3GPP TSG-RAN WG2 Meeting #119 Electronic R2-220xxxx

Online Meeting, 17th - 26th August, 2022

**Agenda item: 6.11.2.2**

**Source: CATT**

**Title:**  **[AT119-e][421][POS] Delta configuration for SRSp in RRC\_INACTIVE (CATT)**

**WID/SID: NR\_pos\_enh-Core**

**Document for: Discussion and Agreement**

# 1 Introduction

This document is to kick off the following email discussion:

* [AT119-e][421][POS] Delta configuration for SRSp in RRC\_INACTIVE (CATT)

Scope: Discuss the situation described in R2-2207112 and determine if RAN2 should take action; if the issue is deemed valid, attempt to agree on at least the direction of a solution.

Intended outcome: Report to CB session

Deadline: Tuesday 2022-08-23 1200 UTC

This document will discuss the delta configuration for SRSp in RRC\_INACTIVE.

# 2 Contact Information

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| Xiaomi | Xiaolong Li (lixiaolong1@xiaomi.com) |
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| Nokia | mani.thyagarajan@nokia.com |
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# 3 References

1. R2-2207112 Discussion on left over issues of UL positioning in RRC\_Inactive CATT discussion Rel-17 NR\_pos\_enh-Core
2. TS38.331 V17.1.0 Radio Resource Control (RRC) protocol specification.

# 4 Discussion

## 4.1 Analysis on the existing configuration mechanism for SRSp

In R17, the delta configuration of SRS used for inactive positioning is supported.

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| srs-PosRRC-Inactive-r17 SetupRelease { SRS-PosRRC-Inactive-r17 } OPTIONAL, -- Need M  SRS-PosRRC-Inactive-r17 ::= OCTET STRING (CONTAINING SRS-PosRRC-InactiveConfig-r17)  SRS-PosRRC-InactiveConfig-r17 ::= SEQUENCE {  srs-PosConfigNUL-r17 SRS-PosConfig-r17 OPTIONAL, -- Need R  srs-PosConfigSUL-r17 SRS-PosConfig-r17 OPTIONAL, -- Need R  bwp-NUL-r17 BWP OPTIONAL, -- Need S  bwp-SUL-r17 BWP OPTIONAL, -- Need S  inactivePosSRS-TimeAlignmentTimer-r17 TimeAlignmentTimer OPTIONAL, -- Need M  inactivePosSRS-RSRP-changeThreshold-r17 RSRP-ChangeThreshold-r17 OPTIONAL -- Need M  }  RSRP-ChangeThreshold-r17 ::= ENUMERATED {dB4, dB6, dB8, dB10, dB14, dB18, dB22, dB26, dB30, dB34, spare6, spare5, spare4, spare3, spare2, spare1}  SRS-PosConfig-r17 ::= SEQUENCE {  srs-PosResourceSetToReleaseList-r17 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSetId-r16 OPTIONAL,-- Need N  srs-PosResourceSetToAddModList-r17 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSet-r16 OPTIONAL,-- Need N  srs-PosResourceToReleaseList-r17 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResourceId-r16 OPTIONAL,-- Need N  srs-PosResourceToAddModList-r17 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResource-r16 OPTIONAL -- Need N  } |

The validity of SRS configuration is based on the TA validation, which is judged by the TA timer mechanism and the RSRP change solution. Additionally, after cell reselection, the SRS configuration will be released [2].

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| 5.3.13.6 Cell re-selection or cell selection or L2 U2N relay (re)selection while T390, T319, T319a or T302 is running (UE in RRC\_INACTIVE) or SRS transmission in RRC\_INACTIVE is configured The UE shall:  1> if cell reselection occurs while T319 or T302 or T319a is running; or  1> if relay reselection occurs while T319 is running; or  1> if cell changes due to relay reselection while T302 is running:  2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure';  1> else if cell selection or reselection occurs while T390 is running, or cell change due to relay selection or reselection occurs while T390 is running:  2> stop T390 for all access categories;  2> perform the actions as specified in 5.3.14.4.  1> else if cell reselection occurs when *srs-PosRRC-Inactive* is configured:  2> indicate to the lower layer to stop *inactivePosSRS-TimeAlignmentTimer*;  2> release the *srs-PosRRC-Inactive*. |

The above mentioned mechanisms work well in most cases. However, considering the following case, there may occur misalignment on SRS configuration between UE and gNB.

