**3GPP TSG RAN WG2 Meeting#116-e R2-21xxxxx  
Online, 01 – 12 November 2021**

**Agenda item:** 8.11.4

**Source:** Lenovo, Motorola Mobility

**Title:** Summary of Agenda Item 8.11.4: On-demand PRS

**Document for:**Discussion and Decision

Introduction

This document summarizes the following contributions submitted to the On-demand PRS Agenda item 8.11.4:

1. R2-2109462, “Discussion on on-demand PRS”, ZTE.
2. R2-2109484, “Discussion on on-demand PRS”, CATT.
3. R2-2109664 , “Support of on-demand PRS request”, Intel Corporation.
4. R2-2109757, “Discussion on on-demand DL-PRS”, OPPO.
5. R2-2109826, “Support of On-Demand DL-PRS”, Lenovo, Motorola Mobility.
6. R2-2109916, “On demand PRS”, Ericsson.
7. R2-2109981 , “Discussion on on-demand PRS”, vivo.
8. R2-2110040 , “Stage-2 procedure for on-demand PRS”, Apple.
9. R2-2110175, “Discussion on on-demand PRS”, Huawei, HiSilicon.
10. R2-2110247, “On-demand PRS”, Fraunhofer IIS, Fraunhofer HHI.
11. R2-2110361, “Considerations on positioning PRS On-demand”, Sony.
12. R2-2110825, “Remaining issues for on-demand DL-PRS”, Qualcomm Incorporated.
13. R2-2110931, “Discussion on procedures for On-demand PRS for DL-based positioning”, InterDigital, Inc.
14. R2-2110932 , “Discussion on procedure for On-demand PRS for DL+UL based positioning”, InterDigital, Inc.
15. R2-2110956, “Clarifications to on-demand PRS Stage 2”, Nokia, Nokia Shanghai Bell.
16. R2-2110957, “UE-initiated on-demand PRS requests”, Nokia, Nokia Shanghai Bell.
17. R2-2110958, “Pre-configured assistance data for on-demand PRS”, Nokia, Nokia Shanghai Bell.
18. R2-2111107, “Positioning enhancement to on-demand DL PRS”, Xiaomi.

Furthermore, the following 2 draft LSs were also submitted:

1. R2-2110966, “[Draft] LS on MO-LR for on-demand PRS”, CATT.
2. R2-2111090, “[Draft] LS on stage-2 on-demand PRS procedure”, CATT.

**References**

1. R1-2108605, “Session Notes for 8.5 (NR Positioning Enhancements)”, Ad-Hoc Chair (Ericsson), 3GPP RAN1#106-e, Aug. 2021.
2. R1-2110614, “Session Notes for 8.5 (NR Positioning Enhancements)”, Ad-Hoc Chair (Ericsson), 3GPP RAN1#106bis-e, Oct. 2021.

## RAN2#116-e On-demand PRS Topic Areas

The submitted proposals submitted have been identified to fall under the scope of the following sub-topic areas:

1. General Signalling Aspects
   1. Signalling between UE and LMF
      1. UE on-demand PRS request signalling design details
      2. Network on-demand PRS response and signalling content
      3. Control of UE-initiated on-demand PRS requests
      4. On-demand PRS capabilities
   2. Signalling between NG-RAN and LMF
2. UE-LMF and NG-RAN-LMF information transfer
   1. On-demand PRS configuration information
   2. Assistance information from UE to LMF
   3. Assistance information from NG-RAN to LMF
3. Triggering criteria/conditions for on-demand PRS
4. MO-LR aspects
5. Stage 2 aspects
6. Draft Liaisons
7. Other Enhancements

# General Signalling Aspects

## Signalling Between UE and LMF

Company observations/proposals are captured in the following table:

|  |  |
| --- | --- |
| ZTE [1] | **Proposal 4**: Support UE to request explicit PRS parameters no matter in MT-LR or MO-LR case. |
| CATT [2] | **Proposal 2: Only the UEs who received the available DL-PRS can be allowed to initate the on-demand PRS, and the requested PRS configuration should be based on the available PRS for on-demand provided by LMF.**  **Proposal 5**: For UE initiated on-demand PRS, except the identifier of the pre-defined DL-PRS configurations, UE can also request explicit PRS parameters which are within the scope of the pre-defined DL-PRS configurations.  **Proposal 6**: For UE initiated on-demand PRS request, a new LPP IE which can contain the content of the on-demand PRS request, can be included within the LPP *RequestAssistanceData* message.  **Proposal 7**: UE shall initiate the on-demand PRS request per positioning method.  **Proposal 8**: LPP *ProvideAssistanceData* message is reused to carry the on-demand PRS response.  **Proposal 9**: The content of the on-demand PRS response shall at least include:   * ACK of the requested on-demand PRS configuration; * Identify of the set of the parameters within the PRS configuration in the on-demand PRS request that can be fulfilled, or the explicit paramaters that can be fulfilled; * NACK of the requested on-demand PRS configuration; * Error indication with error causes for the PRS configurations in the on-demand PRS request that can not be fulfilled.   **Proposal 10**: The positioning capability that indicates whether UE supports the on-demand PRS should be introduced in TS37.355. |
| Intel [3] | **Proposal 1**: The on-demand DL-PRS request is provided within the LPP Request Assistance Data message, at least for MT-LR. FFS for MO-LR case.  **Proposal 3**: The UE can only send the on-demand PRS request if LMF enables this via LPP message ProvideAssistanceData, i.e. by providing preconfiguration sets to the UE. |
| OPPO [4] | **Proposal 4**: No explicit ACK/NACK is defined for on-demand PRS request.  **Proposal 5**: A prohibit timer is introduced to limit the frequency of on-demand PRS request. |
| Lenovo, Motorola Mobility [5] | **Proposal 5**: UE can at least request an updated DL-PRS configuration per positioning method. |
| vivo [7] | **Observation 1**: The PRS resource type can be divided into the following:   * Type 1: PRS resources that are always transmitted by the gNB. * Type 2: on-demand PRS resources. They are further divided into two:   + Type 2a: on-demand PRS resources which are not activated (not transmitted).   + Type 2b: on-demand PRS resources which are activated (being transmitted).   **Proposal 1**: No need to distinguish the activated on-demand PRS resources and inactivated on-demand PRS resources in the PosSIB.  **Proposal 2**: LMF should not inform which on-demand PRS configuration is activated via posSIB.  **Proposal 5**: Some explicit parameters can be included in the on-demand PRS configuration request.  **Proposal 7**: If the requested on-demand PRS is not available, the LMF shall return an error indication and a timer to prevent the UE from requesting on-demand PRS again in a specific duration. |
| Huawei, HiSilicon [9] | **Proposal 2:** UE should indicate its support for UE-initiated on-demand PRS in LPP *ProvideCapabilities*.  **Proposal 3**: For UE-initiated on-demand PRS request, the UE can only request PRS configuration within the scope of assistance data for on-demand PRS request provided by the network.  **Proposal 4**: For UE-initiated on-demand PRS request, in addition to complete set of PRS configurations, the UE can also request individual PRS configuration parameters which are within the scope of the assistance data for on-demand PRS request provided by the network.  **Proposal 6**: UE may provide an indication of desired PRS configurations for UE-initiated on-demand PRS, e.g., through LPP Request Assistance Data message.  **Proposal 7**: LMF should provide an error indication with error causes in response to the on-demand PRS request if the PRS request is not fully accepted. |
| Fraunhofer [10] | **Observation 1**: High overhead would result when the different on-demand DL-PRS parameters, in multiple combinations, are freely chosen by the UE.  **Observation 2**: The overhead is reduced by grouping on-demand parameters into sets or bundles that can be supported by network, the UE can then identify and request the desired parameter bundle.  **Observation 3**: The network can restrict the parameters that can be combined together, and only allow combinations that can be triggered immediately, thereby reducing latency.  **Proposal 1**: The UE shall only request on-demand PRS from the set of available PRS configurations provided by the network. |
| Qualcomm [12] | **Proposal 1**: UE-initiated on-demand PRS request is enabled by enhancing the IEs *NR-Multi-RTT-RequestAssistanceData*, *NR-DL-AoD-RequestAssistanceData*, and *NR-DL-TDOA-RequestAssistanceData*.  **Proposal 2**: The UE initiated on-demand DL-PRS request can include:   1. A request for the available (predefined) DL-PRS configurations. 2. A Request for one or more predefined DL-PRS configuration IDs, sorted in priority order. 3. An explicit DL-PRS parameter list defining the DL-PRS   **Proposal 4**: The possible on-demand DL-PRS configurations are provided to the UE via the IEs *NR-Multi-RTT-ProvideAssistanceData,* *NR-DL-AoD-ProvideAssistanceData*, and *NR-DL-TDOA-ProvideAssistanceData*.  **Proposal 5**: If the UE on-demand DL-PRS request cannot be fulfilled by an LMF (fully or partially), the LMF provides a LocationServerErrorCause in the LPP Provide Assistance Data message to the target device.  **Proposal 6**: The LocationServerErrorCause in the LPP Provide Assistance Data message can include a 'reattempt time' which indicates a time when the UE is allowed to repeat a LPP Request Assistance Data message.  **Proposal 7**: Specify a new IE NR-OnDemand-DL-PRS-Capability defining the on-demand DL-PRS capabilities of the UE. |
| InterDigital [13] | **Proposal 8**: LMF can send a confirmation/rejection message to UE for indicating whether or not the PRS configuration/parameter indicated in on-demand PRS is fulfilled  **Observation 4**: At LMF, awareness the parameters/configurations used by UE when performing measurements using the conventional PRS (semi-static) and on-demand PRS (dynamic) is beneficial for improving accuracy and efficiency  **Proposal 11**: UE can indicate to LMF on the PRS configurations used (i.e. IDs of conventional PRS or on-demand PRS configurations) during measurements in the measurement report  **Proposal 12**: UE can receive from LMF the indication to report measurements made using only on-demand PRS configuration  **Proposal 13**: For UE-based positioning, UE can indicate to LMF on whether on-demand PRS configuration is used to estimate location information  **Proposal 15**: UE can send on-demand PRS request before completion of sending of configured amount of measurement reports |
| InterDigital [14] | **Proposal 1**: RAN2 supports on-demand PRS for DL+UL positioning method |
| Nokia [15] | **Proposal 1**: RAN2 is kindly requested to discuss whether a new LPP message should be defined for UE-initiated on-demand PRS request instead of using the request for assistance data that RAN2 agreed before. |
| Nokia [16] | **Observation 1**: Request for explicit parameters and values by the UEs for UE-initiated on-demand PRS, would incur additional latency and decrease network efficiency and increase system complexity, hence not feasible from the network operation point of view.  **Proposal 1**: UE-initiated on-demand PRS request shall only indicate IDs of predefined PRS configurations that have been provided to the UE by the network via LPP Provide Assistance Data message and/or a new posSIB. |
| Xiaomi [18] | **Proposal 1:** If UE receives the predefined PRS configuration for on-demand PRS, the UE can send on-demand PRS request to the LMF, otherwise not**.**  **Proposal 3**: The on-demand PRS request can include explicit parameter defining a DL-PRS configuration which is in the predefined PRS configuration, an identifier pointing to a predefined PRS configuration or PRS configuration which is not in the predefined PRS configuration.  **Proposal 4**: LMF may provide the PRS configuration which is not requested by UE or provide an indication to indicate UE to stop sending on-demand PRS request when the LMF rejects the on-demand PRS request from UE.  Proposal 5: The PRS configuration updated by gNB based on on-demand PRS request should not impact the UEs which are not sending on-demand PRS request |

### Rapporteur Summary:

During the RAN2#114-e, an initial agreement was already made regarding the signalling of predefined configurations and selection by the UE of the provided predefined configurations. Given that RAN1 has already agreed in [21] and [22] a set of parameters for both UE-initiated and LMF-initiated on-demand PRS, it would be good continue the discussion on aspects related to the on-demand signalling request and response design. Overall, the proposals can be further grouped according to the following:

#### UE on-demand PRS request signalling design details:

Contributions [1][2][7][9][12] share the view that explicit on-demand PRS parameters can also be separately requested by the UE, aside from the pre-defined PRS configurations. However, in [8] the preference is to request on-demand PRS from a set of available configurations from the network, while in [16], the ID(s) associated with a pre-defined PRS configuration set is the preferred indication. Furthermore, proposals in [2][5][12], indicate that the UE’s on-demand PRS request should be based according to the supported positioning method, i.e., DL-based and (DL+UL)-based positioning methods. Contributions [2][3][12] have also proposed that the on-demand PRS request is provided within the LPP *RequestAssistanceData* message. Given that we had an agreement during the RAN2#113-be meeting on:

***RAN2#113-e Agreement:*** “*UE-initiated on-demand PRS request is enabled by enhancing LPP RequestAssistanceData*”,

further details on the consolidation of the on-demand PRS request signalling would need a further discussion. On the contrary, [15] proposes the use of a new message aside from *RequestAssistanceData* to enable the UE to request an on-demand PRS configuration from the network based on ongoing PRS transmissions prior to the UE’s on-demand PRS request.

