would be helpful if RAN can make some decision, at least field type discussion is too detail.

**10 – Beijing Xiaomi Electronics**

We agree with that RAN guidance on UL/SUL indicator is helpful for RAN1 discussion.

For the proposal in [9], it is too detail and should not be discussed in RAN plenary. The progress of MC scheduling in RAN1 is reasonable and the situation is also acceptable at this point.

**11 – New H3C Technologies Co.**

proposal 2 in [9] can be addressed under WGs

**12 – Intel Deutschland GmbH**

Regarding proposal 1 of [1], this was heavily discussed in the last RAN1 meeting. however, no conclusion was made. It would be helpful that RAN can provide guidance on this issue so as to save RAN1 discussion time.

Regarding proposal 2 of [9], we share similar view as other companies that this should be further discussed in RAN1.

**13 – HUAWEI TECHNOLOGIES Co. Ltd.**

No need to discuss any of the proposals listed in this RAN and they can be left to WGs. Our detailed comments for them can be found below:

Proposal 1 of [1]: We don't agree with this proposal. Firstly, it was specified in Rel-15 that each serving cell can be configured with SUL, there is no reason to support SUL configuration for only one cell within the set of co-scheduled cells. In addition, two SUL bands configured in two cells together with other TDD NR band(s) are emerging as a prospective solution for operators to enhance the wideband UL performance. Making restrictions on scenarios seems premature at the moment. Therefore, we think no RAN guidance for UL/SUL indicator in DCI format 0\_X is needed and it is more appropriate to leave to WG to decide which type the SUL field to go just as tens of other fields.

Proposal 2 of [1]: We don't agree with this proposal. We think the technical solutions for UL Tx switching of inter-band CA without SUL, and Inter-band CA Option1 with SUL can be also applicable to dual SUL scenario. The reasons are as follow,

- It was specified in Rel-15 that each serving cell can be configured with SUL, and current CA framework is specified on a basis of serving cell.
- The technical solutions specified in previous RAN1 meetings are band agnostic.
- In the whole Q4, no company points out any technical issues for UL Tx switching with dual SUL.

Proposal 2 of [9]: We think it is better to leave to WG discussions to decide whether fields can be omitted or not and which field type if not omitted, since the decision should be based on detailed discussion about these fields on whether scheduling flexibility or scheduling performance will be affected or not.

#### **14 – LG Electronics France**

Regarding proposal 1 of [1], we are supportive for the proposal.

Regarding proposal 2 of [9], we don't think RAN discussion is necessary.

#### **15 – MediaTek Inc.**

For Proposal 1 of [1], whether there can be more than one SUL configured in CA case, this has been discussed in RAN1 extensively while no consensus can be achieved. **It would be helpful if RAN plenary can discuss potential way forward for this point.**

For Proposal 2 of [9], it is not necessary to discuss RAN1 design details in RAN plenary.

#### **16 – vivo Communication Technology**

For the Proposal 1 of [1], it seems to be a controversial topic in RAN1, thus it would be helpful if RAN can make a decision or provide the guidance.

For the proposal 2 of [9], we don't think RAN discussion on such RAN1 details is needed - it should be left to RAN1.

#### **17 – Esurfing IoT**

China Telecom

The proposals can be left for WG discussion.

For proposal 1 of [1], there is no convinced reason to limit SUL configuration for only one cell. From our perspective, SUL configured for more than one bands has benefit on wideband UL. The type of UL/SUL can be discussed in WG level.

For observation 2 and proposal 2 of [1], we do not agree RAN1 didn't have any technical discussion on inter-band CA Option 2 with SUL, 2 SUL + 2 NUL cases. The Tx switching solutions specified in previous RAN1 meeting were discussed in band agnostic way. The remaining issue can be discussed in WG also in the same way.

For proposal 2 of [9], these are RAN1 design details to be solved by RAN1.

#### **18 – Lenovo (Beijing) Ltd**

For SUL indicator, we propose discussing it in RAN plenary as this is quite controversial. If we discuss it in RAN1#112, the whole progress on detailed DCI field design may be delayed.

For other fields, e.g., enhanced Type 3 codebook indicator, HARQ-ACK retransmission indicator, Minimum applicable scheduling offset indicator, SCell dormancy indication, PDCCH monitoring adaptation indication, PUCCH Cell indicator, DFI flag, HARQ-ACK bitmap, Invalid symbol pattern indicator, ChannelAccess-CPext-CAPC, and so on, we are OK to discuss them in RAN or leave it to RAN1#112.