As shown in Figure 1 (a), after UE reported an event report, cell 1 configured SRS#1 for UE with the timer *inactivePosSRS-TimeAlignmentTimer*. During the time, UE reselect to cell 2, shown as Figure 1 (b). After a short time, UE reselect back to cell 1 and detect a new positioning event, shown as Figure 1 (c).

Assuming that in this process, the UE is at the edge of cell 1 and cell 2. During the whole process, the RSRP has not increased/decreased by more than the configured threshold, and the TA timer *inactivePosSRS-TimeAlignmentTimer* is not expired. Upon reselecting to cell 2, UE stop the *inactivePosSRS-TimeAlignmentTimer* and release SRS#1. However the NW know nothing about reselect is occurred to the UE. The NW consider UE still hold the SRS#1 and keep running the *inactivePosSRS-TimeAlignmentTimer*. Then UE move back to cell 1 and send an event report to the core network. Since the *inactivePosSRS-TimeAlignmentTimer* of SRS#1 is still running, cell 1 may want UE still use SRS#1 for this positioning event and not contain SRS configuration in RRCRelease message due to delta configuration. Then UE have no available SRS configuration for positioning, which will lead to positioning failure.







Figure 1. The case of UE reselect to the previous cell again

**Question 1: Do you agree that in case of UE reselect to another cell and then reselect back within the *inactivePosSRS-TimeAlignmentTimer*, there will be misalignment on SRS configuration between UE and gNB?**

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| --- | --- | --- |
| Company | Yes/ No | Comments |
| Intel | Yes | gNB has no idea whether the UE has released the SRS configuration or not. To avoid potential misalignment, the only choice the gNB can do is to provide the full configuration instead of delta signalling. Otherwise, the UE may trigger the restablishment. |
| Xiaomi | Yes | UE releases the SRS configuration but gNB think UE still stores the SRS configuration provided by the gNB previously. |
| ZTE | Yes | After further checking the agreements in RAN2#118e:  Proposal 2 (8/10): The UE shall release the SRSp configuration for RRC\_INACTIVE upon cell re-selection. Correspondingly, remove the description of the UE behavior when performing connection resumption in a different cell than the cell where srs-PosRRC-InactiveConfig was configured in RRC spec.  Then that will cause the misalignment. However this issue may not needed to be solved because NW’s implementation, for example, NW can always configure the whole SRS configuration. |
| OPPO | Yes | The scenario is valid. The UE does not notify the network of the release of the SRS configuration after the UE performs reselection |
| Apple | Yes | Agree with Intel and Xiaomi |
| Huawei, HiSilicon | Yes |  |
| vivo | Yes |  |
| Samsung | Yes | The motivation in the contribution seems clear. |
| Ericsson | Pls see comments | Except TA timer, the RSRP should also be valid (i.e within a limit). Why is RSRP not considered. If UE has moved to new cell; it has performed cell reselection; implying, there should be change in RSRP. This would also cause the UE to release the SRS config.  Anyhow, the same RSRP changes could happen in the same cell and UE may have released the SRS config.  Agree with ZTE: this issue may not need to be solved because NW’s implementation, for example, NW can always configure the whole SRS configuration. |
| CATT | Yes(proponent) | There is an issue. Since the inactivePosSRS-TimeAlignmentTimer of SRS#1 is still running, cell 1 may want UE still use SRS#1 for this positioning event and not contain SRS configuration in RRCRelease message due to delta configuration. Then UE have no available SRS configuration for positioning, which will lead to positioning failure. |
| Nokia | See comments | Agree with ZTE. Instead of optimising for a corner case, we can leave it to implementation to use full config. |
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**Summary:**

## 4.2 Discussion on possible solutions

To solve the above mentioned issue, two potential solutions are given in [1].

