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

Online, February 24th – March 6th, 2020

Agenda Item: 7.2.8.2

Source: Moderator (Ericsson)

Title: TPs and remaining open issues from email discussion [100b-e-NR-Pos-03] on UL SRS for positioning and UL RTOA reference time

Document for: Discussion

# 1 Introduction

This document summarize the discussion regarding the remaining text proposals and open issues from email discussion [100b-e-NR-Pos-03] on UL SRS for positioning and UL RTOA reference time.

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| [100b-e-NR-Pos-03] Email discussion/approval on the following issues by 4/23; if necessary, followed by endorsing the corresponding TPs by 4/28 – Florent (Ericsson)* UL SRS for positioning
	+ Simultaneous SRS transmission in a single symbol
	+ Intra-band collision between PosSRS and MimoSRS
	+ PHR for SRS positioning configuration
* UL RTOA reference time
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The following issues are discussed:

* Simultaneous SRS transmission in a single symbol
	+ FFS: Capability for simultaneous SRS transmission across bands for inter-band CA
	+ Continue discussion on capability for intra-band/inter-band CA, including potential TP to 38.214 to reflect the new capability.
* Intra-band collision between PosSRS and MimoSRS
	+ discuss a potential merge from TP1 until the TP deadline (28/4)
* PHR for SRSpos
	+ TP to reflect the conclusion in 38.213. Use the option 1 TP from R1-2001686 as a starting point.
	+ Note: Option 1 is UE report type 3 PHR only based on SRS configured by *SRS-Resource / ResourceSet.*
* UL RTOA reference time
	+ continue discussing the scope of the TP (e.g. remove bracket only, or include the reference time details proposed in the TP).

# 4 TPs and open issues

## 4.1 Simultaneous SRS transmission in a single symbol

The simultaneous transmission of multiple SRS resources in a symbol was discussed during the email discussion and it was agreed to introduce a capability for transmission of multiple SRS resources in a symbol in intra band CA. the remaining issue is whether to introduce another capability for inter-band CA. Since there is little time for concluding the discussion, we suggest to prioritize getting to an agreement on whether to have a new capability, and treat the details of the capability (e.g.value for number of resources signaled in the capability) as an item in the UE feature discussion or, if companies want to discuss it in this discussion, as a second priority.

During the email discussion, Huawei proposed not to specify the support for inter band CA, as the current specification can be interpreted as already supporting it. Several companies (Vivo, Intel, LG, CATT, Qualcomm) support adding a capability for inter band CA. The options are as follow:

1. For the number of SRS resources for positioning on a symbol for inter-band CA, where the SRS resources are on different CCs
	* + - Option 1: Introduce a new UE capability for the number of simultaneous transmissions of SRS resources for positioning on a symbol for inter-band CA, where the SRS resources are on different CCs.
			- Option 2: do not define a new capability for the number of SRS resources for positioning on a symbol in inter band CA

 The current draft TP for simultaneous transmission of SRS on different CCs is not yet endorsed, and so far focuses on intra-band CA. There is a discussion regarding whether the text should be restricted to simultaneous transmission of SRS resources with the same *resourceType* configuration.

===================== Unchanged parts omitted ======================

For intra-band CA operations, a UE can simultaneously transmit more than one SRS resources configured by *SRS-PosResource* with same *resourceType* on different CCs, subject to UE’s capability provided by [XX].

===================== Unchanged parts omitted ======================

Companies are encouraged to give their comment on whether to endorse the TP as it is, or provide a suggested rewording, which may or may not include inter band CA based on the preferred option.

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| company | comment |
| Qualcomm | Option 1. For the intra-band CA, we don’t see the need of resourceType-based restriction, so the TP can just be: For intra-band and inter-band CA operations, a UE can simultaneously transmit more than one SRS resources configured by *SRS-PosResource* ~~with same~~ *~~resourceType~~* on different CCs, subject to UE’s capability provided by [XX] and [YY] respectively.  |
| vivo | We support Option 1 to define a new UE capability for simultaneous transmission of SRS for positioning for inter-band CA. We also prefer the above revised TP from Qualcomm for intra-band CA case.  |
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## 4.2 Intra-band collision between PosSRS and MimoSRS

The following TP (TP#2 in the email discussion) was agreed:

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| R1-2002286 |
| **Start of Text Proposal #1 to the TS 38.214 -------------------- -------------------------------------------------------**6.2.1 UE sounding procedure<omitted text>For operations 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 operations 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’.<omitted text>**End of Text Proposal #1 to the TS 38.214 -----------------------------------------------------------------------------------------------**  |

Several companies proposed to merge the other TP (TP#1) in the discussion to the agreed to. TP#1 is as follow:

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| R1-2001559 |
| ***Proposal 4: Endorse the following TP for clause 6.2.1 of TS 38.214.***===================== Unchanged parts omitted ======================For single carrier and intra-band CA operations, the UE does not expect 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 single carrier and intra-band CA operations, the UE does not expect to be triggered to transmit SRS on overlapping symbols with a SRS resource configured by the higher layer parameter *SRS-Pos-Resource* and a SRS resource configured by the higher layer parameter *SRS-Resource* with *resourceType* of both SRS resources as ‘semi-persistent’ or ‘aperiodic’.===================== Unchanged parts omitted ====================== |

 CATT proposed a merge version in the comments to the email discussion:

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| **------------------------Start of Text Proposal to the TS 38.214 ------------------------------------**6.2.1 UE sounding procedure<omitted text>For operations in the same carrier or intra-band CA case(when 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* are in different component carriers), 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 operations in the same carrier or intra-band CA case(when 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* are in different component carriers), 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’.<omitted text>**--------------------------End of Text Proposal #1 to the TS 38.214 ------------------------------------** |

Companies are encouraged to provide their view on merging TP#1 to TP#2, as well as proposals for the merged TP

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| Company | Comment |
| Qualcomm | We don’t agree with the new TP. For intra-band CA, we don’t see the problem of having 2 SRS in different CCs independent of whether these 2 resources are one for positioning and for MIMO.  |
| vivo | We do not agree with the reason to have TP#1. We support to have TP#2 only. |
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## 4.3 PHR for SRSpos

 During the email discussion it was concluded that for release 16, type3 PHR based on SRS for positioning is not supported. In R1-2001686 a text proposal was given to capture the conclusion.

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| *TS 38.213-g10*7.7.3 Type 3 PH report< Unchanged parts are omitted >If a UE determines that a Type 3 power headroom report for an activated serving cell is based on an actual SRS transmission then, for SRS transmission occasion  on active UL BWP  of carrier  of serving cell  and if the UE is not configured for PUSCH transmissions on carrier  of serving cell , and the SRS is configured by *SRS-Config,* the UE computes a Type 3 power headroom report as  [dB]where , , , ,  and  are defined in Clause 7.3.1 with corresponding values obtained from *SRS-ResourceSet*.If the UE determines that a Type 3 power headroom report for an activated serving cell is based on a reference SRS transmission then, for SRS transmission occasion  on UL BWP  of carrier  of serving cell , and if the UE is not configured for PUSCH transmissions on UL BWP  of carrier  of serving cell , and the reference SRS is configured by *SRS-Config，*the UE computes a Type 3 power headroom report as   [dB]where  is a SRS resource set corresponding to *SRS-ResourceSetId = 0* for UL BWP  and , ,  and  are defined in Clause 7.3.1 with corresponding values obtained from *SRS-ResourceSetId = 0* for UL BWP .  is computed assuming MPR=0 dB, A-MPR=0 dB, P-MPR=0 dB and TC =0 dB. MPR, A-MPR, P-MPR and TC are defined in [8-1, TS 38.101-1], [8-2, TS38.101-2] and [8-3, TS 38.101-3]. If a UE is configured with two UL carriers for a serving cell and the UE determines a Type 3 power headroom report for the serving cell based on a reference SRS transmission, the UE computes a Type 3 power headroom report for the serving cell assuming a reference SRS transmission on the UL carrier provided by *pucch-Config*. If *pucch-Config* is not provided to the UE for any of the two UL carriers, the UE computes a Type 3 power headroom report for the serving cell assuming a reference SRS transmission on the non-supplementary UL carrier.< Unchanged parts are omitted > |

Companies are encouraged to provide their view on the TP and possible edits.

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| Company | Comment |
| Qualcomm | It looks OK |
| Nokia/NSB | Wouldn’t it be more clear to just say that the SRS is configured with SRS-ResourceSet or something similar? As written the first change does not exclude positioning SRS.  |
| vivo | I guess Nokia’s comment is coming from *SRS-Config*, where in TS 38.331 v16.0.0, both SRS for MIMO and SRS for positioning are configured in *SRS-Config*. To address that, the TP should be updated to the following by replacing *SRS-Config* into *SRS-Resource*.

