**3GPP TSG RAN WG1 Meeting #109-e R1-220xxxx**

**E-Meeting, May 9 – May 20, 2022**

**Agenda Item: 7.2.5**

**Source: Moderator (Huawei, HiSilicon)**

**Title: Summary of [109-e-R16-URLLC-04] Issue#6: Correction on SRS resource set with ‘*antennaSwitching*’**

**Document for: Discussion and Decision**

# Introduction

Following email thread is dedicated to discuss the Determination of SRS resource set with usage ‘*antennaSwitching*’. This issue has been raised in R1-2204905 [1].

[109-e-R16-URLLC-04] Issue#6: Correction on SRS resource set with '*antennaSwitching*' by May 13 – Thorsten (Huawei)

**Due to the short time available for discussion, please provide you input for the first round before May 10, 17:00 pm (UTC)**

**Background**

Follow up from the discussion under [108-e-R16-URLLC-04]. The remaining issue is on the note in the agreement "The need to make RAN1 specification change with regards to this agreement needs further discussion" [1].

# Discussion

## Round 1

The issue is raised in R1-2204905 [2]. In the RAN1#108-e meeting [3], the following agreement was achieved to clarify the number of configured SRS resource set(s) with usage ‘*antennaSwitching*’ configured *in srs-ResourceSetToAddModListDCI-0-2*.

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| Agreement  For the maximum number of SRS resource sets with *usage* ‘antennaSwitching’, adopt Option 2:   * Opt 2 – The SRS resource set(s) with usage=”*antennaswitching*” configured in *srs-ResourceSetToAddModListDCI-0-2* shall not be different from the SRS resource set(s) configured in *srs-ResourceSetToAddModListDCI* with the same usage   Note: The need to make RAN1 specification change with regards to this agreement needs further discussion. |

This approach avoids that the UE is configured with more SRS resource set(s) for '*antennaSwitchin*g' than what are possible compared to Rel-15. During the discussion in RAN1#108-e, it was pointed out that this would require a new UE capability and it is not feasible at this late stage. The remaining issue is the note in the agreement, i.e. whether it has spec impact or not.

In [2] a TP for 38.214 is suggested to avoid a misunderstanding between gNB and UE and to avoid that the UE becomes configured with more SRS resource sets that it can support. Otherwise, the specification is incomplete without the below TP.

**Text Proposal 1:**

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| 6.2 UE reference signal (RS) procedure  6.2.1 UE sounding procedure  The UE may be configured with one or more Sounding Reference Signal (SRS) resource sets as configured by the higher layer parameter *SRS-ResourceSet* or *SRS-PosResourceSet*. For each SRS resource set configured by *SRS-ResourceSet*, a UE may be configured with SRS resources (higher layer parameter *SRS-Resource*), where the maximum value of K is indicated by UE capability[13, 38.306]. When SRS resource set is configured with the higher layer parameter *SRS-PosResourceSet,* a UE may be configured with *K* ≥1 SRS resources (higher layer parameter *SRS-PosResource*), where the maximum value of K is 16. The SRS resource set applicability is configured by the higher layer parameter *usage* in *SRS-ResourceSet.* When the higher layer parameter *usage* is set to 'beamManagement'*,* only one SRS resource in each of multiple SRS resource sets may be transmitted at a given time instant, but the SRS resources in different SRS resource sets with the same time domain behaviour in the same BWP may be transmitted simultaneously.  When the higher layer parameter *usage* is set to '*antennaSwitching*', the SRS resource set(s) configured in *srs-ResourceSetToAddModListDCI-0-2* are either equal to or are a subset of the SRS resource set(s) with the same usage configured in *srs-ResourceSetToAddModList.*  For aperiodic SRS at least one state of the DCI field is used to select at least one out of the configured SRS resource set(s).  < Unchanged parts are omitted > |

