3GPP TSG-RAN WG1 Meeting #104-e R1- 21NNNN

e-Meeting, January 25th– February 5th, 2021

**Source: Moderator (Ericsson)**

**Title: Output #1 for email discussion [104-e-NR-Pos-02]**

**Agenda item: 7.2.8**

**Document for: Discussion and Decision**

1. Introduction

This contribution documents the output of email discussion [104-e-NR-Pos-02] triggered by the following Chairman’s decision and based on the feature lead summary for AI 7.2.8[TBD,[4]:

[104-e-NR-Pos-02] Email discussion/approval on SRS for positioning until Jan-29 – Florent (Ericsson)

* Aspect 2.2 – Semi-persistent SRS for Positioning Activation
* Aspect 2.10 – Editorial Corrections for the TS 38.214
* Aspect 2.11 – Misalignment of dl-PRS-r16 in spatialRelationInfoPos
* Aspect 2.12 – Corrections to Positioning SRS and Higher Layer Parameters

1. List of Remaining Opens on NR Positioning

## Aspect 2.2 Semi-persistent SRS for Positioning Activation

### Feature Lead Summary

In [ZTE, [1]], it is pointed out that terminology “activated” should be used for semi-persistent SRS for positioning in order to have consistent descriptions in current specification for MAC CE and semi-persistent positioning SRS in clause 6.2.1 of the TS 38.214.

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| <TS 38.214 sub-clause 6.2.1 unchanged parts omitted>  For operation in the same carrier, the UE is not expected to be configured on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-PosResource* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'periodic'.  For operation in the same carrier, the UE is not expected to be activated or triggered to transmit SRS on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-PosResource* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'semi-persistent' or 'aperiodic'.  For operations in the same carrier, the UE is not expected to be configured on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-PosResource* with *resourceType* of the SRS resources as 'periodic'.  For operations in the same carrier, the UE is not expected to be activated or triggered to transmit SRS on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-PosResource* with *resourceType* of the SRS resources as 'semi-persistent' or 'aperiodic'.  <unchanged parts omitted> |

### first round of comments

Companies are encouraged to provide their view on the TP in the table below

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| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Fine with the change, but we have “Triggering SP-SRS” description in other paragraphs since Rel-15.  In case a SRS resource with *resourceType* set as 'semi-persistent' is triggered on the OFDM symbol(s) configured with periodic SRS transmission, the UE shall transmit the semi-persistent SRS resource and only the periodic SRS symbol(s) overlapping within the symbol(s) are dropped, while the periodic SRS symbol(s) that are not overlapped with the semi-persistent SRS resource are transmitted. |
| ZTE | Support for consistency. At least for most of places, the specification use “activate” to describe semi-persistent SRS. Regarding the place mentioned by Huawei, it can be handled in MIMO session. |
| OPPO | Indeed, generally “activation” is used for SP SRS and “triggering” is used in AP SRS. So we are ok with the proposed change. |
| Qualcomm | OK |
| CATT | Support. |
| Apple | Support |
| LG | OK |
| Intel | OK to change |
| Ericsson | Support |

### Update #1 on aspect 2.2

Based on the received comments, it seems that all companies commenting agree with the TP. It is proposed to endorse the TP and close the discussion.

1. TP 2.1.3 below is endorsed

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| TP#2.1.3  <TS 38.214 sub-clause 6.2.1 unchanged parts omitted>  For operation in the same carrier, the UE is not expected to be configured on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-PosResource* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'periodic'.  For operation in the same carrier, the UE is not expected to be activated or triggered to transmit SRS on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-PosResource* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as 'semi-persistent' or 'aperiodic'.  For operations in the same carrier, the UE is not expected to be configured on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-PosResource* with *resourceType* of the SRS resources as 'periodic'.  For operations in the same carrier, the UE is not expected to be activated or triggered to transmit SRS on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-PosResource* with *resourceType* of the SRS resources as 'semi-persistent' or 'aperiodic'.  <unchanged parts omitted> |

### Second round of comments

Companies are encouraged to provide their view on the proposal in the table below:

|  |  |
| --- | --- |
| Company | Comment |
| vivo | Support |

## Aspect 2.10 – Editorial Corrections for the TS 38.214

### Feature Lead Summary

The following editorial corrections for the TS 38.214 were proposed in [vivo,[2]].

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| **TS38.214-g40**  **6.2.1 PRS reception procedure**  < Unchanged parts are omitted >  *- dl-PRS-CyclicPrefix* defines the cyclic prefix for the DL PRS resource. All DL PRS Resources and DL PRS Resource sets in the same ~~DL-PRS-positioningfrequencylayer~~ DL PRS positioning frequency layer have the same value of *dl-PRS-CyclicPrefix.* The supported values of *dl-PRS-CyclicPrefix* are given in Table 4.2-1 of [4, TS38.211].  < Unchanged parts are omitted >  A DL PRS resource set is configured by *NR-DL-PRS-ResourceSet*, consists of one or more DL PRS resources and it is defined by:  …  *- dl-PRS-ResourceRepetitionFactor* defines how many times each DL-PRS resource is repeated for a single instance of the DL-PRS resource set and takes values ~~,~~. All the DL PRS resources within one resource set have the same resource repetition factor.  < Unchanged parts are omitted > |