### 19 – Ericsson LM

Proposal 1 of [1]: We think RAN plenary decision is needed. All companies involved in RAN1 discussions are aware that this topic takes a lot of meeting time . Considering the amount of remaining work, guidance from plenary would be very helpful. We are supportive of the proposal.

Proposal 2 of [1]: We agree with the observation, but have similar view as Nokia regarding the proposal. It seems to us push it into capability, would lead us to the same discussion, but in UE features. Maybe proponent can clarify more how that helps the progress. Regarding the comment disagreeing with the observation, true that the issue was brought up in RAN1, but the discussion was repetition of plenary guidance without any technical discussion. therefore the observation is factual in our view.

Proposal 1 of [9]: We think it can be left to RAN1.

### 20 – China Mobile Com. Corporation

The proposals are all related to detailed RAN1 design, we do not think RAN guidance is needed. We support to leave the WG level discussion to RAN1.

### 21 – China Unicom

Since that all the proposals in [1] and [9] include technique details, it seems hard to achieve agreements in RAN plenary. So we support all the proposals can be left to RAN1 WG to discuss and decide.

## 5.2 Initial round summary

Based on the initial round discussion, almost all companies prefer to discuss the proposal 2 in [1] and the proposal 2 in [9] in WG meeting. On the other hand, for the proposal 1 in [1], companies' feedbacks are as below.

- RAN guidance/discussion is necessary/helpful: Nokia, ZTE, Qualcomm, CATT, NTT DOCOMO, Xiaomi, Intel, LG, MediaTek, vivo, Lenovo, Ericsson (12)
- RAN guidance/discussion is not necessary: Huawei, China Telecom, CMCC, China Unicom (4)

Since the proposal 1 in [1], i.e., UL/SUL indicator field type for DCI format 0\_X, was extensively discussed at the last RAN1 meeting but no consensus could be achieved, there is a risk even in RAN1#112 meeting to remain in the same situation (i.e., could not complete this WI even after RAN1#112) as multiple companies commented. Actually, alternatives are already clear and we should just make a decision. Or, we should try to find some way forward to reduce the risk.

Therefore, the moderator would like to ask companies' feedback on following alternatives to make a decision on this issue, or any other possible way forward on this issue to reduce the above risk.

- **Alt.1: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is 1 bit (when it is present), which is for one serving cell within the set of co-scheduled cells (i.e., Type 1C).**

- **Alt.2: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is sum of {0, 1} bits for each cell in the set configured for the DCI format 0\_X (i.e., Type 2).**
- **Alt.3: UL/SUL indicator field is excluded from a DCI format 0\_X.**

### 5.3 Intermediate round discussion

The moderator would like to ask companies' feedback on following alternatives to make a decision on this issue, or any other possible way forward on this issue to reduce the risk to not conclude this issue at RAN1#112 meeting.

**Alt.1: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is 1 bit (when it is present), which is for one serving cell within the set of co-scheduled cells (i.e., Type 1C).**

**Alt.2: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is sum of {0, 1} bits for each cell in the set configured for the DCI format 0\_X (i.e., Type 2).**

**Alt.3: UL/SUL indicator field is excluded from a DCI format 0\_X.**

#### Feedback Form 4: Intermediate round Feedback form 5.3

##### 1 – Nokia Corporation

First, we agree that it would be good to find an outcome to this question in RAN to allow RAN1 to focus on technical work rather than debate on what combinations should or should not be possible.

There is no fundamental reason why multi-cell PUSCH scheduling must work with any cells with supplemental uplink. Hence the agreement on this issue is not the most critical one for the feature. It only matters in the context of whether/how scheduling of SUL is possible with multi-cell PUSCH DCI, or if a single-cell PUSCH scheduling DCI would need to be applied for SUL scheduling. That is, adopting Alt.3 would be just fine, not break the multi-cell PUSCH scheduling feature, and would still allow for any current and future SUL configurations to coexist with multi-cell PUSCH scheduling although SUL carrier(s) would be limited to single-cell PUSCH scheduling.

In our view, if RAN cannot agree to adopt either Alt.1 or Alt.2, then RAN should default to Alt.3 and task RAN1 to design multi-cell PUSCH scheduling DCI with no SUL bit. However, even if there has been no agreement in RAN1 to support PUSCH on a SUL carrier and another PUSCH on another uplink, we could consider Alt.1 a a middle-ground and move on with the design aspects that are critical to the feature.

