3GPP TSG-RAN WG2 Meeting #116bis-e ***R2-220xxxx***

Electronic Meeting, January 17 – 25, 2022

**Agenda item:** 8.11.2

**Source:** Qualcomm Incorporated

**Title:** Summary of [AT116bis-e][616][POS] Remaining proposals on latency reduction

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion.

* [AT116bis-e][616][POS] Remaining proposals on latency reduction (Qualcomm)

Scope: Discuss the remaining proposals on validity conditions for preconfigured assistance data, measurement gaps, and PRS processing window.

Intended outcome: Report to CB session

Deadline: Friday 2022-01-21 1600 UTC

Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

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| --- | --- | --- |
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# 2. Validity Conditions for DL-PRS Assistance Data

Company Proposals:

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| Intel [2] | Proposal 1: Introduce an Add/mod/release mechanism for pre-configured DL-PRS assistance data.  Proposal 2: RAN2 to discuss if a validity timer associated with pre-configured DL-PRS assistance data shall be defined to ensure that UE and LMF are aligned on the validity of the AD. |
| CATT [4] | Proposal 15: RAN2 to agree to area ID within each TRP for pre-configured assistance based on a specified area.  Proposal 16: RAN2 to discuss the candidate areaID: systemInformationAreaID（SIAID）or RAN ID. |
| vivo [5] | Proposal 1: To support mobility, the pre-configured assistance data shall be associated with a validity area, which is a list of cells that the target UE may camp on.  Proposal 2: The pre-configured assistance data shall be associated with a validity timer.  Proposal 3: The UE shall request new assistance data when no pre-configured assistance data is valid.  Proposal 4: The UE shall release the pre-configured assistance data when the validity timer expires.  Proposal 6: RAN2 to discuss how to solve the coexistence of normal configuration and pre-configuration.  • Alt1: left to LMF implementation to configure either configuration or pre-configuration, the previous one is overwritten by the new one.  • Alt2: when the UE has both normal configuration and pre-configuration, the UE only performs the measurement based on the normal configuration. Meanwhile, the UE shall store and utilize the pre-configuration when the normal one is released. |
| Huawei [6] | Proposal 1: The LMF should be able to release part or all of the PRS assistance data from the UE. |
| OPPO [8] | Proposal 1: RAN2 to agree that the validity condition(s) A (validity area), B (validity timer or a numerical limit on number of times the AD is utilized) and C (explicit modification or releases from the LMF/NG-RAN) of the pre-configured positioning assistance data. |
| Xiaomi [9] | Proposal 3: If PRS configuration broadcasted by gNB is different from the pre-configured assistance data stored by UE, UE will use the PRS configuration broadcasted by the gNB. |
| Fraunhofer [12] | Proposal 1: RAN2 shall agree to provide UE with multiple instances of pre-configured assistance data applicable to different areas within the network.  Proposal 2: The selection of an instance of AD from multiple AD provided may be based on one or more of the following:  a. Based on UE measurement (FFS)  b. Based on logical information (e.g. the camped cell) |
| Lenovo [14] | Proposal 3: RAN2 to support validity of pre-configured assistance data based on a validity area (e.g. list of cells). FFS signalling details.  Proposal 4: Timer-based validity criteria requires further discussion.  Proposal 5: Further discussion in relation to the extra signalling cost vs latency reduction of additional modification/release signalling of pre-configured AD is needed.  Proposal 6: Support the priority indication for multiple pre-configured assistance data sets. Details can be further discussed under the context of the complete definition of priority of PRS configuration for assistance data and measurement. |
| InterDigital [16] | Proposal 3: Support providing a validity area (e.g. consisting of a list of cell) to UE, where the validity area is associated with preconfigured assistance data  Proposal 4: Support providing validity time (e.g. valid time duration/timer) to UE, where the vadlity time is associated with preconfigured assistance data  Proposal 5: The validity conditions/criteria associated with the preconfigured PRS configurations are provided to the UE using LPP assistance data transfer procedure or posSIB  Proposal 6: The validity conditions/criteria are associated on a per-PRS configuration basis when the assistance data is transfered via dedicated signalling (e.g. via LPP assistance data)  Proposal 7: The validity conditions/criteria are associated on a per-assistance data basis (e.g. consisting of multiple PRS configurations) when the assistance data is transferred via posSIB |

Proposals for discussion [22]:

**Proposal 3a:** Pre-configured assistance data can be associated with a "validity area". FFS on details.

**Proposal 3b:** Pre-configured assistance data can be associated with a "validity time". FFS on details.

**Proposal 3c:** Pre-configured assistance data can be explicitly modified or released. FFS on details.

**Proposal 3d:** Pre-configured assistance data can consist of multiple instances, where each instance is applicable to a different area within the network. FFS on details.

The (modified) Proposal 3a was agreed:

Agreements:

Proposal 3a (modified): Pre-configured DL-PRS assistance data can be associated with a "validity area" at least in LPP. FFS on details and whether it would be included in RRC broadcast.

Companies are asked to provide their views on the remaining Proposals 3b-3d.

**Question 1:** Do you agree that pre-configured DL-PRS assistance data can be associated with a "validity time"? Please provide the reason for your answer in the comments column.