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| **TS38.214-g40**  **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 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.  …  The following SRS parameters are semi-statically configurable by higher layer parameter *SRS-Resource* or *SRS-PosResource*.  - *srs-ResourceId* or *SRS-PosResourceId* determines SRS resource configuration identity.  - Number of SRS ports, as defined by the higher layer parameter *nrofSRS-Ports* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, *nrofSRS-Ports* is 1.  *-* Time domain behaviour of SRS resource configuration, as indicated by the higher layer parameter *resourceType*, which may be periodic, semi-persistent, aperiodic SRS transmission as defined in Clause 6.4.1.4 of [4, TS 38.211].  - Slot level periodicity and slot level offset, as defined by the higher layer parameters *periodicityAndOffset-p* or *periodicityAndOffset-sp* for an SRS resource of type periodic or semi-persistent, which is configured by *SRS-Resource*, and *periodicityAndOffset-p* or *periodicityAndOffset-sp* for an SRS resource of type periodic or semi-persistent, which is configured by *SRS-PosResource*. The UE is not expected to be configured with SRS resources in the same SRS resource set *SRS-ResourceSet* or *SRS-PosResourceSet* with different slot level periodicities. For an *SRS-ResourceSet* configured with higher layer parameter *resourceType* set to 'aperiodic', a slot level offset is defined by the higher layer parameter *slotOffset.* For an *SRS-PosResourceSet* configured with higher layer parameter r*esourceType-r16* set to 'aperiodic-r16', the slot level offset is defined by the higher layer parameter *slotOffset-r16* for each SRS resource.  - Number of OFDM symbols in the SRS resource, starting OFDM symbol of the SRS resource within a slot including repetition factor R, as defined by the higher layer parameter *resourceMapping* or *resourceMapping-r16* and described in Clause 6.4.1.4 of [4, TS 38.211]. If *R* is not configured, then *R* is equal to the number of OFDM symbols in the SRS resource.  - SRS bandwidth and , as defined by the higher layer parameter *freqHopping* or *freqHopping-r16* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then= 0.  - Frequency hopping bandwidth~~,~~, as defined by the higher layer parameter *freqHopping* or *freqHopping-r16* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then = 0.  - Defining frequency domain position and configurable shift, as defined by the higher layer parameters *freqDomainPosition* and *freqDomainShift* or *freqDomainShift-r16*, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211]. If *freqDomainPosition* is not configured, *freqDomainPosition* is zero.  - Cyclic shift, as defined by the higher layer parameter *cyclicShift-n2* or *cyclicShift-n4* for transmission comb value 2 or 4for an SRS configured by *SRS-Resource* respectively, and defined by the higher layer parameter *cyclicShift-n2-r16*, *cyclicShift-n4-r16, or cyclicShift-n8-r16* for transmission comb value 2, 4 or 8 for an SRS configured by *SRS-PosResource*, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb value, as defined by the higher layer parameter *transmissionComb* described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb offset, as defined by the higher layer parameter *combOffset-n2* or *combOffset-n4* for transmission comb value 2 or 4 for an SRS configured by *SRS-Resource* respectively, and defined by the higher layer parameter *combOffset-n2-r16*, *combOffset-n4-r16*, or *combOffset-n8-r16* for transmission comb value 2, 4, or 8 for an SRS configured by *SRS-PosResource*, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - SRS sequence ID, as defined by the higher layer parameter *sequenceId* or *sequenceId-r16* in Clause 6.4.1.4 of [4].  …  The UE may be configured by the higher layer parameter resourceMapping in SRS-Resource with an SRS resource occupying  adjacent OFDM symbols within the last 6 symbols of the slot, or at any symbol location within the slot if resourceMapping-r16 is provided subject to UE capability, where all antenna ports of the SRS resources are mapped to each symbol of the resource. When the SRS is configured with the higher layer parameter SRS-PosResourceSet the higher layer parameter resourceMapping-r16 in SRS-PosResource with an SRS resource occupying adjacent symbols anywhere within the slot.  … |

### first round of comments

Companies are encouraged to provide their view on the TP in the table below

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| --- | --- |
| Company | Comment |
| ~~Huawei/HiSilicon~~ | ~~Support.~~ |
| ZTE | Support. |
| OPPO | Ok |
| Nokia/NSB | Okay except for the final part of the final change on ‘-r16’. In our understanding this should be handled in the Alignment CR thread and not discussed in this thread. Recommend the proponent to bring it up in that thread. |
| Vivo | Support |
| Qualcomm | OK |
| CATT | We share the same view with Nokia/NSB. We prefer that the issue of suffix ‘-r16’ can be discussed in corresponding email thread. |
| Apple | Support |
| Huawei/HiSilicon2 | We would like modify our comments for further clarification.  1. In the previous meeting, in other agendas, they made conclusion whether some changes could be included in the alignment CR, and if so FL would report that to the editor, while in positioning, moderator final CRs were agreed, which results in the collision/overlap with the editor CRs. Should positioning follow the same approach?  2. Procedure-wise, is it the best approach for us to directly comment to the thread 104-e-NR-AlignmentCRs-xxx, without discussion under positioning agenda?  In either case, we think that the both the editorial changes can be included in the editor CR. |
| LG | Similar view with Nokia/SNB. It can be handled in Alignment CR. |
| Intel | Support changes. Open to discuss/conclude in either this thread or alignment CR thread whatever is preferred by group. Given that companies have already checked TPs and expressed support maybe it is better to directly agree them in positioning thread. |
| Ericsson | The changes seem mostly editorial, so it could be addressed in alignment CRs. |

### Update #1 on aspect 2.10

Based on the received comments, it seems that all companies commenting agree with the TP, but some companies would prefer to address the issue in alignment CRs. It is proposed to check if the TP can be moved to the alignment CR discussion, or if it should be endorsed in this discussion instead.

1. Aspect 2.10 is treated in alignment CR and the issue closed.

### Second round of comments

Companies are encouraged to provide their view on the proposal in the table below:

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| --- | --- |
| Company | Comment |
| vivo | Given companies have already checked TP and found no technical issues of the text, we prefer to agree them in positioning thread (the same treatment as to change#4 in section 2.4) and no need to duplicate the work again in Alignment CR thread. |

## Aspect 2.11 – Misalignment of dl-PRS-r16 in spatialRelationInfoPos

### Feature Lead Summary

For aperiodic SRS, description of ‘spatialRelationInfoPos’ for aperiodic SRS-PosResourceSet in TS 38.214 was changed as following to align with the parameter in TS38.331, according to the endorsed CR R1-2009778.