##### 2 – Samsung Electronics Co.

Although we do not see a particular need to support SUL operation by MC-DCI, especially considering RAN4 restrictions, we can be OK to use the UL/SUL indicator as a "Type-1A" field with 1 bit (as for the BWP indicator) and the same value can apply to cells with both NUL and SUL carriers.

### 3 – Samsung Electronics Co.

To make it clear, we don't support Alt.1/Alt.2. If it is not possible to conclude on the exact signaling, RAN may just decide whether or not to support scheduling on SUL using MC-DCI.

### 4 – Qualcomm Incorporated

We think a decision at the Plenary would be useful.

The main design principle of SUL is supporting switched UL operation. From that perspective, configuring SUL doesn't seem to play a role in any multi-CC scheduling. Therefore Alt.3 seems the most appropriate.

In order to avoid controversial discussions, we can also accept Alt.1 as a compromise. But we would have an objection to Alt.2.

### 5 – New H3C Technologies Co.

We fail to see any motivation to draw specific technical conclusion on UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling in RAN level. We suggest leaving this issue to RAN1 for further discussion.

In addition, if we have to select one among above alternatives, we slightly prefer Alt.2 at this stage in order to support flexible scheduling UL/SUL for multi-cells.

We are also open to discuss about Alt.1

### 6 – HUAWEI TECHNOLOGIES Co. Ltd.

As we expressed in the initial round, we don't see the need to discuss this kind of detailed discussion in RAN plenary here, just same as tens of other fields in DCI format 0\_X, all details are up to WG discussions. Some companies argued that there is no consensus for this issue from RAN1 thus RAN guidance is needed here, but there are quite many other issues discussed several times in RAN1 with no consensus also, then how all others need no RAN guidance but this one.

Anyway, if people really want to discuss here, our views are as below:

To make Alt.2 clearer, the following update can be made to Alt.2 to clarify how to determine the number of bit for a cell in the set of co-scheduled cells.

**Alt.2: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is sum of {0, 1} bits for each cell in the set configured for the DCI format 0\_X (i.e., Type 2).**

**- The number of bit (i.e. 0 or 1) for a cell in the set is determined according to the existing mechanism defined in TS 38.212 for UL/SUL indicator field**

We support Alt.2, and Alt.2 is the only reasonable way to go. Firstly, it was specified in Rel-15 that more than one serving cell can be configured with SUL, which means that more than one cell in the set of co-scheduled cells can be configured with SUL, in which case separate UL/SUL indicator bits are needed to indicate the scheduling situation for different cells with SUL, which can be achieved by Alt. 2 here. Secondly, Alt.2 actually can meet the interests from different camps. For the camp that wants to support more than one serving cell configured with SUL, UL/SUL indicator field can be equal to the number of cells configured with SUL in order to do separate scheduling indication, while for the camp that only wants to support one cell with SUL, then this UL/SUL indicator field is only 1 bit just as defined by Alt.1 since there will be only one cell configured with SUL and thus according to Alt 2 overall there would be only 1 bit.

Alt. 1 doesn't make sense. It was specified in Rel-15 that more than one serving cell can be configured with SUL, thus there is no reason to restrict that only one cell within the set of co-scheduled cells can be configured with SUL. Note that some companies may argue that they don't agree that more than one serving cell configured with SUL is supported, however there is explicit agreement from RAN1#92b to show that more than one serving cell can be configured with SUL, we really don't know how companies can ignore the agreements.

Alt.3 should not be on the table to discuss, since it will revert the agreement from RAN1#111 meeting that UL/SUL indicator is supported for DCI format 0\_X.

### **7 – Spreadtrum Communications**

For UL/SUL indicator field, our first preference is Alt 2 with HW's update, for compromise Alt 1 is acceptable.

The bit length SUL/UL indicator for a cell is one when SUL is configured and PUSCH transmission on two carriers of one cell is enabled.

UL/SUL indicator field has been supported since Rel-15, it can also support it in one single DCI scheduling multiple cells without much additional effort. So at least it can be included in DCI 0\_X.

### **8 – vivo Communication Technology**

It is beneficial if RAN can make a decision, so that RAN1 can make use of the TU efficiently.

Among the alternatives, Alt 3 seems unfavorable as it reverses the RAN1 agreement. Alt 2 is preferable than Alt 1 as it is more future proof.

