3GPP TSG-RAN WG2 Meeting #115 electronic R2-210xxxx

Online Meeting, August 16th – 27th 2021

**Agenda item: 8.11.4**

**Source: CATT**

**Title: [Post115-e][606][POS] MO-LR for on-demand PRS (CATT)**

**WID/SID: NR\_pos\_enh-Core**

**Document for: Discussion and Agreement**

# 1 Introduction

This document is to kick off the following email discussion related with the stage 2 procedures of on-demand PRS:

* [Post115-e][606][POS] MO-LR for on-demand PRS (CATT)

      Scope: Determine whether UE-originated request of on-demand PRS is supported via MO-LR, including the case of a client at the UE, and determine what the impact would be to the procedure agreed as a stage 2 baseline in RAN2#115-e for on-demand PRS request.

      Intended outcome: Report to next meeting

      Deadline:  Long

The rapporteur would like to organize this email discussion in two phases:

- Phase 1: Companies are invited to provide their views on the questions by Oct 15th, 1200 UTC.

- Phase 2: Rapporteur submits the summary with easy agreements and controversial issues, companies can further comment by Oct 20th, 1200 UTC.

This email discussion is structured as follows:

- Section 3: Discussion of UE-originated request of on-demand PRS via MO-LR, including whether UE-originated request of on-demand PRS is supported via MO-LR and its impact on the procedure agreed as stage 2 baseline in RAN2#115-e for on-demand PRS request.

- Section 4: Discussion of open issues left on the stage 2 procedure of on-demand PRS.

# 2 Contact Information

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

|  |  |
| --- | --- |
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# 3 UE-originated request of on-demand PRS via MO-LR

## 3.1 Whether to support UE originated request of on-demand PRS via MO-LR

For UE initiated on-demand PRS request, we have already concluded that it can be supported during an active LPP session in RAN2#115e[1], while whether it also can be supported via MO-LR request is still an FFS.

Companies supporting on-demand PRS request via MO-LR argue that if the client is in the UE who wants to use DL-TDOA or DL-AoD for UE-based positioning and there is no PRS, then the UE can request the PRS via MO-LR directly, and we cannot preclude such scenario.

According to MO-LR Service Support description in TS38.305 [2]:

|  |
| --- |
| The MO-LR location service request message may carry an LPP PDU to instigate one or more LPP procedures to transfer capabilities, request assistance data, and/or transfer location information. So it seems this LPP Request Assistance Data would be the same as in an active LPP session (e.g., may include the on-demand PRS details). |

According to the description of 5GC-MO-LR Procedure in clause 6.2 in TS23.273 [3]:

|  |
| --- |
| 2) The UE sends an MO-LR Request message included in a UL NAS TRANSPORT message. The MO-LR Request may optionally include up to three LPP positioning message(s). Different types of location services can be requested: location estimate of the UE, location estimate of the UE to be sent to an LCS client or AF, or location assistance data. …. If the UE is instead requesting location assistance data, the embedded LPP message specifies the type of assistance data and the positioning method for which the assistance data applies.  …  5) If the UE is requesting its own location, the actions described in clause 6.11 are performed. If the UE is instead requesting location assistance data, the LMF transfers this data to the UE as described in clause 6.11.1. The LMF determines the exact location assistance data to transfer according to the type of data specified by the UE, the UE location capabilities, the MO-LR subscribed assistance data and the current cell. |

According to the definition of MOLR-Type in clause 4.4.2 in TS24.080 [7]:

MOLR-Type::= ENUMERATED {

locationEstimate (0),

assistanceData (1),

deCipheringKeys (2),

... ,

…

It seems that requesting location assistance data via MO-LR is already supported in TS23.273 [3] and TS 24.080 [7].

**Question 1:** **Do companies agree to support the UE originated request of on-demand PRS via MO-LR? Please specify the reasons or comments if any.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Huawei, HiSilicon | Agree | We think that the issue mainly lies in when does the UE perform PRS measurement with the proper PRS configuration and know which PRS to request for on-demand PRS request.  We think this can be achieved by the UE receiving PRS configuration and assistance information for the on-demand PRS request in the posSIB, even if there is no active LPP session ongoing. |
| ZTE | Agree | UE is able to request location assistance data in the MO-LR request according to 23.273. |
| Qualcomm | Agree | As summarized by the rapporteur, there are three use cases/subscriptions specified for MO-LR (23.273):  - Basic Self Location (UE can receive its own location)  - Autonomous Self Location (UE can receive location assistance data)  - Transfer to 3rd party.  For Autonomous Self Location the *MOLR-Type* is set to '*assistanceData*' (24.080), and the UE includes the details of the requested assistance data in a LPP Request Assistance Data message. For example, the UE may provide the IE *NR-DL-TDOA-RequestAssistanceData* with *nr-AdType* set to 'dl-prs'. Since the UE-initiated on-demand PRS request is enabled by enhancing LPP Request Assistance Data, additional information on the (on-demand) DL-PRS details can be provided, which however, is independent of MO-LR. |
| Apple | Agree | Same view as HW |
| Ericsson | Agree, however | As indicated by rapporteur, there is already possibility for the UE to request AD for DL-PRS. That can be reused by UE. We do not see the need to have a separate unsolicited indication for on-demand DL-PRS. |
| vivo | See comments | The spec already supports the UE originated request of assistance data via MO-LR. However, when the UE sends the MO-LR Request message, the positioning method has not been decided by the LMF yet. It is likely that the positioning methods decided by the LMF is unrelated to PRS, e.g., A-GNSS, UL-AoA, UL-TDOA.  Therefore, we think the UE is not prohibited to send request of on-demand PRS via MO-LR from the spec point of view but it is a little strange that the UE sends the request at the very beginning. If the majority think the UE can send the request in MO-LR Request for information, we are ok. |
| Xiaomi | Agree | As summarized by rapporteur, the UE is able to send LPP PDU including request assistance data. |
| Lenovo, Motorola Mobility | Agree | This can be supported in a straight-forward manner. |
| InterDigital | Agree | Same understanding with others; the UE can send the request for DL PRS via MO-LR as per the current spec (TS 23.273) |
| Fraunhofer | Agree | Same understanding as the companies above. |
| CATT | Agree | The UE can send the request for DL PRS via MO-LR following the current spec (TS 23.273). |
| Nokia | See comments | Even for UE-based DL methods with the LCS client in the UE, the procedure requires the LMF to decide the positioning methods to use and provide the relevant AD to the UE. UE cannot autonomously decide to use a specific UE-based DL method and ask for PRS AD. So, the argument that LPP Request Assistance Data through MO-LR would mean the UE is in an active LPP session is not correct. If the intention is to get on to a LPP session, and do position estimate, then it is fine but it is not OK to use the MO-LR procedure purely for the purpose of getting a specific PRS configuration and then terminating the MO-LR procedure. |
| Intel | See comments | Agree with Rapporteur, based on TS23.273 and TS38.305, the UE can request AD in MO-LR request. However, can UE autonomously decide the positioning methods? |
| OPPO | Agree | UE can request DL-PRS directly via MO-LR. |
| Huawei, Hisilicon2 |  | In response to Nokia’s comments, there seems to be no restriction in the current spec that RequstAD has to be sent during a active LPP session. Then, there is no blocking issue for an UE to request PRS with requestAD during MO-LR request. The requestAD can be sent with provideUEcapabilities and provideLocationInformation for E-CID such that the PRS can be requested.  But, we have some sympathies over Nokia’s comment and the MO-LR request should not terminate for the sole purpose of PRS request. Is it possible that the request is for both location estimate and assistance data request? The current SS signalling does not seem to support this with the type as ENUMERATED  MOLR-Type::= ENUMERATED {  locationEstimate (0),  assistanceData (1),  deCipheringKeys (2),  ... ,  deferredMo-lrTTTPInitiation (3),  deferredMo-lrSelfLocationInitiation (4),  deferredMt-lrOrmo-lrTTTPLocationEstimate (5),  deferredMt-lrOrmo-lrCancellation (6),  periodicEvent (7),  enteringAreaEvent (8),  leavingAreaEvent (9),  beingInsideAreaEvent (10),  motionEvent (11),  maximumIntervalExpirationEvent (12) } |
| Qualcomm-2 |  | In response to some comments above:  As mentioned in our comment above, three use cases (with separate subscription) are defined in 23.273 (analogous to 23.271 for LTE (and the same was already the case for UMTS and GSM)):  - Basic Self Location (UE can receive its own location)  - Autonomous Self Location (UE can receive location assistance data)  - Transfer to 3rd party.  The MO-LR for Assistance Data is for "Autonomous Self Location". There is no, e.g., positioning method selection by an LMF etc. For example, a UE may just want to keep it's stored assistance data up-to-date (e.g., for GNSS), or may need assistance data for determining a current location (e.g., DL-PRS), etc..  A MO-LR for Autonomous Self Location (assistance data) normally always results in a LPP session instigated by an LMF (i.e., to send a LPP Provide Assistance Data; see also Stage 2 Figure below for Question 3), and then all LPP procedures can be executed as desired/needed. But a UE can normally not instigate a LPP session; that's why the MO-LR wrapper is needed.  The UE knows whether a NW supports MO-LR or not, but the UE does not know what assistance data a NW supports (e.g., the list of GNSS assistance data is quite long and its unlikely that an LMF supports all of them even if it supports GNSS). The LMF may provide the assistance data it has available, and/or provide an error cause. But all this is not specific to MO-LR. For MO-LR, there is nothing new here, as multiple companies also pointed out. |
|  |  |  |