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| For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'aperiodic':  …  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* containing the ID of a reference 'ssb-Index', 'ssb-IndexServing-r16' or 'ssb-IndexNcell-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, or of the latest reference aperiodic CSI-RS. If the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'srs' or 'srs-SpatialRelation-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS or of the reference semi-persistent SRS or of the reference aperiodic SRS. When the SRS is configured by the higher layer parameter *SRS-PosResourceSet* and if the higher layer parameter *spatialRelationInfoPos* contains the ID of a reference 'dl-PRS-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS. |

For the description of ‘periodic’ and ‘semi-persistent’ SRS-PosResourceSet, similar descriptions have not been modified. The following TPs are proposed to address this issue[vivo,[2]].

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| --- |
| **TS38.214-g40**  < Unchanged parts are omitted >  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter resourceType in SRS-Resource or SRS-PosResource is set to 'periodic':  -if the UE is configured with the higher layer parameter spatialRelationInfo or spatialRelationInfoPos containing the ID of a reference 'ssb-Index', 'ssb-IndexServing-r16', or 'ssb-IndexNcell-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter spatialRelationInfo or spatialRelationInfoPos contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, if the higher layer parameter spatialRelationInfo or spatialRelationInfoPoscontaining the ID of a reference 'srs' or 'srs-spatialRelation-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS. When the SRS is configured by the higher layer parameter SRS-PosResource and if the higher layer parameter spatialRelationInfoPos contains the ID of a reference ~~'dl-PRS-ResourceId-r16'~~' dl-PRS-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  < Unchanged parts are omitted >  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'semi-persistent':  …  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* containing the ID of a reference 'ssb-Index', 'ssb-IndexServing-r16', or 'ssb-IndexNcell-r16' the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'srs' or 'srs-SpatialRelation-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS or of the reference semi-persistent SRS. When the SRS is configured by the higher layer parameter *SRS-PosResourceSet* and if the higher layer parameter *spatialRelationInfoPos* contains the ID of a reference~~'dl-PRS-ResourceId-r16'~~' dl-PRS-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  < Unchanged parts are omitted > |

### first round of comments

Companies are encouraged to provide their view on the TP in the table below

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support. |
| ZTE | Support |
| OPPO | Ok |
| Nokia/NSB | Support |
| Vivo | Support |
| Qualcomm | OK |
| CATT | Support. |
| Apple | Support |
| LG | Support |
| Intel | Support |
| Ericsson | Support |

### Update #1 on aspect 2.11

Based on the received comments, it is proposed that the TP is endorsed and the issue is closed.

1. TP#2.3.3 below is endorsed:

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| --- |
| **TS38.214-g40**  < Unchanged parts are omitted >  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter resourceType in SRS-Resource or SRS-PosResource is set to 'periodic':  -if the UE is configured with the higher layer parameter spatialRelationInfo or spatialRelationInfoPos containing the ID of a reference 'ssb-Index', 'ssb-IndexServing-r16', or 'ssb-IndexNcell-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter spatialRelationInfo or spatialRelationInfoPos contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, if the higher layer parameter spatialRelationInfo or spatialRelationInfoPoscontaining the ID of a reference 'srs' or 'srs-spatialRelation-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS. When the SRS is configured by the higher layer parameter SRS-PosResource and if the higher layer parameter spatialRelationInfoPos contains the ID of a reference ~~'dl-PRS-ResourceId-r16'~~' dl-PRS-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  < Unchanged parts are omitted >  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'semi-persistent':  …  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* containing the ID of a reference 'ssb-Index', 'ssb-IndexServing-r16', or 'ssb-IndexNcell-r16' the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'srs' or 'srs-SpatialRelation-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS or of the reference semi-persistent SRS. When the SRS is configured by the higher layer parameter *SRS-PosResourceSet* and if the higher layer parameter *spatialRelationInfoPos* contains the ID of a reference~~'dl-PRS-ResourceId-r16'~~' dl-PRS-r16', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  < Unchanged parts are omitted > |

### Second round of comments

Companies are encouraged to provide their view on the proposal in the table below:

|  |  |
| --- | --- |
| Company | Comment |
| vivo | Support |

## Aspect 2.12 – Corrections to Positioning SRS and Higher Layer Parameters

### Feature Lead Summary

In [Huawei, [3]], the corrections to positioning SRS and higher layer parameters are proposed. In summary, the following changes are proposed in draft CR:

* + Change #1: Terminology “cell”, which may be discussed in 2.4
  + Change #2: Clarification of positioning SRS carrier switching
  + Change #3: Fixing “-r16” suffix
  + Change #4: one editorial change below
    - “The UE is only expected to transmit an SRS configured ~~the~~ by the higher layer parameter SRS-PosResource within the active UL BWP of the UE.”