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| Company | | Yes/No | Comments |
| Fraunhofer | | Yes | We could also have a value of validity time, which allows the UE to retain assistance data for longer than expiry of SI for handling (relatively) static deployments. |
| Apple | | No | Validity time is clearly not essential, but rather an optimization. |
| Huawei, HiSilicon | No | Not sure how it reduces the latency, since the timer is only used to release the PRS resource when the timer expires |
| InterDigital | Yes | We think there are clear benefits for associating the pre-configured DL-PRS assistance data and validity time. For example, by configuring validity time the LMF does not need to send another explicit indication to UE for releasing the preconfigured DL-PRS assistance data and the UE can stop using or release the preconfigured DL-PRS after expiry of the validity time. |
| Intel | Yes | The validity area criterion cannot work for the case that the UE does not move around. Then the question is whether the UE should store the preconfigured AD forever and only discard it when the area is not valid. We think it is suboptimal design to ask the UE to store the preconfigured AD forever, and a better solution is needed. That could be:  Option 1: Leave it to UE implementation on when to discard the stored preconfigured AD; But this will make preconfigured AD not efficient.  Option 2: The UE discards the preconfigured AD based on a validity timer. We think it is important to ensure when the UE should discard the preconfigured AD and validity timer is the cleaner solution than leaving it to UE implementation. |
| Xiaomi | | No | One validity condition is enough for pre-configured PRS assistance data and UE can release the pre-configured assistance data when the area condition is not met or UE receives the new PRS assistance data. |
| CATT | | No | The signal of these pre-configuration DL-PRS is always on air. Even if the pre-configuration DL-PRS were out of time, this signal still is on air and still can be searched by the UE if the DL-PRS AD is stored in the device. Only when UE moves out of this area, the UE won’t search the on air PRS signal. So we don’t find the value of validity time. |
| Ericsson | | Yes | We are fine to support it based upon Intel’s comment. |
| vivo | | Yes | As we already agreed that pre-configured assistance data can be independent of any LPP positioning session, the UE can store the pre-AD even when the location session ends.  Therefore, the timer is essential to enable the UE to release it, especially when the pre-AD will change after the validity time. For instance, the gNB transmitting the DL-PRS is configured to be turned off at a future time due to energy saving.  With the validity timer, the overall latency can be reduced as the UE can request for new AD immediately when the AD is invalid, instead of requesting a new one after failed measurement. |
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**Question 2:** Do you agree that pre-configured DL-PRS assistance data can be explicitly modified or released?   
Please provide the reason for your answer in the comments column.

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| Company | | Yes/No | Comments |
| Fraunhofer | | Yes | In general, we find usefulness of being able to manage AD given to the UE. If we take this agreement, we think we need to align on at what granularity these updates shall be made.  We also need to take into account that the updates should keep the data from broadcast and unicast consistent.  Therefore, we propose that modifying or releasing DL-PRS assistance data would be helpful together with the feature of configuring multiple instants of assistance data. Then each instant of assistance data can be updated (added/modified/released). This would then also be suitable for broadcast (since each instance is applicable to certain area). |
| Apple | |  | Initially we were against this but if there is a majority support we can accept it. |
| Huawei, HiSIlicon | Yes | We think it is beneficial to have this to ensure that the LMF and the UE has the same understanding on the PRS being used |
| InterDigital |  | We do not think it is necessary but ok if there is consensus |
| Intel | Yes | This is useful to ensure that part of the DL-PRS assistance data can be modified or released. If we do not have the modification/release mechanism, we have to specify the UE shall discard all original preconfigured AD when the network configures the new preconfigured AD, even if the network only wants to change some of them. This will waste signalling resources and can easily be addressed by having this addition/modification procedure. |
| Xiaomi | | No | This is not essential since the network can provide the new PRS assistance data by the existing LPP procedure and also UE can release the pre-configured assistance data when the validity condition is not met. |
| CATT | | No | DL-PRS signals are always on air whatever the DL-PRS assistance data are sent to UE or not. So we don’t see the benefit to release the AD. Please refer to the AD definition in LPP, all AD are “Need ON”. |
| Ericsson | | No | Only when multiple AD is provided, the add/mod/rel seems beneficial. Else we do not see the need of it. |
| vivo | | Yes | Agree with intel that it can provide the flexibility to modify part of pre-AD. |
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**Question 3:** Do you agree that pre-configured DL-PRS assistance data can consist of multiple instances, where each instance is applicable to a different area within the network?  
Please provide the reason for your answer in the comments column.

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| Company | | Yes/No | Comments |
| Fraunhofer | | Yes | Multiple instances of A/D pre-configured to the UE, where the UE selects the applicable A/D corresponding to its location (e.g. camped cell) reduces latency, signalling overhead (in mid-term).  If we consider RRC\_INACTIVE UEs in a simple deployment scenario consisting of indoor factory with two floors, and let’s take a simple scenario that the UE moves between two floors of a factory, each of which is equipped with multiple TRPs.  The A/D of floor 1 could have validity indicated as Area 1 (e.g. group of cells in area 1), and A/D of floor 2 can have validity indicated as Area 2 (e.g. group of cells in area 2). If a UE is provided with AD of Area 1 and A/D of Area 2, then the UE can switch between these two A/Ds already provided to the UE with corresponding validity.  In Rel. 16, if the UE moves between these two floors, in Rel. 16, each time the UE moves it needs to get the A/D, and has to initiate the corresponding signaling. According to our proposal, we get the AD once and switch between them. We save signaling and also delay. If we consider UE-based positioning, then we have a lot of signalling reduction and reduction in delay.  When some PRS configuration changes in an area, this can be updated in the corresponding instance. |
| Apple | | No | The benefit is not clear |
| Huawei, HiSIlicon |  | This is a special implementation of area-based validity and we think this can already been supported if we support area validity |
| InterDigital | Yes |  |
| Intel | Yes | We are fine to consider this enhancement considering:  1 it is the addition on top of 3a, i.e. only need to additional introduce the lists; Therefore, the specification impact can be minimal  2 We could see the benefit from the scenario mentioned by Fraunhofer |
| Xiaomi | | Yes | If Multiple instances of pre-configured assistance data is supported, we think how to select pre-configured data is based on UE implementation. |
| CATT | |  | It seems the same idea of validity area according to the feedback from Fraunhofer. We already agreed at meeting: Pre-configured DL-PRS assistance data can be associated with a "validity area" at least in LPP. |
| Ericsson | | Yes |  |
| vivo | | Yes | The priority of PRS resources to be measured shall be different in different areas. With the pre-AD associated with different validity areas, the UE can utilize the most suitable pre-AD to perform the measurement. |
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# 3. Measurement Gaps for Positioning