Therefore, the following is proposed:

**Proposal 1.1: The UE may initiate an on-demand PRS request per positioning method including DL-TDoA, DL-AoD and Multi-RTT, via the existing LPP *RequestAssistanceData* message.**

**Proposal 1.2: If Proposal 1.1 is agreed, then there is no need for introducing a new LPP message to carry the on-demand PRS request.**

From the Rapporteur perspective, enabling explicit on-demand PRS parameter(s) request by the UE has the trade-off of flexibility vs signalling overhead but offers the opportunity to request additional explicit parameters if the pre-defined configurations do not satisfy the UE’s requirements. Therefore, based on the company inputs, the following proposal is provided:

**Proposal 2: The UE may request explicit on-demand PRS parameter(s) from the network,**

#### Network on-demand PRS response and signalling content

Another open issue mentioned by companies includes the details on the LMF response to the UE’s on-demand PRS request. According to [2], such a response may include ACK/NACK of the on-demand PRS request, identifying a set of on-demand PRS configurations/explicit parameters that can be fulfilled. On the contrary, [4] proposes there is no need to define separate ACK/NACK response signalling as part of the on-demand PRS response. Contributions [2][7][9][12] mention the use of an error indication as part of the on-demand response to a fully or partially unfulfilled on-demand PRS request. In [7], it has been proposed that there is no need for a distinction between on-demand PRS resources, which are activated/not activated. Furthermore, in [12] it is proposed that the existing *ProvideAssistanceData* message is used to carry the on-demand PRS configuration according to the positioning technique.

Since this would be the initial discussion regarding on-demand PRS response signalling, the following on-demand PRS response proposal is presented as a way forward:

**Proposal 3: LPP *ProvideAssistanceData* message is enhanced to enable the on-demand PRS response signalling from the LMF based on the UE’s on-demand PRS request.**

* **Error indication is supported for a partial or completely unfulfilled on-demand PRS request.**
* **FFS other scope of enhancements (e.g., ACK/NACK signalling).**

#### Control of UE-initiated on-demand PRS requests

During the RAN2#113-e bis meeting, the following agreement was reached:

***RAN2#113-e Agreement:*** “*UE-initiated on-demand PRS request is enabled by enhancing LPP RequestAssistanceData. FFS how much control the network has over the UE request*”.

Multiple companies have explored the issue of controlling the number of UE on-demand PRS requests by the network. In [3][18], it has been proposed that the UE only sends the on-demand PRS via *ProvideAssistanceData*, provided that the LMF has already transmitted the on-demand PRS preconfiguration (pre-defined) sets to the UE. In [4][6], a timer (e.g. prohibit timer) is proposed to limit the frequency of on-demand PRS requests. In [12], a reattempt duration is proposed whereby a UE is allowed to repeat an on-demand PRS request, while in [18] a stop indication from the LMF is proposed in order to avoid the UE from transmitting multiple on-demand PRS requests in the event that cannot be fulfilled.

Given the divergent proposals, a further discussion is encouraged to consider different options via the following proposal:

**Proposal 4: Network control of UE-initiated on-demand PRS is supported. The following options are to be downselected:**

* **Option A: UE can only request on-demand PRS based on prior reception of on-demand PRS configuration sets.**
* **Option B: Configuration of a prohibit timer**
* **Option C: Reattempt timer**
* **Option D: Stop message indication from the LMF**

#### On-demand PRS Capabilities

A few companies [2][9][12] have also raised the issue of supporting on-demand PRS capabilities. Contribution [2] is supportive a introducing a new capability in TS37.355. According to the RAN1#106-e UE feature discussion, UE-initiated on-demand PRS has already been agreed as a baseline UE feature (FG-27-5-1) [R1-2109915], so a further discussion on whether to align with RAN1 could be further discussed. In [9], it has been proposed that the UE indicates its capability support for UE-initiated on-demand PRS via the *ProvideCapabilities* message, while in [12] a new on-demand PRS capability IE is proposed. Given that this aspect falls under the capability discussion, which will be needed to complete the on-demand PRS feature, we have the following proposal:

**Proposal 5: Further discuss the on-demand PRS capability definition for UE-initiated on-demand PRS and whether additional alignment with RAN1 is required.**

## Signalling Between NG-RAN and LMF

Company observations/proposals are captured in the following table:

|  |  |
| --- | --- |
| CATT [2] | **Proposal 1:** Sent to RAN3 to inform RAN3 agreements on the TP of the on-demand PRS agreed by RAN2. |
| Ericsson [6] | **Observation 1**: The DL PRS on-demand signaling defined by RAN3 is cell specific.  **Observation 2**: The utilization of each beam of each cell per TRP may be taken from statistics (aggregation) based upon UEs measurement report to LMF.  **Observation 3**: It is necessary to send helpful information aggregated by LMF such as UEs statistics and PRS average beam utilization to gNB, so that gNB can optimize the PRS transmission.  **Proposal 1**: Send LS to RAN3 to include a PRS Activity Report as discussed above. |
| Huawei, HiSilicon [9] | **Observation 3**: RAN3 has agreed to enhance the TRP Information Exchange procedure to support pre-defined PRS configurations.  **Observation 4**: RAN3 has agreed that there’s no need to support explicit indication of TRP capabilities in NRPPa.  **Proposal 9**: For a certain DL-PRS configuration in the TRP INFORMATION REPONSE, the following information should be included under the granularity of PRS resource, PRS resource set, frequency layer and TRP:   * What can be requested by LMF, e.g., allowed/supported PRS configuration ID, individual PRS configuration parameters * The PRS configuration currently being transmitted |

### Rapporteur Summary:

A few contributions raised some aspects related to the signalling needed between NG-RAN and LMF. It is noted that RAN3 has made some agreements [R3-214286] to the effect of supporting pre-defined PRS configurations by enhancing the TRP INFORMATION REQUEST message. Furthermore, during the RAN2#115-e meeting, the following agreement was made:

***RAN2#115-e Agreement***: “*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*”.

In [6], the transmission of an activity report from the LMF to NG-RAN is proposed in order to share assistance information that would be helpful for the gNB. In [9], it was further mentioned that since the TRP Information exchange has been agreed to be enhanced to support pre-defined PRS configurations by RAN3 and there no need to support any capability indication of TRP capabilities via NRPPa. In addition, [9] also proposed enhancements to the TRP information response message, including PRS configuration granularity information (e.g. PRS resource ID/resource set ID/TRP/frequency layer) and aligning the existing PRS configuration with the on-demand PRS configuration requested by the LMF. Overall, it seems beneficial for RAN2 to await any official feedback from RAN3 to trigger any work to support their agreements.