### **9 – CATT**

Among the three alternatives, we also think Alt 3 should not be considered as it is contradictory with previous RAN1 agreement. Between Alt 1 and Alt 2, our preference is Alt 2 considering that Alt 1 has restriction that only one serving cell within the set of co-scheduled cells can be configured with SUL.

### **10 – Esurfing IoT**

China Telecom

Although we think the decision of this issue is up to WG discussion together with other remaining issues, if companies think it would be helpful to conclude in this RAN plenary, Alt2 is our supported alternative, and we are also fine with HW's update. UL/SUL indicator was agreed to be supported for DCI format 0\_X. With Alt 2, more than one cells can be configured with SUL. For companies do not support more than one cells configured with SUL, they can also configure one cell with SUL based on Alt2.

### **11 – Beijing Xiaomi Electronics**

As mentioned by many companies, alt.3 should not be on the table. For the other two alternatives, our preference is alt.2.

SUL is supported since Rel-15 which is coupled with a NUL. There is no obstacles to configure and operate on more than one carrier which has SUL. With agreeing on UL/SUL indicator in DCI format 0\_x is type 2, everything related to UL/SUL is accomplished. From this perspective, alt.2 has no other specification impacts and the current specification on indicating SUL can be fully reused. On the other hand, alt.1 brings additional issue as it is not clear which carrier the 1 bit UL/SUL indicator is related to. We need to further discuss how to handle this issue.

From our reading on the comments so far, we see strong interests from operator, i.e. at least China Telecom, on alt 2. It should be fair to go with alt.2.

#### **12 – Intel Deutschland GmbH**

The main benefit of multi-carrier scheduling is for capacity improvement, which is typically targeting for UEs with good channel conditions. In this regard, the motivation to support SUL within the context of multi-carrier scheduling is not clear. Although in the last RAN1 meeting, it was agreed to support UL/SUL indicator in the DCI format 0\_X, it is reasonable to consider Alt. 1, i.e., only one SUL for one serving cell within the set of co-scheduled cells.

#### **13 – NTT DOCOMO INC.**

Although RAN1 agreed to support UL/SUL indicator in the DCI format 0\_X at the last RAN1 meeting, if RAN/RAN1 cannot reach consensus on the design of the field (i.e., Type), we think Alt.3 should be considered to complete the design of DCI format 0\_X. As some companies commented, supporting UL/SUL indicator in the DCI format 0\_X would not be essential as anyway legacy DCI formats can be used. So, if any particular design is not acceptable to at least some companies due to potential impact to any other discussion related to CA with SUL scenario, Alt.3 can avoid any impact to other discussions. We would not object to Alt.1/2 and Samsung's proposal (Type 1A).

#### **14 – China Unicom**

We support Alt2 with Huawei's update, and we support that no need to restrict on the numbers of configured cells with SUL.

#### **15 – China Mobile Com. Corporation**

First, Alt 3 should be excluded from the discussion, we don't see the motivation to exclude the SUL feature from multi-carrier scheduling and also against the RAN1 agreement. Second, if we need down-select between Alt 1 and Alt2, we prefer Alt.2. We think more than one serving cell can be configured with SUL depending on different operator's spectrum deployment and provides more scheduling flexibility. In addition, we don't see issue on supporting separate indication for different scheduled cells configured with SUL which will not introduce too many DCI bits.

#### **16 – Ericsson LM**

As we stated in previous round we are supportive of Alt-1. In fact, Alt-1 should be considered **as default** where Alt-2 is in fact additional enhancement. In that sense, there should be consensus to support Alt-2 to start with.

If companies can not agree with this, then we see that DCM description of the situation is very accurate and doesn't leave us with anything than Alt-3, as it would be the natural consequence since the essential design for the default case (as in legacy) would be incomplete and hence out.

Therefore, we think RAN1 can go ahead to complete the design based on Alt-1, similarly to other remaining issues. That would be manageable. If that is not the case, then Alt-3 would be consequence.

#### **17 – VODAFONE Group Plc**

We agree that Alt.3 should be excluded from the proposal. Apart from that, we share similar views as Intel.

## 5.4 Intermediate round summary

Based on the intermediate round discussion, companies' views on the UL/SUL indicator field in a DCI format 0\_X can be summarized as below.