## 3.1 Pre-configuration of Measurement Gaps for Positioning

Company Proposals:

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| Intel [3] | Proposal 2: The UE can be pre-configured with a set of MG patterns for DL PRS processing in order to reduce overall positioning latency. FFS any specification impact.  Proposal 5: The MG configuration itself shall not be configured via MAC CE. |
| CATT [4] | Proposal 1: The pre-configured positioning MG(s) can be provided to UE via RRCReconfiguration message, e.g., a new IE named preConfiguredMGforPosInfotoAddModList-r17 is introduced within the MeasGapConfig, where each entry of the list indicates a positioning MG.  Proposal 2: The content of the legacy measurement gap configutation can also apply for R17 newly introduced pre-configured positioning MG. |
| vivo [5] | Proposal 16: Introduce the pre-configuration signaling of measurement gaps in MeasConfig.  • Introduce a list of pre-configured MGs in MeasGapConfig  • Each pre-configured MG is associated with a preconfiguredGapID  • The initial status of each pre-configured MG: activated or not  Proposal 17: Allow UE to use the legacy RRC location measurement indication procedure to request the gap even when pre-configured measurement gaps are provided to the UE in case, e.g., the (part of) PRSs do not fall into the gap duration. |
| Hiawei [7] | Proposal 3: When UE supports UL MAC CE for measurement gap request, network configures UL MAC CE based activation request, and MG is pre-configured to the UE, the UE should:   If one of the pre-configured MG can satisfy the need of PRS measurement in the UE, the UE triggers UL MAC CE for MG request   Otherwise, UE sends the MG request by RRC message LocationMeasurementIndication  Proposal 12: R2 confirms that concurrent MG can only be associated with only multiple pre-configured gaps for positioning, but there can be only one activated MG at a time.  Proposal 13: R2 confirms that NCSG is not supported for PRS measurement in R17. |
| Sony [11] | Proposal 1: gNB provides the configuration of supported MG(s) for positioning latency improvements to UE / LMF. |
| Lenovo [14] | Proposal 7: A preconfigured measurement gap (MG) configuration is associated with a single ID. Multiple preconfigured MG configuration, each with associated IDs may be delivered by the network. |
| InterDigital [17] | Proposal 1: RAN2 confirms preconfiguring of multiple MG configurations for positioning in UE via RRC signalling  Proposal 2: The parameters associated with each MG configuration preconfigured in UE includes at least start timing/slot, measurement duration, periodicity and ID of MG |
| Samsung [20] | Proposal 1. RAN2 agree to reuse the legacy MG configuration information in RRCReconfiguration message for new MG activation mechanism requested by LMF.  Proposal 3. RAN2 agree that gap Offset, MG length, MG repetition period, MG timing advance are used for a single MG configuration as in the legacy MG configuration.  Proposal 4. RAN2 discuss and conclude whether preconfigured MG list is located in legacy MeasGapConfig or in new field for only preconfigured MG list for positioning. |
| ZTE [21] | Proposal 1: Support to add a new IE parallel to MeasGapConfig in 38.331 for pre-configuration of MG. |

Proposals for discussion [22]:

**Proposal 4a:** The pre-configured Measurement Gap Configurations for Positioning are provided via RRCReconfiguration message. FFS whether an existing IE can be re-used for adding the pre-configured Measurement Gap Configurations for Positioning or whether a new IE should be introduced.

**Proposal 4b:** The content of a pre-configured Measurement Gap for Positioning Configuration includes at least the existing measurement gap parameter and an ID. Other parameter are FFS.

**Proposal 4c:** The existing RRC LocationMeasurementIndication procedure to request the positioning measurement gaps can still be used by a UE, even when pre-configured measurement gaps are provided to the UE.

**Proposal 4d:** Concurrent measurement gap can only be associated with only multiple pre-configured gaps for positioning, but there can be only one activated measurement gap at a time.

**Proposal 4e:** Network-Controlled Small Gap is not supported for PRS measurement.

Companies are asked to provide their views on the Proposals 4a-4e.

**Question 4:** Do you agree that the pre-configured Measurement Gap Configurations for Positioning are provided via *RRCReconfiguration* message?   
If Yes, should the pre-configured Measurement Gap Configurations for Positioning be included in IE *MeasGapConfig* or should they be included in any other IE (please specify).  
Please provide the reason for your answer in the comments column.

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| --- | --- | --- | --- |
| Company | RRCReconfiguration?  Yes/No | MeasGapConfig?  Yes/No | Comments |
| Apple | Yes |  | We already agreed to support MAC CE activation, which would make little sense without pre-configuration. |
| Huawei, HiSilicon | Yes | Yes |  |
| InterDigital | Yes | Yes |  |
| Intel | Yes | Yes |  |
| Xiaomi | Yes | Yes |  |
| CATT | Yes | Yes | Positioning MG has no difference from the legacy MG, but just dedicated for positioning. |
| Ericsson | Yes | Yes |  |
| vivo | Yes | Yes |  |
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**Question 5:** Do you agree that the content of a pre-configured Measurement Gap for Positioning Configuration includes at least the existing measurement gap parameter together with an ID?  
Please provide the reason for your answer in the comments column.

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| Company | Yes/No | Comments |
| Apple | Yes | That’s the RAN1 agreement |
| Huawei, HiSIlicon | Yes | This is aligned with the R1 agreement that the gap should be requested/activated/deactivated with an ID |
| InterDigital | Yes | Confirm RAN1’s agreement |
| Intel | Yes | The use of ID based configuration was agreed in RAN1 |
| Xiaomi | Yes |  |
| CATT | Yes | Positioning MG has no difference from the legacy MG, but just dedicated for positioning, thus the existing measurement gap parameter can also apply to positioning MG.  Further, as per RAN1 LS indicated, each positioning MG should be associated with an ID. |
| Ericsson | Yes |  |
| vivo | Yes | Align with RAN1 agreement. |
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**Question 6:** Do you agree that the existing RRC *LocationMeasurementIndication* procedure to request the positioning measurement gaps can still be used by a UE, even when pre-configured measurement gaps are provided to the UE?  
Please provide the reason for your answer in the comments column.

