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

Online, February 24th – March 6th, 2020

Agenda Item: 7.2.8.2

Source: Moderator (Ericsson)

Title: Output of email discussion 100b-e-NR-Pos-03] on UL SRS for positioning and UL RTOA reference time

Document for: Discussion

# 1 Introduction

This document summarizes the output of the email discussion thread [100b-e-NR-Pos-03] help during RAN1#100b-e. the scope of the email discussion was discussed in a preceding email discussion captured in R1-2002715 and focused on UL SRS for positioning. Additionally, a discussion from agenda item 7.2.8.3 regarding UL RTOA reference time was added during the consolidation of email discussion threads. The email discussion scope was confirmed by chairman’s decision available in the chairman’s notes:

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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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# 2 UL SRS for positioning

## 2.1 Simultaneous SRS transmission in a single symbol

The issue was discussed in R1-2001559, with the following proposal and TP:

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|  ***Proposal 1: Introduce a new UE capability for the number of SRS resources for positioning on a symbol for intra-band CA. The candidate number at least includes {1, 2}.******Proposal 2: Endorse the following TP for clause 6.2.1.4 of TS 38.214.***===================== Unchanged parts omitted ======================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* 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-Pos-Resource* with *resourceType* of the SRS resources as ‘semi-persistent’ or ‘aperiodic’.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 provide their comments below:

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| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support.In response to Nokia’s comment: Proposal 1 can be updated to the following. Would that be better? I guess the TP is more aligned with the updated proposal.***Introduce a new UE capability for the number of SRS resources for positioning on a symbol for intra-band CA, where the SRS resources are on different CCs. The candidate number at least includes {1, 2}.*** |
| Nokia/NSB | On proposal 1: We think we should be more specific that this is for different CCs and that it is across SRS resource sets for positioning. Is that the correct understanding? If so we support.  |

## 2.2 Intra-band collision between PosSRS and MimoSRS

The issue was discussed in R1-2001559, andR1- 2002286 with the following proposals and TPs:

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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 ====================== |

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| R1-2001559 |
| **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 -----------------------------------------------------------------------------------------------**1.
* **Adopt Text Proposal #1 to the TS38.214 in the next revision of the TS 38.214**
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The two proposals differ in that R1-2001559 proposes to extend the specification text to includes intra-band CA, while R1- 2002286 is only providing text clarification. Companies are encouraged to provide their comments in the table below

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| Company | Comment |
| Huawei/HiSilicon | Support the TP that proposed to extend the specification text to include intra-band CA. |
| OPPO | Support the 2nd TP |
| Nokia/NSB | Support the 1st TP.  |

## 2.3 PHR for SRS positioning configuration

The issue was discussed in R1-2001686 with the following proposals and TPs.

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| ***Proposal 1: Clarify whether UE can report*** ***type 3 PHR based on SRS for positioning or not.***For Option 1, if UE type 3 PHR can only be based on SRS configured by *SRS-Config*, the text proposal is as below:

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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 > |

For Option 2, if UE type 3 PHR report can be based on SRS configured by *SRS-Resource* or *SRS for positioning*, the text proposal is as below:

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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 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-Positioning-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-PosResourceSet*].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-Positioning-Config，*the UE computes a Type 3 power headroom report as   [dB]where  is a SRS resource set corresponding to [*SRS-PosResourceSetId*] *= 0* for UL BWP  and ,  and  are defined in Clause 7.3.1 with corresponding values obtained from [*SRS-PosResourceSetId*] *= 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 > |

***Proposal 2: UE type 3 PHR report can be based on SRS for positioning.******Proposal 3: Adopt the following text proposal into TS 38.213 for Type 3 PHR.***

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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 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-Positioning-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-PosResourceSet*].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-Positioning-Config，*the UE computes a Type 3 power headroom report as   [dB]where  is a SRS resource set corresponding to [*SRS-PosResourceSetId*] *= 0* for UL BWP  and ,  and  are defined in Clause 7.3.1 with corresponding values obtained from [*SRS-PosResourceSetId*] *= 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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Note that R1-2001686 presents two TP options and proposes to endorse option 2. However this email discussion is not limited to these options and companies are encouraged to provide their own TP options (if any).

