3GPP TSG-RAN WG2 #113e Tdoc R2-20xxxxx

Electronic meeting, Jan 25th – Feb 5th, 2021

Agenda Item: 8.11.2.2

Source: Ericsson

Title: Summary of Email Discussion [AT113-e][610][POS] Continue discussion of on-demand PRS (Ericsson)

Document for: Discussion, Decision

# 1 Introduction

This document addresses the below email discussion

* [AT113-e][610][POS] Continue discussion of on-demand PRS (Ericsson)

Scope: Continue the discussion of R2-2101389 and converge to an agreeable TP.

Intended outcome: Endorsable TP

Deadline: Tuesday 2021-02-02 1200 UTC

# 2 Discussion

Based upon the email discussion R2-2101389 the below proposals have been drafted

Proposal 1 RAN2 to capture in TR that RAN2 see benefits of “On demand PRS” Functionality.

Proposal 2 RAN2 to provide recommendation for UE-initiated “on demand Request” during active LPP session

Proposal 3 RAN2 to provide recommendation for LMF Initiated on Demand request in order to be able to dynamically vary the PRS configuration and also for recommending turning on/off beams.

Proposal 4 RAN2 during WI phase decides or takes assistance from RAN1 to identify which DL-PRS configuration parameters can be dynamically changed.

Proposal 5 For existing Rel-16 NR Positioning architecture, gNB based dynamic PRS configuration is not supported.

Proposal 6 RAN2 during WI phase identifies ways for the LMF to be able to obtain measurement results from UE operating in UE based mode in order to support LMF-initiated on demand PRS.

Companies are requested to provide their veiw on the above proposals.

Please express your concern for any of the Proposals in below table. Please indicate P numbers and why the Proposal is invalid or have concerns. Please also review the Text Proposal below (section 3) prior to providing your comments; e.g. P2, P3 have been simplified in the Text Proposal.