**Summary:**

**Out of 14 responding companies, the following table presents a summary of responses regarding Question 1:**

|  |  |  |
| --- | --- | --- |
| **Support the UE originated request of on-demand PRS via MO-LR** | | |
| **Agree with comments** | **Not sure with comments** | **No** |
| **11** | **2** | **1** |

**Agree with comments (11/14):** Huawei, HiSilicon, ZTE, Qualcomm, Apple, Ericsson, Xiaomi, Lenovo, Motorola Mobility, InterDigital, Fraunhofer, CATT, OPPO

**Not sure with comments (2/14):** vivo, Intel

**No (1/14):** Nokia

So **11/14** company agree to support the UE originated request of on-demand PRS via MO-LR; **2/14** company have no strong view, but wondering whether the UE autonomously decide the positioning methods; **1/14** company do not agree to support the UE originated request of on-demand PRS via MO-LR.

**Rapporteur’s comments:** As for the doubts that if UE can autonomously decide the positioning methods or not, when Autonomous Self Location happens in UE (23.273), the *MOLR-Type* is set to '*assistanceData*' (24.080) and the UE includes the details of the requested assistance data in a LPP Request Assistance Data message. There are no positioning methods involved between LMF and UE, just only assistance data. Rapporteur thinks that Autonomous Self Location use case makes sense.

Additionally, the following key comments were noted:

**Views of agree with comments:**

* The UE can send the request for DL PRS via MO-LR following the current spec (TS 23.273).

**Views of not sure with comments:**

* When the UE sends the MO-LR Request message, the positioning method has not been decided by the LMF yet. It is likely that the positioning methods decided by the LMF are unrelated to PRS, e.g., A-GNSS, UL-AoA, UL-TDOA.
* Can UE autonomously decide the positioning methods?

**Views of no:**

* UE cannot autonomously decide to use a specific UE-based DL method and ask for PRS AD.

It seems there is majority in the table. Based on company feedback, the following is proposed:

**Proposal 1: RAN2 to agree to support the UE originated request of on-demand PRS via MO-LR. (11/14).**

## 3.2 Impact on the stage 2 baseline on-demand PRS request procedure

Once we agree to support the UE initiated on-demand PRS request via MO-LR, some impacts on the stage 2 baseline on-demand PRS request procedure may be introduced.

***Issues 1: how to provide the available DL-PRS configurations to UE?***

UE initiated on-demand PRS request via MO-LR is performed when there is no any LPP session. Companies will discuss if the available DL-PRS configurations for on-demand via posSIBs should be pre-condition for on-demand PRS request via MO-LR.