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| Company | Yes/No | Comments |
| Apple | Yes | This is aligned with the RAN1 agreements |
| Huawei, HiSIlicon | Yes | Sometimes the candidate pre-configured MG may not be able to satisfy the need for MG for PRS measurement. In this case, the UE should be able to fallback to the legacy procedure to request the gap |
| InterDigital | Yes |  |
| Intel | Yes |  |
| Xiaomi | Yes | It is up to UE implementation to use the existing procedure to request MG or to request pre-configured MG. |
| CATT | Yes | Up to UE implementation whether to initiate the legacy mechanism to obtain MG or R17 mechanism. |
| Ericsson | Yes | Rel-17 is simply add on optional; Rel-16 behaviour can always be used or fallback to legacy behaviour should be allowed |
| vivo | Yes | When no pre-MG is sufficient, the UE can request MG via existing way. |
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**Question 7:**  Do you agree that concurrent measurement gap can only be associated with only multiple pre-configured gaps for positioning, but there can be only one activated measurement gap at a time?  
Please provide the reason for your answer in the comments column.

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes | This is aligned with the RAN1 agreements |
| Huawei, HiSilicon | Yes, but | There can be multiple preconfigured MG associated with positioning but there should only be one activated MG for positioning as R4 has agreed  If positioning MG supports per-FR MG, we would consider it still being possible to have only one activated for each FR at a time. |
| InterDigital | Yes |  |
| Intel | Yes | As per RAN1 agreement, the UE may have multiple pre-configured MG, while one may be activated using MAC CE |
| Xiaomi | Yes |  |
| CATT | No | This discussion is out of latency scope.  RAN2 didn't receive the LS from RAN4 on “concurrent measurement gap can only be associated with only multiple pre-configured gaps for positioning”. We do not support the concurrent measurement gap can only be associated with only multiple pre-configured gaps for positioning so far.  #018 is discussing the concurrent gap as well.  **Feature 2** – Concurrent Gap   * Concurrent gaps are multiple measurement gaps, and each gap pattern could be associated with one or multiple frequency layers. * No new gap pattern is introduced for concurrent gap, the existing R15/R16 gap pattern could be configured for the concurrent gaps.   + Note that NTN is discussing to have more than one measurement gap, which seems to be covered by this work.   **Feature 4** – ePOS gap (Pre-configured MG for PRS)   * R1 intend to have *multiple* pre-configured measurement gaps (MG) for PRS measurement. RRC to provide the pre-configuration. * **UL** MAC CE is used to request activate/deactivate of pre-configured PRS MG. * **DL** MAC CE is used to activate/deactivate a pre-configured PRS MG. * It seems that same R15/R16 measurement gap pattern will be reused * Assuming only one activated at a given time |
| Ericsson | Not for us to agree; upto RAN1/RAN4 |  |
| vivo | Yes |  |
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**Question 8:** Do you agree that Network-Controlled Small Gap is not supported for PRS measurement?  
Please provide the reason for your answer in the comments column.

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| Company | Yes/No | Comments |
| Huawei, HiSilicon | Yes | R4 has already agreed on this so we need to confirm on R4 agreement |
| Intel | Yes | We can follow RAN4 |
| CATT | Yes but | This discussion is out of latency scope.  **#018 offline**  **Feature 3** – Network control small gap (NCSG)   * NCSG is a kind of measurement gap but causes small interruption to the serving cell(s) (i.e. interruption only at start and end of the MGL, not whole MGL). * R15 gap pattern is reused (Positioning gap pattern is NOT applicable) * The UE has to report whether it support NCSG per target band per BC |
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| Ericsson | Agree with CATT |  |
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## 3.2 Activation/Deactivation of Measurement Gaps for Positioning

Company Proposals:

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| Intel [3] | Proposal 3: The UE may perform request for (de)activation of MG from this pre-configured set using new UL MAC CE (e.g. MG (De)activation Request MAC CE) indicating the requested MG ID, following which the UE should utilize the MG once it gets confirmation from the network.  Proposal 4: A new DL MAC CE for activation/deactivation of configured MG (by using (de)activated MG ID) shall be supported to allow the gNB to activate/deactivate MG at the UE. |
| CATT [4] | Proposal 4: A new UL MAC CE for positioning MG(s) activation/deactivation is introduced, which provides the bitmaps of the activation status of each positioning MG(s).  Proposal 5: RAN2 to agree that the above example MAC CE can be taken as baseline for UE initiated positioning MG activation/deactivation MAC CE.  Proposal 6: Not support the activation of MG by LMF. |
| vivo [5] | Proposal 18: RAN2 to discuss whether the UL MAC CE activation of the pre-configured gap is used only for positioning scenario, or also for other purposes, e.g., RRM measurement. |
| Huawei [7] | Proposal 2: UL MAC CE can be used for MG/PPW activation/deactivation request.  Proposal 4: Trigger SR when there is no PUSCH and UL MAC CE for MG/PPW activation/deactivation request is triggered.  Proposal5: Priority of the UL MAC CE for MG/PPW activation/deactivation request is higher than BSR while lower than LBT failure MAC CE in LCP  Proposal7: R2 confirms that DL MAC CE can be supported for pre-configured MG/PPW activation/deactivation command. |
| Xiaomi [9] | Proposal 5: The UE shouldn’t send MG activation request to gNB if LMF has already sent the MG activation request to the gNB.  Proposal 6: Whether UE can send MG activation request to gNB or not is based on the indication from the LMF by LPP provide assistance data or LPP request location information message. |
| Sony [11] | Proposal 2: Support DL MAC CE payload contains the triggering/activation of MG(s) for positioning measurement, including the index of the selected measurement gap configuration. |
| Lenovo [14] | Proposal 9: RAN2 to further discuss the relationship between the two activation options (by the UE and/or LMF) of the MG. |
| Ericsson [15] | Proposal 1 MAC CE for measurement gap request is not supported |
| InterDigital [17] | Proposal 3: RAN2 confirms support for activation of a preconfigured MG by gNB via DL MAC CE  Proposal 4: RAN2 confirms UE sends the request for MG activation to gNB in UL MAC CE which includes the ID of a preconfigured MF configuration for Option 1 (UE-initiated MG activation)  Proposal 6: LMF can send an indication/flag to UE in LPP message for indicating not to send a request for MG configuration/activation when Option 2 (LMF-initiated MG activation) is supported  Proposal 7: Support deactivation of a preconfigured MG by gNB (via DL MAC CE)or UE (via UL MAC CE) |
| Samsung [20] | Proposal 5. RAN2 design new UL and DL MAC CE which are used for indicating a single ID, one of preconfigured MG list, to be used MG activation request from UE, and its confirm from serving gNB, respectively. |

