3GPP TSG RAN WG1 #100bis R1- 200xxxx

**e-Meeting** **2, April 20th – 30th, 2020**

Source: Moderator (CATT)

Title: FL Summary of Remaining issues on NR Positioning Measurements

Agenda Item: 7.2.8.3

Document for: Discussion and Decision

# Introduction

This document provides a summary of the remaining issues and proposals for AI 7.2.8.3 related to UE and gNB measurements for NR Positioning based on the contributions submitted under this AI [1-7]. According to the guidance of RAN1 Chairman, the intention of this summary is to identiy a list of critical issues/proposals for further email discussion in RAN1#100bis. To facilitate the discussion, the issues/proposals from the submitted contributions and the FL views are presented in Section 2. The summary of the issues/proposals is provided in Section 3, where the feature lead has also provided his assessment on the critical issues/proposals. Interested companies are welcome to present their views on the priority of these issues.

Issues/proposals for UE/gNB measurements

## UL RTOA reference time

Submitted Proposals

* (Huawei) ***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:*
    - *UL RTOA definition*
    - *Search window configuration for gNB to receive SRS.*
* (Huawei) ***Proposal 2:*** 
  + *Introduce the following new parameter to the higher layer parameter list.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 LPPa  BIT 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. |

* (Huawei) ***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)**   |  |  | | --- | --- | | **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 , where  - is the nominal beginning time of SFN 0 provided by [yy] [xx, TS 38.455]  - 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 ====================== |

FL Comments

This issue of the definition of the UL RTOA reference time was discussed in RAN1#100-e[8]. At that time, the majority view was to let RAN3 to handle this issue. Given that RAN3 has not provided the definition so far, we suggest RAN1 to take a look at this issue again to see if there is a need or RAN1 to provide inputs to RAN3. Intereted companies are also welcome to express their view on whether it is critical for RAN1 to provide the definition in this meeting.

Comments from interested companies

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| --- | --- | --- |
| **Company** | | **Comments** |
|  |  |
|  |  |

## Search window for configuration gNB to receive SRS

Submitted Proposals

* (Huawei) ***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:*
    - *UL RTOA definition*
    - *Search window configuration for gNB to receive SRS.*
* (Huawei) ***Proposal 5:*** 
  + *Introduce the following new parameters to the higher layer parameter list.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR\_pos-Core | NR UL Measurement Report Configuration |  |  | FFS in RAN3 WG | Expected Propagation Delay | Expected Propagation Delay | New |  | For providing an indication of when the SRS is expected to arrive in time at the gNB relative to the UL-RTOA reference time. | FFS in RAN4 WG |  |  | NRPPa 38.455 |  | Similar to expected propagation delay in SLmAP. |
| NR\_pos-Core | NR UL Measurement Report Configuration |  |  | FFS in RAN3 WG | Delay Uncertainty | Delay Uncertainty | New |  | For providing an indication of when the SRS is expected to arrive in time at the gNB with uncertainty (search window). | FFS in RAN4 WG |  |  | NRPPa 38.455 |  | Similar to delay uncertainty in SLmAP. |

FL Comments

This issue was not brought up before. In LTE ULTDOA, the location server does not provide the search window configuration for the reception of SRS. Intereted companies are welcome to express their views on whether it is critical to provide the search window for gNB for SRS reception.

Comments from interested companies

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| --- | --- | --- |
| **Company** | | **Comments** |
| Huawei/HiSilicon | In LTE, such a search window is provided (see [SLmAP, TS 36.459]).  We believe an similar approach should be adopted for NR. At least we should let RAN3 know this is needed for any UL positioning method that requires receiving SRS. |
|  |  |

## NR-TimingMeasQuality for RSTD

Submitted Proposals

* (Huawei) ***Proposal 6:*** 
  + *RAN1 to clarify which interpretation should be used for the timing measurement quality for RSTD.*
    - *Interpretation 1:*
    - *Interpretation 2:*
    - *Where is the TOA quality of the reference and is the TOA quality of the TRP .*
* (Huawei) ***Proposal 7:*** 
  + *RAN1 to clarify whether the reference TRP can have NR-TimingMeasQuality*

FL Comments

Suggest having a discussion in this meeting for the clarification on the timing measurement quality for RSTD.

