3GPP TSG-RAN WG2 Meeting #123 R2-230xxxx

Toulouse, France, August 21st – 25th, 2023

**Agenda item: 7.2.4**

**Source: OPPO (Rapporteur)**

**Title: Summary for 7.2.4 LPHAP excluding SRS configuration & activation part**

**WID/SID: NR\_pos\_enh2 - Release 18**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the summary for agenda item for 7.2.4 (LPHAP) **excluding SRS configuration & activation part**. This document considers the following input papers:

[R2-2307121](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_122/Docs/R2-2305483.zip) Discussion on LPHAP Huawei

R2-2307186 Enhancements for supporting LPHssssAP, Fraunhofer IIS, Fraunhofer HHI

R2-2307394 Discussion on SRS configuration with validity area and alignment between PRS and (e)DRX, CATT

R2-2307428 Discussion on solution of LPHAP, vivo

R2-2307665 Support of LPHAP, Intel Corporation

R2-2307824 Alignment between DRX and PRS, Apple

R2-2308000 Discussion on low power high accuracy positioning, Lenovo

R2-2308051 Discussion on LPHAP enhancement, OPPO

R2-2308126 Discussion on LPHAP, Spreadtrum Communications

R2-2308135 Discussion on LPHAP, ZTE

R2-2308153 Considerations on Low Power High Accuracy Positioning, Sony

R2-2308261 Discussion on LPHA positioning, Xiaomi

R2-2308317 Further considerations on LPHAP, CMCC

R2-2308398 Enhancements for LPHAP, Qualcomm

R2-2308481 Discussion on Low Power High Accuracy Positioning, Ericsson

R2-2308618 Discussion on LPHAP, InterDigital

R2-2308693 Discussion on alignment between (e)DRX and PRS, Samsung

# 2 Discussion

## 2.1 Alignment between (e)DRX and PRS

There are the following proposals in this area:

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| [R2-2307121](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_122/Docs/R2-2305483.zip)Huawei | Proposal11: Support PRS alignment with fixed DRX and deprioritize DRX alignment with fixed PRS.Obeservation2: For the PRS alignment with fixed DRX for UE in RRC\_IDLE, the legacy UE-based on-demand PRS procedure can be sent in RRC\_CONNECTED with no stage-3 impacts.Observation3: For the PRS alignment with fixed DRX for UE in RRC\_INACTIVE, the legacy UE-based on-demand PRS procedure can be sent in RRC\_CONNECTED or RRC\_INACTIVE by SDT with no stage-3 impacts. Proposal12: For the DL-PRS alignment with fixed (e)DRX, UE-initiated on-demand DL-PRS procedures are used.Proposal13: LMF-initiated alignment between PRS and (e)DRX is not supported. |
| R2-2307394CATT | Proposal 8: Support PRS align to fixed DRX. The fixed DRX refer to all the potential PF and PO of the cell, which can be determined by the cell level parameters, e.g. PF\_offset, N and minimum DRX cycle.Proposal 9: There are some impacts on RAN3 to support PRS align to fixed DRX. Send RAN2 agreement to RAN3 to trigger the discussion. |
| R2-2307428vivo | Proposal 8: Both UE-initiated and LMF-initiated On-demand PRS can be used to align the PRS configuration with fixed (e)DRX.Proposal 9: For LMF-initiated On-demand PRS, LMF should obtain UE-related (e)DRX and cell-related (e)DRX in advance, and then it may take the information into account when setting the periodicity and/or response time of deferred MT-LR. Proposal 10: For UE-initiated On-demand PRS, UE should include UE-related (e)DRX information and LPHAP indication in the On-Demand PRS Request. Upon receiving the indication, LMF should obtain cell-related (e)DRX information from serving gNB and neighboring gNBs.Proposal 11: On-demand PRS configured by gNBs(serving gNB and neighboring gNBs) includes several PRS configurations aligned with UE’s (e)DRXes in the current serving cell and neighboring cells to avoid frequent on-demand PRS procedures due to cell reselection. Proposal 12: To align the PRS configuration with fixed (e)DRX, the following solution can be considered:- LMF should negotiate PRS configuration with selected TRP(s) to ensure there is valid PRS around PO within PTW. (in RAN3 scope) - UE should perform PRS measurement around PO within PTW. (RAN1/RAN4 related)Proposal 13: LS to RAN1/RAN3/RAN4 to trigger the discussion on aligning PRS configuration with fixed (e)DRX when RAN2 reaches a consensus on the solution.Proposal 14: Considering the following aspects, the discussion on aligning (e)DRX with fixed PRS can be de deprioritized in Rel-18.- It is not feasible to align the (e)DRX of multiple target UEs with fixed PRS considering that different UEs have different PO.- The (e)DRX cycle can be set depending on the data delay tolerance and power-saving requirements. In this sense, the (e)DRX cannot be adjusted significantly for positioning purposes. |
| R2-2307665Intel | Proposal 10: Confirm SA2 conclusion that during the positioning procedure, AMF provides the LPHAP indication to the LMF, and the LMF also sends LPHAP indication to RAN in the NRPPa message (stage 2 and RAN3 impact). Proposal 11: For DRX alignment with fixed PRS configurations, it is up to RAN to align DRX configuration with fixed PRS based on LPHAP indication obtained from the LMF and available PRS configuration in RAN.Proposal 12: For PRS alignment with fixed (e)DRX configurations, it can be achieved by on-demand PRS request without stage 3 impact. If the UE wants to change PRS configuration to align with (e)DRX configuration, the UE can send on-Demand PRS request to the LMF with suitable recommendation on PRS configuration. |
| R2-2307824Apple | Proposal 1: to discuss and agree which RRC states (RRC\_CONNECTED, RRC\_INACTIVE, RRC\_IDLE) the solution for DRX and PRS alignment is applicable to; furthermore, to discuss and agree whether the solution is applicable to both DRX and eDRX. (Rapporteur: the WID RP-231460 presents the following objective: Specify solutions for alignment between (e)DRX in RRC\_INACTIVE and PRS configurations [RAN2], which may address the concern)Proposal 2: to agree on the general solution direction: PRS alignment to fixed DRX, DRX alignment to fixed PRS, or both.Proposal 3: if RAN2 is to standardize both solutions (alignment of PRS to fixed DRX and alignment of DRX to fixed PRS), these should be separate features with separate UE capabilities.Proposal 4: support network-based solution for PRS alignment to fixed DRX (potentially in addition to a UE based solution). |
| R2-2308000Lenovo | Proposal 8: In the case of LMF performs the alignment, (e)DRX configurations depending on the UE’s RRC state should be shared with the LMF from the gNB or from the UE.Proposal 9: In the case of gNB performs the alignment, gNB should be indicated to perform the alignment between (e)DRX and PRS configuration explicitly or implicitly.  |
| R2-2308051OPPO | Proposal 1: RAN2 to agree to align the DL-PRS timing pattern with the fixed (e)DRX configuration.Proposal 2 : Reuse UE-initiated LPP on-demand PRS procedure for PRS to align with fixed (e)DRX. |
| R2-2308126Spreadtrum | Proposal 1: PRS alignment with fixed DRX is preferred by reusing UE-initiated on demand PRS procedure. |
| R2-2308135ZTE | Proposal 17: Support to use UE-initiated on-demand PRS procedure for PRS to align with fixed DRX. Proposal 18: In LPP on-demand PRS request message, support UE to request the PRS time offset associated with each requested PRS periodicity to better align the actual paging location.Proposal 19: In LPP on-demand PRS request message, support UE to request separate PRS periodicities per PFL in order to align with the paging cycle inside-PTW and outside-PTW, respectively.Proposal 20: In LPP on-demand PRS request message, support UE to use dl-prs-StartTime-and-Duration to request the PRS reception within the PTW(if existed).Proposal 21: Support LMF to include UE’s requested PRS periodicities or PRS time offsets in the NRPPa PRS CONFIGURATION REQUEST message. For NRPPa design, LMF requests the PRS transmission characteristics to the serving gNB and neighbor gNBs in the NRPPa PRS CONFIGURATION REQUEST message. |
| R2-2308153Sony | Proposal 7: In case of aperiodic/event triggered PRS transmission let the LMF align the PRS transmission to the UE DRX cycle/PO, Proposal 8: In case of periodic PRS transmission let the AMF (or gNB) align the UE DRX/PO to the Periodic PRS transmissions by adding an Offset to the UE-ID for PO calculation, similar to the solution in LTE for MuSIM as specified in 36.304 and 23.502 used for avoiding paging collision. |
| R2-2308261Xiaomi | Proposal 8: PRS is aligned with eDRX for alignment between eDRX and PRS. if eDRX is changed, the other service except positioning will be impacted. For Alt 1, PRS only relates positioning, the other service of UE will not be impacted.Proposal 9: Both UE initiated on-demand PRS and LMF initiated on-demand PRS should be considered to support PRS and DRX alignment. |
| R2-2308398Qualcomm | Proposal 10: For the (e)DRX alignment with configured DL-PRS, support adding the UE configured LCS reporting activity and configured DL-PRS information (e.g., DL-PRS periodicity) to the IE 'Core Network Assistance Information for RRC INACTIVE' (TS 38.413). Inform RAN3 and SA2 on RAN2's decision. Proposal 11: For the DL-PRS alignment with configured (e)DRX, the LPP Request Assistance Data for on-demand DL-PRS is used. The UE may set the dl-prs-ResourceSetPeriodicityReq according to the configured LCS reporting activity and (e)DRX configuration. FFS whether additional parameter are needed (e.g., DL-PRS slot offset). (UE sends the Request Assistance Data msg to the LMF) |
| R2-2308481Ericsson | Proposal 9 Cell specific wake up occasion for LPHA users is configured so that PRS can be aligned with the LPHA users wake up occasion. This is achieved by configuring a common UE\_ID for paging for LPHAP users present in the factory.Proposal 10 Send an LS to RAN4 for gNB to configure suitable Paging time window to complete the PRS measurement in one PTW.Proposal 11 Send LS to RAN3 to request for NRPPa/OAM signaling support for cell/UE specific DRX/eDRX configurations.  |
| R2-2308618InterDigital | Proposal 3: Standardise the alignment of PRS configuration with fixed DRX only. Proposal 4: Reuse the legacy UE-initiated on-demand PRS signalling for the alignment of PRS with fixed DRX |
| R2-2308693Samsung | Proposal 1: RAN2 to support only DL-PRS alignment with configured/fixed (e)DRX in RRC\_INACTIVE.Proposal 2: RAN2 to reuse the existing UE-initiated on-demand DL-PRS procedure for the DL-PRS alignment with configured/fixed (e)DRX.Proposal 3: RAN2 to support UE to include requested DL-PRS resource set duration/start offset associated with each requested periodicity in the on-demand DL-PRS request.Proposal 4: RAN2 to support the UE to include two separate requested DL-PRS information in the on-demand PRS request, considering the case 2 (i.e., two different DRX cycle for inside and outside the PTW) and the case 3 (i.e., two different DRX cycle for CN PTW and RAN PTW.). |

