**3GPP TSG RAN WG1 #118bis R1-2408511**

**Hefei, China, October 14th – 18th, 2024**

**Source: Moderator(ZTE)**

**Title: Summary on LS of CSI-RS and SRS for spatial relation**

**Agenda item: 8.1**

**Document for: Discussion and Decision**

# Introduction

RAN1 received an LS from RAN2 on CSI-RS/SRS for spatial relation in RRC\_INACTIVE [1] as below.

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| **1. Overall Description:**RAN2 has agreed to reuse the SP Positioning SRS Activation/Deactivation MAC CE (TS38.321-i20, section 6.1.3.36) for activating/deactivating SRS transmission in RRC\_INACTIVE state for both, semi-persistent SRS for positioning without validity area (Rel-17) and semi-persistent SRS for positioning with validity area (Rel-18). RAN2 has also specified a new Aggregated SP Positioning SRS Activation/Deactivation MAC CE (TS38.321-i20, section 6.1.3.83) in Rel-18 for activating/deactivating aggregated semi-persistent SRS for positioning in both, RRC\_CONNECTED and RRC\_INACTIVE state.Those two MAC CEs can both contain spatial relation field to indicate specific spatial relation for specific SRS resource (or specific aggregated SRS resource). Specifically, spatial relation for resource IDi with NZP-CSI-RS and SRS contains serving cell ID and BWP ID where the NZP-CSI-RS or the SRS is configured, see below:

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| TS38.321-i206.1.3.36 SP Positioning SRS Activation/Deactivation MAC CEFigure 6.1.3.36-2: Spatial Relation for Resource IDi with NZP CSI-RSFigure 6.1.3.36-4: Spatial Relation for Resource IDi with SRS |

In the current specification, a UE stores the RRC configurations in RRC\_CONNECTED into the UE Inactive AS Context when transferring from RRC\_CONNECTED to RRC\_INACTIVE, and UE in RRC\_INACTIVE state only works on single cell and single BWP. Therefore, it is unclear to RAN2 whether the NZP-CSI-RS or SRS configured in RRC\_CONNECTED can be used as spatial relation RS in RRC\_INACTIVE or not. Therefore, RAN2 would like to invite RAN1 to answer the following questions:**Q1: When activating semi-persistent SRS for positioning in RRC\_INACTIVE, whether NZP-CSI-RS and SRS can be used as source for spatial relation indication in the MAC CE?****Q2: When activating semi-persistent SRS for positioning in RRC\_INACTIVE, whether NZP-CSI-RS and SRS which are configured in RRC\_CONNECTED can be used as source for spatial relation indication in the MAC CE?****Q3: Whether the above answers are applicable for SP-SRS without validity area activation in RRC\_INACTIVE, SP-SRS with validity area activation in RRC\_INACTIVE and aggregated SP-SRS activation in RRC\_INACTIVE?** |

In this contribution, the views of RAN1 companies are summarized, and a proposal to reply RAN2 is suggested.

# Discussion on LS

Since in RRC\_INACTIVE state, positioning SRS is supported. So, from moderator perspective, it is clear positioning SRS can be used as source for spatial relation indication in MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE state.

Huawei, vivo, CATT, Ericsson, etc. do not think CSI-RS/MIMO SRS can be configured for UE in RRC\_INACTIVE state or they are configured for communication in RRC\_CONNECTED state, so CSI-RS/SRS cannot be used as the source for spatial relation indication in the MAC CE in RRC\_INACTIVE state.

ZTE thinks CSI-RS/SRS can be used as the source for spatial relation indication in RRC\_INACTIVE state because of the following agreement and spec description of Rel-17. UE can just store the beam information based on the configured CSI-RS/SRS, then use it later when it goes into RRC\_INACTIVE state.

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| Agreement:Spatial relation defined in Rel.16 for transmission of SRS for positioning by RRC\_CONNECTED UEs is applicable for RRC\_INACTIVE UEs. |

TS 38.214-ha0 Rel-17:

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| 6.2.1.4 UE sounding procedure for positioning purposesWhen the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. If the UE is configured for transmission of *SRS-PosResource* in RRC\_INACTIVE mode, the configured *spatialRelationInfoPos* is also applicable. |

Intel thinks CSI-RS/SRS can be used as the source for spatial relation indication in RRC\_INACTIVE state as long as the CSI-RS/SRS is within DL/UL initial BWP.