**Q1: Companies are encouraged to share their view on the TP. If you do not support it, please also give your reason.**

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| Company | Comments |
| Moderator | From the specification point of view, there is currently no restriction how to configure SRS resource set(s) in *ResourceSetToAddModListDCI-0-2.* It seems not obvious that the resource set(s) in *ResourceSetToAddModListDCI-0-2,* cannot be different from the *resource set(s) configured in srs-ResourceSetToAddModList,* Therefore it would be good to clarify this in the specification. |
| Samsung | We still think that the agreement is sufficient without capturing it in the specification. However, if majority companies are fine with the proposed TP, we can live with that. Otherwise, it is not preferable to us.  We have a clarification question on the proposed TP. Actually, the agreement seems to say “the SRS resource set(s) configured in *srs-ResourceSetToAddModListDCI-0-2* are ~~either~~ equal to ~~or are a subset of~~ the SRS resource set(s) with the same usage configured in *srs-ResourceSetToAddModList.*”.  This is because “The SRS resource set(s) with usage=”*antennaswitching*” configured in *srs-ResourceSetToAddModListDCI-0-2* shall not be different from the SRS resource set(s) configured in *srs-ResourceSetToAddModListDCI* with the same usage”. If “a subset of” is considered, we think that it is not aligned with the agreement since it is different configuration. |
| vivo | We share the same view with Samsung. According to the agreement, the same SRS resource set(s) with usage=”*antennaswitching*” would be configured in both *srs-ResourceSetToAddModListDCI-0-2* and *srs-ResourceSetToAddModList.* |
| Nokia/NSB | We are fine of having this captured in the specifications.  And we do agree with the comments by Samsung, that capturing the available agreement does not include any notion of ‘a subset’ there and therefore the TP would need to adjusted accordingly. |
| ZTE | We slightly prefer not to have spec impact for this issue. We think the agreement is sufficient. |
| HW/HiSi | Support the TP |

## Round 2

**Due to the short time available for discussion, please provide you input for the first round before May 11, 17:00 pm (UTC)**

From round 1 we have the following situation based on the feedback that 5 companies provided:

Preferred to capture the agreement in the specification:

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| Yes | Nokia/NSB, HW/HiSi |
| No | Samsung (1st preference, but can live with TP), ZTE (slightly), [vivo] |

There are too few views so far to make a decision if spec impact is needed and more companies are encouraged to share their view.

Another question that was raised and should be clarified is how to interpret the “shall not be different” from the agreement from last meeting:

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| The SRS resource set(s) with usage=”*antennaswitching*” configured in *srs-ResourceSetToAddModListDCI-0-2* shall not be different from the SRS resource set(s) configured in *srs-ResourceSetToAddModListDCI* with the same usage |

**Interpretation 1**: if a resource set with a usage ‘*antennaSwitching*’ is configured in the new list (*srs-ResourceSetToAddModListDCI-0-2*), then the very same resource set also needs to be configured in the Rel-15 list (*srs-ResourceSetToAddModListDCI)*. Thus, the resource set that is included in *srs-ResourceSetToAddModListDCI-0-2* is not different from a resource set that is configured in *ResourceSetToAddModListDCI*. But there can also be additional SRS resource sets with the same usage in *ResourceSetToAddModListDCI*

**Interpretation 2:** the SRS resource sets with the same usage have to be exactly the same in both lists.

To get clarification on this topic, more input from companies is needed and I encourage companies to answer the following two question:

**Q1: Which is your interpretation of the “shall not be different” from the agreement made last meeting“, is it Interpretation 1 or Interpretation 2? And please also indicate if we need to add a clarification to the agreement from last meeting to avoid any misunderstanding?**

