**3GPP TSG-RAN WG2 Meeting #113bis-e *R2-210xxxx***

**Online, 12–20 April 2021**

**Agenda item: 6.3.4**

**Source: CATT**

**Title:** **Report of [AT113bis-e][608][POS] SP positioning SRS activation/deactivation MAC CE (CATT)**

**Document for: Discussion and Agreement**

# 1 Introduction

This is to report the result of the following email discussion in RAN2#113bis-e Meeting.

* [AT113bis-e][608][POS] SP positioning SRS activation/deactivation MAC CE (CATT)

      Scope: Discuss R2-2104504 including backward compatibility aspects, and determine if a revision is needed.

Intended outcome: Agreed CR if possible, in R2-2104412

Deadline: Tuesday 2021-04-20 0800 UTC

# 2 Contact Information

|  |  |
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# 3 Discussion

The length of the SRS resource ID within the field ‘Spatial Relation for Resource IDi with SRS’ within SP Positioning SRS Activation/Deactivation MAC CE is only 5bits, which is unable to indicate the maximum SRS resource or positioning SRS resource in Rel-16 for positioning. This CR was discussed online and decided as NBC change. Companies accept NBC and the length of the field should be extended during the online discussion.

R2-2104504 Corrections on SP Positioning SRS Activation and Deactivation MAC CE CATT CR Rel-16 38.321 16.4.0 1072 - F NR\_pos-Core

Here we will discuss if a description is needed for the bit order of the split fields and determine if a revision is needed.

## 3.1 Background of MAC PDU

According to the MAC PDU description in Medium Access Control (MAC) protocol specification TS38.321, more generally the bit string is to be read from left to right and then in the reading order of the lines. For your convenience, the general description [1]was copied here:

# 6 Protocol Data Units, formats and parameters

## 6.1 Protocol Data Units

### 6.1.1 General

A MAC PDU is a bit string that is byte aligned (i.e. multiple of 8 bits) in length. In the figures in clause 6, bit strings are represented by tables in which the most significant bit is the leftmost bit of the first line of the table, the least significant bit is the rightmost bit on the last line of the table, and more generally the bit string is to be read from left to right and then in the reading order of the lines. The bit order of each parameter field within a MAC PDU is represented with the first and most significant bit in the leftmost bit and the last and least significant bit in the rightmost bit.

A MAC SDU is a bit string that is byte aligned (i.e. multiple of 8 bits) in length. A MAC SDU is included into a MAC PDU from the first bit onward.

A MAC CE is a bit string that is byte aligned (i.e. multiple of 8 bits) in length.

A MAC subheader is a bit string that is byte aligned (i.e. multiple of 8 bits) in length. Each MAC subheader is placed immediately in front of the corresponding MAC SDU, MAC CE, or padding.

The MAC entity shall ignore the value of the Reserved bits in downlink MAC PDUs.

Meanwhile, here is another example of some MAC CE which has split fields for your reference[1]:

The CORESET ID in TCI State Indication for UE-specific PDCCH MAC CE has split fields as below. We can find there is no description of order on it.

#### 6.1.3.15 TCI State Indication for UE-specific PDCCH MAC CE

The TCI State Indication for UE-specific PDCCH MAC CE is identified by a MAC subheader with LCID as specified in Table 6.2.1-1. It has a fixed size of 16 bits with following fields:

- Serving Cell ID: This field indicates the identity of the Serving Cell for which the MAC CE applies. The length of the field is 5 bits. If the indicated Serving Cell is configured as part of a simultaneousTCI-UpdateList1 or simultaneousTCI-UpdateList2 as specified in TS 38.331 [5], this MAC CE applies to all theServing Cells in the set simultaneousTCI-UpdateList1 or simultaneousTCI-UpdateList2, respectively;

- CORESET ID: This field indicates a Control Resource Set identified with ControlResourceSetId as specified in TS 38.331 [5], for which the TCI State is being indicated. In case the value of the field is 0, the field refers to the Control Resource Set configured by controlResourceSetZero as specified in TS 38.331 [5]. The length of the field is 4 bits;



Figure 6.1.3.15-1: TCI State Indication for UE-specific PDCCH MAC CE

## 3.2 Corrections on SP Positioning SRS Activation and Deactivation MAC CE

So we suggest to extend the length of the field ‘SRS resource ID’ within ‘Spatial Relation for Resource Idi’ with SRS within SP Positioning SRS Activation/Deactivation MAC CE to 6bits without additional description which follows the rules in MAC protocol.