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| 5.1.6.5 PRS reception procedure The UE can be configured with one or more DL PRS resource set configuration(s) as indicated by the higher layer parameters *NR-DL-PRS-ResourceSet* and *NR-DL-PRS-Resource* as defined by Clause 6.4.3 [17, TS 37.355]. Each DL PRS resource set consists of K≥1 DL PRS resource(s) where each has an associated spatial transmission filter. The UE can be configured with one or more DL PRS positioning frequency layer configuration(s) as indicated by the higher layer parameter *NR-DL-PRS-PositioningFrequencyLayer.* A DL PRS positioning frequency layer is defined as a collection of DL PRS resource sets which have common parameters configured by *NR-DL-PRS-PositioningFrequencyLayer*.  The UE assumes that the following parameters for each DL PRS resource(s) are configured via higher layer parameters *NR-DL-PRS-PositioningFrequencyLayer, NR-DL-PRS-ResourceSet* and *NR-DL-PRS-Resource*.  A positioning frequency layer is configured by *NR-DL-PRS-PositioningFrequencyLayer,* consists of one or more DL PRS resource sets and it is defined by:  *- dl-PRS-SubcarrierSpacing* defines the subcarrier spacing for the DL PRS resource. All DL PRS resources and DL PRS resource sets in the same DL PRS positioning frequency layer have the same value of *dl-PRS-SubcarrierSpacing*. The supported values of *dl-PRS-SubcarrierSpacing* are given in Table 4.2-1 of [4, TS38.211].  *- dl-PRS-CyclicPrefix* defines the cyclic prefix for the DL PRS resource. All DL PRS Resources and DL PRS Resource sets in the same DL-PRS-positioningfrequencylayer have the same value of *dl-PRS-CyclicPrefix.* The supported values of *dl-PRS-CyclicPrefix* are given in Table 4.2-1 of [4, TS38.211].  *- dl-PRS-PointA* defines the absolute frequency of the reference resource block. Its lowest subcarrier is also known as Point A. All DL PRS resources belonging to the same DL PRS resource set have common Point A and all DL PRS resources sets belonging to the same DL PRS positioning frequency layer have a common Point A.  The UE expects that it will be configured with *dl-PRS-ID* each of which is defined such that it is associated with multiple DL PRS resource sets from the same point. The UE expects that one of these *dl-PRS-ID* along with a *nr-DL-PRS-ResourceSetID* and a *nr-DL-PRS-ResourceID* can be used to uniquely identify a DL PRS resource.  A DL PRS resource set is configured by *NR-DL-PRS-ResourceSet*, consists of one or more DL PRS resources and it is defined by:  *- nr-DL-PRS-ResourceSetID* defines the identity of the DL PRS resource set configuration.  *- dl-PRS-Periodicity-and-ResourceSetSlotOffset* defines the DL PRS resource periodicity and takes values slots, where for *dl-PRS-SubcarrierSpacing*=15, 30, 60 and 120 kHz respectively and the slot offset for DL PRS resource set with respect to SFN0 slot 0. All the DL PRS resources within one DL PRS resource set are configured with the same DL PRS resource periodicity.  *- dl-PRS-ResourceRepetitionFactor* defines how many times each DL-PRS resource is repeated for a single instance of the DL-PRS resource set and takes values ,. All the DL PRS resources within one resource set have the same resource repetition factor.  *- dl-PRS-ResourceTimeGap* defines the offset in number of slots between two repeated instances of a DL PRS resource with the same *nr-DL-PRS-ResourceSetId* within a single instance of the DL PRS resource set. The UE only expects to be configured with *dl-PRS-ResourceTimeGap* if *dl-PRS-ResourceRepetitionFactor* is configured with value greater than 1. The time duration spanned by one instance of a *nr-DL-PRS-ResourceSet* is not expected to exceed the configured value of DL PRS periodicity. All the DL PRS resources within one resource set have the same value of *dl-PRS-ResourceTimeGap.*  *- dl-PRS-MutingOption1* and *dl-PRS-MutingOption2* define the time locations where the DL PRS resource is expected to not be transmitted for a DL PRS resource set. If *dl-PRS-MutingOption1* is configured, each bit in the bitmap of *dl-PRS-MutingOption1* corresponds to a configurable number provided by higher layer parameter *dl-prs-MutingBitRepetitionFactor* of consecutive instances of a DL PRS resource set where all the DL PRS resources within the set are muted for the instance that is indicated to be muted. The length of the bitmap can be {2, 4, 6, 8, 16, 32} bits. If *dl-PRS-MutingOption2* is configured each bit in the bitmap of *dl-PRS-MutingOption2* corresponds to a single repetition index for each of the DL PRS resources within each instance of a *nr-DL-PRS-ResourceSet* and the length of the bitmap is equal to the values of *dl-PRS-ResourceRepetitionFactor*. Both *dl-PRS-MutingOption1* and *dl-PRS-MutingOption2* may be configured at the same time in which case the logical AND operation is applied to the bit maps as described in Clause 7.4.1.7.4 of [4, TS 38.211].  *- NR-DL-PRS-SFN0-Offset* defines the time offset of the SFN0 slot 0 for the *dl-PRS-ID* with respect to SFN0 slot 0 of the reference.  *- dl-PRS-ResourceList* determines the DL PRS resources that are contained within one DL PRS resource set.  *- dl-PRS-CombSizeN* defines the comb size of a DL PRS resource where the allowable values are given in Clause 7.4.1.7.3 of [TS38.211]. All DL PRS resource sets belonging to the same positioning frequency layer have the same value of *dl-PRS-CombSizeN*.  *- dl-PRS-ResourceBandwidth* defines the number of resource blocks configured for DL PRS transmission. The parameter has a granularity of 4 PRBs with a minimum of 24 PRBs and a maximum of 272 PRBs. All DL PRS resources sets within a positioning frequency layer have the same value of *dl-PRS-ResourceBandwidth*.  *- dl-PRS-StartPRB* defines the starting PRB index of the DL PRS resource with respect to reference Point A, where reference Point A is given by the higher-layer parameter *dl-PRS-PointA*. The starting PRB index has a granularity of one PRB with a minimum value of 0 and a maximum value of 2176 PRBs. All DL PRS resource sets belonging to the same positioning frequency layer have the same value of *dl-PRS-StartPRB*.  *- dl-PRS-NumSymbols* defines the number of symbols of the DL PRS resource within a slot where the allowable values are given in Clause 7.4.1.7.3 of [4, TS38.211].  A DL PRS resource is defined by:  *- nr-DL-PRS-ResourceID* determines the DL PRS resource configuration identity. All DL PRS resource IDs are locally defined within a DL PRS resource set.  *- dl-PRS-SequenceID* is used to initialize cinit value used in pseudo random generator as described in Clause 7.4.1.7.2 [4, TS 38.211] for generation of DL PRS sequence for a given DL PRS resource.  *- dl-PRS-CombSizeN-AndReOffset* defines the starting RE offset of the first symbol within a DL PRS resource in frequency. The relative RE offsets of the remaining symbols within a DL PRS resource are defined based on the initial offset and the rule described in Clause 7.4.1.7.3 of [4, TS 38.211].  *- dl-PRS-ResourceSlotOffset* determines the starting slot of the DL PRS resource with respect to corresponding DL PRS resource set slot offset.  *- dl-PRS-ResourceSymbolOffset* determines the starting symbol of a slot configured with the DL PRS resource.  *- dl-PRS-QCL-Info* defines any quasi co-location information of the DL PRS resource with other reference signals. The DL PRS may be configured with QCL 'typeD' with a DL PRS from a serving cell or a non-serving cell, or with *rs-Type* set to 'typeC', 'typeD', or 'typeC-plus-typeD' with a SS/PBCH Block from a serving or non-serving cell.  