**3GPP TSG-RAN WG2 Meeting #127 R2-240xxxx**

**Maastricht, Netherlands, Aug 19 – 23, 2024**

**Agenda item:** 7.2.6

**Source:** ZTE Corporation

**Title:** [AT127][405][POS] C field in relation to cell ID and BWP ID in RRC\_INACTIVE (ZTE)

**Document for:**  Discussion and decision

# Introduction

This is to discuss the following offline discussion:

* [AT127][405][POS] C field in relation to cell ID and BWP ID in RRC\_INACTIVE (ZTE)

 Scope: Discuss change 4 from R2-2406792 and the related issues on handling of the cell ID and BWP ID fields in RRC\_INACTIVE, including Rel-17 and Rel-18 impact.

 Intended outcome: Report to CB session in R2-2407723

 Deadline: Wednesday 2024-08-21 1900 CET

The related papers are as below:

[R2-2406788](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202408%20-%20RAN2_127%2C%20Maastricht%5CExtracts%5CR2-2406788%20Correction%20on%20SP%20SRS%20activation%20deactivation%20MAC%20CE%28R17%29.docx) Correction on SP SRS activation/deactivation MAC CE ZTE Corporation, Ericsson CR Rel-17 38.321 17.9.0 1840 1 F NR\_pos\_enh-Core R2-2404625

[R2-2406789](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202408%20-%20RAN2_127%2C%20Maastricht%5CExtracts%5CR2-2406789%20Correction%20on%20SP%20SRS%20activation%20deactivation%20MAC%20CE%28R18%29.docx) Correction on SP SRS activation/deactivation MAC CE ZTE Corporation, Ericsson CR Rel-18 38.321 18.2.0 1841 1 A NR\_pos\_enh-Core R2-2404626

[R2-2406790](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202408%20-%20RAN2_127%2C%20Maastricht%5CExtracts%5CR2-2406790%20Discussion%20on%20DL%20MAC%20CE%20in%20Rel-17%20and%20Rel-18%20SP%20SRS%20in%20RRC_INACTIVE.docx) Discussion on DL MAC CE in Rel-17 and Rel-18 SP SRS in RRC\_INACTIVE ZTE Corporation, Ericsson discussion Rel-17 38.321 NR\_pos\_enh-Core

[R2-2406792](file:///C%3A%5CUsers%5Cmtk16923%5CDocuments%5C3GPP%20Meetings%5C202408%20-%20RAN2_127%2C%20Maastricht%5CExtracts%5CR2-2406792%20Correction%20on%20SL%20pos%20in%20dedicated%20pool%20and%20SRS%20aggregation%20MAC%20CE%20in%20MAC%20spec.docx) Correction on SL pos in dedicated pool and SRS aggregation MAC CE in MAC spec ZTE Corporation draftCR Rel-18 38.321 18.2.0 F NR\_pos\_enh2  **(issue 4)**

# Discussion

RAN2 agrees that, the SP SRS activation/deactivation MAC CE (section 6.1.3.36) can be reused to activate Rel-17 INACTIVE SRS in last serving cell:

|  |
| --- |
| **RAN2#116 agreement**SP Positioning SRS Activation/Deactivation MAC CE is reused for triggering SRSp transmission in RRC\_INACTIVE. (12/12)  |

RAN2 agrees that, the SP SRS activation/deactivation MAC CE (section 6.1.3.36) can be reused to activate Rel-18 INACTIVE SRS in validity area(s):

|  |
| --- |
| **RAN2#126 agreement**For both *srs-PosRRC-InactiveValidityAreaPreConfigList* and *srs-PosRRC-InactiveValidityAreaNonPreConfig* (non-aggregated cases), the transmission of SP SRS is activated by MAC CE as legacy.  |

RAN2 agrees that, the aggregated SP SRS activation/deactivation MAC CE (section 6.1.3.83) is introduced to activate/deactivate aggregated SP SRS in RRC\_INACTIVE:

|  |
| --- |
| **RAN2#126 agreement**The currently designed SRS BW aggregation MAC CE can be used for RRC\_CONNECTED and RRC\_INACTIVE.Adopt up to 16 Spatial Relation for Resource IDi fields in the new MAC CE. |

when the SP SRS activation/deactivation MAC CE (section 6.1.3.36) or the aggregated SP SRS activation/deactivation MAC CE (section 6.1.3.83) is reused in RRC\_INACTIVE, the MAC CE can also include one or more Spatial Relation for Resource Idi field, i.e., gNB can still activate spatial relation for specific SP SRS resource (or specific aggregated SP SRS resource) in RRC\_INACTIVE.