**Proposal 6: On the gNB on-demand PRS response to the LMF, consider the following options:**

* **Option A: Further discuss the type of DL PRS configuration information to be transmitted from the gNB to the LMF, e.g., activity report, supported configuration IDs, PRS configuration currently being transmitted.**
* **Option B: Leave the discussion up to RAN3.**

In addition, a RAN3 LS has been drafted in [20] based on the TS38.305 TP that was discussed during the [Post115-e][609] email discussion [R2-2109673] and it is therefore recommended to be discussed under the scope of that discussion. From the Rapporteur’s perspective, it would be reasonable to send an LS to RAN3 align RAN2 Stage 2 agreements and provide any feedback on associated impacts to NRPPa, subject to the outcome of the parallel discussion.

**Proposal 7: Send LS to RAN3 relating to the latest on-demand PRS Stage 2 Running CR based on the draft LS of [20].**

# Information transferred between UE, NG-RAN and LMF

## On-demand DL-PRS configuration information

Company observations/proposals are captured in the following table:

|  |  |
| --- | --- |
| ZTE [1] | **Proposal 3**: UE initiated on-demand PRS request can indicate some identifiers provided in a set of possible on-demand DL-PRS configurations, e.g. positioning frequency layer ID list, TRP ID list or DL PRS resource set list. |
| CATT [2] | **Proposal 3**: All of the configuration paramaters within the PRS assistance data currently in spec TS37.355 can be included within the available PRS for on-demand.  **Proposal 4**: RAN2 to further discuss the signalling design of the available on-demand PRS based on the following two options:   * Option 1: available value range of PRS parameters, with each value assigned an identifier used for UE to request, i.e., bandwidth of the PRS, with value range of {24 PRB, 28 PRB, 32 PRB…}, corresponding to identifier {1, 2, 3…}; * Option 2: resue the current signalling structure of PRS assistance data provided by LMF, i.e., the NR-DL-PRS-AssistanceData; |
| Intel [3] | **Proposal 2**: A new LPP assistance data IE shall be defined to indicate the requested DL-PRS configuration parameters/associated identifier.  **Proposal 5**: The UE shall only select the DL-PRS requested parameters within the indicated configuration sets and indicate the selected PRS configuration set ID to the LMF. |
| OPPO [4] | **Proposal 2**: RAN2 study the maximum number of PRS configurations that can be pre-configured to UE.  **Proposal 3**: Follow RAN1 agreement on the PRS parameters that can be dynamically adjusted in the request for UE-initiated on-demand PRS.  **Proposal 6**: UE always follow the latest PRS configuration for PRS measurement. |
| vivo [7] | **Proposal 4**: The configuration of possible available on-demand DL-PRS is valid within a specific area and period.  **Proposal 6**: The configuration of possible available on-demand DL-PRS can include a list available PRS configurations associated with different areas (e.g., distinguished by cell ID). |
| Huawei, HiSilicon [9] | **Observation 2:** UE can request a specific configuration ID associated with the predefined PRS configuration.  **Proposal 5**: UE can request the parameters with different granularities of frequency layer, TRP, PRS resource set and PRS resource.  **Proposal 10**: At least the ON/OFF indicator of the DL PRS in the granularity of PRS configuration ID, PRS resource, PRS resource set, frequency layer and TRP should be supported for LMF-initiated on-demand PRS. |
| Fraunhofer [10] | **Proposal 2**: The network shall signal the UE (e.g. via posSibs) the DL-PRS that are already being transmitted and the set of configurations that can further be requested by the UE.  **Proposal 3**: The available configurations shall be bundled, so that the UE requests an identifier corresponding to the bundle of on-demand DL-PRS from the network. The bundle may consist of one or more DL-PRS resources, which have a common on-demand parameter (e.g. bandwidth), and identified by an identifier. |
| Qualcomm [12] | **Proposal 2**: The UE initiated on-demand DL-PRS request can include:   1. A request for the available (predefined) DL-PRS configurations. 2. A Request for one or more predefined DL-PRS configuration IDs, sorted in priority order. 3. An explicit DL-PRS parameter list defining the DL-PRS.   **Proposal 3**: The UE initiated on-demand DL-PRS request can include:   1. start time and/or time duration for when and/or how long the requested DL-PRS configuration is required at the target device. 2. desired number of TRPs located around the target device location for which the DL-PRS is requested. 3. whether the nr-SSB-Config in IE NR-DL-PRS-AssistanceData is requested or not   **Proposal 8**: Define a new posSIBType6-4 for the IE NR-DL-PRS-On-Demand-Configurations, which contains a list of possible on-demand DL-PRS configurations where each configuration is identified by a DL-PRS-Configuration-ID. |
| InterDigital [13] | **Proposal 10**: Support providing assistance data to UE on different sets of PRS parameters and criteria for groupping the PRS parameter sets when indicating in on-demand PRS. |
| Nokia [16] | **Observation 1**: Request for explicit parameters and values by the UEs for UE-initiated on-demand PRS, would incur additional latency and decrease network efficiency and increase system complexity, hence not feasible from the network operation point of view.  **Proposal 1**: UE-initiated on-demand PRS request shall only indicate IDs of predefined PRS configurations that have been provided to the UE by the network via LPP Provide Assistance Data message and/or a new posSIB.  **Proposal 2**: Multiple predefined PRS configurations should be provided to UEs with an indication of order of (network) preference and the UE should be able to indicate multiple predefined PRS configurations in the UE-initiated on-demand PRS request in order to indicate an alternate UE preference. |
| Nokia [17] | **Observation 1**: It should be understood that the terms “pre-configuration” in “pre-configuration of assistance data” and “predefined” in “predefined PRS configurations” refer to the same operation of provisioning of assistance data (where PRS configurations refers to a specific assistance data) to the UEs beforehand of any specific positioning measurement procedure.  **Proposal 1**: Predefined PRS configurations, shall have an associated ID and each predefined PRS configuration is associated with a (set of) condition(s) in terms of positioning QoS and/or radio condition for UE to initiate an on-demand PRS request. |
| Xiaomi [18] | **Proposal 3**: The on-demand PRS request can include explicit parameter defining a DL-PRS configuration which is in the predefined PRS configuration, an identifier pointing to a predefined PRS configuration or PRS configuration which is not in the predefined PRS configuration. |