- Alt. 1 (0~1 bit, type 1C)
  - Support: Nokia, Qualcomm, Spreadtrum, Intel, Ericsson, Vodafone (6)
  - Objection: Samsung, Huawei (2)
- Alt. 1' (0~1 bit, type 1A)
  - Support: Samsung (1)
  - Objection:
- Alt. 2 (0~4 bits, Type 2)
  - Support: New H3C, Huawei, Spreadtrum, vivo, CATT, China Telecom, Xiaomi, China Unicom, CMCC (9)
  - Objection: Samsung, Qualcomm (2)
- Alt.3 (omit)
  - Support: Nokia, Samsung, Qualcomm, NTT DOCOMO, Ericsson (5)
  - Objection: Huawei, vivo, CATT, Xiaomi, CMCC, Vodafone (6)

As in the last RAN1 meeting, it is difficult to reach consensus on this issue. Between Alt.1 and Alt.2, slightly larger number of companies including operators support Alt.2, but there are objecting companies for Alt. 2 as well as for Alt.1. There are multiple companies considering Alt.3 if down-selection between Alt.1 and Alt.2 could not be achieved, while there are other companies objecting to Alt.3 as it was agreed to support UL/SUL indicator in DCI format 0\_X at the last RAN1 meeting.

Based on above situation, the moderator would like to check if companies can accept Alt.2 to conclude this issue at this plenary in Final round, instead of continuing the discussion on this issue in next RAN1 meeting.

**Alt.2: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is sum of {0, 1} bits for each cell in the set configured for the DCI format 0\_X (i.e., Type 2).**

**- The number of bit (i.e., 0 or 1) for a cell in the set is determined according to the existing mechanism defined in TS 38.212 for UL/SUL indicator field.**

## 5.5 Final round discussion

The moderator would like to check if companies can accept Alt.2 based on intermediate round discussion.

**Alt.2: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is sum of {0, 1} bits for each cell in the set configured for the DCI format 0\_X (i.e., Type 2).**

**- The number of bit (i.e., 0 or 1) for a cell in the set is determined according to the existing mechanism defined in TS 38.212 for UL/SUL indicator field.**

### Feedback Form 5: Final round discussion

#### 1 – Qualcomm Incorporated

We object to this proposal. Adding more than one (or adding any) UL/SUL indicator bits would be for forward compatibility with features that may or may not get introduced in the future, which is not what 3GPP should be normally doing.

#### 2 – Samsung Electronics Co.

(as RAN1 chair)

It's clear that RAN1 will repeat the same discussion in February if there is no guidance from RAN. If RAN cannot converge on this, my suggestion as RAN1 chair will be to drop this field in Rel-18. At least with this, RAN1 should be able to focus on the other open aspects and complete the Rel-18 MC-Enh in 2023.Q1.

#### 3 – China Mobile Com. Corporation

We support the proposal from the moderator.

In addition, we don't agree to just simply drop this UL/SUL indicator field if RAN cannot converge this time, instead we should encourage people to go to the most reasonable direction. It is so easy for companies to say No for a certain solution, but 3GPP is a technical group and thus conclusions should be made based on technique comments. We cannot accept the intention to preclude certain scenario requested by operators, especially that Alt.2 can meet the interest from all sides and it obviously doesn't hurt anything for the proponents of Alt.1, we don't see any reason to object Alt.2.

We want to clarify that forward compatibility is always considered in RAN1 design. A very simple example, since Rel-15 RAN1 design can enable carrier aggregation of 16 CC, however till today RAN4 can only support CA of a few carriers.

#### 4 – China Telecommunications

Support the latest proposal from the moderator, which is the right way to go.

Again, we do not understand why only UL/SUL indicator needs RAN guidance. There are many other fields to be handled. If companies think there are no remaining issues for other fields, then why do we need to extend this WI? As pointed out by many companies in second round discussion, Alt.3 reverts RAN1

agreement, we cannot drop UL/SUL indicator unless we have additional agreement. Alt.2 is more flexible than Alt.1 and more than one operator support this. If RAN guidance is really needed, from our perspective, Alt.2 is the only choice.

**5 – New H3C Technologies Co.**

Support this proposal. If we have no any consensus, leave it to WG for further discussion

**6 – Nokia Corporation**

We do not support the proposal and agree with the RAN1 chair's assessment of the situation.

**7 – Ericsson LM**

We don't support the proposal (Alt-2).

As we explained, in previous round, we were supposed to enable single DCI scheduling multi-cell without enhancing any underlying features (for example without enhancing any HARQ-ACK codebook, etc.), but just enabling them.