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| Company | Concerns for Proposals |
| Qualcomm | P2: Disagree. For an UE-initiated request of on-demand DL-PRS transmission, there is no "active LPP session". A UE can not instigate an LPP session (an LPP session is always instigated by an LMF). A UE can instigate an MO-LR session, which can carry LPP messages as well (but this is not an UE instigated LPP session). If an LPP session is already "active" there is no need for UE-triggered on-demand PRS anymore, since LMF initiated a location request already. P2 could be rephrased:  "RAN2 to provide recommendation for UE-initiated on demand DL PRS transmission. The details of UE-initiated on-demand DL-PRS will be decided during WI phase."  P3: Partly disagree. Not clear why turning on/off beams need to be explicitly mentioned; this should be covered by "dynamically vary the PRS configuration" and P4. P3 could be rephrased:  "RAN2 to provide recommendation for LMF initiated on demand DL-PRS transmission. The details of LMF initiated on-demand DL-PRS will be decided during WI phase."  P4: Partly disagree. We think the responsibility for deciding the on-demand DL-PRS configuration parameter should be RAN1 (not RAN2). P4 could be rephrased:  "The details on which DL-PRS configuration parameters can be dynamically changed are expected to be decided by RAN1 during WI phase".  P5: Unclear what "gNB based dynamic PRS configuration" means. At the end, the gNB need to configure the (dynamic) PRS configuration/transmission.  P6: Disagree. PRS transmission is not dependent on the positioning mode (UE-based or UE-assisted). If an LMF needs additional measurements for deciding on the DL-PRS configuration parameters, the LMF can request the required (and already defined) measurements. No additional/new functionality is needed for requesting/reporting measurements. |
| Huawei, HiSilicon | P2, Similar comment as QC, we are not sure what does it mean by active LPP session. Does it mean that for MO-LR, the UE can only request for the PRS after MO-LR request is transmitted? OK with QC’s wording for the proposal.  P3, turning on/off of the beams is a special case of dynamically varying the PRS configuration. We think the proposal can be a general one as follows:  “ RAN2 to provide recommendation for LMF Initiated on Demand request. RAN 2 should further study what is the granularity of PRS resource for the PRS request”  P6, No need to mention LMF-initiated on-demand PRS. We think this can also be applicable for UE-initated. |
| Intel | Agree Qualcomm’s comments and rewording on P2, P3, P4 and P6.  In addition, agree the changes on text proposal from QC and Huawei in section 3. |
| Xiaomi | We agree with Qualcomm’s comments and rewording on P2, P3, P4 and P6. |
| CATT | P2: Understood that raporteur want to limit when to demand PRS by UE. Agree to disucss detail in WI. "RAN2 to provide recommendation for UE-initiated on demand DL PRS transmission. The details of UE-initiated on-demand DL-PRS will be decided during WI phase."  P3: ”beams” are also a part of resources which should be aligned with RAN1. So we prefer to simplify P3 as “ RAN2 to provide recommendation for LMF Initiated on Demand request in order to be able to dynamically vary the PRS configuration.”  P4: Share the same view as QC. RAN2 will follow the configuration agreement from RAN1 like Rel-16. Agree with QC’s rewording.  P6: The existing procedure already supports LMF request measurement report from UE. If LMF needs addtional measurement report for on-demand purpose, we can discuss detail together with RAN1 in WI. It’s too early to reach this proposal. No need to mention this proposal here. |
| oppo | Agree with Qualcomm’s comments |
| Lenovo, Motorola Mobility | P2, P3, P4 – Agree with Qualcomm’s rewording for a more a generalised recommendation with details left for FFS during WI phase. For P4 RAN1 should take the lead on the PRS configuration.  P6- Based on our understanding, the LMF may not require measurement results for LMF-initiated on-demand PRS, since the LMF already knows the prior PRS configuration and can request an update to the gNB accordingly. In the case of UE-initiated on-demand PRS, the LMF receives a recommendation request triggered from the UE to adapt/update the PRS configuration accordingly for the UE-based positioning case. |
| Nokia | We are mostly fine with the rephrased proposals P2, P3 and P4 from Qualcomm and the proposal P1, but in the proposed text from Qualcomm for P3 we suggest the following update to cover also the case of turning ON/OFF of PRS transmissions:  "RAN2 to provide recommendation for LMF initiated on demand control of DL-PRS transmission. The details of LMF initiated on-demand control of DL-PRS will be decided during WI phase."  P5: If P5 is saying the gNB does not dynamically control the on-demand PRS transmission by itself but acts based on LMF decisions and that this applies for the current positioning architecture, then it is fine for us. Our understanding is this does not preclude such actions in gNB if in the future we have LMF functions in gNB.  P6: If our understanding of P6 that we also need to take in to account UEs involved in UE-based positioning to decide dynamic changes to PRS configuration then P6 is also fine |
| Apple | Agree with Qualcomm’s comments on P2, P3,P4, P5 and P6 |
| ZTE | P2: we share the same view with QC.  P3: From our understanding, truning on/off of beams is the critical case of dynamically varying PRS configuration.” and also for recommending turning on/off beams.” is not needed.  P4: the PRS configuration should be decided by RAN1. |
| InterDigital | P2: We agree with Qualcomm’s proposed changes, as in essence it captures what we think is the Rapporteur’s intention where the UE can send an on-demand request to LMF for changing the DL-PRS configuration for an ongoing positioning session.  P3: We agree with Nokia’s modification to the proposal to distinguish between UE-initiated and LMF initiated on-demand PRS.  P4: We agree with Qualcomm’s proposed changes to the proposal.  P5: We do not think this proposal is needed if it implies that the actions of gNB is restricted by what LMF decides as this is already covered by the (modified) proposal 3.  P6: We are generally ok with the proposal, assuming the intention is to support UE measurement reporting in UE-based mode. We think the proposal can be modified by omitting LMF-initiated on-demand PRS since it can also be applicable for UE-initiated on-demand PRS. |
| vivo | Agree with Qualcomm’s comments. |
| Samsung | Agree with QC comments. |
| Sony | We agree with Qualcomm´s suggestions above. |
| Convida | Agree with Qualcomm suggestions for P2-P3.  Suggested modifications that should be reflected in the text proposal:  P4:  RAN2 should take into account dynamic DL-PRS configuration parameters that are expected to be decided by RAN1 during the WI phase.  P5:  Dynamic PRS configurations are supported by LMF-based coordination for multiple gNBs. Details will be decided during the normative phase.  P6:  The LMF obtains measurement results from the UE in order to support LMF-initiated on-demand PRS. Details will be decided in the normative phase. |
| Spreadtrum | Agree with QC suggestions for P2, P3, P4, P6  P5: Agree with Nokia, gNB does not dynamically control the on-demand PRS transmission by itself. But it’s ok to dynamically adjust PRS configuration based on LMF decisions. |

