3GPP TSG-RAN WG1 Meeting #100-e R1-200NNNN

e-Meeting, May 25th –June 5th, 2020

Agenda Item: 7.2.8.2

Source: Moderator (Ericsson)

Title: Output of email discussion [101-e-NR-Pos-02] on DL PRS and UL SRS for NR positioning in rel16 maintenance

Document for: Discussion

# Introduction

This document is a summary of the email discussion [101-e-NR-Pos-02] on DL PRS and UL SRS for NR positioning in rel16 maintenance. The topics were decided as stated in the chairman’s notes:

[101-e-NR-Pos-02] Email discussion/approval on DL and UL PRS for NR positioning focusing on the following until 5/29; if necessary, endorse associated TPs by 6/4 – Florent (Ericsson)

* From summary on DL PRS (R1-2004726)
  + TPs with corrections to the TS 38.211 (4-1, 7-1, 8-2, 10-1, 10-2) and TS 38.214 (4-3, 7-2, 10-3), that are editorial in nature. The aspects 4-3 and 10-3 address the same section and can be merged in one TP.
  + DL PRS processing order (3-6, 8-1, 9-4)
* From summary on UL PRS (R1-2004718):
  + Parameter level of a reference signal of spatialRelationInfo (Issue 1)
  + Aperiodic SRS for positioning in release 16 (Issue 2, 6)
  + Spatial relation of SRS positioning (Issue 4)
  + SRS collisions (Issues 5a, 5b)
  + TPs with corrections to 38.211 (Issue 8), 38.213 (Issue 9), 38.214 (Issue 7)
  + Simultaneous transmission of SRS-mimo and SRS-pos in CA (Issue 15)

The discussion is organized between DL issues, UL issues, corrections regarding the DL PRS and corrections regarding the UL SRS.

# DL PRS maintenance issues

## DL PRS processing order

### Proposals

#### Aspect 9-4. DL PRS processing order

DL-PRS Resources in the assistance data are sorted in a decreasing order of measurement priority. Specifically, according to the current RAN2 structure of the assistance data, the following priority is assumed:

* the 4 frequency layers are sorted according to priority,
* the 64 TRPs per frequency layer are sorted according to priority,
* the 2 sets per TRP of the frequency layer are sorted according to priority,
* the 64 resources of the set per TRP per frequency layer are sorted according to priority.

Feature lead response:

* RAN1 needs to make some agreement on raised aspect
* The discussion on similar topic is in the following aspects:
  + Aspect 3-5. DL PRS processing configuration
  + Aspect 8-1. It is proposed for the case that measurement gap is not configured and the configured PRS resources exceed the UE’s DL PRS processing capability, which PRS resources to be measured is up to UE implementation.

The initial proposal from [21] is

1. Proposal 4. When a UE is configured in the assistance data of a positioning method with a number of PRS resources beyond its capability (FG 13-2,13-3,13-4 for AoD, TDOA, MRTT respectively), the UE assumes the DL-PRS Resources in the assistance data are sorted in a decreasing order of measurement priority. Specifically, according to the current RAN2 structure of the assistance data, the following priority is assumed:
   1. the 4 frequency layers are sorted according to priority,
   2. the 64 TRPs per frequency layer are sorted according to priority,
   3. the 2 sets per TRP of the frequency layer are sorted according to priority,
   4. the 64 resources of the set per TRP per frequency layer are sorted according to priority.

#### Aspect 3-6. TP on DL PRS configuration priority

Discuss priority for DL PRS configuration and provides related TP to clause 5.1.6.5 of TS 38.214.

Feature lead response:

* Further discussion is needed on DL PRS processing order and if it is agreed on relevant TP.

The initial proposal from [15] is as follow (FL note: slight rewording to allow identifying the TP in the email discussion)

1. Endorse TP#1 to clause 5.1.6.5 of TS 38.214.

TP 1 on PRS configuration priority

|  |
| --- |
| ===================== Unchanged parts are omitted ======================  If UE reports DL PRS resource capability for a positioning method in higher layer parameters [XX], and if UE is provided by the higher layers to receive PRS, UE is only expected to measure the DL PRS resources selected according to the following steps:  *-* Step.1 Select the first [X1] positioning frequency layers that does not exceed the higher layer parameter [YY1];  *-* Step.2 Select the first [X6] positioning nodes within all [X1] positioning frequency layers that does not exceed the higher layer parameter [YY6];  *-* Step.3 Select the first [X3] DL PRS resource sets within each positioning node on each positioning frequency layer from the X6 positioning nodes that does not exceed the higher layer parameter [YY3];  *-* Step.4 Select the first [X4] DL PRS resources within each DL PRS resource sets from the [X3] DL PRS resource sets that does not exceed the higher layer parameter [YY4];  *-* Step.5 Select the first [X7] DL PRS resources in the order of positioning node, DL PRS resource set, and DL PRS resource within a positioning frequency layer so that they do not exceed the higher layer parameter [YY7];  *-* Step.6 Select the first [X5] DL PRS resources in the order of positioning frequency layer, positioning node, DL PRS resource set, and DL PRS resource across all positioning frequency layers so that they do not exceed the higher layer parameter [YY5].  ===================== Unchanged parts are omitted ====================== |

### Feature lead summary and proposals:

Both proposal 1 and 2 provide a similar approach on how to handle prioritizing the PRS when the configuration exceeds the UE capability. If proposal 1 is agreeable, then the TP from proposal 2 can be discussed to capture the agreement in RAN1 specifications

Feature lead proposal#1: discuss proposal 1 during the first week (i.e. until 5/29) of the meeting and, if agreed, proceed to discuss the TP impact based on the TP in proposal 2 in the second week (i.e. from 6/1 to 6/5).

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | We just want to make sure that the consequence prioritization in section 2.1.1.1 is that UE will only process the prioritized PRS within its capability? If so, we support proposal 1, and TP in proposal 2. |

### Conclusions

TBD

## Processing of PRS without measurement gaps

### Aspect 8-1. DL PRS processing capability for the case w/o MG configured

It is proposed to not support DL PRS processing capability for the case without measurement gap. In case that measurement gap is not configured and the configured PRS resources exceed the UE’s DL PRS processing capability, which PRS resources to be measured is up to UE implementation.