Comments from interested companies

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| --- | --- | --- |
| **Company** | | **Comments** |
| Nokia/Nokia Shanghai Bell | This should be resolved. In our view discussing Proposal 7 should be the higher priority in RAN1 and that RAN4 may be better to discuss Proposal 6 though we are also open to discussing in RAN1. In either case if this is discussed an LS to RAN4 should be sent with the conclusion. |
|  |  |

## Inter-frequency UE Rx – Tx time difference

Submitted Proposals

* (Huawei) ***Proposal 8:*** 
  + - *Limit UE Rx – Tx time difference only to PRS and SRS in the same band.*
* (Huawei) ***Proposal 9:*** 
  + Adopt the following TP to TS 38.215
* ===================== Unchanged parts omitted ======================

|  |  |
| --- | --- |
| **Definition** | The UE Rx – Tx time difference is defined as TUE-RX –TUE-TX  Where:  TUE-RX is the UE received timing of downlink subframe #*i* from a positioning node, defined by the first detected path in time.  TUE-TX is the UE transmit timing of uplink subframe #*j* that is closest in time to the subframe #i received from the positioning node.  TUE-RX and TUE-TX shall be measured on the same band.  Multiple DL PRS resources can be used to determine the start of one subframe of the first arrival path of the positioning node.  For frequency range 1, the reference point for TUE-RX measurement shall be the Rx antenna connector of the UE and the reference point for TUE-TX measurement shall be the Tx antenna connector of the UE. For frequency range 2, the reference point for TUE‑RX measurement shall be the Rx antenna of the UE and the reference point for TUE‑TX measurement shall be the Tx antenna of the UE. |
| **Applicable for** | RRC\_CONNECTED intra-frequency  RRC\_CONNECTED inter-frequency |

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

FL Comments

Our understanding is that UE Rx – Tx time difference is not limited to the scenarios that PRS and SRS are in the same band.

Comments from interested companies

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| --- | --- | --- |
| **Company** | | **Comments** |
| Huawei/HiSilicon | As there is no higher layer signalling to resolve the PRS-SRS pairing issue based on the current LPP/RRC specification, we suggest to either put the explicit measurement restriction or introduce new higher layer parameters to fix this issue. |
|  |  |

## Reference point for gNB RSRP measurements

Submitted Proposals

* (Huawei) ***Proposal 10:*** 
  + *Send a reply LS to RAN4 to ask RAN4 whether the reference point for the UL SRS RSRP at gNB, currently captured in TS 38.215, is correct or not.*

FL Comments

This seems not critical at this moment. If RAN4 finds any issue on the reference point for the UL SRS RSRP, or any other issues on the measurement definition in TS 38.215, we may assume RAN4 would send LS to RAN1 for the clarification.

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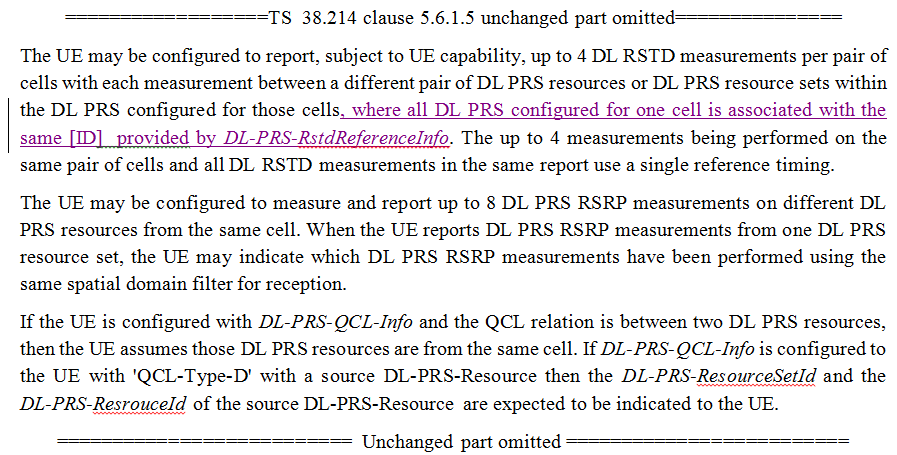
Comments from interested companies

|  |  |  |
| --- | --- | --- |
| **Company** | | **Comments** |
| Huawei/HiSilicon | The previous RAN4 discussion was triggered by RAN1 LS, which does not indicated the issue on power measurement. We think an reply LS to RAN4 may be a good way. |
|  |  |

## Cell ID of DL RSTD measurements

Submitted Proposals

* (ZTE) Proposal 1
  + ***The terminology ‘cell’ should have a clear indication to be associated with the [ID] provided by DL-PRS-RstdReferenceInfo. Adopt the following text changes,***



FL Comments

May need to discuss whether there is a need to make further clarification on the definition of ‘cell’ in the requirement. Our understanding is that a cell is identied by *nr-PhysCellId* together with *nr-CellGlobalId* etc.