**Question 2: Do companies agree that the available DL-PRS configurations must be provided to UE via posSIBs for the scenario that the UE initiate the on-demand PRS request via MO-LR? Please specify the reasons or comments if any.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Huawei, HiSilicon | Agree | Since there is no active LPP session in the UE, provision of PRS configuration to the UE with posSIB seems to be the only feasible way. |
| ZTE | Agree with comments | 1. Firstly we think UE can be provided with available DL-PRS configurations before MO-LR request, but it is not mandatory. The reason is:   Even if there is no available DL-PRS configuration sent to UE before on-demand PRS request, UE can still request PRSs which satisfy its own QoS requirement in MO-LR request. For example, UE wants a 20MHz bandwidth PRS according to UE capability or UE positioning requirements, then UE can require the parameter directly.   1. If UE is provided with available DL-PRS configurations before MO-LR request, we agree that broadcast of available DL-PRS configurations should be undisputed. |
| Qualcomm | Disagree; see comment | posSIBs are desired, but not necessarily required.  For example, the UE can send a LPP *NR-DL-TDOA-RequestAssistanceData* with *nr-AdType* set to 'dl-prs'*.* This message may then include additional information on the specific PRS requested (i.e., the explicit parameter list from RAN1 (List#1 in Question 6 below)).  Alternatively, or in addition, this message could also include a request for the NW supported DL-PRS Configurations. The LMF would then provide the available DL-PRS Configurations to the UE in the LPP session shown as Step 5 in the procedure of Question 4 below and the UE could send a second LPP Request Assistance Data with the requested DL-PRS configuration ID. With reference to Figure 1 in Question 4 below:  Step 3: MO-LR with LPP Request Assistance Data incl. a request for available on-demand DL-PRS configurations.  Step 5a: LPP Provide Assistance Data with available on-demand DL-PRS configurations.  Step 5b: LPP Request Assistance Data with specific DL-PRS Configuration ID requested.  (This should also be independent of MO-LR.)  Note, any LPP Request Assistance Data is "best effort" currently since a UE does not know what an LMF supports (independent from any positioning method). With OMA LPPe for example, the UE could know the LMF capabilities, but this is not supported in LPP. |
| Apple | Agree | Agree with HW.  To ZTE – we disagree with ZTE’s point 1, we think that a UE should only request on-demand PRS using an “id”. |
| Ericsson | Agree | Yes, if there is already DL-PRS config available via posSIB or based upon request of AD based upon current framework (IE *NR-DL-TDOA-RequestAssistanceData* with *nr-AdType* set to 'dl-prs') and UE is unable to meet its positioning requirements, it may use MO-LR to ask for UE specific DL-PRS configuration which would meet UE requirements.  We do not foresee the need to increase Uu load without definite gain. |
| vivo | Agree, with clarification | We think a UE should only request the on-demand PRS that the LMF allowed. Whether the request includes “id” or “explicit parameter” will be further discussed after RAN1 provide the list of parameters that can be dynamically adjusted.  In the current baseline procedure, the available DL-PRS configuration is provided by LMF while not requested by the UE. Therefore, whether the UE can send the request for the available DL-PRS configuration need further discussion in the overall procedure. Similar with Q1, we think it is a little strange that the UE sends the request of available DL-PRS configuration when the location method has not been decided yet. |
| Xiaomi | Agree | From network perspective, whether support on-demand PRS function is based on the TRP capability, so the available PRS configuration in posSIB can be the indication that the network support the on-demand PRS, then the UE can send the on-demand PRS request within the MO-LR request. |
| Lenovo, Motorola Mobility | Agree, but see comments | The idea of on-demand PRS is for the UE to request an updated DL-PRS configuration based on an available/prior PRS configuration. This should also apply even if the available PRS configuration is valid or invalid.  We also think that this should not be restricted to the case that the UE has no LPP session (only posSIB solution), UE-initiated on-demand PRS should also support the on-demand PRS via dedicated signalling, once the UE initiates an LPP session. |
| InterDigital | Agree, with comments | Generally ok, however, we think that the on-demand request should not be limited only to the PRS configurations available via posSIB. The UE should be able to send an on-demand request with MO-LR for PRS parameters outside of what is available via posSIB, e.g. when the request is intended for meeting a particular positioning requirement when the PRS available via posSIB are inadequate. |
| Fraunhofer | Agree | Yes. The information about available DL-PRS configuration is useful for multiple UEs and is ideally suited for broadcast. However, the information on the available posSibs "can be provided" rather than "must be provided" because of flexibility reasons. |
| CATT | Agree | 1st: we think that UE can only request the on-demand PRS configuration within the available DL-PRS configurations provided by NW, that is, UE must be provided with available DL-PRS configuration before UE can initiate the on-demand PRS request.  2nd: since there is not any LPP session, the available DL-PRS configurations can only be provided via posSIBs for the case of on-demand PRS request via MO-LR. |
| Nokia | See comments | What is the definition of “available DL-PRS configurations”? is it the pre-configured DL-PRS configurations set where each DL-PRS configuration has an associated ID? If it is the pre-configured PRS set, then we are talking about broadcast of pre-configured PRS configurations. This was already agreed if I recall correctly. |
| Intel | Agree with comments | It is related to trigger condition of UE initiated on demand PRS request, e.g. whether the UE can only trigger this request when the network allows this. If yes, then the UE has to get the permission via posSIB, e.g. preconfigured PRS set before triggering the request.  So we may discuss the trigger condition first? |
| OPPO | Agree | It is the most stightforward way to provide available PRS configurations via posSIBs since there is no active LPP session. |
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**Summary:**

**Out of 14 responding companies, the following table presents a summary of responses regarding Question 2:**

|  |  |
| --- | --- |
| **The available DL-PRS configurations must be provided to UE via posSIBs for the scenario that the UE initiate the on-demand PRS request via MO-LR** | |
| **Agree with comments** | **Partly agree with comments (yes for posSIBs if needed, no for must to provide the available DL-PRS)** |
| **10** | **4** |

**Agree with comments (10/14):** Huawei, HiSilicon, Apple, Ericsson, vivo, Xiaomi, Lenovo, Motorola Mobility, Fraunhofer, CATT, Intel, OPPO

**Partly agree with comments (yes for posSIBs if needed, no for must to provide the available DL-PRS) (4/14):** ZTE, Qualcomm, InterDigital, Nokia

So, **10/14** company agree Question 2, i.e., the available DL-PRS must be provided and via posSIBs; **4/14** company agree part of the Question 2, i.e., the available DL-PRS shall be provided via posSIBs, if needed, but whether the available DL-PRS must be provided is FFS.

Additionally, the following key comments were noted:

**Views of agree with comments:**

* A UE should only request the on-demand PRS that the LMF allowed.
* From network perspective, whether support on-demand PRS function is based on the TRP capability, so the available PRS configuration in posSIB can be the indication that the network support the on-demand PRS, then the UE can send the on-demand PRS request within the MO-LR request.
* The information about available DL-PRS configuration is useful for multiple UEs and is ideally suited for broadcast.

**Views of partly agree with comments:**

* Even if there is no available DL-PRS configuration sent to UE before on-demand PRS request, UE can still request PRSs which satisfy its own QoS requirement in MO-LR request.
* Any LPP Request Assistance Data is "best effort" currently since a UE does not know what an LMF supports (independent from any positioning method). In addition, this message (MO-LR) could also include a request for the NW supported DL-PRS Configurations. The LMF would then provide the available DL-PRS Configurations to the UE in the LPP session shown as Step 5 in the procedure of Question 4.

It seems there is majority in the table. Moreover, based on feedback and summary of Question 5, UE initiate the on-demand PRS request only when the available DL-PRS configurations are provided to UE. Thus, the following is proposed:

**Proposal 2: RAN2 to agree that UE initiate the on-demand PRS request via MO-LR only if the available DL-PRS configurations are provided to UE via posSIBs (10/14).**

***Issue 2: how to transfer the on-demand PRS request via MO-LR?***

Considering how to transfer the on-demand PRS request via MO-LR, the following method can be considered:

The UE sends an MO-LR Request message included in an UL NAS TRANSPORT message to the serving AMF including an LPP Request Assistance Data message which is used for on-demand DL-PRS transmission [4].

The MOLR-Type of this MO-LR Request message is assistanceData [7].