Proposals for discussion [22]:

**Proposal 5a:** A new UL MAC CE for positioning measurement gap activation and deactivation request is introduced.

**Proposal 5b:** The new UL MAC CE for positioning measurement gap activation and deactivation request includes at least the ID of the pre-configured positioning measurement gap configuration for which the activation/deactivation is requested. Other parameter are FFS.

**Proposal 5c:** A new DL MAC CE for positioning measurement gap activation and deactivation command is introduced.  
Note, if this Proposal is agreed, RAN2 may need to send an LS to RAN1 confirming that DL MAC CE can also be used for positioning measurement gap deactivation.

**Proposal 5d:** The new DL MAC CE for positioning measurement gap activation and deactivation command includes at least the ID of the pre-configured positioning measurement gap configuration which has been configured/activated by the gNB. Other parameter are FFS.

**Proposal 5e:** The Scheduling Request should be triggered when there is no PUSCH and UL MAC CE for positioning measurement gap activation/deactivation request is triggered.

The (modified) Proposals were already agreed.

Agreements:

Proposal 5a: A new UL MAC CE for positioning measurement gap activation and deactivation request is introduced.

Proposal 5b: The new UL MAC CE for positioning measurement gap activation and deactivation request includes at least the ID of the pre-configured positioning measurement gap configuration for which the activation/deactivation is requested. Other parameter are FFS.

Proposal 5c (modified): A new DL MAC CE for positioning measurement gap activation and deactivation command is introduced for positioning latency reduction. LS to RAN1/4 indicating our conclusion, and confirming that DL MAC CE can also be used for positioning measurement gap deactivation as well as activation (to be drafted by email).

Proposal 5d: The new DL MAC CE for positioning measurement gap activation and deactivation command includes at least the ID of the pre-configured positioning measurement gap configuration which has been configured/activated by the gNB. Other parameter are FFS.

Proposal 5e: The Scheduling Request should be triggered when there is no PUSCH and UL MAC CE for positioning measurement gap activation/deactivation request is triggered.

## 3.3 LMF Assistance Information / NRPPa Aspects

Company Proposals:

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| --- | --- |
| Intel [3] | Proposal 1: In order to support MG activation request procedure, LMF needs to be able to provide MG configuration related information to the gNB. For this purpose, NRPPa signaling needs to be defined, for which RAN3 needs to be consulted. |
| CATT [4] | Proposal 3: RAN2 to agree and send a LS to indicate to RAN3, that it is gNB to determine the pre-configuration of positioning MG(s), and LMF provides a full PRS configuration, and/or the positioning MG related capability to gNB to assist the gNB to determine the pre-configuraton of positioning MG(s).  Proposal 6: Not support the activation of MG by LMF. |
| vivo [5] | Proposal 13: LS to RAN3 to specify the NRPPa message including the assistance data from LMF to gNB to help with the pre-configured MG configuration.  • the time/frequency characteristics of PRS of related TRPs  Proposal 14: LS to RAN3 to specify the NRPPa message including the PRS measurement characteristics from LMF to gNB to request MG.  • the time/frequency characteristics of PRS of related TRPs  • the required QoS of positioning  Proposal 15: The LMF should indicate whether the LMF will help to request MG when LMF sends the LPP RequestLocationInformation message to the UE. |
| Huawei [7] | Proposal 1: For MG/PPW preconfiguration, LMF may assist gNBs to exchange the PRS configuration via a non-UE associated NRPPa message.   It is up RAN3 to decide whether other methods can be considered.   Send an reply LS to RAN3/RAN1.  Proposal6: NRPPa message for MG/PPW activation/deactivation request should include the same content as the RRC message LocationMeasurementIndication: |
| Xiaomi [9] | Proposal 4: In order to assist gNB to determine the pre-configuration MGs, LMF provides PRS configuration and /or recommended MG configuration to the gNB. |
| Sony [11] | Proposal 1: gNB provides the configuration of supported MG(s) for positioning latency improvements to UE / LMF.  Proposal 3: Define a timing relationship between LPP location information request and NRPPa on MG activation request. |
| Lenovo [14] | Proposal 8: LMF may align with the gNB on the preconfiguration of measurement gap (MGs). FFS DL-PRS configuration details in coordination with RAN3. |
| InterDigital [17] | Proposal 5: LMF can indicate to gNB information on the DL-PRS configuration provided to UE and the request for MG activation for Option 2 (LMF-initiated MG activation) |
| Samsung [20] | Proposal 2. RAN2 discuss whether MG preconfiguration at serving gNB is impacted only by LMF’s PRS information or can be determined by serving gNB itself. |

Proposals for discussion [22]:

**Proposal 6a:** The information that needs to be transferred between LMF and gNB to support the positioning measurement gap configuration and pre-configuration may include one or more of the following options:

- DL-PRS configuration of the relevant TRPs

- Positioning measurement gap capabilities of the UE

- Positioning QoS

- Explicit Positioning measurement gap configuration information (e.g., as defined in RRC GapConfig)

- Positioning measurement gap configuration information as defined in RRC LocationMeasurementIndication message

FFS on other option(s).