Therefore, it is strange for us that Alt-1 can not be considered as the default to enable the legacy features, similarly to other cases.

With Alt-2, comes discussions on related controversial issues, that we all are aware of that, e.g. if two of the scheduled cells are SUL, etc. and we end up repeating the same discussions.

With all the remaining issues to on the essential design aspects, we should be mindful on how the time is spent in the upcoming RAN1 meeting to complete the task at hand. Hence, we totally understand the concerns raised by RAN1 Chair, as well as Rapporteur in the previous round.

We suggest to endorse Alt-1. If no consensus, the plenary should announce Alt-3 (as the clear outcome) for proper time management in WG in our view.

**8 – vivo Communication Technology**

It is essentially helpful if RAN can provide the guidance. We are fine with the moderator's proposal. Maybe a possible compromise is to limit the maximum bit number of the UL/SUL indicator (e.g., 0~2 bits instead of 0~4 bits).

**9 – LG Electronics Inc.**

We object to this proposal and share the same view with QC that the forward compatibility on uncertain feature cannot be the reason to adopt Type 2 for this field in DCI 0\_X/1\_X which is UE-specifically configured based on UE optional capability.

In addition, we agree with Chair that omitting this field in DCI 0\_X can be considered as a middle-ground by adopting neither Type 1C nor Type 2, and then legacy DCI formats which remain unchanged can be used for UL carrier indication as usual.

**10 – Samsung Electronics Co.**

We don't support the proposal (Alt-2).

We do not think MC scheduling needs to be optimized for SUL – there are no use cases and, even if there were, it is unclear what a benefit would be to support scheduling on a mixture of NUL and SUL instead of only NUL or only SUL.

RAN1 concluded on Type 1A signaling for several other fields of MC-DCI that could be argued to be more important.

The proposal would essentially introduce a bitmap for MC scheduling on NUL vs. SUL when such granularity is not supported even for indicating ‘normal’ cells. Although the necessity to support SUL by MC-DCI is questionable, we can be OK to enable it in RAN1 but to additionally optimize it more than for “usual” scheduling, as Alt. 2 suggests, cannot be justified.

#### **11 – China Unicom**

During the online and offline discussion, many companies clearly indicated that Alt.3 with dropping UL/SUL indicator is not align with the existed RAN1 agreement, thus we cannot agree to just drop the indicator unless we have additional agreement.. As for Alt.1 and Alt.2, Alt.2 can meet the technical needs of the proponents of Alt.1, and it has more flexibility for the future’s network deployment. So it’s more reasonable to choose A12.t.indicator from Rel-18. As for Alt.1 and Alt.2, Alt.2 can meet the technical needs of the proponents of Alt.1, and it has more flexibility for the future’s network deployment. So it’s more reasonable to choose A12.t.

#### **12 – HUAWEI TECHNOLOGIES Co. Ltd.**

We support the proposal from the moderator.

Even we don’t agree that adding more than 1 UL/SUL indicator bit is forward compatibility, since from Rel-15 RAN1 already support more than one cell configured with SUL. But since some company used it as the reason to object alt.2, we want to say that forward compatibility is often used in RAN1 design. In addition to the example given by CMCC, since Rel-15 many design took forward compatibility as one of the key design principle, e.g. numerology design.

As we expressed in the intermediate round, alt.2 can meet the interests from different camps and the number of bits actually can adjust based on the practical deployment scenarios, meanwhile it won’t hurt anything for the proponents of Alt.1. Therefore, we really don’t see any technical reason not to go with it. It is not acceptable to drop UL/SUL indicator field just because of some companies don’t want to accept the reasonable way.

#### **13 – CATT**

We support the moderator’s proposal. We agree with the comments from CMCC and Huawei that Alt. 2 can also meet the requirement of scenario of Alt. 1 so that it is the reasonable way to go.

#### **14 – Beijing Xiaomi Electronics**

We support the proposal from the moderator.

We respect the guidance and understand the concerns about divergent views on alt.1 and alt.2 from RAN1 chair. However, as alt.3 is basically against the previous RAN1 agreement while the previous RAN1 agreement is not technically wrong, we don’t think it is a reasonable direction to revise something we agreed in RAN1 on plenary level.

Regarding proposal 2 itself, we still fail to see there is any obstacles to support it. The procedure of SUL operation is exactly same as what we do for single cell scheduling. It is just a simple extension to an important feature we need to support in Rel-18.