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| *TS 38.213-g10*7.7.3 Type 3 PH report< Unchanged parts are omitted >If a UE determines that a Type 3 power headroom report for an activated serving cell is based on an actual SRS transmission then, for SRS transmission occasion  on active UL BWP  of carrier  of serving cell  and if the UE is not configured for PUSCH transmissions on carrier  of serving cell , and the SRS is configured by *SRS-Resource,* the UE computes a Type 3 power headroom report as  [dB]where , , , ,  and  are defined in Clause 7.3.1 with corresponding values obtained from *SRS-ResourceSet*.If the UE determines that a Type 3 power headroom report for an activated serving cell is based on a reference SRS transmission then, for SRS transmission occasion  on UL BWP  of carrier  of serving cell , and if the UE is not configured for PUSCH transmissions on UL BWP  of carrier  of serving cell , and the reference SRS is configured by *SRS-Resource，*the UE computes a Type 3 power headroom report as   [dB]where  is a SRS resource set corresponding to *SRS-ResourceSetId = 0* for UL BWP  and , ,  and  are defined in Clause 7.3.1 with corresponding values obtained from *SRS-ResourceSetId = 0* for UL BWP .  is computed assuming MPR=0 dB, A-MPR=0 dB, P-MPR=0 dB and TC =0 dB. MPR, A-MPR, P-MPR and TC are defined in [8-1, TS 38.101-1], [8-2, TS38.101-2] and [8-3, TS 38.101-3]. If a UE is configured with two UL carriers for a serving cell and the UE determines a Type 3 power headroom report for the serving cell based on a reference SRS transmission, the UE computes a Type 3 power headroom report for the serving cell assuming a reference SRS transmission on the UL carrier provided by *pucch-Config*. If *pucch-Config* is not provided to the UE for any of the two UL carriers, the UE computes a Type 3 power headroom report for the serving cell assuming a reference SRS transmission on the non-supplementary UL carrier.< Unchanged parts are omitted > |

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## 4.4 UL RTOA reference time

 During the email discussion it was agree to introduce the higher layer parameter for the nominal beginning time of SFN 0 (provided by LMF) and to define The RTOA reference time as T0+tSRS, where

* T0 is the nominal beginning time of SFN 0 provided by LMF.
* $t\_{SRS}=\left(10n\_{f}+n\_{sf}\right)×10^{-3}$, where $n\_{f}$ and $n\_{sf}$ are the system frame number and the subframe number of the SRS, respectively

A text proposal was being discussed to capture the agreement in 38.215.

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| ===================== Unchanged parts omitted ======================**2 References**===================== Unchanged parts omitted ======================[xx] 3GPP TS 38.455: "NG-RAN; NR Positioning Protocol A (NRPPa)"===================== Unchanged parts omitted ======================**5.2.2 UL Relative Time of Arrival (TUL-RTOA)**

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| **Definition** | The UL Relative Time of Arrival (TUL-RTOA) is the beginning of subframe *i* containing SRS received in positioning node *j*, relative to the UL RTOA reference time.[The UL RTOA reference time is defined as $T\_{0}+t\_{SRS}$, where- $T\_{0}$ is the nominal beginning time of SFN 0 provided by [yy] [xx, TS 38.455]- $t\_{SRS}$ is the nominal time offset of the beginning of the subframe that contains the target SRS relative to the nominal beginning time of SFN0.] Multiple SRS resources for positioning can be used to determine the beginning of one subframe containing SRS received at a positioning node.The reference point for TUL-RTOA shall be:- for type 1-C base station TS 38.104 [9]: the Rx antenna connector,- for type 1-O or 2-O base station TS 38.104 [9]: the Rx antenna (i.e. the centre location of the radiating region of the Rx antenna),- for type 1-H base station TS 38.104 [9]: the Rx Transceiver Array Boundary connector. |

===================== Unchanged parts omitted ====================== |

Companies are encouraged to provide their view on the TP and possible edits.

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| Company | Comment |
| Qualcomm | No need to be written in 38.215, we can just remove the brackets and then RAN3 will handle it from there. |
| Nokia/NSB | At this time we only support removing the brackets of the first paragraph and leaving the rest pending RAN3 input or to be resolved at next meeting.  |
| vivo | Same preference as Qualcomm and Nokia. |
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#  5 References

1. R1-2002715 Feature lead summary for UL Reference Signals for NR Positioning, Moderator (Ericsson)
2. R1-2002716 FL Summary of Remaining issues on NR Positioning Measurements, Moderator (CATT)
3. [R1-2001559](file:///C%3A/Users/wanshic/OneDrive%20-%20Qualcomm/Documents/Standards/3GPP%20Standards/Meeting%20Documents/TSGR1_100b/Docs/R1-2001559.zip) Maintenance of SRS for NR positioning Huawei, HiSilicon
4. R1-2001560 Maintenance of NR positioning measurements Huawei, HiSilicon
5. [R1-2001686](file:///C%3A/Users/wanshic/OneDrive%20-%20Qualcomm/Documents/Standards/3GPP%20Standards/Meeting%20Documents/TSGR1_100b/Docs/R1-2001686.zip) Discussion on remaining issues on UL RS for NR positioning vivo
6. [R1-2002286](file:///C%3A/Users/wanshic/OneDrive%20-%20Qualcomm/Documents/Standards/3GPP%20Standards/Meeting%20Documents/TSGR1_100b/Docs/R1-2002286.zip) Corrections to UL reference signals for NR positioning Intel Corporation