**Observation 1: When the SP SRS activation/deactivation MAC CE (section 6.1.3.36) or the aggregated SP SRS activation/deactivation MAC CE (section 6.1.3.83) is reused in RRC\_INACTIVE, the MAC CE can also include one or more Spatial Relation for Resource Idi field, i.e., gNB can still activate spatial relation for specific SP SRS resource (or specific aggregated SP SRS resource) in RRC\_INACTIVE.**

RAN2 should discuss how to interpret/reinterpret the spatial relation field for RRC\_INACTIVE scenario.

According to current RRC spec, when UE enters RRC\_INACTIVE, the UE stores the UE Inactive AS Context, which should include cell configuration/BWP configuration/RS configuration. See below 38.331 explanation:

|  |
| --- |
| **TS38.331-i20****3.1 Definitions**<omitted>**UE Inactive AS Context**: UE Inactive AS Context is stored when the connection is suspended and restored when the connection is resumed. It includes information as defined in clause 5.3.8.3.**4.2 Architecture****4.2.1 UE states and state transitions including inter RAT**<omitted>**- RRC\_INACTIVE**:- A UE specific DRX may be configured by upper layers or by RRC layer;- At lower layers, the UE may be configured with a DRX for PTM transmission of MBS broadcast and/or a DRX for PTM transmission of MBS multicast;- UE controlled mobility based on network configuration;- The UE stores the UE Inactive AS context;- A RAN-based notification area is configured by RRC layer;- Transfer of unicast data and/or signalling to/from UE over radio bearers configured for SDT.**5.3 Connection control****5.3.1 Introduction**5.3.1.1 RRC connection control<omitted>The suspension of the RRC connection is initiated by the network. When the RRC connection is suspended, the UE stores the UE Inactive AS context and any configuration received from the network, and transits to RRC\_INACTIVE state. The RRC message to suspend the RRC connection is integrity protected and ciphered.5.3.8.3 Reception of the *RRCRelease* by the UE<omitted>NOTE 1c: *suspendConfig* is not stored as part of UE Inactive AS Context, except for the fields explicitly specified.5.3.13 RRC connection resume<omitted>5.3.13.2 InitiationUpon initiation of the procedure, the UE shall:<omitted>1> if the UE is in NE-DC or NR-DC:2> if the UE does not support maintaining SCG configuration upon connection resumption:3> release the MR-DC related configurations (i.e., as specified in 5.3.5.10) from the UE Inactive AS context, if stored;1> if the UE does not support maintaining the MCG SCell configurations upon connection resumption:2> release the MCG SCell(s) from the UE Inactive AS context, if stored; |

**Observation 2: According to current RRC spec, when UE enters RRC\_INACTIVE, the UE stores the UE Inactive AS Context, which should include cell configuration/BWP configuration/RS configuration that was received in RRC\_CONNECTED.**

Some companies commented online that the spatial relation RS configuration used in RRC\_INACTIVE should only come from RRC Release with SuspendConfig message, not come from the RS configured in RRC\_CONNECTED. Considering the fact that UE still stores the AS context in RRC\_INACTIVE, companies are asked to answer the following question:

**Q1: For spatial relation RS used in RRC\_INACTIVE, which option do you agree?**

* **Option 1: UE can be scheduled by gNB to use both the RS configured in RRC\_CONNECTED and the RS configured in RRC Release as the spatial relation RS in RRC\_INACTIVE.**
* **Option 2: UE can only be scheduled by gNB to use the RS configured in RRC Release as the spatial relation RS in RRC\_INACTIVE.**

|  |  |  |
| --- | --- | --- |
| Company | Option1/option2/none | comments |
| Huawei, HSilicon | Option2 | The RS configuration in RRC\_CONNECCTED is only stored in the UE AS context but not actually APPLIED. We shouldn’t change that. Otherwise there will be changes to UE procedure text as well: The CSI-RS configuration needs to be applied upon reception of RRCRelease msg with suspendConfig. |
| Ericsson | Both Options | Both Options should be possible. It is up to gNB. When the UE is RRC Connected mode, the NW can switch the UE to inactive mode (state transition from Connected mode to Inactive mode) and in such case UE will store the information it receives as part of suspend config and can transmit SRS with spatial relation as received. |
| Samsung | comment | We need to ask RAN1 whether the RS configured in RRC\_CONNECTED can be used as spatial information for positioning SRS in RRC\_INACTIVE state. By the way, in our view, it is unlikely that the RS configured by the last serving cell in RRC\_CONNECTED is used for SRS Tx in RRC\_INACTIVE especially when we assume the R18 SRS Tx within validity area.  |
| ZTE | Option 1 | There is no restriction in current spec that the configuration in RRC\_CONNECTED cannot be used in RRC\_INACTIVE. Option2 restricts gNB’s scheduling.  |

Q2 impacts that whether gNB is allowed to set C=1 in RRC\_INACTIVE.