### Rapporteur Summary:

Certain Stage 3 aspects relating to the on-demand PRS configuration information have also been discussed by many of the companies. Two aspects have been identified, which aims to address the following issues:

1. How to structure the on-demand PRS pre-defined configurations, e.g., using configuration identifiers for explicit parameters, PRS granularities, bundling/grouping mechanism
2. Meta information related to how to distinguish/process on-demand PRS pre-defined configurations, e.g. based on areas, priority orders, network preferences, etc.

#### On-demand PRS configuration structure

Several companies [1][2][3][9][12][13][17][18] have proposed that a pre-defined PRS configuration be associated with an identifier in order to easily identify a set of PRS parameters within a set and distinguish multiple sets of on-demand PRS configurations and for easier handling. It can be noted that the following agreement during RAN2#114-e was made to this effect:

***RAN2#114-e Agreement***: “*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*”.

In [2], it has been proposed that identifiers be associated with each of the explicit on-demand PRS parameters (Option 1), while another alternative of reusing the NR-DL-PRS-AssistanceData IE for transmitting the on-demand PRS was also suggested (Option 2). A new assistance data IE is proposed in [3] to associate the configuration parameters/associated ID. In [12] a parameter list is proposed to be associated with an explicit UE-initiated on-demand PRS request. The maximum number of on-demand pre-defined PRS configurations to be provisioned was raised in [4], which according to Rapportuer’s view could also be left up to network implementation. Different PRS granularities (e.g. based on frequency layer, TRP, PRS resource set, PRS resource) and ON/OFF indicator (with different PRS granularities) are proposed in [9] to be defined for a pre-defined PRS configuration. Note that the ON/OFF indicator has already been agreed by RAN1 as seen in the consolidated on-demand PRS list in Sec. 3.1.1.2. This aspect may also require RAN1 coordination and feedback. In [10], it is proposed that the bundling of the different parameters in on-demand PRS sets could be beneficial to reduce signalling overhead, while [13] also suggests a grouping criterion managing the PRS parameters from different sets.

Due to the varied proposals on the table, the following proposals are therefore considered to address the remaining aspects related to on-demand PRS configuration:

**Proposal 8.1: A DL-PRS configuration set may contain one or more explicit DL-PRS parameters in the case of UE-initiated on-demand PRS. RAN2 to further discuss:**

* **Whether a parameter list may be associated with the request of one or more DL-PRS parameters**
* **If there is need to associate each explicit parameter is associated with a separate ID.**

**Proposal 8.2: On the pre-defined on-demand PRS configuration, further discuss whether the pre-defined on-demand PRS configuration sets should be provided based on:**

* **Different PRS granularities (e.g. per frequency layer/TRP/Resource Set/Resource ID)**
* **Bundling/grouping mechanism for pre-defined configuration sets**
* **A limit on the maximum number of PRS configuration sets**

#### Information related to on-demand PRS configurations

In [7], the on-demand PRS pre-defined configuration is proposed to be associated with validity criteria such as the area and duration for which it is valid. In [12], the on-demand PRS parameters including start time, time duration, desired duration of the on-demand PRS configuration are proposed to be associated with an on-demand PRS configuration. It can be noted that start/end time of the DL-PRS transmission was already agreed by RAN1, during the previous meetings based on the following consolidated list [21][22]:

|  |
| --- |
| RAN1#106-e Agreement  At least the following list of on-demand DL PRS parameters is supported for UE-initiated and LMF-initiated on-demand DL PRS requests:   1. DL PRS Periodicity 2. DL PRS resource bandwidth 3. DL PRS QCL information   Conclude on remaining parameters at RAN1#106-bis-e  RAN1#106bis-e Agreement   1. The following list of parameters is supported for UE-initiated and LMF initiated on-demand DL PRS request 2. Start/end time of DL PRS transmission 3. DL PRS resource repetition factor 4. Number of DL PRS resource symbols per DL PRS resource 5. DL-PRS CombSizeN 6. Number of DL PRS frequency layers 7. ON/OFF indicator (for LMF initiated request only) 8. FFS values for requested on-demand DL PRS parameters and whether parameters are resource-specific, TRP-specific, or PFL-specific |

According to the Rapporteur’s view, the number of TRPs is still under discussion in RAN1, while SSB configuration in the on-demand PRS assistance data request may also require RAN1 inputs. It also the Rapporteur’s understanding that RRC parameter list will be provided to RAN2 and can therefore be handled accordingly. According to [16], a network order of preference is proposed to be indicated for multiple sets of pre-defined PRS configuration, while in [12] a priority order is defined to enable the UE to indicate its order preference for the different predefined on-demand PRS configuration sets. Accordingly, two sets of priority are distinguished for on-demand PRS configurations, 1) UE-configured priority and 2) network configured priority (network order of preference).

**Proposal 9: Further discuss the information associated with a pre-defined on-demand PRS configuration, which may include the following options:**

* **Option A: Validity criteria, e.g., area, timer**
* **Option B: Prioritization indications, FFS whether the pre-defined PRS configuration is based on a network and/or UE configured priority.**

Note: Since the area information is somewhat dependent on the UE’s location, while the UE-configured priority may relate to UE assistance information provided to the network, Proposal 10 could also be jointly discussed with Proposal 11.