Feature lead response:

* Aspect require RAN1 discussion and conclusion
* TBD whether it is to be discussed in DL PRS AI or under UE feature list

The initial proposal in [20] is as follow

1. Not support to define DL PRS processing capability especially for the case without measurement gap
   1. In case that measurement gap is not configured and the configured PRS resources exceed the UE’s DL PRS processing capability, which PRS resources to be measured is up to UE implementation.

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | If we go with this proposal, we should send an LS to RAN4 not to define requirements for PRS measurement without gap. |

### Conclusions

TBD

# UL SRS maintenance issues

## Parameter level of a reference signal of spatialRelationInfo

### proposals

The following proposals are made in [1] regarding the reference for the DL PRS in *spatialRelationInfo*

1. Change ’DL-PRS-ResourceId’ to ’dl-PRS-r16’.
2. Adopt the following text proposal into TS 38.214 for a reference ’dl-PRS-r16’.

TP 2

|  |
| --- |
| *TS 38.214-g10*  *6.2.1 UE sounding procedure*  < Unchanged parts are omitted >  - if the UE is configured with the higher layer parameter *spatialRelationInfo* containing the ID of a reference'ssb-Index', 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* contains the ID of a reference 'csi-RS-Index', 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* containing the ID of a reference 'srs', 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-r16* ~~[SRS-for-positioning]~~ and if the higher layer parameter *spatialRelationInfo* contains the ID of a reference ’*dl-PRS-r16~~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.  < Unchanged parts are omitted > |

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | We do not see a strong reason to change '*DL-PRS-ResourceId*' to ‘dl-PRS-r16’; rather, we think it should be changed to '*dl-PRS-ResourceId-r16*' (as mentioned in TP 21 in Section 5.3.1.2). Note that only ‘ssb-index’ and ‘csi-RS-Index’ are used in Rel-15 to refer to the spatialRelationInfo in38.214. We prefer to use a similar approach and only mention the index of the spatialRelationInfo RS in 38.214. Also, if DL PRS is used as a spatialRelationInfo RS, for a given SRS resource, there is only ONE ‘dl-PRS-16’ configured which includes only ONE ‘dl-PRS-ResourceId-r16’. Therefore, there is a one to one mapping between ‘dl-PRS-16’ and ‘dl-PRS-ResourceId-r16’ within the SRS resource configuration and no confusion occurs if ‘dl-PRS-ResourceId-r16’ is kept in this part of the specification.  Also, this TP (TP2) concerns a part of the text in Clause 6.2.1 of 38.214 that TP 21 in Section 5.3.1.2 has covered. Multiple other changes in this part of the text are necessary that are not covered in TP2. |

### Conclusions

TBD

## Aperiodic SRS for positioning in release 16 (issue 2, ,6)

### Proposals:

3 contributions [2][9][11] discuss the issue of aperiodic SRS for positioning triggered with DCI format 2\_3.

#### Parameter alignments for aperiodic SRS

The first proposal is a TP to align parameter alignment [2] (FL note: proposal was edited to allow tracking the TPs in the summary).

1. Adopt the TP in TP#3.

TP 3 : changes to table for SRS request in 38.212

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| =====================TS 38.212 clause 7.3.1.1.2 unchanged parts omitted=========================  Table 7.3.1.1.2-24: SRS request   |  |  |  | | --- | --- | --- | | Value of SRS request field | Triggered aperiodic SRS resource set(s) for DCI format 0\_1, 0\_2, 1\_1, 1\_2, and 2\_3 configured with higher layer parameter *srs-TPC-PDCCH-Group* set to 'typeB' | Triggered aperiodic SRS resource set(s) for DCI format 2\_3 configured with higher layer parameter *srs-TPC-PDCCH-Group* set to 'typeA' | | 00 | No aperiodic SRS resource set triggered | No aperiodic SRS resource set triggered | | 01 | SRS resource set(s) configured by *SRS-ResourceSet* with higher layer parameter *aperiodicSRS-ResourceTrigger* set to 1 or an entry in *aperiodicSRS-ResourceTriggerList* set to 1  SRS resource set(s) configured by *SRS-PosResourceSet-16* with an entry in *aperiodicSRS-ResourceTriggerList-r16* set to 1 | SRS resource set(s) configured with higher layer parameter *usage* in *SRS-ResourceSet* set to '*antennaSwitching*' and *resourceType* in *SRS-ResourceSet* set to 'aperiodic' for a 1st set of serving cells configured by higher layers, or  SRS resource set(s) configured by *SRS-PosResourceSet-r16* and *resourceType* in *SRS-PosResourceSet-r16* set to 'aperiodic' for a 1st set of serving cells configured by higher layers | | 10 | SRS resource set(s) configured by *SRS-ResourceSet* with higher layer parameter *aperiodicSRS-ResourceTrigger* set to 2 or an entry in *aperiodicSRS-ResourceTriggerList* set to 2  SRS resource set(s) configured by *SRS-PosResourceSet-r16* with an entry in *aperiodicSRS-ResourceTriggerList-r16* set to 2 | SRS resource set(s) configured with higher layer parameter *usage* in *SRS-ResourceSet* set to '*antennaSwitching*' and *resourceType* in *SRS-ResourceSet* set to 'aperiodic' for a 2nd set of serving cells configured by higher layers, or  SRS resource set(s) configured by *SRS-PosResourceSet-r16* and *resourceType* in *SRS-PosResourceSet-r16* set to 'aperiodic' for a 2nd set of serving cells configured by higher layers | | 11 | SRS resource set(s) configured by *SRS-ResourceSet* with higher layer parameter *aperiodicSRS-ResourceTrigger* set to 3 or an entry in *aperiodicSRS-ResourceTriggerList* set to 3  SRS resource set(s) configured by *SRS-PosResourceSet-16* with an entry in *aperiodicSRS-ResourceTriggerList-r16* set to 3 | SRS resource set(s) configured with higher layer parameter *usage* in *SRS-ResourceSet* set to '*antennaSwitching*' and *resourceType* in *SRS-ResourceSet* set to 'aperiodic' for a 3rd set of serving cells configured by higher layers, or  SRS resource set(s) configured by *SRS-PosResourceSet-r16* and *resourceType* in *SRS-PosResourceSet-r16* set to 'aperiodic' for a 3rd set of serving cells configured by higher layers |   ==================================unchanged parts omitted=============================== |