Companies’ views are summarized below:

* **Q1: When activating semi-persistent SRS for positioning in RRC\_INACTIVE, whether NZP-CSI-RS and SRS can be used as** **source for spatial relation indication in the MAC CE?**
	+ Yes: ZTE, Samsung (for SRS), Intel (CSI-RS/SRS within initial BWP), Qualcomm (SRS)
	+ No: Huawei, vivo, CATT, Samsung (for CSI-RS), Ericsson, Qualcomm (CSIRS)
* **Q2: When activating semi-persistent SRS for positioning in RRC\_INACTIVE, whether NZP-CSI-RS and SRS which are configured in RRC\_CONNECTED can be used as source for spatial relation indication in the MAC CE?**
	+ Yes: ZTE, Intel
	+ No: Huawei, vivo, CATT, Samsung, Ericsson, Qualcomm (see also note below)
* **Q3: Whether the above answers are applicable for SP-SRS without validity area activation in RRC\_INACTIVE, SP-SRS with validity area activation in RRC\_INACTIVE and aggregated SP-SRS activation in RRC\_INACTIVE?**
	+ Yes: ZTE, Huawei, vivo, CATT, Samsung, Intel, Ericsson, Qualcomm

Based on the majority views, the following reply is suggested:

**Proposal 1:** Reply to RAN2 that

* For Q1, positioning SRS can be used as source and NZP CSI-RS cannot be used as source for spatial relation indication in MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE state.
* For Q2, NZP-CSI-RS and SRS which are configured in RRC\_CONNECTED cannot be used as source for spatial relation indication in the MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE.
* For Q3, the above answers can be applicable for SP-SRS without validity area activation in RRC\_INACTIVE, SP-SRS with validity area activation in RRC\_INACTIVE and aggregated SP-SRS activation in RRC\_INACTIVE.

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| **Companies** | **Comments if you don’t support the above proposal** |
| Qualcomm | Added our views above with “tracking” We are OK with answer in Q1. With regards to Q2, we are OK to support SRS from connected state to be used as spatial relation for SRS in inactive, but it would still need to be a separate UE capability. Without a UE capability, we prefer to go with the answer as shown above. OK with the answer for Q3. |
| Huawei, HiSilicon | Ok with FL proposal.  |
| CATT | For SRS, we have positioning SRS configured with *SRS-PosResource* and non-positioning SRS configured with *SRS-Resource.* In the answer to Q1 mentions, ‘positioning SRS’ is used, while in the answer to Q2 ‘SRS’ is used without ‘positioning’. Suggested change: * For Q1, SRS configured by the *SRS-PosResource* can be used as source, but NZP CSI-RS and SRS configured by the *SRS-Resource* cannot be used as source for spatial relation indication in MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE state.
* For Q2, NZP-CSI-RS and SRS configured by the *SRS-PosResource* or *SRS-Resource* in RRC\_CONNECTED cannot be used as source for spatial relation indication in the MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE.
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| Intel | Thanks, Moderator for the proposals. As also noted by the Moderator quoting the Rel-17 decisions and current spec text in TS 38.214, we do not see a fundamental reason why CSI-RS and SRS (even “MIMO SRS”) configured to a UE in CONNECTED state cannot be stored and used by the UE in INACTIVE state if the resource is indicated as a spatial relation resource. As long as the indicated DL RS can be measured or UL RS be transmitted within the initial DL/UL BWP respectively, there is no issue. In fact, with the proposed restrictions, we would need to introduce these new restrictions to the RAN1 specs, including to Rel-17 specs, which seems unnecessary. Thus, we prefer to respond to the questions in the affirmative stating with the condition that they should be included within the initial DL/UL BWPs, respectively.  |
| vivo | Based on my understanding, only the SRS for positioning configured for RRC\_ INACTIVE can be used as spatial relation.In this case, we propose* For Q1, SRS configured by the *SRS-PosResource* for RRC\_INACTIVE can be used as source, but NZP CSI-RS and SRS configured by the *SRS-Resource* cannot be used as source for spatial relation indication in MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE state.
* For Q2, NZP-CSI-RS and SRS configured by the *SRS-PosResource* or *SRS-Resource* in RRC\_CONNECTED cannot be used as source for spatial relation indication in the MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE.
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| Ericsson | Same view as other companies that at least the SRS for positioning can be kept, but SRS MIMO / CSI-RS cannot, since they are not transmitted / received in inactive state and thus the relation cannot be maintained. Last update from vivo is fine for us.  |
| Intel2 | We’d like to understand a bit further regarding the comments above that CSI-RS cannot be used since they may not be transmitted for a UE in INACTIVE state. In our understanding, this is up to gNB decision, and if gNB does not intend to transmit the CSI-RS, it would NOT indicate the RS as a spatial relation resource for SRSp transmissions in INACTIVE. On the other hand, if the indicated CSI-RS is one that the gNB may still transmit (e.g., if it is same as configured TRS for PEI purposes), then it can be provided to a UE as spatial relation resource for SRSp transmissions in INACTIVE. |
| Moderator | Thanks all your inputs. @Intel, my understanding now is, in RRC Release configuration for UE going to RRC\_INACTIVE state, there is no CSI-RS configuration. Then, there is no UE behavior specified in such case. UE may not be expected to receive CSI-RS. Based on majority, I think vivo’s update for Q1 and Q2 is agreeable. **Updated Proposal 1:** Reply to RAN2 that * For Q1, SRS configured by the *SRS-PosResource* for RRC\_INACTIVE can be used as source, but NZP CSI-RS and SRS configured by the *SRS-Resource* cannot be used as source for spatial relation indication in MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE state.
* For Q2, NZP-CSI-RS and SRS configured by the *SRS-PosResource* or *SRS-Resource* in RRC\_CONNECTED cannot be used as source for spatial relation indication in the MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE.
* For Q3, the above answers can be applicable for SP-SRS without validity area activation in RRC\_INACTIVE, SP-SRS with validity area activation in RRC\_INACTIVE and aggregated SP-SRS activation in RRC\_INACTIVE.
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# Draft CR