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| * Not use delta configuration for *srs-PosRRC-Inactive*.   The network configures the full SRS configuration after each event report. By this way, even if UE release the previous SRS after cell reselection, when UE reselect back to the previous cell and send an event report, UE can get available SRS. However, by this way, the signalling overhead may be increased.   * The *srs-PosRRC-Inactive* is judged whether to be released in procedure of resume instead of cell reselection.   When cell reselection is occurred, the *srs-PosRRC-Inactive* will not be released. Only when the RRC resume procedure is triggered, UE need to judge whether the resume procedure is initiated in a cell different to the cell where *srs-PosRRC-Inactive* was configured. If yes, UE will release *srs-PosRRC-Inactive*. Otherwise, *srs-PosRRC-Inactive* will not be released. There will be no misalignment on SRS configuration between UE and gNB. |

During the online discussion, serval companies mentioned the delta configuration is important and should be kept. We confirm that the delta configuration can reduce the signalling overhead of configure SRS for UE. For CONNECTED mode there will be no problems, but for INACTIVE UE the misalignment on SRS configuration between UE and gNB mentioned in section 4.1 should be considered.

**Question 2: Do you agree to keep the mechanism of delta configuration for SRSp in RRC\_INACTIVE？Please share your comments in the table.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| Intel | Yes |  |
| Xiaomi | Yes | Delta configuration can reduce the signalling overhead and it is more flexible. |
| ZTE |  | Replace the ‘ToAddModList’ ’ToReleaseList’ to ‘SetupRelease’ is one way of solving the issue. However we think even the delta configuration is remained, NW can still configure the whole configuration based on NW’s implementation |
| OPPO | Yes |  |
| Apple | Yes |  |
| Huawei, HiSIlicon | Yes | Delta configuration is still useful when there is a parallel SDT procedure and SRS transmission procedure in RRC\_INACTIVE. |
| vivo | Yes |  |
| Samsung | Yes | No need to revert the previous agreement to use delta-configuration. |
| Ericsson | Yes, but | Agree with ZTE.  However rather than having new cause; we are fine to remove delta config and have full config |
| CATT | Maybe | We agree delta configuration can reduce the signalling overhead, but without delta configuration there will be no misalignment on SRS configuration between UE and gNB. |
| Nokia | Yes | However, we can leave it to NW implementation to use full config for the described problem scenario. |

**Summary:**

Another way to solve the misalignment problem is to judge whether to release *srs-PosRRC-Inactive* in procedure of resume instead of cell reselection. Only if the resume procedure is initiated in a cell different to the cell where *srs-PosRRC-Inactive* was configured, the configured SRS will be released.

Additionally during the online discussion, one company mentioned this method could cause interference. However we think the problem does not exist. On the one hand, upon cell reselection, the *inactivePosSRS-TimeAlignmentTimer* is stopped and UE stop sending SRS. On the other hand, even if UE keep sending SRS, since the SRS is originally received by the surrounding cells, the limited movement of UE will not change the spatial relationship obviously.