The UE assumes constant EPRE is used for all REs of a given DL PRS resource.  The UE may be indicated by the network that DL PRS resource(s) can be used as the reference for the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements in a higher layer parameter *nr-DL-PRS-ReferenceInfo*. The reference indicated by the network to the UE can also be used by the UE to determine how to apply higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncerainty*. The UE expects the reference to be indicated whenever it is expected to receive the DL PRS. This reference provided by *nr-DL-PRS-ReferenceInfo* may include a *dl-PRS-ID*, a DL PRS resource set ID, and optionally a single DL PRS resource ID or a list of DL PRS resource IDs [17, TS 37.355]. The UE may use different DL PRS resources or a different DL PRS resource set to determine the reference for the RSTD measurement as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met. If the UE chooses to use a different reference than indicated by the network, then it is expected to report the *dl-PRS-ID*, the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference.  The UE may be configured to report quality metrics *NR-TimingQuality* corresponding to the DL RSTD and UE Rx-Tx time difference measurements which include the following fields:  *- timingQualityValue* which provides the best estimate of the uncertainty of the measurement  *- timingQualityResolution* which specifies the resolution levels used in the *timingQualityValue* field.  The UE expects to be configured with higher layer parameter *nr-DL-PRS-ExpectedRSTD*, which defines the time difference with respect to the received DL subframe timing the UE is expected to receive DL PRS, and *nr-DL-PRS-ExpectedRSTD-Uncertainty*, which defines a search window around the *nr-DL-PRS-ExpectedRSTD*.  For DL UE positioning measurement reporting in higher layer parameters *NR-DL-TDOA-SignalMeasurementInformation* or *NR-Multi-RTT-SignalMeasurementInformation* the UE can be configured to report the DL PRS resource ID(s) or the DL PRS resource set ID(s) associated with the DL PRS resource(s) or the DL PRS resource set(s) which are used in determining the UE measurements DL RSTD, UE Rx-Tx time difference.  For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE can report an associated higher layer parameter *nr-TimeStamp*. The *nr-TimeStamp* can include the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *nr-DL-PRS-ReferenceInfo*.  The UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP if the measurement is made during a configured measurement gap. When the UE is expected to measure the DL PRS resource outside the active DL BWP it may request a measurement gap in higher layer parameter *MeasGapConfig* [12, TS 38.331].  The UE assumes that the DL PRS from the serving cell is not mapped to any symbol that contains SS/PBCH block from the serving cell. If the time frequency location of the SS/PBCH block transmissions from non-serving cells are provided to the UE then the UE also assumes that the DL PRS from a non-serving cell is not mapped to any symbol that contains the SS/PBCH block of the same non-serving cell.  The UE may be configured to measure and report, subject to UE capability, up to 4 DL RSTD measurements per pair of *dl-PRS-ID* with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those *dl-PRS-ID*. The up to 4 measurements being performed on the same pair of *dl-PRS-ID* and all DL RSTD measurements in the same report use a single reference timing.  The UE may be configured to measure and report, subject to UE capability, up to 8 DL PRS-RSRP measurements on different DL PRS resources associated with the same *dl-PRS-ID*. When the UE reports DL PRS-RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS-RSRP measurements associated with the same higher layer parameter *nr-DL-PRS-RxBeamIndex* [17, TS 37.355] have been performed using the same spatial domain filter for reception if for each *nr-DL-PRS-RxBeamIndex* reported there are at least 2 DL PRS-RSRP measurements associated with it within the DL PRS resource set.  The UE may be configured to measure and report, subject to UE capability, up to 4 UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in different positioning frequency layers.  The UE may be configured to measure and report, subject to UE capability, the timing and the quality metrics of up to 2 additional detected paths that are associated with each RSTD or UE Rx – Tx time difference. The timing of each additional path is reported relative to the path timing used for determining *nr-RSTD* or *nr-UE-RxTxTimeDiff*.  If the UE is configured with *DL-PRS-QCL-Info* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are associated with the same *dl-PRS-ID*. If *DL-PRS-QCL-Info* is configured to the UE with *qcl-Type* set to 'type-D' with a source DL-PRS-Resource then the *nr-DL-PRS-ResourceSetId* and the *nr-DL-PRS-ResourceId* of the source DL PRS resource are expected to be indicated to the UE.  UE is not expected to process DL PRS without configuration of measurement gap.  Within a positioning frequency layer, the DL PRS resources are sorted in the decreasing order of priority for measurement to be performed by the UE, with the reference indicated by *nr-DL-PRS-ReferenceInfo* being the highest priority for measurement, and the following priority is assumed:  - Up to 64 *dl-PRS-ID*s of the frequency layer are sorted according to priority;  - Up to 2 DL PRS resource sets per *dl-PRS-ID* of the frequency layer are sorted according to priority.  For the case when measurement gap is configured, the UE DL PRS processing capability is defined in [TS 37.355]. For the purpose of DL PRS processing capability, the duration *K* msec of DL PRS symbols within *P* msec window corresponding to the maximum PRS periodicity in a positioning frequency layer, is calculated by  *-* Type 1 duration calculation with UE symbol level buffering capability  *-* Type 2 duration calculation with UE slot level buffering capability  *- S* is the set of slots based on the numerology of the DL PRS of a serving cell within the *P* msec window in the positioning frequency layer that contains potential DL PRS resources considering the actual *nr-DL-PRS-ExpectedRSTD*, *nr-DL-PRS-ExpectedRSTD-Uncertainty* provided for each pair of DL PRS Resource Sets.  *-* For Type 1, is the smallest interval in msec within slot corresponding to an integer number of OFDM symbols based on the numerology of the DL PRS of a serving cell that covers the union of the potential PRS symbols and determines the PRS symbol occupancy within slot , where the interval considers the actual *nr-DL-PRS-ExpectedRSTD*, *nr-DL-PRS-ExpectedRSTD-Uncertainty* provided for each pair of DL PRS resource sets (target and reference).  *-* For Type 2, is the numerology of the DL PRS, and is the cardinality of the set .  ====================== Unchanged parts ====================== 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 is configured with the higher layer parameter *SRS-PosResourceSet,* a UE may be configured with 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 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 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).  