**Question 3: Do companies agree the above method for UE initiated on-demand PRS via MO-LR? Please specify the reasons or comments if any.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/ Disagree | Comments |
| Huawei, HiSilicon | Agree | In addition, the UE can also include *procideLocationInformation* to include the UE measurements e.g., E-CID measurements to assist the PRS configuration. UE can also include *provideCapability* to the network to indicate the UE’s capabilities for DL positioning. |
| ZTE | Agree | Tha above procedure is aligned with 23.273.  UE capability is not needed to be embedded in MO-LR request, since in the next ongoing LPP session, there will have capability transfer procedure. No need to have duplicated procedure. |
| Qualcomm | Agree | This is how MO-LR is currently specified and according to the agreement: "UE-initiated on-demand PRS request is enabled by enhancing LPP Request Assistance Data". Therefore, there should be no additional RAN2 impacts for MO-LR. |
| Apple | Agree |  |
| Ericsson | Agree | Agree with Huawei |
| vivo | Agree |  |
| Xiaomi | Agree |  |
| Lenovo, Motorola Mobility | Agree |  |
| InterDigital | Agree |  |
| Fraunhofer | Agree |  |
| CATT | Agree | The MOLR-Type of this MO-LR Request message is assistanceData according to the TS 24.080 defined:  MOLR-Type::= ENUMERATED {  locationEstimate (0),  assistanceData (1),  deCipheringKeys (2),  ... , |
| Nokia | See comments | This depends on the outcome of Question 1. Currently, we are not sure if there is a strong need for sending UE-initiated ODPRS request in MO-LR given that the UE cannot decide by itself to use a DL-PRS based positioning method. |
| Intel | See comments | Agree with Rapporteur’s view on providing On-Demand PRS request via LPP Request Assistance Data message. But we need to confirm whether UE can decide positioning method or not first.  Regarding Huawei’s comment, Can UE provide multiple LPP messages in the same NAS message? Accordingly the MOLR-Type, seems no. |
| OPPO | Agree |  |
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|  |  |  |

**Summary:**

**Out of 14 responding companies, the following table presents a summary of responses regarding Question 3:**

|  |  |
| --- | --- |
| **The method proposed by the rapporteur for UE initiated on-demand PRS via MO-LR** | |
| **Agree** | **No (or not sure) with comments** |
| **12** | **2** |

**Agree (12/14):** Huawei, HiSilicon, ZTE, Qualcomm, Apple, Ericsson, vivo, Xiaomi, Lenovo, Motorola Mobility, InterDigital, Fraunhofer, CATT, OPPO

**No (or not sure) with comments (2/14):** Nokia, Intel

So **12/14** company agree the method proposed by the rapporteur for UE initiated on-demand PRS via MO-LR; **2/14** company express concern on whether the UE initiated on-demand PRS via MO-LR should be supported, e.g., whether UE can decide positioning method or not.

Additionally, the following key comments were noted:

**Views of agree camp:**

* This is how MO-LR is currently specified and according to the agreement: "UE-initiated on-demand PRS request is enabled by enhancing LPP Request Assistance Data".
* The MOLR-Type of this MO-LR Request message is assistanceData according to the TS 24.080 defined.

**Views of no (or not sure) with comments camp:**

* Need to confirm whether UE can decide positioning method or not first.

It seems there is clear majority in the table. Based on company feedback, the following is proposed:

**Proposal 3: RAN2 to agree that UE can send an MO-LR Request message included in an UL NAS TRANSPORT message to the serving AMF including an LPP Request Assistance Data message which is used for on-demand DL-PRS transmission, and the MOLR-Type of this MO-LR Request message is “assistanceData”** **(12/14).**

Based on the discussion above, a general procedure for UE initiated on-demand PRS via MO-LR is provided as the following:



Figure 1: stage 2 procedure for UE initiated on-demand PRS via MO-LR

1. An LMF may provide one or more posSIBs containing a set of available on-demand DL-PRS configurations to a gNB in an NRPPa Assistance Information Control message for broadcast in positioning System Information.
2. The NG-RAN node broadcast the received available on-demand DL-PRS configurations in RRC System Information Messages
3. The UE sends an MO-LR Request message (MOLR-Type is assistanceData) included in an UL NAS TRANSPORT message to the serving AMF including a request for on-demand DL-PRS transmission. The request may in addition include a LPP Provide Capabilities message including the DL-PRS capabilities of the UE, and a LPP Provide Location Information message (e.g., providing E-CID measurements).
4. The AMF invokes the Nlmf\_Location\_DetermineLocation service operation towards the LMF.
5. The LMF may perform one or more LPP procedures; e.g. to obtain the DL-PRS positioning capabilities of the UE.
6. The LMF determines DL-PRS configuration based on the request received at Step 4 and/or the DL-PRS positioning capabilities of the UE obtained at step 5.
7. The LMF insitigates a NRPPa DL-PRS Configuration procedure with each of the gNBs determined at Step 6.
8. The gNB returns acknowledged for step 7.
9. The LMF determines the exact location assistance data and transfer to UE.
10. The LMF returns an Nlmf\_Location\_DetermineLocation Response to the AMF.
11. the AMF forwards the response to the target UE.