Based on proposal 1, it is supposed that at least NZP CSI-RS may not be applicable as the source for spatial relation indication in MAC CE for positioning in RRC\_INACTIVE state. Then, the next question is whether to further clarify this in RAN1 specification.

vivo proposed a draft CR for TS 38.214 in R1-2407840 [11]. The wording as below can be a starting point if companies think the clarification in RAN1 spec is needed.

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| 6.2.1.4 UE sounding procedure for positioning purposesWhen the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. If the UE is configured for transmission of *SRS-PosResource* in RRC\_INACTIVE mode, the configured *spatialRelationInfoPos* is also applicable.In RRC\_INACTIVE mode, when *spatialRelationInfoPos* is configured for a semi-persistent SRS or periodic SRS or *spatialRelationInfoPos* is activated/updated for a semi-persistent SRS, the reference RS indicated by *spatialRelationInfoPos* according to Clause 6.3.2 of [TS 38.331] or Clause 6.1.3.36of [TS 38.321] can be SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell**.**<omitted text> |

**Question 1:** Based on the outcome of proposal 1, is a CR needed to clarify that in RAN1 specification ?

* If yes, please check the wording in draft CR R1-2407840

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| **Companies** | **Comments**  |
| Ericsson | OK with the CR in principle. It seems the positioning SRS is missing from the list of valid source for spatial relation? Also, we propose to group all the RRC\_INACTIVE part as a block. Last, 38.331 refers to RRC\_INACTIVE as a “state” not a mode, so we propose to also correct this:6.2.1.4 UE sounding procedure for positioning purposesWhen the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. If the UE is configured for transmission of *SRS-PosResource* in RRC\_INACTIVE state, the configured *spatialRelationInfoPos* is also applicable. In RRC\_INACTIVE state, when *spatialRelationInfoPos* is configured for a semi-persistent SRS or periodic SRS or *spatialRelationInfoPos* is activated/updated for a semi-persistent SRS, the reference RS indicated by *spatialRelationInfoPos* according to Clause 6.3.2 of [TS 38.331] or Clause 6.1.3.36of [TS 38.321] can be an SRS configured by the higher layer parameter *SRS-PosResource*, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell**.** |

**Proposal 2: Agree the following TP for TS 38.214 section 6.2.1.4.**

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| ***Reason for change:*** | According to the LS from RAN2(R2-2407853), RAN2 asked whether NZP-CSI-RS and SRS can be used as source for spatial relation indication. Then, RAN1 agreed that SRS configured by the *SRS-PosResource* for RRC\_INACTIVE can be used as source, but NZP CSI-RS and SRS configured by the *SRS-Resource* cannot be used as source for spatial relation indication in MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE state. Furthermore, NZP-CSI-RS and SRS configured by the *SRS-PosResource* or *SRS-Resource* in RRC\_CONNECTED cannot be used as source for spatial relation indication in the MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE.  |
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| ***Summary of change:*** | Update TS38.214 to clarify whether NZP CSI-RS and SRS can be used for spatial relation source for positioning SRS in RRC\_INACTIVE mode. |
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| ***Consequences if not approved:*** | It is unclear in RAN1 specification if NZP CSI-RS and SRS can be used for spatial relation source for positioning SRS in RRC\_INACTIVE mode.  |

6.2.1.4 UE sounding procedure for positioning purposes

When the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell.