## Assistance information from UE to LMF

Company observations/proposals are captured in the following table:

|  |  |
| --- | --- |
| Intel [3] | **Proposal 6**: No additional signaling needs to be defined to provide assistance information to LMF to assist in the determination of on-demand DL-PRS configuration(s). |
| Lenovo, Motorola Mobility [5] | **Proposal 6**: Support the following UE assistance information to LMF for providing an updated DL-PRS configuration:   * Indication of course location information, e.g., E-CID, TRP/beam (group) indices. * Indication of change in radio conditions, e.g., beam-failure indication, candidate beams for re-selection.Indication of measurement quality metrics such as LOS/NLOS and other relevant quality estimates to LMF. |
| Ericsson [6] | **Observation 4**: *NR-ECID-SignalMeasurementInformation* IE can include reference signal received power and quality of SSB and CSI-RS (SS-RSRP, SS-RSRQ, CSI-RSRP and CSI-RSRQ) for up to 32 neighbor cells.  **Proposal 2**: Request ECID measurements from UE to send SS-RSRP, SS-RSRQ, CSI-RSRP and CSI-RSRQ of the neighbor cells (with timestamp) is helpful to LMF to determine the suitable cells for each UE.  **Proposal 3**: Report the below parameters from UE together ECID measurements is helpful for on-demand PRS configuration, especially for the case of UE in mobility:   * Location estimates of UE * Detected LOS/NLOS links * TRPs/Beams leading to Poor positioning QoS (accuracy and latency)   **Proposal 4**: UE provides the reasons as why current configuration is not suitable.  **Proposal 5**: To minimize signalling, NW may indicate that the UE logs its preferred configuration or worst contributor. |
| InterDigitial [13] | **Proposal 14**: UE can be requested by the network to identify and indicate the LOS/NLOS paths to LMF in the on-demand PRS. |

### Rapporteur Summary:

Another open issue relates to the provision of UE assistance information to assist the LMF in determining the on-demand PRS configuration. According to [3], no such UE assistance information signalling needs to be specified. However, in [5][6][13], UE assistance information has been proposed to be beneficial in terms of assisting the LMF in terms of providing location information to the UE, detected LOS/NLOS paths, poor/unreliable TRPs. From the Rapporteur perspective, UE side information to assist the LMF on-demand can be considered for further discussion and given the slight majority, the following proposal is provided:

**Proposal 10: Support the need of transmitting assistance information from UE to LMF to aid in configuring on-demand PRS. FFS further details such as signalling and content of UE assistance information.**

## Assistance information from NG-RAN to LMF

Company observations/proposals are captured in the following table:

|  |  |
| --- | --- |
| Huawei, HiSilicon [9] | **Proposal 8**: The assistance information for LMF-initiated on-demand PRS for possible/allowed PRS configuration should share the same structure of the PRS configuration in the TRP INFORMATION RESPONSE. |

### Rapporteur Summary:

One contribution [9] proposes that the NG-RAN assistance information should share the same structure of the PRS configuration as transmitted within the TRP information response. The following RAN2#115-e agreement was made,

***RAN2#115-e***: “*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*”.

This configuration information can be deemed to be UE assistance information. This aspect can be further discussed under the context of Proposal 7 and also given that the scope of the proposal falls under RAN3, no recommended summary proposal is provided.

On-demand PRS trigger condition/criteria

Company observations/proposals are captured in the following table:

|  |  |
| --- | --- |
| ZTE [1] | **Proposal 5**: NOT to specify triggering condition/criteria for UE-initiated and LMF-initiated on-demand PRS request. |
| Intel [3] | **Proposal 4**: No additional triggering criteria or events need to be specified to allow/disallow the UE from triggering on-demand PRS request. |
| OPPO [4] | **Observation 1**: There are multiple factors to consider for the trigger of on-demand PRS request.  **Proposal 1**: It is left to implementation to trigger the request for both UE-initiated and LMF-initiated on-demand PRS. |
| Lenovo, Motorola Mobility [5] | **Proposal 3:** RAN2 to specify UE-initiated trigger criteria based on at least measurement quality and change/disruption in radio conditions, e.g., beam failure, LOS/NLOS measurements.  **Proposal 4:** LMF-initiated triggering criteria can be left up to network implementation. |
| Sony [11] | **Proposal 3:** Support the indication of positioning requirement / service level in the on-demand PRS operation. |
| Interdigital [13] | **Observation 1:** Configuring triggering conditions can be useful for assisting the UE to trigger on-demand PRS when certain measurements or QoS evaluations indicate inadequacy of the existing PRS configuration  **Observation 2:** For ensuring deterministic UE behavior, it is important to identify and discuss the triggering conditions as to when/how the UE sends the on-demand PRS  **Proposal 3**: Support triggering conditions (e.g. parameters and thresholds) that can be used by UE for sending on-demand PRS  **Proposal 4**: The parameters in triggering conditions that can be monitored by UE for sending on-demand PRS includes: RSRP, TDoA (for timing-based positioning method), number of multipaths and positioning QoS (e.g. accuracy, measurement latency)  **Proposal 5**: Triggering conditions for supporting on-demand PRS are provided to UE as assistance information using LPP assistance data transfer procedure or via posSIB |
| Interdigital [14] | **Observation 1:** Reconfiguring the PRS/SRSp configurations reactively based on measurements at UE and TRPs/gNBs can result in significantly high latency  **Observation 2:** A UE can send a request for reconfiguration of PRS at different stages in multi-RTT (e.g. after receiving PRS configuration, after performing measurements on PRS, after transmitting SRSp)  **Proposal 2**: Support triggering conditions (e.g. parameters and thresholds) that can be by UE for sending on-demand PRS to request for updating PRS configuration and/or SRSp configuration for DL+UL positioning  **Proposal 3**: Triggering conditions for supporting on-demand PRS for DL+UL positioning are provided to UE as assistance information in LPP message and/or in RRC signalling |
| Nokia [17] | **Observation 1**: It should be understood that the terms “pre-configuration” in “pre-configuration of assistance data” and “predefined” in “predefined PRS configurations” refer to the same operation of provisioning of assistance data (where PRS configurations refers to a specific assistance data) to the UEs beforehand of any specific positioning measurement procedure.  **Proposal 1**: Predefined PRS configurations, shall have an associated ID and each predefined PRS configuration is associated with a (set of) condition(s) in terms of positioning QoS and/or radio condition for UE to initiate an on-demand PRS request. |
| Xiaomi [18] | **Proposal 2**: When and why UE to send on-demand PRS request to LMF can be left to UE implementation. |

## Rapporteur Summary:

Another remaining open issue is the discussion of the triggering condition/criteria for both LMF-initiated and UE-initiated on-demand PRS. Since the discussion on whether MO-LR can be used trigger an on-demand PRS procedure is handled under the report summary of the [Post-115-e][606] email discussion (R2-2109483), this aspect is recommended to be handled that discussion. On the aspect of other triggering criteria/conditions contributions [1][3][4][18] propose that there is no need to specify any triggering conditions/criteria for both UE- and LMF- initiated on-demand PRS, while [5] also shares the view that the LMF-initiated on-demand PRS criteria can be left up to network implementation. However, in [5][11][13][14][17], there is a shared view that are benefits to support triggering conditions for UE-initiated on-demand PRS. Given the balanced views for and against the triggering conditions for UE-initiated on-demand PRS, the following proposals are provided:

**Proposal 11: Trigger conditions/criteria for LMF-initiated on-demand PRS is up to network implementation.**

**Proposal 12: FFS the support for triggering condition/criteria for UE-initiated on-demand PRS.**

# MO-LR On-demand PRS

Company observations/proposals are captured in the following table:

|  |  |
| --- | --- |
| ZTE [1] | **Proposal 1**: In MO-LR, support UE to request on-demand PRS without the acknowledge of available on-demand PRS configuration.  **Proposal 2**: support UE to request explicit PRS parameters via MO-LR Request message when no available on-demand PRS configuration received, or support UE to request indexes/explicit PRS parameters via MO-LR Request message after receiving available on-demand PRS configuration. |
| CATT [2] | **Proposal 2**: Only the UEs who received the available DL-PRS can be allowed to initate the on-demand PRS, and the requested PRS configuration should be based on the available PRS for on-demand provided by LMF. |
| Lenovo, Motorola Mobility [5] | **Proposal 1:** RAN 2 supports UE trigger of on-demand PRS based on available PRS (pre-) configurations at the UE.  **Proposal 2:** RAN2 to consider best effort provisioning of the DL-PRS configuration based on the UE’s desired initial on-demand DL-PRS request. FFS which of the RAN1 on-demand parameters can be provided in best effort manner. |
| Vivo [7] | **Proposal 3**: For on-demand PRS requests in MO-LR, other cases than the autonomous self-location is not excluded. |
| Huawei, HiSilicon [9] | **Observation 1**: UE can obtain the available DL-PRS configurations from posSIB or pre-configured assistance data in the case of MO-LR.  **Proposal 1:** UE-initiated on-demand PRS can be supported for MO-LR and deferred MT-LR. On-demand PRS request is not supported for NI-LR and immediate MT-LR. |
| Qualcomm [12] | **Observation 1**: With the RAN2 agreement that UE-initiated on-demand PRS request is enabled by enhancing LPP Request Assistance Data on-demand DL-PRS via MO-LR is already supported.  **Observation 2**: Since a UE does not know a priori what an LMF supports, any initial LPP Request Assistance Data is either a success, partial success, or failure (see also section 4 above). Therefore, this is also the case with any DL-PRS assistance data request (for both, Rel-16 request or Rel-17 on-demand request, and independent of MO-LR). The UE would recognize any non-support by an LMF from the received location server error causes.  **Observation 3**: Any MO-LR with LPP Request Assistance Data results in a LPP session instigated by an LMF. (Note, as specified in TS 24.571, the UE would initiate an MO-LR only if the network indicated support for MO-LR (see section 5.1 above)).  **Observation 4**: As per previous RAN2 agreement, the new LPP assistance data IE which contains the set of possible on-demand DL-PRS configurations can be included in an LPP Provide Assistance Data message and/or a new posSIB and there is no difference with MO-LR.  **Observation 5**: The available DL-PRS configurations must not necessarily be provided to UE via posSIBs for on-demand PRS requests via MO-LR. This is up to network implementation (and UE support).  **Observation 6**: It is not mandatory for a network to provide the possible DL-PRS configurations before a UE initiates the on-demand PRS request. |
| InterDigital [13] | **Proposal 1**: UE can send on-demand PRS to request for PRS configuration or PRS parameters, irrespectice of whether the requested PRS configuration/parameter are available via dedicated LPP signalling or posSIB or found to be valid/invalid as per any validity conditions  **Proposal 2**: For MO-LR, UE can send on-demand PRS with MO-LR to request for PRS configuration or PRS parameters outside of what is indicated in posSIB |
| Xiaomi [18] | **Proposal 1**: If UE receives the predefined PRS configuration for on-demand PRS, the UE can send on-demand PRS request to the LMF, otherwise not. |

## Rapporteur Summary:

Given that this discussion is treated in the report summary of the [Post115-e][606] email discussion (R2-2109483), it is recommended that the discussion not be duplicated and be treated in the corresponding discussion.

# Stage 2 Procedures for on-demand PRS

Company proposals are captured in the following table:

|  |  |
| --- | --- |
| Apple [8] | **Observation 1**: the diagram for “stage 2 procedure for UE initiated on-demand PRS via MO-LR” used in the email discussion “[Post115-e][606][POS] MO-LR for on-demand PRS (CATT)” is more suitable for TS 23.273 rather than TS 38.305.  **Proposal 1**: to capture the agreements for on-demand PRS request via MO-LR in the existing “MO-LR Service Support” procedure (clause 7.3.3 in TS 38.305).  **Proposal 2**: to liaise SA2, notifying them about our agreements and asking them to reflect these in their specification TS 23.273. |
| Nokia [15] | **Observation 1**: The procedure in Figure 1 assumes that, at step 3, LMF has acquired the necessary information for determining PRS resources at beam level as indicated by NOTE 1 in the stage 2 procedure. This information is used in step 4 to request PRS resources from gNBs at beam level.  **Proposal 2**: RAN2 is kindly requested to consider the updated text proposal for the stage 2 call flow and steps for the on-demand PRS procedure. |

## Rapporteur Summary:

Given that this discussion is treated in the report summary of the [Post115-e][606] email discussion (R2-2106467), it is recommended that the discussion not be duplicated and be treated in the corresponding discussion.

# Draft Liaisons

Company proposals relating to any liaisons to be sent to other WGs are listed. Additionally, the Draft LSs are captured as follows:

|  |  |
| --- | --- |
| CATT [2] | **Proposal 1:** Sent to RAN3 to inform RAN3 agreements on the TP of the on-demand PRS agreed by RAN2. |
| CATT [19] | **1. Overall Description**:  RAN2 has discussed and agreed to support the UE-originated request of on-demand PRS via MO-LR for autonomous self-location, i.e., MOLR-Type of this MO-LR Request message is assistanceData. And RAN2 would like SA2 to take the above agreements into account in future work.  **2. Actions**:  To SA2:  ACTION: RAN2 respectfully asks SA2 to take the above information into account in future work. |
| CATT [20] | **1. Overall Description**:  RAN2 has discussed and made the TS38.305 TP on On-Demand DL-PRS transmission, as shown below. However, there are some RAN3 impacts for the NRPPa procedure, i.e., TRP configuration information exchange, as well as the NRPPa PRS configuration request procedure.  Thus, RAN2 would like RAN3 to determine which signaling/procedures related to the NRPPa specification need to be captured into TS 38.305.  **2. Actions**:  To RAN WG3  ACTION: RAN2 respectfully asks RAN3 to take the above information into consideration in future work. |

## Rapporteur Summary:

The draft LS to be sent to RAN3 [19][20] has been addressed in the corresponding proposal 8 under Section 2.2.1. Furthermore, the draft LS to be sent to SA2 on the support of MO-LR autonomous self-location is handled under Proposal 10 of the report summary of the [Post115-e][606] email discussion (R2-2109483) and thus no specific proposals are recommended at this stage.