**Question 4: Do companies agree the above stage 2 procedure for UE initiated on-demand PRS via MO-LR? Please specify the reasons or comments if any.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Huawei, HiSilicon | Agree, but see the comments | We are generally fine with the overall procedure but have the following comments regarding the details of some of the steps   * Before step1, the LMF should acquire necessary information from the TRP with NRPPa message (e.g., TRP INFORMATION EXCHANGE) with which the LMF can compose the assistance data for PRS configuration and on-demand PRS configuration, to be broadcasted in posSIB. * Step1 should also include the PRS configuration for the UE to measure * Step5 can be very much performed in step3, that the UE sends un-solicited provideCapabilities to the network piggybacked in the LCS request message. * Step7, RAN3 has already agree on the NRPPa message for the on-demand PRS request as PRS CONFIGURATION REQUEST, PRS CONFIGURATION RESPONSE, and PRS CONFIGURATION FAILURE. Please refer to the baseline CR in R3-212779 * Step 9 can be merged to one box with the other LPP messages, such as provideLocationInformation that the UE sends to the LMF after PRS measurement and/or location estimate. Check Clause 6.2 in 23.273 |
| ZTE | Agree with comments | 1. Step 5 and step 3 have duplicate UE DL-PRS capability transfer procedure. Since now there is no capability transfer procedure in MO-LR Request message, and UE capability transfer means not only the PRS capability, so we suggest to delete capability transfer procedure in step 3, and remain the capability transfer procedure in step 5, which has less spec impact. 2. Step 9 may consist of many procedures like Fig 6.2-1 step 5 in 23.273, so it should be in a box. |
| Qualcomm | Agree | Step 1/2 would be optional.  Step 5 could for example be used for the LMF to provide the available DL-PRS configurations to the UE and the UE could send a LPP Request Assistance Data with specific DL-PRS configuration requested as mentioned in our response to Question 2. |
| Apple | Agree with comments | On the high level the procedure is OK, but if the proposal would be to capture it in the spec we will have more detailed comments. |
| Ericsson | Agree | Also Agree with below two Huawei comments   * Before step1, the LMF should acquire necessary information from the TRP with NRPPa message (e.g., TRP INFORMATION EXCHANGE) with which the LMF can compose the assistance data for PRS configuration and on-demand PRS configuration, to be broadcasted in posSIB. * Step1 should also include the PRS configuration for the UE to measure |
| vivo | Agree with comments | Similar view with Apple, we agree the procedure in general, but we do not think we need to capture the whole stage 2 procedure for UE initiated on-demand PRS via MO-LR in the spec.  As the only difference in MO-LR is step 3, we suggest that one Note can be added in the pending overall stage 2 spec for UE initiated on-demand PRS procedure in step 3, if necessary.  Note: For MO-LR, the on-demand PRS request can be included in the MO-LR Request included in a UL NAS TRANSPORT message as specified in TS 24.501 [29] from UE to AMF. |
| Xiaomi | Agree | We agree with Ericsson’s comments. |
| Lenovo, Motorola Mobility | Agree | Generally, support Stage 2 procedure in principle. Also share Qualcomm’s view that Step 1 and 2 are optional. |
| InterDigital | Agree | We share same view with QC and Lenovo that step 1 and 2 should be optional in the procedure for UE-initiated on-demand with MO-LR |
| Fraunhofer | Agree | We support the view that the UE at least in Rel. 17 downselects from one of the available PRS configurations, and therefore have preference that Step 1 and Step 2 are mandatory in this release.  In step 0, it is necessary for LMF to retrieve the available configuration from NG-RAN nodes. |
| CATT | Agree | Agree with HW/Ericsson on the following comment:   * Before step1, the LMF should acquire necessary information from the TRP with NRPPa message (e.g., TRP INFORMATION EXCHANGE) with which the LMF can compose the assistance data for PRS configuration and on-demand PRS configuration, to be broadcasted in posSIB.   To the comment of QC/Lenovo/IntelDigital on whether step 1 and step 2 should be mandatory:  We think UE can only request the on-demand PRS configuration within the available DL-PRS configuration provided by NW, thus the step 1 and step 2 should be mandatory. |
| Nokia | See comments | The main discussion point is whether a specific preconfigured DL-PRS configuration can be requested in step 3 and the request forwarded to LMF in step 4. Question is, if LMF in step 5 decides to trigger a positioning method that does not rely on DL-PRS, what shall the LMF do with the on-demand PRS request. This depends on the outcome of Question 1. Currently, we are not sure if there is a strong need for sending UE-initiated ODPRS request in MO-LR given that the UE cannot decide by itself to use a DL-PRS based positioning method. |
| Intel | Agree with comments | Agree with ZTE that, in MO-LR request message, we should focus on On-Demand PRS request. We do not see the purpose to mention ECID results, LPP capabilities since they are unrelated to On-Demand PRS request procedure.  Regarding comments from ZTE and Huawei, we think the procedure can focus on ON-Demand PRS request, and rest parts of procedure can be skipped, and therefore we do not need to copy whole procedure like 23.273. |
| OPPO | Agree | We generally agree with the stage2 procedure provided above. And we also share similar view as ZTE and Intel, there is no need to introduce redundant procedure which has already captured in TS23.273. |
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**Summary:**

**Out of 14 responding companies, the following table presents a summary of responses regarding Question 4:**

|  |  |
| --- | --- |
| **The above stage 2 procedure for UE initiated on-demand PRS via MO-LR** | |
| **Agree with comments** | **Disagree** |
| **13** | **1** |

**Agree with comments (13/14):** Huawei, HiSilicon, ZTE, Qualcomm, Apple, Ericsson, vivo, Xiaomi, Lenovo, Motorola Mobility, InterDigital, Fraunhofer, CATT, Intel, OPPO

**Disagree (1/14):** Nokia

So **13/14** company agree above stage 2 procedure, but with some comments; **1/14** company do not support the above procedure, and wondering whether there is a strong need for sending UE-initiated ODPRS request in MO-LR.

Additionally, the following key comments were noted:

**Views of agree with comments:**

* Before step1, the LMF should acquire necessary information from the TRP with NRPPa message (e.g., TRP INFORMATION EXCHANGE) with which the LMF can compose the assistance data for PRS configuration and on-demand PRS configuration, to be broadcasted in posSIB.
* Step 1/2 would be optional.
* Step1 should also include the PRS configuration for the UE to measure
* The procedure can focus on ON-Demand PRS request, and rest parts of procedure can be skipped, and therefore we do not need to copy whole procedure like 23.273.
* Step7, RAN3 has already agree on the NRPPa message for the on-demand PRS request as PRS CONFIGURATION REQUEST, PRS CONFIGURATION RESPONSE, and PRS CONFIGURATION FAILURE. Please refer to the baseline CR in R3-212779
* Step 9 may consist of many procedures like Fig 6.2-1 step 5 in 23.273, so it should be in a box.

**Views of partly agree with comments:**

* Not sure if there is a strong need for sending UE-initiated ODPRS request in MO-LR given that the UE cannot decide by itself to use a DL-PRS based positioning method.

**Rapporteur’s comments:**

* The procedure here only focuses on the use case that *MOLR-Type* is set to '*assistanceData*' (24.080), so there won't be provideLocationInformation that the UE sends to the LMF and/or location estimate in step9. As for the use case that *MOLR-Type* is set to ‘*locationEstimate* ’(24.080) together with LPP message which carries on-demand request, can be merged into the normal on-demand PRS procedure discussion.

It seems there is majority in the table, thus we think the above stage 2 procedure with updates can be captured as baseline. Moreover, the following majority comment from companies can also be agreed and captured into the baseline procedure:

1st: Before step1, the LMF should acquire necessary information from the TRP with NRPPa message (e.g., TRP INFORMATION EXCHANGE) with which the LMF can compose the assistance data for PRS configuration and on-demand PRS configuration, to be broadcasted in posSIB.

2nd: Step7, RAN3 has already agreed on the NRPPa message for the on-demand PRS request as PRS CONFIGURATION REQUEST, PRS CONFIGURATION RESPONSE, and PRS CONFIGURATION FAILURE. Please refer to the baseline CR in R3-212779.

**Proposal 4: RAN2 to agree the following general stage 2 procedure as baseline for** **UE initiated on-demand PRS via MO-LR (13/14).**

 Figure 2: stage 2 procedure for UE initiated on-demand PRS via MO-LR

Step 0: LMF interacts with the TRP via TRP INFORMATION EXCHANGE procedure to obtain the available DL-PRS configurations.

Step 1/2: LMF provide the available on-demand PRS via posSIB to UE.

Step 3: The UE sends an MO-LR Request message (MOLR-Type is assistanceData) included in an UL NAS TRANSPORT message to the serving AMF including a request for on-demand DL-PRS transmission.

Step 4: The AMF invokes the Nlmf\_Location\_DetermineLocation service operation towards the LMF.

Step 5: Possible LPP procedures between LMF and UE, e.g., to obtain the DL-PRS positioning capabilities of the UE.

Step 6: LMF determines DL-PRS configuration based on the request received at Step 4 and/or the DL-PRS positioning capabilities of the UE.

Step 7: LMF instigates an NRPPa PRS CONFIGURATION REQUEST to the NG-RAN node including the requested on-demand PRS configurations.

Step 8: The NG-RAN node feedback the on-demand PRS request via PRS CONFIGURATION RESPONSE if the request can be accepted, or PRS CONFIGURATION FAILURE if the request cannot be filled.