If the UE is configured for transmission of *SRS-PosResource* in RRC\_INACTIVE state, the configured *spatialRelationInfoPos* is also applicable. In RRC\_INACTIVE state, when *spatialRelationInfoPos* is configured for a semi-persistent SRS or periodic SRS or *spatialRelationInfoPos* is activated/updated for a semi-persistent SRS, the reference RS indicated by *spatialRelationInfoPos* according to Clause 6.3.2 of [TS 38.331] or Clause 6.1.3.36of [TS 38.321] can be an SRS configured by the higher layer parameter *SRS-PosResource*, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell**.**<omitted text>

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| **Companies** | **Comments if you don’t support the above proposal** |
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# Draft LS

Based on the agreement, moderator drat the CR as follows, where the yellow part can be deleted if the draft CR is not agreed eventually.

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| RAN1 thanks RAN2 for the LS on CSI-RS/SRS for spatial relation in RRC\_INACTIVE, with regard to RAN2’s following questions, RAN1 provides the corresponding answers.**Q1: When activating semi-persistent SRS for positioning in RRC\_INACTIVE, whether NZP-CSI-RS and SRS can be used as source for spatial relation indication in the MAC CE?**[RAN1 reply] SRS configured by the *SRS-PosResource* for RRC\_INACTIVE can be used as source, but NZP CSI-RS and SRS configured by the *SRS-Resource* cannot be used as source for spatial relation indication in MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE state.**Q2: When activating semi-persistent SRS for positioning in RRC\_INACTIVE, whether NZP-CSI-RS and SRS which are configured in RRC\_CONNECTED can be used as source for spatial relation indication in the MAC CE?**[RAN1 reply] NZP-CSI-RS and SRS configured by the *SRS-PosResource* or *SRS-Resource* in RRC\_CONNECTED cannot be used as source for spatial relation indication in the MAC CE for activating semi-persistent SRS for positioning in RRC\_INACTIVE.**Q3: Whether the above answers are applicable for SP-SRS without validity area activation in RRC\_INACTIVE, SP-SRS with validity area activation in RRC\_INACTIVE and aggregated SP-SRS activation in RRC\_INACTIVE?**[RAN1 reply] The above answers can be applicable for SP-SRS without validity area activation in RRC\_INACTIVE, SP-SRS with validity area activation in RRC\_INACTIVE and aggregated SP-SRS activation in RRC\_INACTIVE.In addition, the corresponding RAN1 CR in TS 38.214 is provided for information.  |

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| **Companies** | **Comments if you don’t support the above proposal** |
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# Reference

1. R1-2407605 LS on CSI-RS/SRS for spatial relation in RRC\_INACTIVE RAN2, ZTE
2. R1-2407682 Discussion on LS on CSI-RS/SRS for spatial relation in RRC\_INACTIVE Huawei, HiSilicon
3. R1-2407828 Draft Reply LS on CSI-RS/SRS for spatial relation in RRC\_INACTIVE vivo
4. R1-2408000 Discussion on CSI-RS/SRS for spatial relation in RRC\_INACTIVE CATT
5. R1-2408001 Draft reply LS on CSI-RS/SRS for spatial relation in RRC\_INACTIVE CATT
6. R1-2408613 Draft LS reply on CSI-RS/SRS for spatial relation in RRC\_INACTIVE Samsung
7. R1-2408286 Draft Reply LS on CSI-RS/SRS for spatial relation in RRC\_INACTIVE Intel Corporation
8. R1-2408509 Draft reply LS on CSI-RS and SRS for spatial relation ZTE Corporation, Sanechips
9. R1-2408915 Draft reply LS on CSI-RS and SRS for spatial relation in RRC\_INACTIVE Ericsson
10. R1-2408913 Discussion on CSI-RS and SRS for spatial relation in RRC\_INACTIVE Ericsson
11. R1-2407840 Draft CR on spatial relation of SRS for positioning in RRC\_INACTIVE Mode vivo