For your convience, the modifications in the CR were copied as below. You can also refer to the CR directly here: **[https://www.3gpp.org/ftp/tsg\_ran/WG2\_RL2/TSGR2\_113bis-e/Inbox/Drafts/%5BOffline-608%5D%5BPOS%5D%20SP%20positioning%20SRS%20activationdeactivation%20MAC%20CE%20(CATT)](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113bis-e/Inbox/Drafts/%5BOffline-608%5D%5BPOS%5D%20SP%20positioning%20SRS%20activationdeactivation%20MAC%20CE%20(CATT)" \o "here)**

**Option A: R bit becomes the LSB, of the 6-bit field. The modification on MAC as below:**

- 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;

- E: is the extension of SRS resource ID as the LSB of SRS resource ID. The total length of the extended SRS resource ID is 6 bits.



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

According to comments from MediaTek, here is new option to correct the MAC CE:

**Option B: R bit becomes the MSB, rather than LSB, of the 6-bit field. The modification on MAC as below:**- 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;

- E: is 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.



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

**Q1. Do you agree that the changes in the CR** **R2-2104504**  **are needed? In the comment field please indicate if you request some changes in the CR.**

|  |  |  |
| --- | --- | --- |
| Company | Agree as it is;  Agree with changes;  Disagree | Detailed Comments |
| Intel |  | The suggestion from Huawei on the coversheet looks good to us. |
| Samsung | Agree with changes | As Intel said, Huawei’s proposals seems to be needed in the cover sheet. |
| MediaTek | See comment | This CR can be rendered backward compatible by defining the bit order so that the R bit becomes the MSB, rather than LSB, of the 6-bit field. We would also need a UE capability to indicate support of the 6-bit version of the field. Then, if the UE does not indicate support, the network uses the 5 LSBs to signal a value from 0 to 31 (same as a legacy network); if the UE does indicate support, the network uses the full 6-bit field.  So we suggest that there should be companion CRs to introduce a capability to 38.306/38.331, and the bit order should be changed in the MAC CR. |
| Huawei, HiSilicon | Agree with changes | See the comments to the following questions |
| vivo | Agree |  |
| CATT | Agree | See the comments of Q2 |
| ZTE | Agree |  |
| Nokia | See comment | We agree with MediaTek that it is possible to come up with a backward compatible correction to the problem. Given that RAN2 chairman had indicated that we should try to avoid NBC changes for Rel-16, we are fine to go with the BC solution suggested by MediaTek. We also agree that a UE capability CR is needed.  The existing SRS resource ID field can remain as a 5-bit field and follow the MAC convention for MSB on the leftmost side of the field. The R bit should be defined as an extension bit, E, which extends the value range of SRS resource ID field. If E bit is set to 1, the SRS resource ID value is (value of 5-bit SRS resource ID field + 32) which should be described as part of the E bit description.  The existing field description for SRS resource ID must also be updated to indicate that it represents the index 0 to 31 for (Positioning) SRS resource... |
| Apple | Agree |  |
| CATT |  | To Nokia:  Thanks for the valuable comments but  1. The description of extension: the wording in option B clarifies that the E is the extension as MSB which means value of 5-bit SRS resource ID field + 32\*MSB. I think we are on the same page on the understanding of MSB but not sure if it is proper to add such wording: “ If E bit is set to 1, the SRS resource ID value is (value of 5-bit SRS resource ID field + 32)” in the description of E.  Hopefully more comments from other companies will come.  2. The existing field description of SRS resource ID in option B already says: “The length of the field is 5 bits.” which means it represents the index 0 to 31.  If we want backward compatible, we would better not modify the existing description of SRS resource ID, and only add the extension. So I prefer not to modify the existing resource ID. |