Step 9: The LMF determines the exact location assistance data and transfer to UE.

Step 10: The LMF returns an Nlmf\_Location\_DetermineLocation Response to the AMF.

Step 11: the AMF forwards the response to the target UE.

# 4 Open issues left on the stage 2 procedure of on-demand PRS

There are still two open issues left on the stage 2 procedure of on-demand PRS according to the discussion

***Issue 1: Whether it is mandatory to provide the available PRS for on-demand before UE initiate the on-demand PRS request?***

In RAN2#114e, RAN2 made the following agreement:

The network can signal predefined PRS configurations to the UE and the UE can select one to request. FFS if the UE can request a configuration with different parameters and exactly which parameters are flexible.

We agreed that UE can initiate the on-demand PRS request based on the available DL-PRS configurations, however it is still an FFS that whether the UE can also initiate the on-demand PRS request under the scenario that NW didn’t provide the available DL-PRS configurations to UE. And this need to be confirmed since it has impact on the stage 2 procedures, i.e., once we confirmed, the procedure that LMF interact with NG-RAN to obtain the available DL-PRS as well as NW provide the available DL-PRS to UE is mandatory.

**Rapporteurs comment:** NW should control the UE initiated on-demand PRS to avoid such autonomous UE behaviours, i.e., only the UE that was provided the available DL-PRS by NW can be allowed to initiate the on-demand PRS.

**Question 5: Do companies agree that it is mandatory to provide the available PRS before UE initiate the on-demand PRS request? Please specify the reasons or comments if any.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Huawei, HiSilicon | Agree | We think the PRS should be provided to the UE before the UE can make request. Only after measuring the PRS, can the UE know what PRS it likes and what PRS it does not like. In order to let the UE make informed decisions on the PRS request, the UE should measure on the PRS provided by the network first.  Additionally, it would increase the possibility for the request to be accepted by the network, which may improve the device efficiency to avoid invalid request.  Hence, we think the PRS configuration provision to the UE before PRS request is necessary. |
| ZTE | Disagree | Like our comments in Q2, even if there is no available DL-PRS configuration sent to UE before on-demand PRS request, UE can still request PRSs which satisfy its own QoS requirement in MO-LR request. For example, UE wants a 20MHz bandwidth PRS according to UE capability or UE positioning requirements, then UE can require the parameter directly.  To HW:  Available DL-PRS configurations do not mean TRP should actually send all these DL-PRSs. They can be seen as TRP capability, to let UE know about which PRSs the TRPs have the capability to send. |
| Qualcomm | Disagree; see comments. | We don't think this has to be mandatory. It should be up to NW implementation. However, an optimal deployment would support posSIBs and provide the available DL-PRS in advance. But as mentioned in our response to Questions 2 above, any LPP Request Assistance Data is "best effort" currently and the NW may provide what it can support (e.g., this is the case for any positioning method, such as GNSS, etc.). However, the LPP Request Assistance Data should give the NW a good idea of what is desired by the UE (but any decision on specific assistance data will be made by the NW anyhow). We also think this is independent of MO-LR. |
| Apple | Agree with comments | “Mandatory” may not be the right word (as the functionality is up to the network), but the point is that a UE should only request (as we have already agreed) on-demand PRS using an id of a predefined RPS configuration. |
| Ericsson | Agree | Yes, if there is already DL-PRS config available via posSIB or based upon request of AD based upon current framework (IE *NR-DL-TDOA-RequestAssistanceData* with *nr-AdType* set to 'dl-prs') and UE is unable to meet its positioning requirements, it may use MO-LR to ask for UE specific DL-PRS configuration which would meet UE requirements.  We do not foresee the need to increase Uu load without definite gain. |
| vivo | Agree | In our understanding, RAN2 only agreed on-demand PRS request with a set ID, whether the “explicit parameter” can be requested will be further discussed after RAN1 provide the list of parameters that can be dynamically adjusted.  Besides, we do not prefer the mechanism that the UE request on-demand PRS configuration autonomously when it even does not know the capability of the Network, that is, it is mandatory to provide the available PRS before UE initiate the on-demand PRS request. Otherwise, the request is likely to be rejected by the network, which increase the time delay and signalling overhead, and should be avoided. |
| Xiaomi | Agree | From network perspective, whether support on-demand PRS function is based on the TRP capability, so the available PRS configuration can be the indication that the network support the on-demand PRS, then the UE can send the on-demand PRS request. |
| Lenovo, Motorola Mobility | Agree | This should be based on a prior DL-PRS configuration. However, mandating it may be too strong of a wording. |
| InterDigital | Disagree | We share similar understanding with others that it is not mandatory for the network to provide the available PRS configurations to UE. It can be up to network implementation on whether it provides all or only certain/subset of PRS configurations that it can support. |
| Fraunhofer | Agree | We agree that it is mandatory to provide the available PRS before UE initiate the on-demand PRS request. We have preference for downselecting a configuration from a set of configuration provided by the network to avoid complicated scheduling scenarios at TRP having to satisfy the different demands from the UEs requesting different PRS configuration with only minor differences.  One simple way to do this would be to introducing a group of PRS resources, where a group has certain common parameters (e.g. same beam direction) but differ in other parameters (e.g. bandwidth). Then the UE could request one of the configurations from the group. |
| CATT | Agree | We think that UE can only request the on-demand PRS configuration within the available DL-PRS configurations provided by NW, that is, UE must be provided with available DL-PRS configuration before UE can initiate the on-demand PRS request. |
| Nokia | Disagree | Nothing is mandatory for NW implementation. Question should be “Should UE initiate on-demand PRS request based only on pre-configured PRS configuration set? Note that we already agreed that pre-configuration of PRS is possible. Then the question is whether UE can only request based on these pre-configured PRS set IDs? |
| OPPO | Agree | Agree with other companies that it is not mandatory for network to configure PRS. Our understanding is that UE can trigger the on-demand PRS request only if the available PRS configurations have been pre-configured. |
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**Summary:**

**Out of 13 responding companies, the following table presents a summary of responses regarding Question 5:**

|  |  |
| --- | --- |
| **It is mandatory to provide the available PRS before UE initiate the on-demand PRS request** | |
| **Agree** | **Disagree** |
| **9** | **4** |

**Agree (9/13):** Huawei, HiSilicon, Apple, Ericsson, vivo, Xiaomi, Lenovo, Motorola Mobility, Fraunhofer, CATT, OPPO

**Disagree (4/13):** ZTE, Qualcomm, InterDigital, Nokia

So **9/13** company agree it is mandatory to provide the available PRS before UE initiate the on-demand PRS request; **4/13** company think it is not mandatory to provide the available PRS before UE initiate the on-demand PRS request.