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| Company | Comment |
| Huawei/HiSilicon | Our understanding is that Type 3 PHR based on MIMO SRS is only applicable when UE capability supports parallel SRS and PUSCH transmission in inter-band CA, that is, the UE capability parallelTxSRS-PUCCH-PUSCH is equal to “Supported”. To our understanding, we do not have any agreement clarifying that parallelTxSRS-PUCCH-PUSCH also includes parallel transmission of SRS for positioning and PUSCH. As such, we suggest to first have an independent discussion on this issue in the next meeting and if companies agreed that parallelTxSRS-PUCCH-PUSCH UE capability also applies to SRS for positioning, then we can work on the TP for supporting Type 3 PHR based on SRS for positioning. Besides this issue, since Type 3 PHR has not been discussed before, we suggest to exercise some caution before hastily agreeing to use the same values as in MIMO SRS for calculation.  Please also note that the TP needs some modification since both SRS-PosResourceSet and SRS-ResourceSet are configured by SRS-Config. SRS-Positioning-Config IE is not included in 38.331. |
| OPPO | Since only open loop power control is supported for SRS for positioning, the PHR reporting based on it is not useful. Thus, the Type 3 PHR based on SRS for positioning should not be supported in Rel-16.The TP for option 1 is not aligned with TS 38.331 v16.0.0, where both SRS for MIMO and SRS for positioning are configured in SRS-Config. These two types of SRS should be differentiated by *SRS-Resource* and *SRS-PosResource-r16* now.SRS-Config ::= SEQUENCE { srs-ResourceSetToReleaseList SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSetId OPTIONAL, -- Need N srs-ResourceSetToAddModList SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet OPTIONAL, -- Need N srs-ResourceToReleaseList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-ResourceId OPTIONAL, -- Need N srs-ResourceToAddModList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SRS-Resource OPTIONAL, -- Need N tpc-Accumulation ENUMERATED {disabled} OPTIONAL, -- Need S ..., [[ srs-RequestForDCI-Format1-2-r16 INTEGER (1..2) OPTIONAL, -- Need S srs-RequestForDCI-Format0-2-r16 INTEGER (1..2) OPTIONAL, -- Need S srs-ResourceSetToAddModListForDCI-Format0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSet OPTIONAL, -- Need N srs-ResourceSetToReleaseListForDCI-Format0-2-r16 SEQUENCE (SIZE(1..maxNrofSRS-ResourceSets)) OF SRS-ResourceSetId OPTIONAL,-- Need N srs-PosResourceSetToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSetId-r16 OPTIONAL, -- Need N srs-PosResourceSetToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResourceSets-r16)) OF SRS-PosResourceSet-r16 OPTIONAL,-- Need N srs-PosResourceToReleaseList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResourceId-r16 OPTIONAL,-- Need N srs-PosResourceToAddModList-r16 SEQUENCE (SIZE(1..maxNrofSRS-PosResources-r16)) OF SRS-PosResource-r16 OPTIONAL -- Need N ]]}One possible TP is to add one sentence (highlighted part) in Section 7.7.3 that all the SRS resource for type 3 PH report is configured by *SRS-Resource*7.7.3 Type 3 PH reportIf 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 , the UE computes a Type 3 power headroom report as  [dB]where , , , ,  and  are defined in Clause 7.3.1.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 , 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.The corresponding SRS resource(s) for a Type 3 power headroom report is configured by *SRS-Resource.*  |

# 3 UL RTOA reference time

This discussion started in agenda item 7.2.8.3, documented in R1-2002716. The proposals originated from R1-2001560 and are listed below.

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| ***Proposal 1: RAN1 continues to discuss the topic of gNB measurement and reaches agreements in RAN1#100b at least on the following issues and sends an LS to RAN3 to notify RAN3 regarding the reached agreements:***1. ***UL RTOA definition***
2. ***Search window configuration for gNB to receive SRS.***
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| ***Proposal 2: Introduce the following new parameter to the higher layer parameter list.***

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR\_pos-Core | NR UL Measurement Report Configuration | 　 | 　 | FFS in RAN3 WG | SFN Initialization time | SFN initialization time | New | 　 | The nominal beginning time of SFN 0 for SRS | Same as SFN initialization time in LPPaBIT STRING (64) | 　 | 　 | NRPPa 38.455 | 　 | Time in seconds relative to 00:00:00 on 1 January 1900 (calculated as continuous time without leap seconds and traceable to a common time reference) where binary encoding of the integer part is in the first 32 bits and binary encoding of the fraction part in the last 32 bits. The fraction part is expressed with a granularity of 1 /2\*\*32 second. |

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| ***Proposal 3: The RTOA reference time is defined as T0+tSRS***, ***where**** ***T0 is the nominal beginning time of SFN 0 provided by LMF.***
* ***tSRS is the nominal time offset of the beginning of the subframe that contains the target SRS relative to the nominal beginning time of SFN 0.***
 |
| ***Proposal 4: Adopt the following TP to TS 38.215.***===================== 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 comments below:

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| Company | Comment |
| Huawei/HiSilicon | Current definition in […] has the problem that SRS received in different subframes will have multiple ms offset for the UL RTOA measurement. Also it may imply that configurable reference time is configured per SRS resource, which has unnecessary overhead.In response to Nokia, we cannot simply remove the bracket, as it is problematic. As from the WID, it should be RAN1 to define the measurement, and RAN3 should do NRPPa signalling to support the measurement, based on the LS from RAN1, which has been the common practice as other higher layer parameters between RAN1 and RAN2. |
| Nokia/NSB | As the proposed TP involves a higher layer parameter from RAN3 specs perhaps we should first agree to remove the brackets in the first line and agree that we need a parameter for the configurable reference time. Then we can send an LS to RAN3 to finalize as we understand this issue has also been submitted to RAN3.  |

# 4 Conclusions and offline consensus

#  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