P6 may need further discussion. We would like to ask a question; as on what basis LMF should initiate on demand PRS configuration. For LMF initiated case, how will LMF identify that certain configuration of DL PRS needs to be altered in order to result in better location estimates?

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| Company | Concerns for Proposals |
| Ericsson | We think it should be based upon UE measurements; quality/uncertainty report from UE. Since, in the specification UE based UEs do not need to report measurement, we see that it is hinderness in having functionality such as LMF-Initiated On demand PRS. Some active feedback between UE and LMF is needed to realize this and thus UE should provide the measurement results. The LMF-Initated dynamic PRS is beneficial for both UE and NW when such active feedback exists. |
| Qualcomm | How an LMF initiates/decides on DL-PRS configuration is up to network implementation. |
| Huawei, HiSilicon | This is exactly the reason why we need UE-initiated on-demand PRS request. For UE-initiated PRS request, UE can provide recommendations to the LMF on what the UE wants.  Also, as mentioned by QC, based on the current LPP measurement report for DL-AoD, DL-TDOA and multi-RTT, the UE can report RSRP to the LMF, based on which the LMF can decide whether to alter the PRS configuration. |
| lntel | Similar view as Huawei that the LMF could get the inputs from UE based on UE initated on demand PRS request. But details are related to P4 above.  For other information, the LMF may get from existing UE reporting. |
| Xiaomi | The LMF decides the PRS configuration based on the requirements of all positioningg UEs, and there may be not all the UEs which are in UE based postioning mode. Morevoer, if the PRS configuration decided by LMF can’t satisfy UE requirements, UE can send on-demand PRS request to LMF. |
| Ericsson | To reply to Huawei:  DL-AoD and DL-TDOA are UE based and UE will not report. If large proportion of Ues are UE based then NW will be blind sighted. |
| CATT | It depends on the algorithm in LMF. If there is evaluation from RAN1 that more report from UE will help improve the accuracy or efficiency, RAN2 may discuss it in WI. |
| Ericsson | We suggest to add ” Assistance information required by LMF to perform LMF-Initaited On demand PRS" will be studied during WI phase |
| oppo | LMF should initiate on demand PRS configuration based on UE measurement result. Suppose majority of the UEs have good measurement results, the LMF may not need to initiate on demand PRS configuration, since PRS is public to all UEs. |
| Lenovo, Motorola Mobility | Use cases for on-demand PRS could be for the UE/LMF to request same/updated PRS configuration e.g. if certain measurements are invalid due to beam failure, etc., LMF/UE positioning requirements e.g. requires more/less accuracy, latency considerations or only requires PRS transmission on relevant TRPs. |
| Nokia | We agree that feedback from UE to LMF is needed irrespective of whether the UE is involved in UE-assisted or UE-based positioning and whether it is UE-initiated or LMF-initiated on-demand PRS transmissions and thus UE should provide some measurement or assistance information to LMF for the purpose of on-demand PRS transmissions. So, we are fine with Ericsson’s suggestion to add something about assistance information required by LMF. What sort of assistance information is needed can be discussed during normative work. |
| Apple | For this LMF optimization issue, we do not support additional UE reporting besides what has been agreed for R16. If large portion of UEs choose to conduct UE-based positioning in IDLE states, then NW just assume UE’s are happy with the current PRS configuration and do nothing in this case. Moreover, such a case is also a corner case. |
| ZTE | It can be based on LMF implementation. |
| InterDigital | From our understanding, the LMF reconfigures/updates the DL-PRS configuration based on measurement report sent by UE. For improving accuracy and efficiency, the LMF can coordinate with gNBs (via NRPPa) for reconfiguring/updating the PRS configuration and indicate to the UE the updated configuration. For enabling LMF-initiated on-demand mechanism in UE-based positioning, we think the UE may be configured (e.g. via assistance data) or requested to send measurement reports (in addition to location estimates), either periodically or based on changes in environment (e.g. detection of blockage in LOS), at least for the MT-LR case. The details related to signalling and configuration can be discussed during WI phase while the measurements that can be reported by UE can be decided by RAN1. |
| vivo | It is LMF implementation. |
| Samsung | It is obvious that the determination of PRS reconfiguration is based on the UE’s reporting. But that could be via already existing UE’s reporting mechanism in R16, or could be any modification from that for the identified necessity during WI phase. Anyhow, the determination is LMF implementation. |
| Sony | We think on-demand PRS transmission could be triggered both from the UE and the LMF. The trigger from the UE can be based on the UE measurement report. The trigger from LMF can be based on the required UE positioning accuracy. For example, LMF knows the (periodic) PRS configuration (e.g. PRS allocation in F/T, and its periodicity) of each gNB. Hence, LMF can judge whether there is a need to provide on-demand PRS based on the required UE positioning accuracy and the (periodic) PRS allocation. On demand PRS is provided with the motivation to improve the measurement and also allocate PRS in efficient manner (in a cell / in a beam) |
| Convida | Suggested wording for P6:  The LMF obtains measurement results from the UE in order to support LMF-initiated on-demand PRS configuration. Details will be decided in the normative phase. |
| Spreadtrum | We share same view with Apple |