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| Company | Comments |
| Moderator | **Interpretation 1**: if a resource set with a usage ‘*antennaSwitching*’ is configured in the new list (*srs-ResourceSetToAddModListDCI-0-2*), then the very same resource set also needs to be configured in the Rel-15 list (*srs-ResourceSetToAddModListDCI)*. Thus, the resource set that is included in *srs-ResourceSetToAddModListDCI-0-2* is not different from a resource set that is configured in *ResourceSetToAddModListDCI*. But there can be additional SRS resource sets with the same usage in *ResourceSetToAddModListDCI*  **Interpretation 2:** the SRS resource sets with the same usage have to be exactly the same in both lists. |
| HW/HiSi | Interpretation 1 |
| Qualcomm | Interpretation 1.  In our understanding, the main purpose of introducing a new RRC parameter “*srs-ResourceSetToAddModListDCI-0-2*” is to allow it to be configured with a smaller number of SRS resource set from *ResourceSetToAddModListDCI.* Interpretation 2 is against such purpose. |
| Nokia/NSB | Changed by Nokia : See update below in Nokia/NSB 2  ~~Interpretation 1~~  ~~The same set(s) only apply to ‘antennaSwitching’ but does not restrict otherwise (in terms of number of sets and other usage). Any other restrictions are not part of this discussions.~~  [Moderator] Thanks for your answer and clarification about your thinking. There might be a misunderstanding between hoe we understand Interpretation 1. Please check the moderator clarification below |
| Moderator | @Nokia: (but please others check, too)  Clarification on interpretation 1.  The intention of Interpretation 1 is that for the usage ‘antennaSwitching’, if a SRS resource set is configured in *srs-ResourceSetToAddModListDCI-0-2*, then the very same SRS resource set also needs to be configured with the same usage in *srs-ResourceSetToAddModListDCI.*, But there can even be other SRS resource sets with usage ‘*antennaSwitching*’ in *srs-ResourceSetToAddModListDCI.*  Please note the last sentence of Interpretation 1: “But there can be additional SRS resource sets with the same usage in *ResourceSetToAddModListDCI”* |
| Nokia/NSB 2 | Interpretation 1.  @Moderator: thanks for the clarification – now understood and fully support Interpretation 1. |
| vivo | Thanks moderator’s clarification. If Interpretation 1 is the common understanding, we can live with it. |
| ZTE | Interpretation 1. |

**Q2: Do you have a concern that the agreement from last meeting is captured in the spec.**

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| Company | Comments |
| HW/HiSi | No concern. It would be helpful to capture it in the specification. It is a simple TP and would avoid confusion in the future. It helps to ensure that the gNB and UE get the same understanding. |
| Qualcomm | We are fine to capture the agreement in the spec (to clarify gNB and UE understanding). |
| Nokia/NSB | We are fine to capture the agreement in the spec (to clarify gNB and UE understanding). |
| vivo | We are fine to capture the agreement in the spec. |
| ZTE | For Rel-16, we think only essential change is considered. This issue is not main feature of URLLC, and that is the reason why it was not discussed in Rel-16. Therefore, we think the agreement is sufficient to align the understanding. |

## Round 3

**Due to the short time available for discussion, please provide you input for the first round before May 12, 23:00 pm (UTC)**

**Outcome from round 2:**

Q1: How to understand “shall not be different”

For the agreement made last meeting (copied below), all companies support Interpretation 1 how to understand “

“Opt 2 – The SRS resource set(s) with usage=”*antennaSwitching*” configured in *srs-ResourceSetToAddModListDCI-0-2* shall not be different from the SRS resource set(s) configured in *srs-ResourceSetToAddModListDCI* with the same usage”

Interpretation 1 is the following: and further clarification was given throughout the discussion

* **Interpretation 1**: if a resource set with a usage ‘*antennaSwitching*’ is configured in the new list (*srs-ResourceSetToAddModListDCI-0-2*), then the very same resource set also needs to be configured in the Rel-15 list (*srs-ResourceSetToAddModListDCI)*. Thus, the resource set that is included in *srs-ResourceSetToAddModListDCI-0-2* is not different from a resource set that is configured in *ResourceSetToAddModListDCI*. But there can be additional SRS resource sets with the same usage in *ResourceSetToAddModListDCI*
* The intention of Interpretation 1 is that for the usage ‘antennaSwitching’, if a SRS resource set is configured in *srs-ResourceSetToAddModListDCI-0-2*, then the very same SRS resource set also needs to be configured with the same usage in *srs-ResourceSetToAddModListDCI.*, But there can even be other SRS resource sets with usage ‘*antennaSwitching*’ in *srs-ResourceSetToAddModListDCI*.

With Interpretation 1, the agreement from last meeting means that all SRS resource set(s) with usage ‘*antennaSwitching*’ that are configured in *ResourceSetToAddModListDCI-0-2* also have to be configured in *srs-ResourceSetToAddModListDCI* and, additionally, there can be further SRS resource set(s) with usage ‘*antennaSwitching*’ configured *srs-ResourceSetToAddModListDCI,* that are not included in  *ResourceSetToAddModListDCI-0-2.* Therefore, the SRS resource sets(s) with usage ‘*antennaSwitching*’ configured in *srs-ResourceSetToAddModListDCI-0-2* are either identical to all SRS resource sets with the same usage in *srs-ResourceSetToAddModListDCI*, or they are a subset of them.