#### Triggering of Aperiodic SRS with DCI 2\_3

In [9], the proposal is to support Aperiodic SRS for antenna switching and SRS for positioning can be triggered with ‘DCI format 2\_3

1. Both Aperiodic SRS for antenna switching and SRS for positioning can be triggered with ‘DCI format 2\_3.

* ***With regards to ‘Type-A’ triggering,*** 
  + ***Update 38.212 Table 7.3.1.1.2-24 by removing the “or” in the corresponding column between the SRS for antenna switching and SRS for positioning.***
  + ***Update the following text in 38.214 Section 6.2.1.3***

|  |
| --- |
| *For an aperiodic SRS triggered in DCI format 2\_3 and if the UE is configured with higher layer parameter srs-TPC-PDCCH-Group set to 'typeA', and given by SRS-CarrierSwitching, without PUSCH/PUCCH transmission, the order of the triggered SRS transmission on the serving cells follow the order of the serving cells in the indicated set of serving cells configured by higher layers, where the UE in each serving cell transmits the configured one or two SRS resource set(s) with higher layer parameter usage set to 'antennaSwitching', and any SRS resource set(s)* *configured* by *SRS-PosResourceSet, ~~and~~ with higher layer parameter resourceType in SRS-ResourceSet, or SRS-PosResourceSet, set to 'aperiodic'.* |

* ***With regards to ‘Type-B’ triggering, update the following text in 38.214 Section 6.2.1.3***

|  |
| --- |
| *For an aperiodic SRS triggered in DCI format 2\_3 and if the UE is configured with higher layer parameter srs-TPC-PDCCH-Group set to 'typeB' without PUSCH/PUCCH transmission, the order of the triggered SRS transmission on the serving cells follow the order of the serving cells with aperiodic SRS triggered in the DCI, and the UE in each serving cell transmits the configured one or two SRS resource set(s) with higher layer parameter usage set to 'antennaSwitching', and any SRS resource set(s)* *configured* by *SRS-PosResourceSet, ~~and~~ with higher layer parameter resourceType in SRS-ResourceSet, or SRS-PosResourceSet, set to 'aperiodic'.* |

In [11], it is proposed to discuss whether to support DCI triggering for both Aperiodic SRS for antenna switching and SRS for positioning in DCI 2\_3, or to only support either in a given codepoint.

1. Discuss whether option 1 or option 2 apply for aperiodic SRS

Option 1: An aperiodic SRS code point can be configured to trigger both one or several *SRS-ResourceSet* AND one or several *SRS-PosResourceSet* with the same value. Both the SRS configured in *SRS-ResourceSet* and the SRS configured by *SRS-PosResourceSet* can be transmitted.

Option 2: an aperiodic SRS code point can be configured to trigger either one or several SRS*-ResourceSet* OR one or several *SRS-PosResourceSet* with the same codepoint value. Either the SRS(s) configured by SRS*-ResourceSet* or the SRS configured by *SRS-PosResourceSet* are transmitted, but they cannot be configured to be transmitted from the same codepoint.

### Feature lead proposal

Companies are encouraged to give their view on the TP#2 from proposal 6, and discuss the issues corresponding to proposal 7 and 8. Since proposal 7 is corresponding to option 1 in proposal 8, proposal 8 can be discussed as a starting point.

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | We prefer Option 1; Option 2 can be realized by gNB implementation by configuration, e.g. assigning code-point.  We also defined collision rule between mimo-SRS and pos-SRS, and we do not see issue from UE implementation when both are triggered non-overlappingly. |

### Conclusions

TBD

## Spatial relation of SRS positioning

### Proposals

This discussion is for an alignment TP based on T2 and T3 in [3]. This TP propose to align 38.214 with 38.321 with respects to the spatial relationship.

1. Support the following TP for Clause 6.2.1 for 38.214.

TP 4 for Clause 6.2.1 for 38.214.

|  |
| --- |
| **<Unchanged part 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-r16* 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 *μ* 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-r16*, 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.  **<Unchanged part omitted>**  - when a UE receives an spatial relation update command, as described in clause 6.1.3.xx 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. |

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support the TP.  The first part of the TP (before <Unchanged part omitted>) concerns semi-persistent SRS for positioning. The MAC CE indication/update of the source spatial relation RS for semi-persistent SRS for positioning and MIMO SRS have some differences in 38.321 as follows   * When the indicated source spatial relation is a SSB, the corresponding cell is optionally indicated by a 5 bit *Resource Serving Cell ID* field for MIMO SRS but it is indicated by a 10 bit *PCI* field for SRS for positioning (see 38.321 Clauses 6.1.3.17 and 6.1.3.36). * When the cell corresponding to the source spatial relation SSB is the same as the serving cell of the target MIMO SRS resource, *Resource Serving Cell ID* field is not indicated. However, indicating *PCI* for the source spatial relation SSB for SRS for positioning is mandatory.   The first part of the TP corrects the current spec and clarifies this issue.  The second part of the TP (after <Unchanged part omitted>) concerns aperiodic SRS. The support for aperiodic SRS for positioning is under discussion in RAN3 and even if it will be supported in Rel-16, RAN1 has not agreed that source spatial relation update in MAC CE for aperiodic MIMO SRS is also applicable to aperiodic SRS for positioning. Even if RAN3 agree to support aperiodic SRS for positioning and RAN1 agree that source spatial relation update in MAC CE for aperiodic MIMO SRS is also applicable to aperiodic SRS for positioning, then RAN2 needs to design a new MAC CE to support spatial relation update of aperiodic SRS for positioning as the current MAC CE to support spatial relation update of aperiodic MIMO SRS cannot be directly used to aperiodic SRS for positioning (similar to the case of semi-persistent MIMO SRS vs. semi-persistent SRS for positioning). In any case, it should be clarified that the corresponding text in 38.214 is only applicable to SRS resource configured with the higher layer parameter *SRS-Resource*. |

### Conclusions

TBD

## SRS collisions (issue 5a, b)

### Proposals

The proposal T4 in [3] is a clarification of the collision rule between PUSCH and the SRS for positioning. the associated text proposal clarifies that the collision rule applies for operations in the same carrier.