FFS on which option(s) are needed.

FFS on whether different information content is needed for positioning measurement gap configuration and positioning measurement gap pre-configuration.

Companies are asked to provide their views on the Proposals 6a.

**Question 9:** Do you agree that an LMF needs to provide "assistance information" to a gNB to support

(a) measurement gap pre-configuration (as discussed in section 3.1 above), and

(b) measurement gap configuration/activation (without UE request)?

NOTE: (b) refers to Option 1 of the following RAN1 agreement:

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| --- |
| Agreement:  Support the following options (in the agreement made in RAN1#106-e) for a new mechanism of MG activation request for the purpose of positioning.   * Option 2: by UE (via UCI or UL MAC CE)   + Select only one of UCI and UL MAC CE in RAN1#106bis-e * Option 1: by LMF (via an NRPPa message)   + Note: This is transparent to the UE |

Please provide the reason for your answer in the comments column.

|  |  |  |
| --- | --- | --- |
| Company | (a), (b)? | Comments |
| Apple |  | Isn’t this in RAN3 domain? |
| Huawei, HiSIlicon | (a),(b) | (a) can be applicable for Option2. On the assistance for gNB to determine the preconfiguration, we understand this can be done by OAM, but if NRPPa solution is needed, it should be non-UE associated.  (a) and (b) are applicable for Option1 |
| InterDigital |  | In principle yes to (a) and (b), but should be up to RAN3 to decide |
| Intel |  | While we think both (a) and (b) are applicable, we also think this is something that needs to be discussed and agreed in RAN3 |
| Xiaomi | (a), (b) | It may achieve more positioning latency. |
| CATT | a), or leave to RAN3 | ***On configuration of positioning MG:***  In general, we support the gNB to configure the positioning MG, since LMF is not aware of the scheduling of service, and the legacy RRM MG configurations.  Further, to assist the gNB to configure the positioning MG, LMF need to at least provide the essential assistance information, e.g., PRS configuration of UE, as well as the positioning MG related capability.  ***On activation/deactivation of positioning MG from NW side:***  Indeed, we have some concerns on the positioning MG activation/deactivation triggered by NW side, since the LMF or the gNB is not aware of the PRS measured by UE.  But if majority agree, we are fine either. And for this case, LMF should firstly trigger the activation “request” or “indication” to the gNB, but it is up to the gNB to decide whether to activate the positioning MG.  or as Apple/IntelDigital indicated, we can also leave it to RAN3 |
| Ericsson | (a), (b) | Yes, we need this as it can save more latency and would need less air interface signaling. |
| vivo | (a),(b) | RAN3 should be informed if RAN2 reaches the consensus. |
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**Question 10:** Which of the following information needs to be transferred between LMF and gNB to support the positioning measurement gap (pre-)configuration:

(a) DL-PRS configuration of the relevant TRPs

(b) Positioning measurement gap capabilities of the UE

(c) Positioning QoS

(d) Explicit Positioning measurement gap configuration information (e.g., as defined in RRC *GapConfig*)

(e) Positioning measurement gap configuration information as defined in RRC *LocationMeasurementIndication* message

(f) other

Please provide the reason for your answer in the comments column.

|  |  |  |
| --- | --- | --- |
| Company | Option(s) (a)-(f) | Comments |
| Apple |  | Isn’t this in RAN3 domaion? |
| Huawei, HiSIlicon | (a) | (a) can be considered. But up to R3 to make the final decision whether this is needed in addition to OAM  We don’t think (b) to (e) is needed for preconfiguraiton   * For (b), the capability is not needed for LMF * For (c), positioning QoS should not be configured by the gNB for the MG configuration and the QoS can be reflected in the NRPPa including the information in LocationMeasurementInformation * For (d), we think the gap should be compiled by the gNB instead of the LMF   For (e), we think it is not needed for preconfiguration, but should be adopted for MG request |
| InterDigital |  | To be left to RAN3 to decide |
| Intel |  | Up to RAN3 |
| Xiaomi | 1. (d) | gNB can determine the pre-configured MG based on (a) , LMF has the UE positioning requirements can recommend MG. |
| CATT | a),b), f), or leave to RAN3 | f) DL-PRS configuration of the **UE**  From our perspective, it is more efficient for the gNB to configure (or activate, if RAN2 agreed the activation trigged from NW side) the positioning MG based on the DL-PRS configuration of a specific UE.  or as Apple/IntelDigital indicated, we can also leave it to RAN3 |
| Ericsson | c), e) | But we can leave to details to RAN3 |
| vivo | a for non-UE associated,  a, c for UE associated | If the LMF knows a specific UE will be located at a future time (e.g., deferred MT-LR), the LMF can send the (a) PRS of related TRP and the (c) QoS (e.g., response time) to serving sell to help with pre-MG configuration.  If the LMF just wants to config pre-MG to the UEs that support pre-MG, then (a) is enough.  Agree with the above that the final decision is left to RAN3. |
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# 4. PRS Processing Window

## 4.1 (Pre-)configuration of PRS Processing Window

Company Proposals:

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| CATT [4] | Proposal 7: The PRS processing window configuration can be provided to UE via RRCReconfiguration message.  Proposal 8: RAN2 to agree that the PRS processing window is configured on per BWP level.  Proposal 9: RAN2 to confirm with RAN1 on the number of PRS processing window can be configurd per BWP before to discuss the detailed RRC and/or MAC CE format |
| Huawei [7] | Proposal8: Configure PPW as PPW-config under servingCellConfig. |
| Lenovo [14] | Proposal 14: RAN2 to support the configuration of the processing via RRC and corresponding activation by DL MAC CE. |
| Ericsson [15] | Proposal 2 PRS Processing window is configured only by means of RRC.  Proposal 3 Extend MeasConfig and Add the proposed PRSProcessingWindow IE for PRS processing window configuration in TS38.331 as shown.  Proposal 4 Wait for RAN1 to decide on the Processing type, Band/CC-ID and Priority Indication from gNB to UE. |
| Lenovo [17] | Proposal 8: RAN2 confirms preconfiguring of prioritization window (with the parameters agreed by RAN1) in UE via RRC signalling  Proposal 10: Support gNB configuring the options for 2-priority states or 3-priority states in UE and providing the priority of DL-PRS to UE via RRC signalling |
| ZTE [21] | Proposal 2: From RAN2 point of view, RRC configuration+MAC CE activation is feasible for PRS processing window configuration.  Proposal 3: From RAN2 point of view, the pre-configuration for PRS processing window configuration is rather similar with pre-configured MG configuration: serving gNB configures multiple PRS processing windows, each of them associates with an ID. Then, a new DL MAC-CE is introduced to choose one ID to activate corresponding PRS processing window for UE. |