Q2: Capturing the Agreement in the specification

In round 2, 4 companies (HW/HiSi, QC, Nokia/NSB, vivo) would like to capture the agreement in the specification whereas 1 company (ZTE) would prefer not to do so. In the first round Samsung replied that they can accept a TP if this is majority view.

Based on the outcome of the discussion to go with Interpretation 1 and that a clear majority of companies prefers or can accept a TP, it is proposed to adopt the following proposal:

@ZTE: I hope it is possible for you to accept the majority view here, please also take into account that the TP helps companies to get a crystal clear understanding about how to interpret the wording “shall not be different” from the agreement made last meeting, whether it includes sub-sets or not.

***Proposal:*** *Adopt the following TP to capture that SRS resource sets(s) with usage ‘antennaSwitching’ configured in ResourceSetToAddModListDCI-0-2 are either equal to all SRS resource sets with the same usage in ResourceSetToAddModListDCI, or they are a subset of them.*

**Text Proposal:**

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| 6.2 UE reference signal (RS) procedure  6.2.1 UE sounding procedure  The UE may be configured with one or more Sounding Reference Signal (SRS) resource sets as configured by the higher layer parameter *SRS-ResourceSet* or *SRS-PosResourceSet*. For each SRS resource set configured by *SRS-ResourceSet*, a UE may be configured with SRS resources (higher layer parameter *SRS-Resource*), where the maximum value of K is indicated by UE capability[13, 38.306]. When SRS resource set is configured with the higher layer parameter *SRS-PosResourceSet,* a UE may be configured with *K* ≥1 SRS resources (higher layer parameter *SRS-PosResource*), where the maximum value of K is 16. The SRS resource set applicability is configured by the higher layer parameter *usage* in *SRS-ResourceSet.* When the higher layer parameter *usage* is set to 'beamManagement'*,* only one SRS resource in each of multiple SRS resource sets may be transmitted at a given time instant, but the SRS resources in different SRS resource sets with the same time domain behaviour in the same BWP may be transmitted simultaneously.  When the higher layer parameter *usage* is set to '*antennaSwitching*', the SRS resource set(s) configured in *srs-ResourceSetToAddModListDCI-0-2* are either equal to or are a subset of the SRS resource set(s) with the same usage configured in *srs-ResourceSetToAddModList.*  For aperiodic SRS at least one state of the DCI field is used to select at least one out of the configured SRS resource set(s).  < Unchanged parts are omitted > |

If companies have a strong concern, please bring up your reason here:

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| Company | Comments |
| Moderator | @ZTE: please check if you can live with the explanation above |
| Nokia/NSB | To us the current formulation of the TP of the intention 1 seems to be ambiguous to ‘which subset’ is meant here (as this could also mean a subset of SRS resource sets that are part of both configurations). All we need to state here is that for the SRS resource set(s) which are part of both Lists, they are the same or equal. We don’t need to say anything about SRS resource sets that are part of the Rel15 List but not part of the smaller list for DCI format 0\_2.  Therefore, an alternative formulation could be:  For the SRS resource set(s) configured *in srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter usage set to '*antennaSwitching*', the UE expects the same usage being configured in *srs-ResourceSetToAddModList.* |
| ZTE | As commented above, we think the agreement is sufficient and TP is not needed. But given that all the companies are fine with the TP, we can live with it for the sake of progress. Regarding the TP, we share the same view with Nokia that we don’t need to say anything about SRS resource not configured for DCI format 0\_2. |
| Qualcomm | We share the same view as Nokia.  The proposed TP from moderator is slightly ambiguous: “the set A in *srs-ResourceSetToAddModListDCI-0-2* is either equal or subset of the set B in *srs-ResourceSetToAddModList*” may also be interpreted as “SRS resource set A contains less SRS resources than SRS resource set B”, which is not what we meant based on the discussion in this threshold.  Nokia’s formulation may be clearer. One minor editorial suggestion below  For the SRS resource set(s) configured *in srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter usage set to '*antennaSwitching*', the UE expects the same ~~usage~~ SRS resource set(s) being configured in *srs-ResourceSetToAddModList.* |
| Nokia/NSB2 | To improve the TP – agree with the QC clarification but maybe we need to still refer to the same usage as well here.  Also thinking about 03 & beam management (as discussed the to have the same procedures), it could be (in blue Nokia on top of QC):  For the SRS resource set(s) configured *in srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter usage set to '*antennaSwitching*' [or '*beamManagement*'], the UE expects the same ~~usage~~ SRS resource set(s) with the same usage being configured in *srs-ResourceSetToAddModList.* |
| Samsung | We are fine with Nokia’s update. |
| HW/HiSi | Fine with the update from Nokia: |

## Round 4

No concerns have been raised about the TP included with updated from Nokia from Round 3. Additionally, it has been suggested to also include the usage ‘*beamManagement*’ (which is discussed in 03) in the same TP. The latter was also raised by the companies in thread 03.