1. Support the following TP for Clause 6.2.1.4 for 38.214.

TP 5 for Clause 6.2.1.4 for 38.214.

|  |
| --- |
| **<Unchanged part omitted>**  For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource-r16* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.  **<Unchanged part omitted>** |

The proposal for TP-A in [4] is to reword single carrier operations to “operations on the same carriers”

1. Adopt the following text proposal (TP-A) for simultaneous SRS-Pos transmission in a single symbol in 38.214:

TP 6 for Clause 6.2.1.4 for 38.214.

|  |
| --- |
| *-----------------------------------------------Start of Text Proposal for 38.214----------------------------------------------*  6.2.1.4 UE sounding procedure for positioning purposes  *-----------------------------------------------------* Unchanged part omitted *------------------------------------------------*  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-r16* with *resourceType* of the SRS resources as ‘periodic’.  For operations in the same carrier, the UE is not expected to be triggered to transmit SRS on overlapping symbols with more than one SRS resources configured by the higher layer parameter *srs-PosResource-r16* with *resourceType* of the SRS resources as ‘semi-persistent’ or ‘aperiodic’.  *-----------------------------------------------------* Unchanged part omitted *------------------------------------------------ --------------------------------------------------------End of Text Proposal --------------------------------------------------* |

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | We support TP 5.  As discussed in [3], if the clarification is not made that dropping the colliding SRS symbols only applies to operation on the same carrier, then the original text in the spec in TP 5 would remain contradicting with the following part of the spec:   |  | | --- | | 38.214 Clause 6.2.1:  In case of intra-band carrier aggregation or in inter-band CA band-band combination where simultaneous SRS and PUCCH/PUSCH transmissions are not allowed, a UE is not expected to be configured with SRS from a carrier and PUSCH/UL DM-RS/UL PT-RS/PUCCH formats from a different carrier in the same symbol. |   Above text in the box says that UE is not expected to be configured with SRS from a carrier and PUSCH from a different carrier in the same symbol in Intra-band CA or Inter-band CA band-band combination where simultaneous SRS and PUSCH transmissions are not allowed (such simultaneous configuration is an “error case” and cannot be handled just by dropping colliding SRS symbols).  We support TP 6. |

### Conclusions

TBD

## Simultaneous transmission of SRS-mimo and SRS-pos in CA (issue 15)

The following is proposed in [8].

1. For intra-band and inter-band CA operations, support the simultaneous transmission of SRS resource for positioning and SRS resource for MIMO.

For intra-band and inter-band CA operations, a UE can simultaneously transmit more than one SRS resources configured by SRS-PosResource-r16 and SRS-Resource on different CCs, subject to UE’s capability

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support. |

### Conclusions

TBD

# DL PRS corrections

## Aspect 4-1. Extension to the case of multiple serving cells

### Proposal:

The TS 38.211 does not capture the case when there is more than one serving cell. Thus, it is proposed to make the following correction to cover the case when there is more than one serving cell[16].

TP 7

|  |
| --- |
| **TS 38.211 Clause 7.4.1.7.3 Mapping to physical resources in a downlink PRS resource** […]  - the resource element is within the resource blocks occupied by the downlink PRS resource for which the UE is configured;  - the symbol is not used by any SS/PBCH block used by ~~the~~ a serving cell for downlink PRS transmitted from the same serving cell or any SS/PBCH block from a non-serving cell indicated by the higher-layer parameter *ssb-PositionsInBurst-r16* for downlink PRS transmitted from the same non-serving cell;  - the slot number satisfies the conditions in clause 7.4.1.7.4.   * […] |

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support. |

### Conclusions

TBD

## Aspect 7-1 and 10-1. Change the higher layer parameter of combOffset to dl-PRS-ReOffset-r16

### Proposals:

Two proposals with the same TP impact where proposed to align the name for comb offset to the correct IE[19][22]:

TP 8

|  |
| --- |
| **In TS 38.211 Section 7.4.1.7**  - the comb size is given by the higher-layer parameter *dl-PRS-CombSizeN-r16* such that the - combination is one of {2, 2},{4, 2}, {6, 2}, {12, 2}, {4, 4}, {12, 4}, {6, 6}, {12, 6} and {12, 12};  - the resource-element offset is given by the higher-layer parameter *~~combOffset~~ dl-PRS-ReOffset-r16*;  - the quantity is given by Table 7.4.1.7.3-1. |

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | OK. |

### Conclusions

TBD

## Aspect 8-2. Clarification on dl-PRS-ResourceSymbolOffset-r16

### Proposal

It is proposed to adopt the following TP on Section 5.1.6.5 of TS 38.214 + add spacing after parameter names[22]

TP 9

|  |
| --- |
| 5.1.6.5 PRS reception procedure  ---- Unchanged parts are omitted ----  *- dl-PRS-ResourceSymbolOffset-r16* determines the starting symbol of a slot configured with the DL PRS resource.  ---- Unchanged parts are omitted ---- |

Feature lead response:

* Seems more accurate wording is proposed in this editorial correction

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | OK. |

### Conclusions

TBD

## Aspect 10-2. TP on PRS muting to the TS 38.211 Section 7.4.1.7.4

### Proposal:

Proposed TP aligns RAN1 specification with RAN2 specification[22]

TP 10

|  |
| --- |
| TS 38.211  7.4.1.7.4 Mapping to slots in a downlink PRS resource set  \*\*\*\*\* unchanged text is omitted \*\*\*\*\*\*\*\*\*\*\*  - the higher-layer parameter *mutingOption1-r16~~DL-PRS-MutingPattern~~* is provided ~~and~~ with bitmap but ~~not~~ *mutingOption2-r16* with bitmap is not provided, and bit is set;  - the higher-layer parameter *mutingOption2-r16~~DL-PRS-MutingPattern~~*is provided ~~and~~ with bitmap but not *mutingOption1-r16* with bitmap is provided, and bit is set;  \*\*\*\*\* unchanged text is omitted \*\*\*\*\*\*\*\*\*\*\* |