Additionally, the following key comments were noted:

**Views of agree camp:**

* Only after measuring the PRS, can the UE know what PRS it likes and what PRS it does not like.
* It would increase the possibility for the request to be accepted by the network, which may improve the device efficiency to avoid invalid request.
* RAN2 only agreed on-demand PRS request with a set ID.
* It is mandatory to provide the available PRS before UE initiate the on-demand PRS request. Otherwise, the request is likely to be rejected by the network, which increase the time delay and signalling overhead, and should be avoided.
* The available PRS configuration can be the indication that the network support the on-demand PRS, then the UE can send the on-demand PRS request.
* UE can only request the on-demand PRS configuration within the available DL-PRS configurations provided by NW.
* UE can trigger the on-demand PRS request only if the available PRS configurations have been pre-configured.

**Views of disagree camp:**

* Even if there is no available DL-PRS configuration sent to UE before on-demand PRS request, UE can still request PRSs which satisfy its own QoS requirement in MO-LR request.
* Any LPP Request Assistance Data is "best effort" currently and the NW may provide what it can support.
* It can be up to network implementation on whether it provides all or only certain/subset of PRS configurations that it can support.

It seems there is majority in the table. Based on company feedback, the following is proposed:

**Proposal 5: RAN2 to agree that UE can trigger the on-demand PRS request only if the available PRS configurations have been provided to the UE. (9/13).**

***Issue 2: Whether*** ***UE can only request the configurations, i.e., identifier associated with the available DL-PRS or the explicit DL-PRS parameters if agreed, within the available DL-PRS provided by NW?***

If Question 5 that it is mandatory to provide the available PRS before UE initiates the on-demand PRS request is agreed, we may discuss the relations between the explicit parameters UE can request, i.e., List #1 and the available DL-PRS configurations provided by NW, i.e., List #3.

|  |
| --- |
| Agreement:   * The following lists of on-demand DL-PRS parameters are discussed/prepared by RAN1 and provided as input to RAN2:   + List#1: List of parameters for UE-initiated on-demand DL PRS request   + List#2: List of parameters for LMF-initiated on-demand DL PRS request * For the following lists of on-demand DL-PRS parameters, send an LS to RAN2 to check whether RAN2 would like RAN1 to send the list of parameters and request feedback as early as possible:   + List #3: List of parameters for UE-initiated on-demand DL PRS request associated with pre-configured set of on-demand DL PRS configurations   + List #4: List of parameters for LMF-initiated on-demand DL PRS request associated with pre-configured set of on-demand DL PRS configurations |

The reply LS to RAN1 on on-demand DL PRS parameters at 115-e meeting is agreed as below:

RAN2 needs to know the list of parameters that can be dynamically adjusted for UE-initiated/LMF-initiated on-demand DL PRS request. RAN2 does not expect RAN1 to send the list of parameters for on-demand DL PRS request associated with pre-configured set of on-demand DL PRS since how to handle DL PRS pre-configuration will be discussed in RAN2.[6]

According to rapporteur's opinion, once UE is allowed to request the DL-PRS configurations outside the available DL-PRS provided by NW, the efficiency of on-demand PRS is quite limited since NW probably rejects the request initiated by UE. Before what the pre-configuration DL PRS, i.e., List #3 from LMF to UE is discussed by RAN2, we may discuss the principle at first.

**Question 6: Do companies agree the UE can only request the configurations within the available DL-PRS provided by NW? Please specify the reasons or comments if any.**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comments |
| Huawei, HiSilicon | Agree | Our understanding is that the intention from the above FFS is that it should be further studied whether the UE can request PRS configuration out of the assistance data for on-demand PRS request.  For the above question, we think that the UE should only be allowed to request the PRS based on the assistance data for PRS request provided by the LMF in order to make reasonable request. For example, if a TRP ony supports PRS bandwidth of 10MHz while the UE requests PRS of 20 MHz, the request will not be satisfied anyway. |
| ZTE | disagree | When UE sends on-demand PRS request without available PRS configuration received, the on-demand PRS request is likely to beyond the scope of available PRS provided by NW. TRP is the one to final decide whether to satisfy UE’s request, even if UE makes the reasonable on-demand PRS request, TRP is also able to ignore it anyway(based on TRP implementation). Therefore, it doesn’t matter that UE’s on-demand PRS request is beyond the TRP capability. If that happens, TRP can send UE the PRS with TRP’s best capability. |
| Qualcomm | Disagree | We don't see a need to restrict an LPP Request Assistance Data. The more details a UE can provide on what is desired should be beneficial for an LMF to select a proper DL-PRS configuration based on NW capabilities and other factors (such as DL-PRS or location requests from/or for other UEs nearby to the target UE which are received by the LMF at about the same time). For example, if a TRP supports a max. 10MHz DL-PRS but a UE requests a e.g., 20 MHz DL-PRS, a DL-PRS with 10 MHz could still be provided. |
| Apple | Agree | PRS configuration negotiations between the UE and the network would increase positioning latency, which goes against the objectives of the WI. |
| Ericsson | Agree | Agree with Apple and Huawei comments |
| vivo | Agree | Agree with Apple and Huawei |
| Xiaomi | Disagree | The available PRS configuration can be the indication that the network support the on-demand PRS, then UE can send on-demand PRS request, but we don’t need to restrict the detailed PRS configuration requested by UE, anyway, the final PRS configuration is decided by LMF regardless of what UE is requested. |
| Lenovo, Motorola Mobility | Disagree | Should be also applicable to pre-configured AD, irrespective of whether it is valid or not. Best effort provisioning of the on-demand DL-PRS configuration should be at least allowed even if it does not meet the UE’s initial desired on-demand DL-PRS request. |
| InterDigital | Disagree | We think it is not necessary for restricting the UE to only request from the PRS provided by network. When the UE requests from one of the PRS configurations or a configuration with different parameters it can be up to network on whether to fulfil/reject the request. |
| Fraunhofer | Agree | We prefer a downselection of a DL-PRS configurations from available configurations signalled by the network will reduce complexity. |
| CATT | Agree | Agree with Apple and Huawei comments. It will bring big network load for operators if there is no restriction to request resources from UEs. |
| Nokia | Agree | Just indicating the ID for the pre-defined PRS configuration set has its benefits (signalling message size reduction, positive impact on latency) and so must be allowed. However, we need to wait and see what parameters RAN1 agrees to first before we can decide whether to allow individual parameter requests from UE. |
| OPPO | Agree | Agree with Apple and Huawei. UE requests the configurations within the available DL-PRS provided by NW also benefit for latency and signalling overhead reduction |
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**Summary:**

**Out of 13 responding companies, the following table presents a summary of responses regarding Question 6:**

|  |  |
| --- | --- |
| **UE can only request the configurations within the available DL-PRS provided by NW** | |
| **Agree** | **Disagree** |
| **8** | **5** |

**Agree (8/13):** Huawei, HiSilicon, Apple, Ericsson, vivo, Fraunhofer, CATT, Nokia, OPPO

**Disagree (5/13):** ZTE, Qualcomm, Xiaomi, Lenovo, Motorola Mobility, InterDigital

So **8/13** company agree that UE can only request the configurations within the available DL-PRS provided by NW; **5/13** company think UE can also request the configurations outside the available DL-PRS provided by NW.