It is the moderator suggestion to take it step-by-step:

* In this thread we can firstly check with the latest TP is stable for ‘*antennaSwitching*’ and can be agreed.
* Then we can see if the unified handling for “*beamManagement*’ gets agreed in Thread 03. If yes, we can update the TP for ‘antennaSwitching’ accordingly

Therefore, the following two proposals are made:

***Proposal A: Adopt the following TP in 38.214 to capture the agreement from RAN1 108-e, “The SRS resource set(s) with usage=”antennaswitching” configured in srs-ResourceSetToAddModListDCI-0-2 shall not be different from the SRS resource set(s) configured in srs-ResourceSetToAddModListDCI with the same usage”***

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| 6.2 UE reference signal (RS) procedure  6.2.1 UE sounding procedure  The UE may be configured with one or more Sounding Reference Signal (SRS) resource sets as configured by the higher layer parameter *SRS-ResourceSet* or *SRS-PosResourceSet*. For each SRS resource set configured by *SRS-ResourceSet*, a UE may be configured with SRS resources (higher layer parameter *SRS-Resource*), where the maximum value of K is indicated by UE capability[13, 38.306]. When SRS resource set is configured with the higher layer parameter *SRS-PosResourceSet,* a UE may be configured with *K* ≥1 SRS resources (higher layer parameter *SRS-PosResource*), where the maximum value of K is 16. The SRS resource set applicability is configured by the higher layer parameter *usage* in *SRS-ResourceSet.* When the higher layer parameter *usage* is set to 'beamManagement'*,* only one SRS resource in each of multiple SRS resource sets may be transmitted at a given time instant, but the SRS resources in different SRS resource sets with the same time domain behaviour in the same BWP may be transmitted simultaneously.  For the SRS resource set(s) configured *in srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter usage set to '*antennaSwitching*', the UE expects the same SRS resource set(s) with the same usage being configured in *srs-ResourceSetToAddModList.*  For aperiodic SRS at least one state of the DCI field is used to select at least one out of the configured SRS resource set(s).  < Unchanged parts are omitted > |

Please check the TP and indicate whether you support

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| Company | Comments |
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Since companies have expressed a desire to include the handling of usage ‘*beamManagement*’ in the same TP as for ‘*antennaSwitching*’ and also proposed a solution for it, I would like to check with companies if the following proposal B is agreeable.

***Proposal B***: ***Update the TP in Proposal A with “or beamManagement” as follows, if***

* ***TP in Proposal A is agreed***
* ***It is agreed in [URLLC-R16-03], that SRS resource sets with usage ‘beamManagement’ follow the rules for ‘usage’ ‘antennaSwitching’ regarding their configurations in ResourceSetToAddModListDCI-0-2 and srs-ResourceSetToAddModList.***

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| For the SRS resource set(s) configured *in srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter usage set to '*antennaSwitching*' or '*beamManagement*', the UE expects the same SRS resource set(s) with the same usage being configured in *srs-ResourceSetToAddModList.* |

Please check the TP and indicate whether you support

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| Company | Comments |
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# Outcome

TBD.

# References

1. R1-2203011 “Final Report of 3GPP TSG RAN WG1 #108-e v1.0.0”, section 7.2.5 e-Meeting, MCC Support
2. R1-2204905 “[Draft] CR Correction on SRS resource set with ‘*antennaSwitchin*g’”, RAN1#109-e, e-Meeting, May 9-20, 2022, Huawei, HiSilicon
3. R1-2202733 “Summary of [108-e-R16-URLLC-04] Issue#6: Discussion on determination of SRS resource set triggered by DCI format 2\_3”, RAN1#108-e, e-Meeting, February 21 – March 3, 2022, Huawei, HiSilicon