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | I checked the latest version, the proposed change seems only to move “not” to make the text in 38.211 section 7.4.1.7.4 on muting grammatically correct.   |  | | --- | | - the higher-layer parameter *mutingOption1-r16* is provided with bitmap but not *mutingOption2-r16* with bitmap is provided, and bit is set;  - the higher-layer parameter *mutingOption2-r16* is provided with bitmap but not *mutingOption1-r16* with bitmap is provided, and bit is set; |   However, why hasn’t the second paragraph been changed? |

### Conclusions

TBD

## Aspect 4-3 AND 10-3 TP to clarify muting operation TS 38.214 Section 5.1.6.5

### Proposals

The description in 38.214 may provide a wrong impression that *dl-PRS-MutingPatternList-r16* only defines one bitmap that has different meanings for the different options. However, from the IE structure of the *dl-PRS-MutingPatternList*, it is clear that *DL-PRS-MutingPatternList* contains two individual bitmaps (*mutingPatterns*): one for *mutingOption1* and the other for *mutingOption2*. The two bitmaps can be configured independently with different lengths, e.g., for option 1, the length of the bitmap can be {2, 4, 6, 8, 16, 32} bits, while for Option 2, the length of the bitmap should be the same as *dl-PRS-ResourceRepetitionFactor-r16.* [16]

TP 11

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| 5.1.6.5 PRS reception procedure […]  *- dl-PRS-MutingPatternList-r16* defines ~~a bitmap of~~ the time locations where the DL PRS resource is expected to not be transmitted for a DL PRS resource set. ~~The bitmap size can be {2, 4, 6, 8, 16, 32} bits long.~~ ~~The bitmap has two options for applicability.~~ If *mutingOption1* is configured , ~~In the first option~~ each bit in the bitmap of *mutingOption1* corresponds to a configurable number provided by higher layer parameter *dl-PRS-MutingBitRepetitionFactor-r16* 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 *mutingOption2* is configured each bit in the bitmap of *mutingOption2* corresponds to a single repetition index for each of the DL PRS resources within each instance of a *nr-DL-PRS-ResourceSet-r16* and the length of the bitmap is equal to the values of *dl-PRS-ResourceRepetitionFactor-r16*. Both *mutingOption1 and 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].   * […] |

In 38.214, the description of PRS muting does not include the name of the different parameters for the bitmap and the muting options. Corrections are provided in the TP below[22]:

TP 12

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| TS 38.214  5.1.6.5 PRS reception procedure  \*\*\*\*\* unchanged text omitted \*\*\*\*\*\*\*\*\*\*\*  *dl-PRS-MutingPatternList-r16* defines a bitmap of the time locations where the DL PRS resource is expected to not be transmitted for a DL PRS resource set. The bitmap is configured by the parameter *mutingPattern-r16* with a size ~~can be~~ {2, 4, 6, 8, 16, 32} bits long. The bitmap has two options for applicability. In the first option set by the parameter *mutingOption1-r16* each bit in the bitmap corresponds to a configurable number provided by higher layer parameter *dl-PRS-MutingBitRepetitionFactor-r16* 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. In the second option set by the parameter *mutingOption2-r16* each bit in the bitmap corresponds to a single repetition index for each of the DL PRS resources within each instance of a *nr-DL-PRS-ResourceSet-r16*and the length of the bitmap is equal to the values of *dl-PRS-ResourceRepetitionFactor-r16*. Both options 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].  \*\*\*\*\* unchanged text omitted \*\*\*\*\*\*\*\*\*\*\* |

### Companies comments

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| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | We think the changes are duplicated from the equation from TS 38.211.   |  | | --- | | For a downlink PRS resource in a downlink PRS resource set, the UE shall assume the downlink PRS resource being transmitted when the slot and frame numbers fulfil  and one of the following conditions are fulfilled:  - the higher-layer parameter *dl-PRS-MutingPatternList-r16* is not provided;  - the higher-layer parameter *mutingOption1-r16* is provided with bitmap but not *mutingOption2-r16* with bitmap is provided, and bit is set;  - the higher-layer parameter *mutingOption2-r16* is provided with bitmap but not *mutingOption1-r16* with bitmap is provided, and bit is set;  - the higher-layer parameters *mutingOption1-r16* with bitmap and *mutingOption2-r16* with are both provided, and both bit and are set.  where  - is bit in the bitmap given by the higher-layer parameter *mutingOption1-r16* where is the size of the bitmap;  - is bit in the bitmap given by the higher-layer parameter *mutingOption2-r16;* |   To us, the current TS 38.211 has already provided the correct and self-explanatory understanding of the muting configuration and is written so elegantly that any explanation in TS 38.214 is useless. We propose to only capture the following in TS 38.214.  *mutingOption1-r16* and *mutingOption2-r16* define the DL PRS muting configuration as described in Clause 7.4.1.7.4 of [4, TS 38.211]. |

### Conclusions

TBD

## Aspect 7-2. Corrections to TS 38.214

### proposal[19]

* Description on the configurations of positioning frequency layer, DL PRS resource set, DL PRS resource in TS 38.214 accordingly
* TRP should be used instead of cell
* DL-PRS-ResourceSymbolOffset not only determines the starting symbol of the DL PRS resource within the starting slot, but also that within the other slot used for transmission.
* SS/PBCH Blocks with the same SSB index may be from the same beam, or may be from different beams, since SS/PBCH block with the same SSB index may be from different servicing cells
* The condition “as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met” should refer to the case with different DL PRS resource rather than different LD PRS resource sets block with the same SSB index may be from different servicing cells
* The condition “as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met” should refer to the case with different DL PRS resource rather than different LD PRS resource sets