**Q2. Which option do you prefer: Option A - R bit becoming the LSB in R2-2104504, or the option B – R bit becoming the MSB? In the comment field please clarify your reason.**

|  |  |  |
| --- | --- | --- |
| Company | Option A/Option B | Detailed Comments |
| Huawei, HiSilicon | Option B | Option A enable the legacy network/UE to indicate SRS id <=31 like current spec. With the R bit extended, can be used for indicate the other 32 SRS resources. Thus, this can help to maintain a certain level of compatibility to the legacy UE and network |
| Intel | Option B | Share the same view with Huawei |
| vivo | Option B |  |
| CATT | Option B | Option B is better backward compatible option compared with option A. |
| ZTE | Option B |  |
| Nokia | Option B with changes | We agree in-principle with Option B but the CR in R2-2104504\_v2\_CATT requires further updates as explained in our comments to Q1. |
| Apple | Option B |  |

## 3.3 UE capability for the extension

Furthermore, UE capability for the extension is discussed here for backward compatibility.

Assuming there is implementation of UE in the field which support the 5bits MAC CE, if we want backward compatibility, i.e. both supporting legacy UEs with 5bit resource ID and the new version UEs with 6bits resource ID in MAC CE, UE capability for the extension is expected here. On the other hand, when assuming there is no implementation of UE which support the 5bits MAC CE, there is no need to introduce the UE capability.

So there are two options of UE capability for the extension for companies’ discussion:

* Option 1 : UE capability for the extension:
  + Assumption: There is implementation of UE which support 5bits MAC CE already.
  + Introducing UE capability for the extension: to create one bit in UE capability indicating UE support this 6bits MAC CE or not.
    - When gNB receives the UE capability supporting 6bits MAC CE, gNB will set the resource ID accordingly with 6bits MAC CE. Otherwise, gNB will set the resource ID still with 5bits format in MAC CE.
  + More modifications:
    - TS 38.321: the description with UE capability indication should be added.
    - TS 38.331 & TS38.306: UE capability for the extension with one bit indication.
* Option 2: No UE capability for the extension:
  + Assumption: Considering positioning of Rel-16 has been recently introduced and believing no one has already started to implement.
  + It is not necessary for this change to introduce a UE capability indication for the extension.

**Q3. Which option do you prefer on the UE capability indication for the extension? In the comment field please explain your preference.**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/ Option 2 | Detailed Comments |
| Huawei, HiSilicon | Option2 | no need for capability. |
| Intel | Option2 | Based on assumption there is no implementation in the field. Otherwise capability is needed. |
| vivo | Option2 |  |
| CATT | Option1 | There won’t be any risk on the Inter-operability issue if UE capability is introduced. Otherwise there is always a risk on the Inter-operability issue when UE doesn’t follow this CR while network already upgrades to the latest version. |
| Ericsson | Option 2 |  |
| ZTE | Option 2 |  |
| Nokia | Option 1 | We need UE capability since the interpretation changes: Otherwise network cannot know whether UE will interpret the (old) R-bit correctly. The capability bit indicates whether UE supports the extended value range for SRS resource ID or not. |
| Apple | No strong view | While it is logical to have a UE capability to take care of the BC issue, it is also probably true that there is no UE using 5-bit SRS resource ID in the market yet. |
| Qualcomm | Option 1 | If we go for Option B in Q2 (which the majority of companies seem to prefer), then we acknowledge that there can be two different implementations. I.e., implementations which support 0-31 and implementations which support 0-62. Therefore, the NW needs to know which value range the UE supports.  If capabilities are not needed, then I cannot see a reason why Option B should be selected in Q2. If we assume all implementations will anyhow support the full value range 0-62, then we can use the existing/defined MAC bit ordering without introducing a special/new bit-order handling for this field. |

# 4 Conclusion

**TBD**

# 5 References

[1] TS 38.321 Medium Access Control (MAC) protocol specification V16.4.0

[2] R2-2104504 Corrections on SP Positioning SRS Activation and Deactivation MAC CE CATT CR Rel-16 38.321 16.4.0 1072 - F NR\_pos-Core