Proposals for discussion [22]:

**Proposal 8a:** The PRS processing window configuration can be provided to the UE via RRCReconfiguration using one of the following options:

- configured per BWP

- included in MeasConfig

FFS on other option(s).

Companies are asked to provide their views on the Proposal 8a.

**Question 11:** Do you agree that the PRS processing window configuration is provided via *RRCReconfiguration* message?   
If Yes, should the PRS processing window configuration be

(a) configured per BWP,

(b) included in MeasConfig,

(c) other

Please provide the reason for your answer in the comments column.

|  |  |  |  |
| --- | --- | --- | --- |
| Company | RRCReconfiguration?  Yes/No | (a),(b),(c)? | Comments |
| Apple | Yes |  |  |
| Huawei, HiSilicon | Yes | (a) | PPW can only be used when PRS is within the active BWP of the UE and the scs of the PRS is the same as that of the BWP. So, configuration under BWP is aligned with the current agreement on PPW. |
| InterDigital | Yes |  | On the question of granularity for PRS processing window configuration, we think this can be left to RAN1 to decide |
| Intel | Yes |  | We think configuration of processing window per BWP should ideally be confirmed by RAN1 and we can follow RAN1 parameter list |
| Xiaomi | Yes |  |  |
| CATT | Yes | a) | As per RAN1 LS indicated, the type of PRS processing window can be per-band specific. |
| Ericsson | Yes |  | Agree with Intel |
| vivo | Yes |  | The configuration shall follow RAN1 decision. |
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## 4.2 Activation/Deactivation of PRS Processing Window

Company Proposals:

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| --- | --- |
| CATT [4] | Proposal 10: If more than one PRS processing window can be configured per BWP, RAN2 to agree that:  - A new PRS processing window activation/deactivation DL MAC CE is introduced to activate or deactivate the PRS processing window pre-configured;  - The newly intrdocued PRS processing window activation/deactivation DL MAC CE provide the bitmap of the activation/deactivation status of each PRS processing window  Proposal 11: If only one PRS processing window can be configured per BWP, RAN2 to agree that the processing window is activated immediately after it is configured to UE. |
| Huawei [7] | Proposal 2: UL MAC CE can be used for MG/PPW activation/deactivation request.  Proposal 4: Trigger SR when there is no PUSCH and UL MAC CE for MG/PPW activation/deactivation request is triggered.  Proposal5: Priority of the UL MAC CE for MG/PPW activation/deactivation request is higher than BSR while lower than LBT failure MAC CE in LCP  Proposal7: R2 confirms that DL MAC CE can be supported for pre-configured MG/PPW activation/deactivation command.  Proposal 9: Capture PPW modelling in the MAC spec.  Proposal 10: UE monitors PDCCH when the ra-ResponseWindow or the ra-ContentionResolutionTimer or the msgB-ResponseWindow is running for the affected symbols in the PPW. |
| InterDigital [17] | Proposal 11: RAN2 confirms support for activation of a preconfigured processing window by gNB in UE via DL MAC CE |

Proposals for discussion [22]:

**Proposal 9a:** A new DL MAC CE for PRS Processing Window activation and deactivation command is introduced.  
Note, if this Proposal is agreed, RAN2 may need to send an LS to RAN1 confirming that DL MAC CE can also be used for PRS Processing Window deactivation.

**Proposal 9b:** The new DL MAC CE for PRS Processing Window activation and deactivation command includes at least the ID of the pre-configured PRS Processing Window configuration. Other parameter are FFS.

**Proposal 9c:** The UE behaviour related to the PRS Processing Window feature is captured in the MAC specification.

**Proposal 9d:** RAN2 to discuss and decide, whether UL MAC CE can also be used for PRS processing window activation/deactivation. If agreed, RAN2 may need to send an LS to RAN1.

Companies are asked to provide their views on the Proposals 9a-9d.

**Question 12:** Do you agree that a new DL MAC CE for PRS Processing Window activation and deactivation command is introduced?

Please provide the reason for your answer in the comments column.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes | This is aligned with the RAN1 agreements |
| Huawei, HiSilicon | Yes | We think the PPW can be treated similarly as pre-configured MG to use a DL MAC CE to activate the PPW. |
| InterDigital | Yes |  |
| Intel | Yes | Agree with Huawei |
| Xiaomi | Yes |  |
| CATT |  | The LS from RAN1 is not clear to us, we are confused whether there is only one PRS processing window, or multiple set of PRS processing window can be pre-configured to UE. And as we know, there is no any agreement in RAN1 yet.  If there is only one PRS processing window, it seems no additional benefit, anyway the processing window can be activated immediately after it is configured to UE via MAC CE or RRC. |
| Ericsson | No | We should avoid cross layer implementation. Having a functionality in both RRC and MAC would entail more cross layer design which incurs both increase in complexity and latency. Cross-layer interactions would increase both implementation complexity and testing efforts. |
| vivo | Yes | Align with RAN1 agreement |
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**Question 13:** If your answer to Question 12 was yes, do you agree that the new DL MAC CE for PRS Processing Window activation and deactivation command includes at least the ID of the pre-configured PRS Processing Window configuration?