TP 13

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| **In TS 38.214 Section 5.1.6.5 (CR R1-2001731)**  5.1.6.5 PRS reception procedure  **<omitted text>**  The UE expects that it will be configured with *~~dl-PRS-ID-r16~~ TRP-ID-r16* each of which is defined such that it is associated with multiple DL PRS resource sets from the same cell. The UE expects that one of these *~~dl-PRS-ID-r16~~ TRP-ID-r16* along with a *nr-DL-PRS-ResourceSetId-r16* and a *nr-DL-PRS-ResourceId-r16* can be used to uniquely identify a DL PRS resource.  **<omitted text>**  A DL PRS resource is defined by:  **<omitted text>**  *- dl-PRS-ResourceSlotOffset-r16*determines the starting slot of the DL PRS resource with respect to corresponding DL PRS resource set slot offset  *- dl-PRS-ResourceSymbolOffset-r16* determines the starting symbol of the DL PRS resource within the ~~starting~~ slot.  *- dl-PRS-NumSymbols-r16*defines the number of symbols of the DL PRS resource within a slot where the allowable values are given in Clause 7.4.1.7.1 of [4, TS38.211].  *- dl-PRS-QCL-Info-r16*defines any quasi-colocation information of the DL PRS resource with other reference signals. The DL PRS may be configured to be ‘QCL-Type-D’ with a DL PRS or SS/PBCH Block from a serving cell or a non-serving cell. The DL PRS may be configured to be ‘QCL-Type-C’ with a SS/PBCH Block from a serving or non-serving cell. If the DL PRS is configured as both ‘QCL-Type-C’ and ‘QCL-Type-D’ with a SS/PBCH Block then the SSB index indicated should be the same and should be from the same 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 a DL PRS resources 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-r16*. 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-r16*and *nr-DL-PRS-expectedRSTD-uncerainty-r16*. 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-r16*may include an *dl-PRS-ID-r16*, a DL PRS resource set ID, and optionally a single DL PRS resource ID or a list of DL PRS resource IDs. The UE may use different DL PRS resources as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met 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-r16*, the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference.  **<omitted text>**  The UE may be configured to measure and report, subject to UE capability, up to 4 DL RSTD measurements per pair of ~~cells~~ *TRP-ID-r16* with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those ~~cells~~ *TRP-ID-r16*. The up to 4 measurements being performed on the same pair of cells 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 ~~from the same cell~~ associated with the same *TRP-ID-r16*. When the UE reports DL PRS RSRP measurements from one DL PRS resource set, the UE may indicate which DL PRS RSRP measurements have been performed using the same spatial domain filter for reception.  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.  If the UE is configured with *dl-PRS-QCL-Info-r16*and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are ~~from the same cell~~ associated with the same *TRP-ID-r16*. If *dl-PRS-QCL-Info-r16*is configured to the UE with ‘QCL-Type-D’ with a source DL-PRS-Resource then the *nr-DL-PRS-ResourceSetId-r16*and the *nr-DL-PRS-ResourceId-r16*of the source DL PRS resource are expected to be indicated to the UE.  **<omitted text>** |

Feature lead response:

* Regarding ID, our understanding that *dl-PRS-ID-r16* is a correct implementation and we do not see the need to change
* Regarding “starting slot” it seems clear that it is a starting slot of DL PRS resource. It seems it is not essential correction.

### Companies comments

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| --- | --- |
| Company | Comment |
| Huawei/HiSIlicon | For starting slot, suggest to merge into 4.3.  TRP-ID should be changed to dl-PRS-ID.  To us, we prefer to break the entire jumbo TP to different issues as does to 4.1 – 4.5. Some of them should even be discussed in procedure agenda. |

### Conclusions

TBD

UL SRS corrections

The following TPs are corrections to 38.211, 38.213 and 38.214, respectively.

* **for 38.214**
  + **The TPs in R1-2004644 (TP#1) R1-2003522 (part A, Part B T1)**
  + **Change “associated SRS resources set” to “SRS resources set to which the SRS resource belongs”, according to TP in proposal 4 of R1-2003407**
* **For 38.211: Remove the redundant description on SRS-PosResourceSet-r16 from Section 6.4.1.4.4 of TS 38.211, according to TP in proposal 1 of R1-2004053**
* **For 38.213, the TPs in R1-2004644 (TP#1), and TP corresponding to proposal 2,3,4 in R1-2004053**

## Editorial issue for 38. 211 SRS slot configuration

### Proposal

In [7] the following proposal is given with an associated TP reproduced below as TP 4

1. Remove the redundant description on SRS-PosResourceSet-r16 from Section 6.4.1.4.4 of TS 38.211

TP 14

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| --- |
| **In TS 38.211 Section 6.4.1.4.4**  **CR R1-2003163**  *<omitted text>*  6.4.1.4.4 Sounding reference signal slot configuration  For an SRS resource configured as periodic or semi-persistent by the higher-layer parameter *resourceType*, a periodicity  (in slots) and slot offset  are configured according to the higher-layer parameter *periodicityAndOffset-p* or *periodicityAndOffset-sp* in the *SRS-Resource* IE ~~or the~~ *~~SRS-PosResource-r16~~* ~~IE~~, or *periodicityAndOffset-p-r16* or *periodicityAndOffset-sp-r16* in the *SRS-PosResource-r16* IE. Candidate slots in which the configured SRS resource may be used for SRS transmission are the slots satisfying    SRS is transmitted as described in clause 11.1 of [5, TS 38.213].  *<omitted text>* |

### Companies comments

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| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support TP 14 |

### Conclusions

TBD

## Editorial issues for 38.213 for uplink

### Proposals

The following TPs 5-8 and proposals have been proposed in [7][11] regarding parameter name alignment.