# Other Enhancements

The observations/proposals in this Section include other aspects that have been discussed by a few companies in the context of on-demand PRS.

Company proposals are captured in the following table:

|  |  |
| --- | --- |
| Sony [11] | **Observation 1:** DL-AoD positioning accuracy can be improved by increasing beam density (number of beam / sweeping range). Simulation also shows that the improvement becomes insignificant when the beam density reaches a certain value (e.g., 16beams/120º in InF-SH, FR2).  **Proposal 1**: On-demand PRS can be transmitted in relation with the legacy / periodic PRS transmission. Both on-demand and periodic PRS can be multiplexed in FDM and TDM.  **Proposal 2:** Support semi-persistent and a-periodic transmission and reception of DL PRS that can be used for DL-TDOA and Multi-RTT.  **Proposal 4:** Support LMF to assist gNBs to facilitate the two-stage beam sweeping operation. It can be performed such as LMF configures sweeping beam directly by on-demand PRS, or LMF sent assistance information to gNB (e.g., the expected AoD range, beam width).  **Proposal 5:** Support two-stage beam sweeping for DL-AOD and DL-TDOA positioning |
| InterDigital [13] | **Observation 3**: Reconfiguration of measurement gap for on-demand PRS should be done with low latency  **Proposal 6:** Support semi-static on-demand PRS request from UE to LMF  **Proposal 7:** Support dynamic on-demand PRS request from UE to gNB  **Proposal 9**: The number of samples in measurement is included as one of the on-demand PRS parameters |
| InterDigital [14] | **Proposal 4:** RAN2 supports dynamic updating of spatial relation between SRSp and PRS in a DL+UL positioning method with on-demand PRS |

### Rapporteur Summary:

The above proposals can be broadly divided according to following aspects including:

* PRS Multiplexing
* 2-Stage Beam Sweeping
* SRS and PRS Spatial Relation for on-demand PRS
* No. of Samples in a measurement as part of the on-demand PRS physical layer parameter list
* Semi-persistent/aperiodic/dynamic on-demand PRS

The aforementioned proposals are deemed to have some RAN1 dependency and in the case of any corresponding support, RAN1 may notify RAN2 accordingly.

# Conclusion

According to the submitted contributions the following proposals are summarized based on the following grouping:

## Potentially agreeable proposals

**Proposal 1.1: The UE may initiate an on-demand PRS request per positioning method including DL-TDoA, DL-AoD and Multi-RTT, via the existing LPP *RequestAssistanceData* message.**

**Proposal 1.2: If Proposal 1.1 is agreed, then there is no need for introducing a new LPP message to carry the on-demand PRS request.**

**Proposal 2: The UE may request explicit on-demand PRS parameter(s) from the network, in addition to the pre-defined on-demand PRS configurations.**

**Proposal 3: LPP *ProvideAssistanceData* message is enhanced to enable the on-demand PRS response signalling from the LMF based on the UE’s on-demand PRS request.**

* **Error indication is supported for a partial or completely unfulfilled on-demand PRS request.**
* **FFS other scope of enhancements (e.g., ACK/NACK signalling).**

**Proposal 7: Send LS to RAN3 relating to the latest on-demand PRS Stage 2 Running CR.**

**Proposal 8.1: A DL-PRS configuration set may contain one or more explicit DL-PRS parameters in the case of UE-initiated on-demand PRS. RAN2 to further discuss:**

* **Whether a parameter list may be associated with the request of one or more DL-PRS parameters**
* **If there is need to associate each explicit parameter is associated with a separate ID.**

**Proposal 10: Support the need of transmitting assistance information from UE to LMF to aid in configuring on-demand PRS. FFS further details such as signalling and content of UE assistance information.**

**Proposal 11: Trigger conditions/criteria for LMF-initiated on-demand PRS is up to network implementation.**

## Requires further discussion

**Proposal 4: Network control of UE-initiated on-demand PRS is supported. The following options are to be downselected:**

* **Option A: UE can only request on-demand PRS based on prior reception of on-demand PRS configuration sets, timer, reattempt duration, LMF stop on-demand PRS request indications.**
* **Option B: Configuration of a prohibit timer**
* **Option C: Reattempt timer**
* **Option D: Stop message indication from the LMF**

**Proposal 5: Further discuss the on-demand PRS capability definition for UE-initiated on-demand PRS and whether additional alignment with RAN1 is required.**

**Proposal 6: On the gNB on-demand PRS response to the LMF, consider the following options:**

* **Option A: Further discuss the type of DL PRS configuration information to be transmitted from the gNB to the LMF, e.g., activity report, supported configuration IDs, PRS configuration currently being transmitted.**
* **Option B: Leave the discussion up to RAN3.**

**Proposal 8.2: On the pre-defined on-demand PRS configuration, further discuss whether the pre-defined on-demand PRS configuration sets should be provided based on:**

* **Different PRS granularities (e.g., per frequency layer/TRP/Resource Set/Resource ID)**
* **Bundling/grouping mechanism for pre-defined configuration sets**
* **A limit on the maximum number of PRS configuration sets**

**Proposal 9: Further discuss the information associated with a pre-defined on-demand PRS configuration, which may include the following options:**

* **Option A: Validity criteria, e.g., area, timer**
* **Option B: Prioritization indications, FFS whether the pre-defined PRS configuration is based on a network and/or UE configured priority.**

**Proposal 12: FFS the support for triggering condition/criteria for UE-initiated on-demand PRS.**

# Annex: RAN2 On-demand PRS Agreements

**RAN2#111-e**：

SI Agreements on on-demand PRS:

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

**RAN2#112-e**：

SI 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#113bis-e**

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-e**

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-e**

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.