We do see the motivation of supporting alt.2 from several aspects: 1) there is strong interests from several operators, 2) there is no technical issue to support type-2 UL/SUL indicator in DCI format 0\_x which fully depends on the SUL configuration, 3) there is flexibility to configure the 0-4 bits UL/SUL indicator hence it covers alt.1, 4) there is no leftovers on UL/SUL stuff once alt.2 is adopted.

#### **15 – Spreadtrum Communications**

We support Moderator’s proposal (Alt 2).

#### **16 – Ericsson LM**

We appreciate clarification to understand better HW comments.

In our understanding, as the MCE WID states, the design of single DCI scheduling multiple cells is for CA (both intra-band and inter-band).

For the configured cells for CA, so far the spec supports one SUL , even though there can be two cells configured with SUL.

At least, that’s why we understood companies comment that Alt-2 would be future proof (when CA includes two SUL).

#### **17 – NTT DOCOMO INC.**

As RAN1 chair commented, we also think RAN1 will repeat same discussion if we cannot conclude this issue in this plenary, and such situation should be avoided considering additional 1 TU is quite precious.

Even though we can accept any alternative on the table to conclude this issue, there are already objections on any of alternatives. So, we are fine to follow RAN1 chair suggestion.

#### **18 – NTT DOCOMO INC.**

As RAN1 chair commented, we also think RAN1 will repeat same discussion if we cannot conclude this issue in this plenary, and such situation should be avoided considering additional 1 TU is quite precious.

Even though we can accept any alternative on the table to conclude this issue, there are already objections on any of alternatives. So, we are fine to follow RAN1 chair suggestion.

## 5.6 Final round summary

Based on the final round discussion, companies’ views on the Alt.2 of the UL/SUL indicator field in a DCI format 0\_X can be summarized as below.

**Alt.2: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is sum of {0, 1} bits for each cell in the set configured for the DCI format 0\_X (i.e., Type 2)**

**- The number of bit (i.e., 0 or 1) for a cell in the set is determined according to the existing mechanism defined in TS 38.212 for UL/SUL indicator field.**

- Support Alt.2: CMCC, China Telecom, New H3C, vivo, China Unicom, Huawei, CATT, Xiaomi, Spreadtrum (9)
  - Alt.2 can meet the interests from different camps and the number of bits actually can adjust based on the practical deployment scenarios

- Even if Alt.2 is for forward compatibility, there are other such cases e.g., CA up to 16 CCs, numerology design
- Possible compromise is to limit maximum number of bits e.g., 2 (vivo)
- If consensus cannot be reached, leave further discussion to WG (New H3C)
- Objection to Alt.2: Qualcomm, Nokia, Ericsson, LG, Samsung (5)
  - Alt.2 is for forward compatibility with features (CA with more than one SULs) that may or may not get introduced in the future, which is not what 3GPP should be normally doing
  - The field is not essential for MC-DCI, and MC scheduling does not need to be optimized for SUL since it is for CA as described in WID
- Suggest to exclude this field from DCI format 0\_X if consensus cannot be reached: RAN1 chair, Nokia, Ericsson, LG, NTT DOCOMO
  - It is repeating same controversial discussion, and RAN1 should focus on other remaining aspects to complete MC scheduling in Q1 2023.

The situation is not changed from that in the intermediate round, and potential extended round discussion would not help so much to resolve this situation.

Therefore, the moderator would like to ask RAN chair to treat this topic with original three alternatives on Friday GTW.

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## 6 Proposal for GTW

**Alt.1: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is 1 bit (when it is present), which is for one serving cell within the set of co-scheduled cells (i.e., Type 1C).**

**Alt.2: UL/SUL indicator in a DCI format 0\_X for multi-cell PUSCH scheduling is sum of {0, 1} bits for each cell in the set configured for the DCI format 0\_X (i.e., Type 2)**

**- The number of bit (i.e., 0 or 1) for a cell in the set is determined according to the existing mechanism defined in TS 38.212 for UL/SUL indicator field.**

**[Alt.3: UL/SUL indicator field is excluded from a DCI format 0\_X.]**

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## 7 Conclusion

It is confirmed by RAN/RAN1 chairs that additional 1 TU is allocated to Rel-18 MC enh WI for RAN1 in Q1 2023 (RAN1#112 meeting) by using one of RAN1 reserved TUs.