The following SRS parameters are semi-statically configurable by higher layer parameter *SRS-Resource* or *SRS-PosResource*.  - *srs-ResourceId* or *SRS-PosResourceId* determines SRS resource configuration identity.  - Number of SRS ports as defined by the higher layer parameter *nrofSRS-Ports* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, *nrofSRS-Ports* is 1.  *-* Time domain behaviour of SRS resource configuration as indicated by the higher layer parameter *resourceType*, which may be periodic, semi-persistent, aperiodic SRS transmission as defined in Clause 6.4.1.4 of [4, TS 38.211].  - Slot level periodicity and slot level offset as defined by the higher layer parameters *periodicityAndOffset-p* or *periodicityAndOffset-sp* for an SRS resource of type periodic or semi-persistent. The UE is not expected to be configured with SRS resources in the same SRS resource set *SRS-ResourceSet* or *SRS-PosResourceSet* with different slot level periodicities. For an *SRS-ResourceSet* configured with higher layer parameter *resourceType* set to 'aperiodic', a slot level offset is defined by the higher layer parameter *slotOffset.* For an *SRS-PosResourceSet* configured with higher layer parameter r*esourceType* set to 'aperiodic', the slot level offset is defined by the higher layer parameter *slotOffset* for each SRS resource.  - Number of OFDM symbols in the SRS resource, starting OFDM symbol of the SRS resource within a slot including repetition factor R as defined by the higher layer parameter *resourceMapping* and described in Clause 6.4.1.4 of [4, TS 38.211]. If *R* is not configured, then *R* is equal to the number of OFDM symbols in the SRS resource.  - SRS bandwidth and , as defined by the higher layer parameter *freqHopping* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then= 0.  - Frequency hopping bandwidth, , as defined by the higher layer parameter *freqHopping* and described in Clause 6.4.1.4 of [4, TS 38.211]. If not configured, then = 0.  - Defining frequency domain position and configurable shift, as defined by the higher layer parameters *freqDomainPosition* and *freqDomainShift*, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211]. If *freqDomainPosition* is not configured, *freqDomainPosition* is zero.  - Cyclic shift, as defined by the higher layer parameter *cyclicShift-n2*, *cyclicShift-n4*,or *cyclicShift-n8* for transmission comb value 2, 4 or 8, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb value as defined by the higher layer parameter *transmissionComb* described in Clause 6.4.1.4 of [4, TS 38.211].  - Transmission comb offset as defined by the higher layer parameter *combOffset-n2*, *combOffset-n4*, and *combOffset-n8* for transmission comb value 2, 4, or 8, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  - SRS sequence ID as defined by the higher layer parameter *sequenceId* in Clause 6.4.1.4 of [4].  - The configuration of the spatial relation between a reference RS and the target SRS, where the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos*, if configured, contains the ID of the reference RS. The reference RS may be an SS/PBCH block, CSI-RS configured on serving cell indicated by higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise, or an SRS configured on uplink BWP indicated by the higher layer parameter *uplinkBWP*, and serving cell indicated by the higher layer parameter *servingCellId* if present, same serving cell as the target SRS otherwise. When the target SRS is configured by the higher layer parameter *SRS-PosResourceSet*, the reference RS may also be a DL PRS configured on a serving cell or a non-serving cell indicated by the higher layer parameter *dl-PRS*, or an SS/PBCH block of a non-serving cell indicated by the higher layer parameter *ssb-Ncell*.  The UE may be configured by the higher layer parameter *resourceMapping* in *SRS-Resource* with an SRS resource occupying  adjacent OFDM symbols within the last 6 symbols of the slot, or at any symbol location within the slot if *resourceMapping-r16* is provided subject to UE capability, where all antenna ports of the SRS resources are mapped to each symbol of the resource. When the SRS is configured with the higher layer parameter *SRS-PosResourceSet* the higher layer parameter *resourceMapping* in *SRS-PosResource* with an SRS resource occupying adjacent symbols anywhere within the slot.  If a PUSCH with a priority index 0 and SRS configured by *SRS-Resource* are transmitted in the same slot on a serving cell, the UE may only be configured to transmit SRS after the transmission of the PUSCH and the corresponding DM-RS.  If a PUSCH transmission with a priority index 1 or a PUCCH transmission with a priority index 1 would overlap in time with an SRS transmission on a serving cell, the UE does not transmit the SRS in the overlapping symbol(s).  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'periodic':  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* containing the ID of a reference'ssb-Index', 'ssb-IndexServing', or 'ssb-IndexNcell', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* containing the ID of a reference 'srs' or 'srs-spatialRelation', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS. When the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* contains the ID of a reference 'dl-PRS-ResourceId', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'semi-persistent':  - when a UE receives an activation command, as described in clause 6.1.3.17 or 6.1.3.36 of [10, TS 38.321], for an SRS resource, and when the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the activation command is transmitted in slot *n*, the corresponding actions in [10, TS 38.321] and the UE assumptions on SRS transmission corresponding to the configured SRS resource set shall be applied starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH. The activation command also contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the activated SRS resource set. When the SRS is configured with the higher layer parameter *SRS-ResourceSet*, each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the activation command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the activation command if present, same serving cell and bandwidth part as the SRS resource set otherwise. When the SRS is configured with the higher layer parameter *SRS-PosResourceSet*, each ID in the list of reference signal IDs may refer to a reference SS/PBCH block on a serving or non-serving cell indicated by *PCI* field in the activation command, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the activation command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by Resource *Serving Cell ID* field and *Resource BWP ID* field in the activation command if present, same serving cell and bandwidth part as the SRS resource set otherwise, or DL PRS of a serving or non-serving cell indicated by a higher layer parameter.  - if an SRS resource in the activated resource set is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos*, the UE shall assume that the ID of the reference signal in the activation command overrides the one configured in *spatialRelationInfo* or *spatialRelationInfoPos.*  - when a UE receives a deactivation command [10, TS 38.321] for an activated SRS resource set, and when the UE would transmit a PUCCH with HARQ-ACK information in slot *n* corresponding to the PDSCH carrying the deactivation command, the corresponding actions in [10, TS 38.321] and UE assumption on cessation of SRS transmission corresponding to the deactivated SRS resource set shall apply starting from the first slot that is after slot where ** is the SCS configuration for the PUCCH.  