Comments from interested companies

|  |  |  |
| --- | --- | --- |
| **Company** | | **Comments** |
| Huawei/HiSilicon | To align with 215, will positioning node to replace cell help? We are OK to discuss the potential fix on the terminology alignment.  To us, PRS Tx/SRS Rx is associated with TRP; SSB is associated with cell (regardless of which TRP is actually transmitting SSB); positioning node is more general. |

## TP for PRS reception procedure

Submitted Proposals

* (OPPO): **Proposal 1**:
  + TP for TS 38.214

|  |
| --- |
| 5.1.6.5 PRS reception procedure  \*\*\* Unchanged text is omitted \*\*\*  For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE can report an associated higher layer parameter *Timestamp*. The *Timestamp* can include the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *DL-PRS-RSTDReferenceInfo*.  The UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP if the measurement is made during a configured measurement gap. When not configured with a measurement gap, the UE is only required to measure DL PRS within the active DL BWP and with the same numerology as the active DL BWP. When the UE is expected to measure the DL PRS resource outside the active DL BWP or with a numerology different from the numerology of the active DL BWP or on any symbols indicated as UL symbol by the serving cell, it may request a measurement gap in higher layer parameter [XYZ].  The UE assumes that the DL PRS from the serving cell is not mapped to any symbol that contains SS/PBCH block from the serving cell. If the time frequency location of the SS/PBCH block transmissions from non-serving cells are provided to the UE then the UE also assumes that the DL PRS from a non-serving cell is not mapped to any symbol that contains the SS/PBCH block of the same non-serving cell.  The UE may be configured to report, subject to UE capability, up to 4 DL RSTD measurements per pair of cells with each measurement between a different pair of DL PRS resources or DL PRS resource sets within the DL PRS configured for those cells. 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 up to 8 DL PRS RSRP measurements on different DL PRS resources from the same cell. 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.When UE reports one DL PRS RSRP measurement, the UE may indicate whether the DL PRS RSRP measurement has been performed using multiple different spatial domain receive filters for receiving the corresponding PRS resource.  If the UE is configured with *DL-PRS-QCL-Info* and the QCL relation is between two DL PRS resources, then the UE assumes those DL PRS resources are from the same cell. If *DL-PRS-QCL-Info* is configured to the UE with 'QCL-Type-D' with a source DL-PRS-Resource then the *DL-PRS-ResourceSetId* and the *DL-PRS-ResrouceId* of the source DL-PRS-Resource are expected to be indicated to the UE.  \*\*\* Unchanged text is omitted \*\*\* |

FL Comments

The proposal is related to UE measurement procedure. Suggest the issue to be discussed in AI 7.2.8.4 together with other similar proposals to AI 7.2.8.4.

Comments from interested companies

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| **Company** | | **Comments** |
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## ‘Positioning node’ in TS 38.215

Submitted Proposals

* (Futurewei, R1-2002048) Proposal 1:
  + The terminology ‘Positioning Node’ in TS 38.215 is replaced by ‘Transmission Point (TP)’ or ‘Reception Point (RP)’, where applicable, as defined in TS38.305.

FL Comments

This issue was discussed in RAN1#100-e. It seems it is simple and reasonable to make the change since ‘TP’ and ‘RP’ are defined in TS 38.305, but ‘Positioning Node’ is undefined.

Comments from interested companies

|  |  |  |
| --- | --- | --- |
| **Company** | | **Comments** |
| Huawei/HiSilicon | To us, PRS Tx/SRS Rx is associated with TRP; SSB is associated with cell (regardless of which TRP is actually transmitting SSB); positioning node is more general. |
| Nokia/Nokia Shanghai Bell | We are okay to discuss as we also proposed to discuss something similar last meeting but given limit of 4 total ED we may not have time. |

## FFSs on Maximum numbers of DL PRS resources and UE capability

Submitted Proposals

* ***(Samsung) Proposal 1***
  + - * *The following values for X1 to X7 should be supported.*:

|  |  |  |
| --- | --- | --- |
| **Description** | **Maximum numbers for DL PRS resources** | **Values that can be signaled as part of UE Capability** |
| Max number of frequency layers (X1) | X1=4 | Values = {1,4}  No other values |
| Max number of TRPs per frequency layer (X2) | X2=64 |  |
| Max number of PRS resource sets per TRP (X3) per frequency layer | X3=2 | Values = {1,2} |
| Max number of Resources per PRS resource set (X4) | X4=64 | Values = {64, 32, 16, 8 ,4, 2,1} |
| Max number of DL PRS Resources per UE (X5) | NA | Values = {16, 8, 4, 2 ,1} |
| Max number of TRPs for all frequency layers (X6) per UE | 256 | Values = {1,…,256} |
| Max number of Resources per frequency layer (X7) | NA | Values = {128, 64, 32, 16, 8 ,4, 2, 1} |

* ***(Samsung) Proposal 2***
  + - * *There is no need to support FR1/FR2 differentiation for the values of X1 to X7*

FL Comments

The FFSs related to UE capability will be further discussed in AI 7.2.11.8. It seems no need to further discuss this issue under this AI.