1. Align the following RRC parameters in TS 38.213 with those in TS 38.331

SRS-Positioning-Config -> SRS-PosResourceSet-r16

TP 15

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| --- |
| **In TS 38.213 Section 7**  7 Uplink Power control  Uplink power control determines a power for PUSCH, PUCCH, SRS, and PRACH transmissions.  A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in Clauses 7.1.1, 7.2.1, and 7.3.1, except for SRS transmissions configured by IE *~~SRS-Positioning-Config~~ SRS-PosResourceSet-r16* as described in Clause 7.3.1.  A PUSCH/PUCCH/SRS/PRACH transmission occasion  is defined by a slot index  within a frame with system frame number , a first symbol  within the slot, and a number of consecutive symbols .  *<omitted text>* |

1. Use SRS-ResourceSet and SRS-PosResourceSet-r16 to differentiate the traditional SRS and SRS for positioning

TP 16

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| --- |
| **In TS 38.213 Section 7** 7.3.1 UE behaviour If a UE transmits SRS based on a configuration by IE *~~SRS-Config~~ SRS-ResourceSet* on active UL BWP  of carrier  of serving cell  using SRS power control adjustment state with index , the UE determines the SRS transmission power  in SRS transmission occasion  as  [dBm]  *<omitted text>* |

TP 17

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| --- |
| **In TS 38.213 Section 7**  Section 7.3.1 UE behaviour  *<omitted text>*  If a UE transmits SRS based on a configuration by IE *~~SRS-Positioning-Config~~ SRS-PosResourceSet-r16* on active UL BWP of carrier of serving cell , the UE determines the SRS transmission power in SRS transmission occasion as  [dBm]  where,  - and are provided by *p0-r16* and *alpha-r16* respectively, for active UL BWP of carrier of serving cell , and SRS resource set is indicated by *SRS-PosResourceSetId-r16* from *SRS-PosResourceSet-r16*, and  - is a downlink pathloss estimate in dB calculated by the UE, as described in Clause 7.1.1 in case of an active DL BWP of a serving cell , using RS resource indexed in a serving or non-serving cell for SRS resource set [6, TS 38.214]. A configuration for RS resource index associated with SRS resource set is provided by *pathlossReferenceRS-Pos-r16*  - if a *ssb-IndexNcell-r16* is provided, *referenceSignalPower* is provided by *ss-PBCH-BlockPower-r16*  - if a *dl-PRS-ResourceId-r16* is provided, *referenceSignalPower* is provided by *dl-PRS-ResourcePower-r16*  *<omitted text>* |

TP 18

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| --- |
| 7 Uplink Power control Uplink power control determines a power for PUSCH, PUCCH, SRS, and PRACH transmissions.  A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in Clauses 7.1.1, 7.2.1, and 7.3.1, except for SRS transmissions configured by *SRS-PosResourceSet-r16* ~~IE~~ *~~SRS-Positioning-Config~~* as described in Clause 7.3.1.  \*\*\* Unchanged text is omitted \*\*\*  7.3.1 UE behaviour  \*\*\* Unchanged text is omitted \*\*\*  If a UE transmits SRS based on a configuration ~~by IE~~ *~~SRS-Positioning-Config~~* provided by *SRS-PosResourceSet-r16* on active UL BWP of carrier of serving cell , the UE determines the SRS transmission power in SRS transmission occasion as  [dBm]  \*\*\* Unchanged text is omitted \*\*\* |

Additionally, in [7] a correction to the power control formula is proposed:

1. Correct the variables for the formula of power control for SRS for positioning

TP 19

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| **In TS 38.213**  Section 7.3.1 UE behaviour  *<omitted text>*  If a UE transmits SRS based on a configuration by IE *SRS-Positioning-Config* on active UL BWP of carrier of serving cell , the UE determines the SRS transmission power in SRS transmission occasion as  [dBm]  where,  - and are provided by *p0-r16* and *alpha-r16* respectively, for active UL BWP of carrier of serving cell , and SRS resource set is indicated by *SRS-PosResourceSetId-r16* from *SRS-PosResourceSet-r16*, and  - is a downlink pathloss estimate in dB calculated by the UE, as described in Clause 7.1.1 in case of an active DL BWP of a serving cell , using RS resource indexed in a serving or non-serving cell for SRS resource set [6, TS 38.214]. A configuration for RS resource index associated with SRS resource set is provided by *pathlossReferenceRS-Pos-r16*  - if a *ssb-IndexNcell-r16* is provided, *referenceSignalPower* is provided by *ss-PBCH-BlockPower-r16*  - if a *dl-PRS-ResourceId-r16* is provided, *referenceSignalPower* is provided by *dl-PRS-ResourcePower-r16*  If the UE determines that the UE is not able to accurately measure , or the UE is not provided with *pathlossReferenceRS-Pos-r16*, the UE calculates using a RS resource obtained from the SS/PBCH block of the serving cell that the UE uses to obtain *MIB*  The UE indicates a capability for a number of pathloss estimates that the UE can simultaneously maintain for all SRS resource sets provided by *SRS-PosResourceSet-r16* in addition to the up to four pathloss estimates that the UE maintains per serving cell for PUSCH/PUCCH/SRS transmissions.  *<omitted text>* |

Companies are encouraged to give their view on the TPs and proposals below.

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | We agree with all TPs with the suggestion that either remove the word “IE” or use the word “IE” everywhere before *SRS-ResourceSet* or *SRS-PosResourceSet-r16* |

### Conclusions

TBD

## Editorial issues for 38.214 for uplink

### Proposals

#### Clarification of associated resource sets

In [1] it is proposed to clarify the meaning of “associated resource set”

***Proposal 3:***

* ***Change “*associated SRS resources set*” to “*SRS resources set to which the SRS resource belongs*”.***

***Proposal 4:***

* ***Adopt the following text proposal into TS 38.214.***

TP 20

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| *TS 38.214-g10*  *6.2.1 UE sounding procedure*  < Unchanged parts are omitted >  The UE is not expected to be configured with different time domain behavior for SRS resources in the same SRS resource set. The UE is also not expected to be configured with different time domain behavior between SRS resource and ~~associated~~ SRS resource~~s~~ set to which the SRS resource belongs.  < Unchanged parts are omitted > |

#### Parameter name alignment in 38.214

In [3], a TP corresponding to the following correction is proposed:

* Replacing [SRS-for-positioning] with *SRS-PosResourceSet-r16* or *SRS-PosResource-r16* whichever applicable.
* Text change to reflect that spatial relation RS for *SRS-PosResource-r16* isprovided with *spatialRelationInfoPos-r16* IE and not *spatialRelationInfo* IE.
* Text change to reflect that *SRS-PosResource-r16* ID is provided with *SRS-PosResourceId-r16* and not *SRS-ResourceId.*
* Text change to reflect that SSB index in *spatialRelationInfoPos-r16* IE is provided with ‘ssb-IndexServing-r16’ or ‘ssb-IndexNcell-r16’ and not 'ssb-Index'.
* Text change to reflect that CSI-RS index in *spatialRelationInfoPos-r16* IE is provided with ‘csi-RS-IndexServing-r16’and not 'csi-RS-Index'.
* Text change to reflect that SRS in *spatialRelationInfoPos-r16* IE is provided with ‘srs-SpatialRelation-r16’ and not ‘srs’.
* Changing *DL-PRS-ResourceId* and *SRS-PosResource* respectively to *DL-PRS-ResourceId-r16* and *SRS-PosResource-r16* to unify the IE names across all RAN1 specifications.
* Changing *srs-Resource* and *srs-PosResource-r16* to *SRS-Resource* and *SRS-PosResource-r16*, respectively.
* Changing fonts of some IEs from normal to *italic*.
* Clarification regarding the configuration of the number of SRS resource for positioning.

TP 21

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| **<Unchanged part omitted>** 6.2 UE reference signal (RS) procedure6.2.1 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-r16*. 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-r16,* a UE may be configured with SRS resources (higher layer parameter *SRS-PosResource-r16*), 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-r16*.  - *srs-ResourceId or srs-PosResourceId-r16* 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-r16* 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-r16* with higher layer parameter *resourceType* set to 'aperiodic', the slot level offset is defined by the higher layer parameter *slotOffset* for eachSRS resource.  **<Unchanged part omitted>**  - The configuration of the spatial relation between a reference RS and the target SRS, where the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16*, 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 SRS is configured by the higher layer parameter *SRS-PosResourceSet-r16* the reference RS may also be a DL PRS configured on a serving cell, an SS/PBCH block or a DL PRS of a non-serving cell indicated by a higher layer parameter.  The UE may be configured by the higher layer parameter *resourceMapping* in *SRS-Resource* with an SRS resource occupying  adjacent symbols within the last 6 symbols of the slot, 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-r16,* the higher layer parameter *resourceMapping* in *SRS-PosResource-r16* indicates adjacent symbols anywhere within the slot.  **<Unchanged part 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-r16* is set to 'periodic':  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16* 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-r16* 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-r16* containing 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-r16* and if the higher layer parameter *spatialRelationInfoPos-r16* contains the ID of a reference 'dl-PRS-ResourceId-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 a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *resourceType* in *SRS-Resource* or *SRS-PosResource-r16* is set to 'semi-persistent':  - **<Unchanged part omitted>**  - if an SRS resource in the activated resource set is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16*, the UE shall assume that the ID of the reference signal in the activation command overrides the one configured in *spatialRelationInfo or spatialRelationInfoPos-r16.*  - 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-r16* 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-r16* 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-r16* 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-r16* contains the ID of a reference 'dl-PRS-ResourceId-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.  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-r16* is set to 'aperiodic':  **<Unchanged part omitted>**  - 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-r16*, the UE transmits aperiodic SRS in each of the triggered SRS resource set(s) in slot , if UE is configured with *CA-slot-offset* 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-slot-offset* for the cell receiving the PDCCH, and are the  and the , respectively, which are determined by higher-layer configured *CA-slot-offset* 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-r16*, the UE transmits every aperiodic SRS resource in each of the triggered SRS resource set(s) in slot  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 the  for the {scheduling, scheduled} carrier pair is defined in [4, TS 38.211] clause 4.5.  - if the UE is configured with the higher layer parameter *spatialRelationInfo* or *spatialRelationInfoPos-r16* 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-r16* 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-r16* 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-r16* and if the higher layer parameter *spatialRelationInfoPos-r16* contains the ID of a reference dl-PRS-ResourceId-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 part omitted>**  The UE is not expected to be configured with different time domain behavior for SRS resources in the same SRS resource set. The UE is also not expected to be configured with different time domain behavior between SRS resource and associated SRS resources set.  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-r16* 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 triggered to transmit SRS on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-PosResource-r16* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as ‘semi-persistent’ or ‘aperiodic’.  For single carrier operations, the UE does not expect to be configured on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-PosResource-r16* with *resourceType* of the SRS resources as ‘periodic’.  For single carrier operations, the UE does not expect to be triggered to transmit SRS on overlapping symbols with more than one SRS resources configured by the higher layer parameter *SRS-PosResource-r16* with *resourceType* of the SRS resources as ‘semi-persistent’ or ‘aperiodic’.   1. For intra-band and inter-band CA operations, a UE can simultaneously transmit more than one SRS resources configured by *SRS-PosResource-r16* on different CCs, subject to UE’s capability provided by [XX] and [YY] respectively.   **<Unchanged part omitted>**  When the higher layer parameter enableDefaultBeamPlForSRS is set 'enabled', and if the higher layer parameter spatialRelationInfo for the SRS resource, except for the SRS resource with the higher layer parameter usage in SRS-ResourceSet set to 'beamManagement' or for the SRS resource with the higher layer parameter usage in SRS-ResourceSet set to 'nonCodebook' with configuration of associatedCSI-RS or for the SRS resource configured by the higher layer parameter *SRS-PosResourceSet-r16*, is not configured in FR2 and if the UE is not configured with higher layer parameter(s) pathlossReferenceRS, the UE shall transmit the target SRS resource  **<Unchanged part omitted>**  **6.2.1.4 UE sounding procedure for positioning purposes**  When the SRS is configured by the higher layer parameter *SRS-PosResource-r16* and if the higher layer parameter *spatialRelationInfoPos-r16* 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-r16*, 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-r16 the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter *SRS-PosResource-r16* 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 the by the higher layer parameter *SRS-PosResource-r16* within the active UL BWP of the UE.  When the configuration of SRS is done by the higher layer parameter *SRS-PosResource-r16*, the UE can only be provided with a single RS source in spatialRelationInfoPos-r16 per SRS resource for positioning.  **<Unchanged part omitted>** |

Companies are encouraged to give their view on the TPs below.

### Companies comments

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support TP 21.  TP 20 is not needed. We prefer not to change a text from Rel-15 unless it causes confusion. This is not the case here. |

### Conclusions

TBD

# Conclusions

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