The spatial relation RS has 4 types, SSB, SRS, CSI-RS, DL-PRS, only CSI-RS and SRS includes cell ID and BWP ID. In which, CSI-RS can only be transmitted by UE’s serving cell(s) in RRC\_CONNECTED. The SRS, SSB and DL-PRS can be transmitted both in RRC\_CONNECTED and RRC\_INACTIVE. That is to say:

* If we go with option1 in Q1, all of the RS types (CSI-RS, SSB, SRS, DL-PRS) can be valid spatial relation RS in RRC\_INACTIVE, so gNB should be able to indicate cell ID/BWP ID directly in spatial relation field, where the indicated cell ID/BWP ID are the stored value in UE Inactive AS context. I.e., C field can be set to 1 in RRC\_INACTIVE.
* If we go with option 2 in Q1, CSI-RS should not be a valid spatial relation RS type in RRC\_INACTIVE, and the cell ID/BWP ID in spatial relation field (for RS type as SRS) should be ignored by UE. I.e., C field should always be set to 0 in RRC\_INACTIVE (for MAC CE in 6.1.3.36), or UE ignores cell ID/BWP ID in spatial relation field in RRC\_INACTIVE (for MAC CE in 6.1.3.83).

So companies are invited to answer the following Q2 and Q3:

**Q2: If you agree with option1 in Q1, do you agree that all the RS type (CSI-RS, SSB, SRS, DL-PRS) can be valid spatial relation RS in RRC\_INACTIVE, and gNB should be able to indicate cell ID/BWP ID directly in spatial relation field, where the indicated cell ID/BWP ID are the stored value in UE Inactive AS context? i.e., C field can be set to 1 in RRC\_INACTIVE?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments |
| Huawei, HiSilicon | NA | NA |
| Ericsson | Agree | From RAN2 perspective, we agreed to reuse the same MAC CE; that is the same spatial relation should be applicable for RRC Inactive mode. RAN2 has not receive any indication from RAN1 that UE cannot use the spatial relation in Inactive mode.  |
| Samsung |  | We first need to get the answer to Q1 by asking RAN1. |
| ZTE | Agree |  |

**Q3: If you agree with option2 in Q1, do you agree that UE should not use CSI-RS for spatial relation RS, and UE should ignore the cell ID/BWP ID in spatial relation field when the spatial relation RS is SRS? I.e., C field should always be set to 0 in RRC\_INACTIVE (for MAC CE in 6.1.3.36), or UE ignores cell ID/BWP ID in spatial relation field in RRC\_INACTIVE (for MAC CE in 6.1.3.83)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | Comments |
| Huawei, HiSilicon | Agreed | The UE should ignore the BWP ID and Cell ID outside spatial relation indication and C field should be set to 0 |
| Ericsson | RAN2 may not decide |  |
| Samsung |  | We first need to get the answer to Q1 by asking RAN1. |
|  |  |  |

No matter which option is supported, Rapporteur prefers to clarify the understanding of the C field in RRC\_INACTIVE in these two impacted MAC CEs. If not so, the previous agreement of using the MAC CEs in RRC\_INACTIVE will not be well captured in spec, and it may cause confusion/CRs at future. So companies are invited to answer the following questions:

**Q4: Do you agree to add clarification for C field in SP SRS activation/deactivation MAC CE (section 6.1.3.36) and the aggregated SP SRS activation/deactivation MAC CE (section 6.1.3.83) after consensus are achieved?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/disagree | comments |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Agree |  |
| Samsung | Agree |  |
| ZTE | Agree |  |

**Draft TP for Aggregated SP Positioning SRS Activation/Deactivation MAC CE**

Based on option2, a modified TP is provided regarding to issue 4 in R2-2406792:

|  |
| --- |
| 6.1.3.83 Aggregated SP Positioning SRS Activation/Deactivation MAC CE<omitted>- Spatial Relation for Resource IDi: The field Spatial Relation for Resource IDi is only present if MAC CE is used for activation, i.e. at least one of the C1, C2, and C3 is set to 1. There can be as many as 16 entries of Spatial Relation for Resource IDi depending on the RRC configuration. There are 4 types of Spatial Relation for Resource IDi, which is indicated by the F (F0 and F1) field within, defined as in Figure 6.1.3.36-2 to 6.1.3.36-5 in clause 6.1.3.36. When the MAC CE is used for activating aggregated SP-SRS in RRC\_INACTIVE, the type of CSI-RS for Spatial Relation is invalid. Spatial Relation for Resource ID1 corresponds to the spatial relation of the first set of aggregated SRS resources corresponding to the indicated Positioning SRS aggregation ID*[ffs what is the first aggregated SRS resource]*;- C: This field indicates whether the octets containing Resource Serving Cell ID field(s) and Resource BWP ID field(s) within the field Spatial Relation for Resource ID i are present, except for Spatial Relation Resource IDi with DL-PRS or SSB. If the combination of the linked SRS resource sets is configured by the field *SRS-PosResourceSetAggBW-CombinationList* and this field is set to 1, the octets containing Resource Serving Cell ID field(s) and Resource BWP ID field(s) in the field Spatial Relation for Resource IDi are present, otherwise if this field is set to 0, they are not present; if the combination of the linked SRS resource sets is configured by the field *SRS-PosRRC-AggBW-InactiveConfigList*, this field shall be set to 0 and the octets containing Resource Serving Cell ID field(s) and Resource BWP ID field(s) in the field Spatial Relation for Resource IDi are not present; |

[Rapp Summary]

Based on companies views, there can be three possible solutions:

Solution 1: RAN2 confirms that all of the RS types (CSI-RS, SSB, SRS, DL-PRS) can be valid spatial relation RS in RRC\_INACTIVE, so gNB should be able to indicate cell ID/BWP ID directly in spatial relation field, where the indicated cell ID/BWP ID are the stored value in UE Inactive AS context.

Solution 2: RAN2 confirms that when the (aggregated)SP-SRS activation/deactivation MAC CE is used in RRC\_INACTIVE, UE should NOT use CSI-RS for spatial relation RS, and UE should ignore the cell ID/BWP ID in spatial relation field when the spatial relation RS is SRS;

Soulution 3: RAN2 sends a LS to ask RAN1 that: whether UE can take the CSI-RS or SRS configuration provided in RRC\_CONNECTED as the spatial relation RS to be applied in RRC\_INACTIVE state.

Since there is no consensus in the email discussion, the draft proposal is given as below:

***Proposal 1: For (re)using MAC CE in RRC\_INACTIVE, RAN2 to adopt one of the following solutions:***

* ***Solution 1: RAN2 confirms that all of the RS types (CSI-RS, SSB, SRS, DL-PRS) can be valid spatial relation RS in RRC\_INACTIVE, so gNB should be able to indicate cell ID/BWP ID directly in spatial relation field, where the indicated cell ID/BWP ID are the stored value in UE Inactive AS context.***
* ***Solution 2: RAN2 confirms that when the (aggregated)SP-SRS activation/deactivation MAC CE is used in RRC\_INACTIVE, UE should NOT use CSI-RS for spatial relation RS, and UE should ignore the cell ID/BWP ID in spatial relation field when the spatial relation RS is SRS;***
* ***Soulution 3: RAN2 sends a LS to ask RAN1 that: whether UE can take the CSI-RS or SRS configuration provided in RRC\_CONNECTED as the spatial relation RS to be applied in RRC\_INACTIVE state.***

***Proposal 2: RAN2 to adopt the corresponding MAC spec change after the consensus is achieved.***

# Summary

Based on the input from companies, we have the following observations and proposals:

Observations

**Observation 1: When the SP SRS activation/deactivation MAC CE (section 6.1.3.36) or the aggregated SP SRS activation/deactivation MAC CE (section 6.1.3.83) is reused in RRC\_INACTIVE, the MAC CE can also include one or more Spatial Relation for Resource Idi field, i.e., gNB can still activate spatial relation for specific SP SRS resource (or specific aggregated SP SRS resource) in RRC\_INACTIVE.**

**Observation 2: According to current RRC spec, when UE enters RRC\_INACTIVE, the UE stores the UE Inactive AS Context, which should include cell configuration/BWP configuration/RS configuration that was received in RRC\_CONNECTED.**

Proposals

***Proposal 1: For (re)using MAC CE in RRC\_INACTIVE, RAN2 to adopt one of the following solutions:***

* ***Solution 1: RAN2 confirms that all of the RS types (CSI-RS, SSB, SRS, DL-PRS) can be valid spatial relation RS in RRC\_INACTIVE, so gNB should be able to indicate cell ID/BWP ID directly in spatial relation field, where the indicated cell ID/BWP ID are the stored value in UE Inactive AS context.***
* ***Solution 2: RAN2 confirms that when the (aggregated)SP-SRS activation/deactivation MAC CE is used in RRC\_INACTIVE, UE should NOT use CSI-RS for spatial relation RS, and UE should ignore the cell ID/BWP ID in spatial relation field when the spatial relation RS is SRS;***
* ***Soulution 3: RAN2 sends a LS to ask RAN1 that: whether UE can take the CSI-RS or SRS configuration provided in RRC\_CONNECTED as the spatial relation RS to be applied in RRC\_INACTIVE state.***