Comments from interested companies

|  |  |  |
| --- | --- | --- |
| **Company** | | **Comments** |
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## UE capability on DL PRS RSRP

Following agreements were made on Rel-16 UE/gNB positioning measurements in RAN1#99, where it is FFS on whether N is a UE capability

|  |
| --- |
| Agreement:  The prior agreement is updated as given below:  UE can be configured to measure and report up to N=8 ~~(> 1)~~ DL PRS RSRP measurements on different DL PRS resources from the same TRP   * ~~N=[3]~~ FFS: N is a UE capability |

Submitted Proposals

* ***(Samsung) Proposal 3***
  + - * *The number of reported DL PRS RSRP measurements N is not a UE capability*
* ***(CATT) Proposal 2***
  + - * + *There is no need to set N as an UE capability, since the UE will at least try to measure all DL PRS from one TRP, and can report N=8 DL PRS RSRP measurements if the UE detects 8 or more DL PRS.*.

FL Comments

The issues related to UE capability will be covered by AI 7.2.11.8. It seems no need to further discuss this issue under this AI.

Comments from interested companiese

|  |  |  |
| --- | --- | --- |
| **Company** | | **Comments** |
| Samsung | Even though it can be discussed in other AI, it seems more appropriate to have the discussion here with all the context related to measurements. |

## UE/gNB RX-TX time difference measurements for NR E-CID

Submitted Proposals

* (Ericsson, ) Proposal 1:
  + - * Support reuse of Rel-15 SRS resource set for gNB Rx-Tx and UE Rx-Tx measurements for positioning in NR.
      * Send an LS to RAN4 regarding UE Rx-Tx requirement

Note: There is no impact to specifications managed by RAN1

FL Comments

This proposal was discussed in RAN1#100-e[8]. It was not considered as critical at that time by some companies. Intereted companies are welcome to express their view on whether it is critical for RAN1 to further discuss this issue in RAN1#100bis.

Comments from interested companies

|  |  |  |
| --- | --- | --- |
| **Company** | | **Comments** |
| Huawei/HiSilicon | We think the contribution from Ericsson does not explicitly limit it to E-CID positioning.  Our understanding is extending Rel-15 SRS beyond E-CID to even multi-RTT will make multi-RTT a more universal solution; Rel-15 SRS will anyway be configured for MIMO purpose. So we are supportive to discuss this issue. |
| Nokia/ Nokia Shanghai Bell | Unclear how UE Rx-Tx measurement works for Rel-15 UE when DL PRS is Rel-16 measurement. We are okay to disucss gNB Rx-Tx in this meeting based on Rel-15 SRS as it seems quite similar to RTOA. |

# Summary on the Priority of the Issues/Proposals

Table 1 summarizes the views of interested companies on the priority of the Issues/Proposals for the discussion in RAN1#100 e-meeting:

**Table 1 Summary on the Priority of the Issues/Proposals for RAN1#100 e-meeting discussion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Issues/Proposals | Companies | | | |
| High Priority | Low Priority | No Need | Other comments |
| 1. UL RTOA reference time | FL, HW, Intel, QC | SS, vivo, LG | NOK, Ericsson | [NOK] RAN3 work seems to be delayed due to overall 3GPP situation. Suggest we be patient unless RAN3 needs specific input.  [Ericsson] We also think this is not an issue for RAN1.  [HW] This is a RAN1 centric objective in the WID, and RAN1 presumably handle it over to RAN3 without any explicit agreement or LS. |
| 1. Search window for gNB to receive SRS | HW, QC | FL, SS, FW, vivo | Intel,NOK, Ericsson, LG | [NOK] Being discussed in RAN2.  [HW] We do not think it is being entirely covered by RAN2. Yes RAN2 is discussing how to provide the starting time for neighbouring gNBs to receive AP-SRS or SP-SRS, but with all due respect, we have not even discussed how to provide information for the neighbouring gNB to receive periodic SRS. Whether a similar mechanism to DL PRS reception using expected RSTD and uncertainty and if so, what the maximum size of uncertainty range is needs further discussion.  We are fine to also include specific handling of AP/SP-SRS reception. |
| 1. NR-TimingMeasQuality for RSTD | FL, HW, Intel, NOK,Ericsson(P7), LG |  | SS, QC, vivo, | [QC] We assume the same as LTE OTDOA: RSTD Quality for an RSTD meauserment and TOA quality for Reference TRP. We don’t see why there is a need to start discussing specific formulas.  [Ericsson] we are concerned that the specific formula for the measurement quality becomes essentially a new measurement. Our understanding was that the quality report was to be an indicator up to UE implementation. We’re ok with Proposal 7.  [HW] The equation is simply imformative and for clarification purpose, and is not our intention either to put it in specification.  Even as Qualcomm suggests in the way as LTE, the current LPP specification specifies generic nr-DL-PRS-TimingMeasQuality without differentiating reference TRP and neighbouring TRPs. Wouldn’t it be better addressed in RAN1 first and RAN1 provide input to RAN2? We do not see any chance of agreeing such in RAN2 LPP correction without RAN1 input.  [LG] It is not clear whether it means TOA or timing difference, so the clarification seems necessary. |
| 1. Inter-frequency UE Rx – Tx time difference | FL, HW, | SS, Intel, FW, NOK, QC, vivo,Ericsson, LG |  |  |
| 1. Reference point for gNB RSRP measurements |  | HW, SS | FL, Intel, FW, NOK, QC, vivo, Ericsson, LG |  |
| 1. Cell ID of DL RSTD measurements |  | FL, HW, SS | Intel, FW, NOK, QC, vivo, ericsson, LG |  |
| 1. TPs for PRS reception procedure in TS 38.214 |  | SS | FL, HW, Intel, FW, NOK, QC, vivo, ericson, LG |  |
| 1. ‘Positioning node’ in TS 38.215 |  | FL, HW, SS, NOK, QC, vivo, ericsson, LG | Intel |  |
| 1. FFSs on Maximum numbers of DL PRS resources and UE capability | SS |  | FL, HW, Intel, FW, NOK, QC, vivo, ericsson, LG | [QC] This can be in UE capability discussion |
| 1. UE capability on DL PRS RSRP | SS |  | FL, HW, Intel, FW, NOK, QC, vivo, ericsson, LG |  |
| 1. UE/gNB RX-TX time difference measurements for NR E-CID | SS | FL, HW, FW, NOK, ericsson, LG | Intel, QC, vivo | [QC] This appears to be a new feature, and it should not be discussed at this stage of Rel-16. |

**Notes:**

* High priority: Critical issues/Proposals need to be discussed and resolved in this AI in this meeting.
* Low priority: Issues/Proposals may be discussed in this meeting with low priority.
* No Need: Issues/Proposals may not necessarily be discussed in this AI.
* Other comments: Additional comments. For example, if there is a strong view on whether the issues/proposals should be included in, or excluded from this meeting.

References

1. [R1-2001560](E:\\1 Meetings\\RAN1\\2020 04_TSGR1_100bis-e\\Inbox\\R1-2001560.doc) Maintenance of NR positioning measurements Huawei, HiSilicon
2. [R1-2001602](file:///E:\1%20Meetings\RAN1\2020%2004_TSGR1_100bis-e\Inbox\R1-2001602.doc) Maintenance of UE and gNB measurements for NR positioning ZTE
3. [R1-2001733](file:///E:\1%20Meetings\RAN1\2020%2004_TSGR1_100bis-e\Inbox\R1-2001733.doc) Remaining Issues on Measurements for NR Positioning OPPO
4. [R1-2002048](file:///E:\1%20Meetings\RAN1\2020%2004_TSGR1_100bis-e\Inbox\R1-2002048.doc) Remaining details on Measurements Futurewei
5. [R1-2002097](file:///E:\1%20Meetings\RAN1\2020%2004_TSGR1_100bis-e\Inbox\R1-2002097.doc) Remaining issues on NR Positioning Measurements CATT
6. [R1-2002146](file:///E:\1%20Meetings\RAN1\2020%2004_TSGR1_100bis-e\Inbox\R1-2002146.doc) UE and gNB measurements for NR Positioning Samsung
7. [R1-2002622](file:///E:\1%20Meetings\RAN1\2020%2004_TSGR1_100bis-e\Inbox\R1-2002622.doc) Maintenance of rel16 UE and gNB measurements for NR Positioning Ericsson
8. R1- 2001156 FL Summary #2 of Remaining issues on NR Positioning Measurements CATT