Additionally, the following key comments were noted:

**Views of agree camp:**

* UE should only be allowed to request the PRS based on the assistance data for PRS request provided by the LMF in order to make reasonable request.
* PRS configuration negotiations between the UE and the network would increase positioning latency, which goes against the objectives of the WI.
* A downselection of a DL-PRS configurations from available configurations signalled by the network will reduce complexity.
* It will bring big network load for operators if there is no restriction to request resources from UEs.

**Views of disagree camp:**

* TRP is the one to final decide whether to satisfy UE’s request, even if UE makes the reasonable on-demand PRS request, TRP is also able to ignore it anyway(based on TRP implementation).
* The more details a UE can provide on what is desired should be beneficial for an LMF to select a proper DL-PRS configuration based on NW capabilities and other factors (such as DL-PRS or location requests from/or for other UEs nearby to the target UE which are received by the LMF at about the same time).
* The final PRS configuration is decided by LMF regardless of what UE is requested.
* Best effort provisioning of the on-demand DL-PRS configuration should be at least allowed even if it does not meet the UE’s initial desired on-demand DL-PRS request.
* When the UE requests from one of the PRS configurations or a configuration with different parameters it can be up to network on whether to fulfil/reject the request.

It seems there is slight majority in the table. Based on company feedback, the following is proposed:

**Proposal 6: RAN2 to agree that UE can only request the configurations within the available DL-PRS provided by NW (8/13).**

# 5 Conclusion

TBD

**Proposal 1: RAN2 to agree to support the UE originated request of on-demand PRS via MO-LR. (11/14).**

**Proposal 2: RAN2 to agree that UE initiate the on-demand PRS request via MO-LR only if the available DL-PRS configurations are provided to UE via posSIBs (10/14).**

**Proposal 3: RAN2 to agree that UE can send an MO-LR Request message included in an UL NAS TRANSPORT message to the serving AMF including an LPP Request Assistance Data message which is used for on-demand DL-PRS transmission, and the MOLR-Type of this MO-LR Request message is “assistanceData”** **(12/14).**

**Proposal 4: RAN2 to agree the following general stage 2 procedure as baseline for** **UE initiated on-demand PRS via MO-LR (13/14).**

 Figure 2: stage 2 procedure for UE initiated on-demand PRS via MO-LR

Step 0: LMF interacts with the TRP via TRP INFORMATION EXCHANGE procedure to obtain the available DL-PRS configurations.

Step 1/2: LMF provide the available on-demand PRS via posSIB to UE.

Step 3: The UE sends an MO-LR Request message (MOLR-Type is assistanceData) included in an UL NAS TRANSPORT message to the serving AMF including a request for on-demand DL-PRS transmission.

Step 4: The AMF invokes the Nlmf\_Location\_DetermineLocation service operation towards the LMF.

Step 5: Possible LPP procedures between LMF and UE, e.g., to obtain the DL-PRS positioning capabilities of the UE.

Step 6: LMF determines DL-PRS configuration based on the request received at Step 4 and/or the DL-PRS positioning capabilities of the UE.

Step 7: LMF instigates an NRPPa PRS CONFIGURATION REQUEST to the NG-RAN node including the requested on-demand PRS configurations.

Step 8: The NG-RAN node feedback the on-demand PRS request via PRS CONFIGURATION RESPONSE if the request can be accepted, or PRS CONFIGURATION FAILURE if the request cannot be filled.

Step 9: The LMF determines the exact location assistance data and transfer to UE.

Step 10: The LMF returns an Nlmf\_Location\_DetermineLocation Response to the AMF.

Step 11: the AMF forwards the response to the target UE.

**Proposal 5: RAN2 to agree that UE can trigger the on-demand PRS request only if the available PRS configurations have been provided to the UE. (9/13).**

**Proposal 6: RAN2 to agree that UE can only request the configurations within the available DL-PRS provided by NW (8/13).**

# 6 References

1. RAN2-115-e-Positioning-Relay-2021-08-27-0330.docx
2. TS 38.305 Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN V16.5.0
3. TS 23.273 5G System (5GS) Location Services (LCS); Stage 2 V16.3.0
4. R2-2108384 On-Demand DL-PRS Qualcomm Incorporated
5. R2-2108827 Summary of Agenda Item 8.11.4 On-demand PRS CATT discussion Rel-17 NR\_pos\_enh-Core
6. R2-2109123 Reply LS to RAN1 on on-demand DL PRS parameters Intel LS out Rel-17 NR\_pos-Core To:RAN1
7. TS24.080 Supplementary services specification; Formats and coding (Release 17) V17.0.0

# 7. Related agreements

**RAN2#111e**：

RAN2 to study positioning in idle/inactive mode, on-demand PRS and latency analysis in the study phase.

**RAN2#112e**：

Agreements on on-demand PRS:

RAN2 study on-demand PRS mechanism for DL-based, UL&DL-based methods (e.g. multi-RTT), and UE-Based and UE-assisted positioning methods in this SI.

**RAN2#113b**

Agreements:

UE-initiated on-demand PRS request is enabled by enhancing LPP RequestAssistanceData. FFS how much control the network has over the UE request.

The UE-initiated mechanism is enabled by the UE request triggering a request from the LMF, and the actual PRS changes are requested by the LMF irrespective of whether the procedure is UE- or LMF-initiated.

Put the stage 2 description for UE-initiated and LMF-initiated PRS request under the same framework.

**RAN2#114**

Agreements:

The network can signal predefined PRS configurations to the UE and the UE can select one to request. FFS if the UE can request a configuration with different parameters and exactly which parameters are flexible.

Agreements:

Proposal 2: Define a new LPP assistance data IE which can contain a set of possible on-demand DL-PRS configurations, where each on-demand DL-PRS configuration has an associated identifier.

Proposal 3 (modified): The new LPP assistance data IE from Proposal 2 can be included in an LPP Provide Assistance Data message and/or a new posSIB.

Agreement:

Proposal 4 (modified): The procedure(s) for on-demand DL-PRS should support at least the following functionality (up to RAN3 what is in NRPPa vs. OAM, etc.):

- Providing the requested on-demand DL-PRS configuration information from an LMF to the gNB (e.g., explicit parameter or identifier of a predefined DL-PRS configuration), and confirmation of the request by the gNB

- Provision of (possible/allowed) on-demand DL-PRS configurations that the gNB can support from a gNB to an LMF

- TRP capability transfer (e.g., whether the RAN node supports the reconfiguration of DL-PRS, etc.)

**RAN2#115**

Agreements:

Before providing available DL-PRS configuration to the UE, the LMF may obtain configuration information on what DL-PRS can be supported from one or more TRPs via NRPPa.

Capture the steps provided above as a baseline, along with a note indicating it remains FFS if the UE can send the MO-LR to request on-demand PRS.

FFS if we indicate to SA2 that MO-LR can be used to trigger on-demand PRS procedure.

It is up to Network (LMF) implementation on the steps to follow (accept/reject/ignore) on receiving request from UE for changing the DL-PRS configurations.