**Question 3: Do you think release the SRS configuration in RRCResume procedure instead of cell reselection will solve the misalignment problem in section 4.1？If you identify some other problems of this solution, please also share your comments in the table.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| Intel | Yes |  |
| Xiaomi | No | If SRS is released when UE performs RRC resume procedure, it means RRC inactive UE should store the SRS configuration for a long time even if the SRS configuration will not be used by UE. We think this is not reasonable. The key issue is that UE already releases the SRS configuration but gNB doesn’t know it. |
| ZTE | Yes | In RAN2#116 we had the agreement:  Proposal 5 (modified) The SRSp configuration is released when the UE sends RRCResumeRequest to a cell other than the cell where it is released to RRC\_INACTIVE state.  But in RAN2#118 the agreement is changed:  Proposal 2 (8/10): The UE shall release the SRSp configuration for RRC\_INACTIVE upon cell re-selection. Correspondingly, remove the description of the UE behavior when performing connection resumption in a different cell than the cell where srs-PosRRC-InactiveConfig was configured in RRC spec.  If UE only releases the SRS configuration after the UE send the RRCResumeRequest, UE will not release the SRS configuration when cell re-selection happens. Then UE still keeps the SRS configuration in RRC when it re-selects to cell 1. So there will be no problem and no other spec change is needed under this scenario |
| OPPO | No | UE will need to memorizes the SRS configuration before performing the resume procedure. This will bring additional load to the UE. |
| Apple | Yes, but | We also acknowledge the points raised by Xiaomi and OPPO, and so perhaps an alternative solution should be considered. |
| Huawei, HiSIlicon | Yes | The configuration does not need to be released when cell reselection happens but the TAT should be stopped, such that the UE stops the SRS transmission with the old SRS config in the new cell |
| vivo | Yes, but | Agree with Xiaomi and OPPO. The UE does not need to store the configuration only for the corner case that UE reselect the previous cell. |
| Samsung | Yes, but | Also fine with the Xiaomi’s proposal in Q4.  On Huawei’s comment, we have the same view. It seems reasonable for the UE to stop SRS transmission when cell reselection happens and the timer is stopped. We are fine with clarifying this aspect in spec if needed. |
| Ericsson | No | We can leave it to UE implementation; the main aspect is that if   * cell reselection happens, * TAT expires, * RSRP changes are beyond threshold.   UE releases the SRS config.  However rather than having new cause; we are fine to remove delta config and have full config. New cause code would introduce additional implementation/verification cost which if possible should be avoided. |
| CATT | Yes | We prefer to adopt this option to solve the misalignment problem. This option will solve the problem well. Additionally, based on the modifications in Annex C of R2-2207112, we further think the behaviour of stop *inactivePosSRS-TimeAlignmentTimer* upon cell reselection should also be deleted, to keep the alignment of valid understanding between UE and the network.   |  | | --- | | ~~1> else if cell reselection occurs when~~ *~~srs-PosRRC-Inactive~~* ~~is configured:~~  ~~2> indicate to the lower layer to stop~~ *~~inactivePosSRS-TimeAlignmentTimer~~*~~;~~  ~~2> release the~~ *~~srs-PosRRC-Inactive~~*~~.~~ |   ①For the concern of interference, it may only happen when the UE is keep sending SRS while cell reselection is happened. However, this will not cause interference, for the TA validation is still restricted by *inactivePosSRS-RSRP-ChangeThreshold*.  ②For the concern that UE need to keep SRS until RRCResume, we need to emphasize on the existence of *inactivePosSRS-TimeAlignmentTimer*. The time UE need to release the SRS configuration should be min{time point of UE sending RRCResume, *inactivePosSRS-TimeAlignmentTimer* expired}, that is the time is must be no later than *inactivePosSRS-TimeAlignmentTimer* expired. In most cases, UE can finish positioning without cell reselect, after that UE will keep the SRS configuration until *inactivePosSRS-TimeAlignmentTimer* is expired. So in case of cell reselection, we don’t think UE keep the SRS configuration until RRCResume is a big deal. |
| Nokia | No | No need to optimise for the described problem scenario. |
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**Question 4: Besides the two above mentioned solutions, if you have any other solutions, please share your comments in the table.**

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| --- | --- | --- |
| Company | Yes/ No | Comments |
| Xiaomi | Yes | UE indicates to gNB that UE has already released the SRS configuration when UE performs the RRC resume procedure. Thus the gNB can decide to use delta configuration or not. |
| ZTE | Yes | If RAN2 is going to keep the delta configuration and keep the mechanism that UE release the SRS when cell re-selection happens, RRC spec may need to add a note (or in field description) that NW may always configure full configuration |
| OPPO | No need | We think this kind of back-forth movement is a corner case:1. The UE leaves the serving cell area and performs re-selection. 2. UE does not perform Resume procedure in the cell covering the entering area (If so, the cell could configure a new SRS for the UE). 3. UE goes back to the previous serving cell and a positioning event occurs.  In our opinion, the spec cannot cover all the use cases. And it is too late to change the UE behaviour at such late stage of R17. |
| Apple | Yes | We have some sympathy for the Xiaomi’s proposal |
| vivo | Yes | Agree with Xiaomi to add a new Resume cause in *RRCResumeRequest* message. |
| Ericsson | No need | Agree with ZTE |
| CATT |  | The solution in Q3 is good enough to fix this issue. Since we figure out this issue, and there is a candidate solution to fix it, it will be perfect to fix this issue at the very early version of Rel-17. |
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# 5 Conclusion

TBD