# 3 Text Proposal

Please review the text proposal and include your changes

Qualcomm: Included changes in the TP below.

Huawei, HiSilicon: included changes in the TP below

Ericsson added a Note in the end.

CATT: Included changes in the TP below.

Nokia: Made some updates to the conclusion text.

## 10.2 On-demand transmission and reception of DL PRS

From a physical layer perspective, on-demand transmission and reception of DL PRS, which includes at least the following is recommended

* UE-initiated request of on-demand DL PRS transmission
* LMF (network)-initiated request of on-demand DL PRS transmission
* Above enhancements are recommended for both DL and DL+UL positioning methods and both UE-based and UE-assisted positioning solutions.

From upper layers perspecive, on-demand DL PRS functionality is deemed beneficial primarily for below reasons:

Efficiency: On-demand DL-PRS avoids unnecessary overhead, waste of energy, etc. in the case that no UE positioning is required during a particular time or in a particular area of a network. In case of beamformed DL-PRS, DL-PRS transmission in all beam sweeping directions may result in an unnecessary transmission of DL-PRSs.

Latency: The current DL-PRS configuration may not be sufficient to meet the response time requirements of the LCS client; e.g., may have a too large periodicity.

Accuracy: The current DL-PRS configuration may not be sufficient to meet the accuracy requirements of the LCS client; e.g., may have a too small bandwidth, too few repetitions, etc.

From Upper layers perspective the below conclusions have been made for on demand PRS functionaity.

* UE-initiated request of on-demand DL-PRS transmission is recommended for normative work; the details will be decided during WI phase.
* LMF Initiated on-demand control of DL-PRS transmission is recommended for normative work; the details will be decided during WI phase.
* The exact parameters that can be dynamically changed and necessary measurement and/or assistance information for LMF/UE initiated on demand PRS are expected to be decided by RAN1 and RAN2 during WI phase.

# Conclusion