***Proposal 2: RAN2 to adopt the corresponding MAC spec change after the consensus is achieved.***

# Annex

#### 6.1.3.36 SP Positioning SRS Activation/Deactivation MAC CE (spatial relation part)



Figure 6.1.3.36-2: Spatial Relation for Resource IDi with NZP CSI-RS



Figure 6.1.3.36-3: Spatial Relation for Resource IDi with SSB



Figure 6.1.3.36-4: Spatial Relation for Resource IDi with SRS



Figure 6.1.3.36-5: Spatial Relation for Resource IDi with DL-PRS

The field Spatial Relation for Resource IDi consists of the following fields:

- F0: This field indicates the type of a resource used as a spatial relation for the ith Positioning SRS resource within the Positioning SRS Resource Set indicated with the field Positioning SRS Resource Set ID. The field is set to 00 to indicate NZP CSI-RS resource index is used; it is set to 01 to indicate SSB index is used; it is set to 10 to indicate SRS resource index is used; it is set to 11 to indicate DL-PRS index is used. The length of the field is 2 bits;

- F1: This field indicates the type of SRS resource used as spatial relation for the ith Positioning SRS resource within the SP Positioning SRS Resource Set indicated with the field Positioning SRS Resource Set ID when F0 is set to 10. The field is set to 0 to indicate SRS resource index *SRS-ResourceId* as defined in TS 38.331 [5] is used; the field is set to 1 to indicate Positioning SRS resource index *SRS-PosResourceId* as defined in TS 38.331 [5] is used;

- NZP CSI-RS Resource ID: This field contains an index of *NZP-CSI-RS-ResourceID*, as specified in TS 38.331 [5], indicating the NZP CSI-RS resource, which is used to derive the spatial relation for the positioning SRS. The length of the field is 8 bits;

- SSB index: This field contains an index of SSB *SSB-Index* as specified in TS 38.331 [5] and/or TS 37.355 [23]. The length of the field is 6 bits;

- PCI: This field contains physical cell identity *PhysCellId* as specified in TS 38.331 [5] and/or TS 37.355 [23]. The length of the field is 10 bits;

- SRS resource ID: When F1 is set to 0, the field indicates an index for SRS resource *SRS-ResourceId* as defined in TS 38.331 [5]; When F1 is set to 1, the field indicates an index for Positioning SRS resource *SRS-PosResourceId* as defined in TS 38.331 [5]. The length of the field is 5 bits representing the index from 0 to 31;

- E: This field indicates the extension of SRS resource ID as the MSB of SRS resource ID. The total length of the extended SRS resource ID is 6 bits. If E bit is set to 1, the SRS resource ID value is 5-bit SRS resource ID field + 32;

- DL-PRS Resource Set ID: This field contains an index for DL-PRS Resource Set *nr-DL-PRS-ResourceSetId* as defined in TS 37.355 [23]. The length of the field is 3 bits;

- DL-PRS Resource ID: This field contains an index for DL-PRS resource *nr-DL-PRS-Resource-Id* as defined in TS 37.355 [23]. The length of the field is 6 bits;

- DL-PRS ID: This field contains an identity for DL-PRS resource *dl-PRS-ID* as defined in TS 37.355 [23]. The length of the field is 8 bits;

- PI: This field indicates whether the field DL-PRS resource ID is present within the Spatial Relation for Resource IDi with DL-PRS. If the field is set to 1, the octet containing the field DL-PRS resource ID is present; otherwise, the octet is omitted;

- SI: This field indicates whether the field SSB index is present within the Spatial Relation for Resource IDi with SSB. If the field is set to 1, the octet containing the field SSB index is present; otherwise, the octet is omitted;

- Resource Serving Cell IDi: This field indicates the identity of the Serving Cell on which the resource used for spatial relationship derivation for the ith Positioning SRS resource is located. The length of the field is 5 bits;

- Resource BWP IDi: This field indicates a UL BWP as the codepoint of the DCI *bandwidth part indicator* field as specified in TS 38.212 [9], on which the resource used for spatial relationship derivation for the ith Positioning SRS resource is located. The length of the field is 2 bits.