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* containing the ID of a reference 'ssb-Index', 'ssb-IndexServing', or 'ssb-IndexNcell' the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'srs' or 'srs-SpatialRelation', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS or of the reference semi-persistent SRS. When the SRS is configured by the higher layer parameter *SRS-PosResourceSet* and if the higher layer parameter *spatialRelationInfoPos* contains the ID of a reference 'dl-PRS-ResourceId', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  If the UE has an active semi-persistent SRS resource configuration and has not received a deactivation command, the semi-persistent SRS configuration is considered to be active in the UL BWP which is active, otherwise it is considered suspended.  For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource* is set to 'aperiodic':  - the UE receives a configuration of SRS resource sets,  - the UE receives a downlink DCI, a group common DCI, or an uplink DCI based command where a codepoint of the DCI may trigger one or more SRS resource set(s). For SRS in a resource set with usage set to 'codebook' or 'antennaSwitching', the minimal time interval between the last symbol of the PDCCH triggering the aperiodic SRS transmission and the first symbol of SRS resource is *N2*  symbols and an additional time duration *Tswitch*. Otherwise, the minimal time interval between the last symbol of the PDCCH triggering the aperiodic SRS transmission and the first symbol of SRS resource is *N2* +14 symbols and an additional time duration *Tswitch*. The minimal time interval unit of OFDM symbol is counted based on the minimum subcarrier spacing given by min(*µPDCCH, µUL*) where *µUL* is given by min(*µUL,carrier1, µUL,carrier2, µSRS*) when the UE is configured with the higher layer parameter *uplinkTxSwitchingOption* set to 'dualUL' for uplink carrier aggregation, and by *µSRS*otherwise. *µSRS* and *µPDCCH*are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively.  - *Tswitch*, *µUL,carrier1* and *µUL,carrier2* are defined in clause 6.4.  - If the UE receives the DCI triggering aperiodic SRS in slot *n* and except when SRS is configured with the higher layer parameter *SRS-PosResource*, the UE transmits aperiodic SRS in each of the triggered SRS resource set(s) in slot , if UE is configured with ca-SlotOffset for at least one of the triggered and triggering cell, *Ks* =, otherwise, and where  *- k* is configured via higher layer parameter *slotOffset* for each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission, *µSRS* and *µPDCCH* are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively;  - and are the and the, respectively, which are determined by higher-layer configured ca-SlotOffset for the cell receiving the PDCCH, and are the  and the , respectively, which are determined by higher-layer configured ca-SlotOffset for the cell transmitting the SRS, as defined in [4, TS 38.211] clause 4.5.  - If the UE receives the DCI triggering aperiodic SRS in slot *n* and when SRS is configured with the higher layer parameter *SRS-PosResource*, the UE transmits every aperiodic SRS resource in each of the triggered SRS resource set(s) in slot , if UE is configured with ca-SlotOffset for at least one of the triggered and triggering cell, *Ks* =, otherwise, and where  *- k* is configured via higher layer parameter *slotOffset* for each aperiodic SRS resource in each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission, *µSRS* and *µPDCCH* are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively;  - and are the and the, respectively, which are determined by higher-layer configured ca-SlotOffset for the cell receiving the PDCCH, and are the  and the , respectively, which are determined by higher-layer configured ca-SlotOffset for the cell transmitting the SRS, as defined in [4, TS 38.211] clause 4.5.  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* containing the ID of a reference 'ssb-Index', 'ssb-IndexServing' or 'ssb-IndexNcell', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference SS/PBCH block, if the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'csi-RS-Index' or 'csi-RS-IndexServing', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference periodic CSI-RS or of the reference semi-persistent CSI-RS, or of the latest reference aperiodic CSI-RS. If the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos* contains the ID of a reference 'srs' or 'srs-SpatialRelation', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the transmission of the reference periodic SRS or of the reference semi-persistent SRS or of the reference aperiodic SRS. When the SRS is configured by the higher layer parameter *SRS-PosResourceSet* and if the higher layer parameter *spatialRelationInfoPos* contains the ID of a reference 'dl-PRS', the UE shall transmit the target SRS resource with the same spatial domain transmission filter used for the reception of the reference DL PRS.  - when a UE receives an spatial relation update command, as described in clause 6.1.3.26 of [10, TS 38.321], for an SRS resource configured with the higher layer parameter *SRS-Resource*, and when the HARQ-ACK corresponding to the PDSCH carrying the update command is transmitted in slot *n*, the corresponding actions in [10, TS 38.321] and the UE assumptions on updating spatial relation for the SRS resource shall be applied for SRS transmission starting from the first slot that is after slot The update command contains spatial relation assumptions provided by a list of references to reference signal IDs, one per element of the updated SRS resource set. Each ID in the list refers to a reference SS/PBCH block, NZP CSI-RS resource configured on serving cell indicated by *Resource Serving Cell ID* field in the update command if present, same serving cell as the SRS resource set otherwise, or SRS resource configured on serving cell and uplink bandwidth part indicated by *Resource* *Serving Cell ID* field and *Resource BWP ID* field in the update command if present, same serving cell and bandwidth part as the SRS resource set otherwise. When the UE is configured with the higher layer parameter *usage* in *SRS-ResourceSet* set to 'antennaSwitching', the UE shall not expect to be configured with different spatial relations for SRS resources in the same SRS resource set.  ====================== Unchanged parts ====================== 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.  The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.  If the UE is not configured with the higher layer parameter *spatialRelationInfoPos* the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter *SRS-PosResource* across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources.  The UE is only expected to transmit an SRS configured by the higher layer parameter *SRS-PosResource* within the active UL BWP of the UE.  When the configuration of SRS is done by the higher layer parameter *SRS-PosResource*, the UE can only be provided with a single RS source in *spatialRelationInfoPos* per SRS resource for positioning.  For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.  The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission. |