Please provide the reason for your answer in the comments column.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes |  |
| Huawei, HiSIliton | Yes |  |
| InterDigital | Yes |  |
| Intel | Yes |  |
| Xiaomi | Yes |  |
| CATT |  | See comments of Question 12 |
| Ericsson | No |  |
| vivo | Not clear in RAN1 LS | For PRS processing window configuration and indication, at least the following mechanism is supported  • RRC (pre-)configuration for PRS processing window configuration and DL MAC CE activation for PRS processing window, respectively.  Include it in the LS to RAN2 and request RAN2 to decide whether DL MAC CE is feasible for this indication.  RAN1 to decide whether multiple PPW is supported. |
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**Question 14:** If your answer to Question 12 was yes, do you agree that the UE behaviour related to the PRS Processing Window feature is captured in the MAC specification?

Please provide the reason for your answer in the comments column.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes |  |
| Huawei, HiSilicon | Yes | PRS processing window impacts PDCCH monitoring and PDSCH reception. This is the scope of MAC spec. Similar handling of this can be seen for measurement gap in the MAC spec |
| InterDigital | Yes |  |
| Intel | Yes |  |
| Xiaomi | Yes |  |
| CATT |  | Sure if MAC CE introduced |
| Ericsson | No |  |
| vivo | Yes | The remaining issue is how to design the MAC CE based on RAN1 conclusion. |
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**Question 15:** Do you agree that UL MAC CE can also be used for PRS processing window activation/deactivation?

Please provide the reason for your answer in the comments column.

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSIlicon | Yes | We think the rationale for the UL MAC CE for PPW activation/deactivation is the same as that for MG. Thus, we can also support UL MAC CE for this |
| InterDigital |  | No strong view on this. We think this can be left to RAN1 to decide |
| Intel |  | While the rationale may make sense, we think ultimately the decision should be up to RAN1 |
| CATT | No | See comments of Question 12 |
| Ericsson | No | No this is not agreed. It is not needed. It is for gNB to configure gapless measurement not for UE to decide. |
| vivo |  | Left to RAN1 |
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## 4.3 LMF Assistance Information / NRPPa Aspects

Company Proposals:

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| CATT [4] | Proposal 12: RAN2 to agree the PRS processing window configuration mechanism need to support the following functionaility and send a LS to indicate to RAN3:  - LMF to transfer the UE’s positioning capability to the gNB;  - LMF to transfer a full PRS configuration of the UE to the gNB |
| Huawei [7] | Proposal 1: For MG/PPW preconfiguration, LMF may assist gNBs to exchange the PRS configuration via a non-UE associated NRPPa message.   It is up RAN3 to decide whether other methods can be considered.   Send an reply LS to RAN3/RAN1.  Proposal6: NRPPa message for MG/PPW activation/deactivation request should include the same content as the RRC message LocationMeasurementIndication: |
| InterDigital [17] | Proposal 9: LMF can send to gNB the priority assigned to DL-PRS via NRPPa signalling |

Proposals for discussion [23]:

**Proposal 10a:** The information that needs to be transferred between LMF and gNB to support PRS Processing Windows may include one or more of the following options:

- DL-PRS configuration of the relevant TRPs

- PRS Processing Window capabilities of the UE

- PRS Processing Window configuration information analogous to RRC LocationMeasurementIndication message

- Priority assigned to DL-PRS

FFS on other option(s).

FFS on which option(s) are needed.

Companies are asked to provide their views on the Proposal 10a.

**Question 16:** Which of the following information needs to be transferred between LMF and gNB to support the PRS Processing Windows configuration at the gNB:

(a) DL-PRS configuration of the relevant TRPs

(b) PRS Processing Window capabilities of the UE

(c) PRS Processing Window configuration information analogous to RRC *LocationMeasurementIndication* message

(d) Priority assigned to DL-PRS

(e) other

Please provide the reason for your answer in the comments column.

|  |  |  |
| --- | --- | --- |
| Company | Option(s) (a)-(e) | Comments |
| Apple |  | This is in RAN3 scope |
| Huawei, HiSilicon | (a) | (a) can be considered. But up to R3 to make the final decision whether this is needed in addition to OAM  We don’t think (b) to (e) is needed for preconfiguraiton   * For (b), the capability is not needed for LMF * For (c), positioning QoS should not be configured by the gNB for the MG configuration and the QoS can be reflected in the NRPPa including the information in LocationMeasurementInformation * For (d), we think the gap should be compiled by the gNB instead of the LMF   For (e), we think it is not needed for preconfiguration, but should be adopted for MG request |
| InterDigital |  | To be left to RAN3 to decide |
| Intel |  | We think this needs to be discussed in RAN3 |
| CATT | a),b), f), or leave to RAN3 | f) DL-PRS configuration of the **UE**  From our perspective, it is more efficient for the gNB to configure (or activate, if RAN2 agreed the activation trigged from NW side) the PRS processing window based on the DL-PRS configuration of a specific UE.  or as Apple/IntelDigital indicated, we can also leave it to RAN3 |
| Ericsson | d) e) | Positioning QoS is useful. |
| vivo | a) e) QoS | The final decision is left to RAN3. |
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# 5. Summary

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[1] R2-2200256, "Discussion on positioning latency reduction", ZTE.

[2] R2-2200278, "Leftover issues on Latency reduction", Intel Corporation.

[3] R2-2200279, "RAN1 issues on Latency reduction", Intel Corporation.

[4] R2-2200304, "Discussion on latency reduction enhancement", CATT.

[5] R2-2200326, "Discussion on latency enhancement", vivo.

[6] R2-2200428, "Discussion on PRS preconfiguration", Huawei, HiSilicon.

[7] R2-2200430, "Discussion on MG/PPW enhancement for positioning", Huawei, HiSilicon.

[8] R2-2200559, "Further consideration of positioning latency enhancements", OPPO.

[9] R2-2200709, "Positioning enhancement on latency reduction", Xiaomi.

[10] R2-2200730, "Discussion on the response time", Samsung.

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