### first round of comments

Companies are encouraged to provide their view on the TP in the tables below. Note there is a separate table to comment on each proposed change.

**Change #1**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support.  The following change has overlapping in Pos-01.  The UE expects that it will be configured with *dl-PRS-ID* each of which is defined such that it is associated with multiple DL PRS resource sets from the same point. |
| ZTE | It can be discussed together in [104-e-NR-Pos-01]. |
| OPPO | 1. Regarding the following change:   “The UE expects that it will be configured with *dl-PRS-ID* each of which is defined such that it is associated with multiple DL PRS resource sets from the same point.”  Suggest to discuss it in Pos-01 and the change we preferred is:  The UE expects that it will be configured with *dl-PRS-ID* each of which is defined such that it is associated with multiple DL PRS resource sets. |
| Nokia/NSB | Suggest to stop discussion here and take it up with [104-e-NR-Pos-01]. |
| vivo | As mentioned by other companies, we also prefer to discuss in [104-e-NR-Pos-01]. |
| Qualcomm | Discuss in 01 |
| CATT | We prefer to discuss this issue in Pos-01. |
| Apple | Similar view as majority to be discussed in Pos-01 |
| Huawei/HiSilicon | OK to discuss it in Pos-01. |
| LG | Prefer to discuss this in Pos-01 |
| Intel | OK to handle in thread Pos-01 |

**Change #2**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support. |
| ZTE | Support. |
| OPPO | We prefer the following change, which is simpler:  The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell not configured for PUSCH/PUCCH transmission. |
| Vivo | OK |
| Qualcomm | OK |
| CATT | Support. |
| Apple | Support |
| Huawei/HiSilicon | To OPPO, we think that configuring SRS on SUL not configured for PUSCH/PUCCH transmission should be allowed, as it is not carrier switching, since it is not comprised of DL and UL symbols. |
| Intel | OK |

**Change #3**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support. |
| ZTE | The alignment CR will be initiated by editors, so it’s better to be treated by the corresponding email thread.   |  | | --- | | [104-e-NR-AlignmentCRs-xxx] Email discussion/approval regarding Rel-16 alignment CRs till 2/2 (editors)   * Where xxx is the spec #. * Including inputs in [R1-2100256](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2100256.zip) for 38.211 | |
| OPPO | Ok |
| Nokia/NSB | Agree with ZTE. This should not be discussed in this thread. |
| vivo | We don’t support all these removals of ‘–r16’.  Current TS 38.331 still has those ‘-r16’ affix for all those IEs related to *SRS-PosResource.* For future specification alignment, that can be handled by the editors in general.  At the beginning of the related paragraph, it says “The following SRS parameters are semi-statically configurable by higher layer parameter *SRS-Resource* or *SRS-PosResource*.”. There’re several places where the proposed changes actually cause confusion. For instance, the following:  Cyclic shift, as defined by the higher layer parameter *cyclicShift-n2*, *cyclicShift-n4*,or *cyclicShift-n8* for transmission comb value 2, 4 or 8, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  Transmission comb offset as defined by the higher layer parameter *combOffset-n2*, *combOffset-n4*, and *combOffset-n8* for transmission comb value 2, 4, or 8, respectively, and described in Clause 6.4.1.4 of [4, TS 38.211].  We don’t think cyclicshift-n8 and/or combOffset-n8 should apply to normal *SRS-Resource.* |
| Qualcomm | Same view as ZTE and Nokia |
| CATT | We share the same view with ZTE, Nokia and Qualcomm. This issue can be discussed in corresponding email thread. |
| LG | We have similar view with ZTE. |
| Intel | Support changes. It is OK to discuss under [104-e-NR-AlignmentCRs-xxx] |

**Change #4**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support. |
| ZTE | Support. |
| OPPO | Ok |
| Nokia/NSB | Support. |
| vivo | Support |
| Qualcomm | OK |
| CATT | Support. |
| Apple | Support |
| LG | Support |
| Intel | Support |
| Ericsson | Support |

### Update #1 on aspect 2.12

Based on the received comments, the following is proposed:

* Change#1: the issue is closed and discussion is moved to the 104-e-NR-Pos-01 thread.
* Change#2: the issue is closed and the TP agreed.
* Change#3: the issue is closed and left to the alignment CR discussion.
* Change#4: the issue is closed and the TP is agreed.

1. TP#2.4.3 below is endorsed:

|  |
| --- |
| TP#2.4.36.2.1.4 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.  The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.  If the UE is not configured with the higher layer parameter *spatialRelationInfoPos* the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter *SRS-PosResource* across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources.  The UE is only expected to transmit an SRS configured by the higher layer parameter *SRS-PosResource* within the active UL BWP of the UE.  When the configuration of SRS is done by the higher layer parameter *SRS-PosResource*, the UE can only be provided with a single RS source in *spatialRelationInfoPos* per SRS resource for positioning.  For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.  The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission. |

### Second round of comments

Companies are encouraged to provide their view on the proposal in the table below:

|  |  |
| --- | --- |
| Company | Comment |
| vivo | Support |

# Conclusion

1. References
2. R1-2100282 Maintenance of NR positioning support ZTE
3. R1-2100419 Maintenance on Rel-16 NR positioning vivo
4. R1-2101731 Corrections to positioning SRS and higher layer parameters Huawei, HiSilicon
5. R1-210zzzz Feature Leads Summary for NR Positioning Maintenance – AI 7.2.8