**Rapporteur’s summary:**

Primarily, regarding the method of achieving alignment between DRX and PRS in time domain, companies’ views/preferences are summarized as follows:

* Only Option 1 (alignment of the (e)DRX to the PRS): 0
* Only Option 2 (alignment of the PRS to the (e)DRX): 13 (Huawei, CATT, vivo, Intel, Lenovo, OPPO, Spreadtrum, ZTE, Sony, Xiaomi, Ericsson, Interdigital, Samsung)
* Both Option 1 and 2: 3 (Intel, Sony, Qualcomm)
* No obvious preference is given: 1 (Apple)

According to the contributions, the exampling reasons why Option 1 is against include

* It is not feasible to align the (e)DRX of multiple target UEs with fixed PRS considering that different UEs have different PO (vivo).
* The (e)DRX cycle can be set depending on the data delay tolerance and power-saving requirements. In this sense, the (e)DRX cannot be adjusted significantly for positioning purposes (vivo).
* Spec impact of Option 1 is more than Option 2 (Spreadtrum)
* If eDRX is changed, the other service except positioning will be impacted (Xiaomi)

Considering the given reasons are reasonable, and majority of companies are in support with alignment of the PRS to the (e)DRX, the rapporteur proposes RAN2 to agree that alignment of the PRS to the (e)DRX should be adopted to ensure the alignment between the PRS and the (e)DRX.

**Proposal 1: RAN2 to agree that alignment of PRS to fixed (e)DRX should be adopted to ensure the alignment between PRS and (e)DRX.**

Next, regarding the question letting who (UE or LMF) to initialize the on-demand PRS request procedure to perform the alignment of the PRS with the DRX, the companies’ views are diverge:

* Prefer UE to initialize: 8 (Huawei, Intel, OPPO, Spreadtrum, ZTE, Qualcomm, Interdigital, Samsung)
* Prefer LMF to initialize: 4 (Apple, Lenovo, Sony, Ericsson)
* Support both: 2 (vivo, Xiaomi)
* Others (prefer AMF or gNB to initialize): 2 (Sony, Lenovo)
* No need on-demand PRS request procedure, relying on NRPPa TRP information exchange between gNB and LMF instead: 1 (CATT)

The exampling reasons of companies preferring UE-based on-demand PRS request are listed as following:

* The gNB has no idea where the UE is currently camping on in RRC\_INACTIVE/RRC\_IDLE, which means in LMF initiate on-demand PRS procedure, it is hard for gNB to update paging information to the LMF when UE cell reselects. On the contrary, UE can trigger on-demand PRS request if the paging location changed during cell-reselection. (ZTE)
* Since the (e)DRX configuration is already known by the UE itself, it is simple for the UE to initialize the on-demand PRS request procedure (Samsung).

On the other hand, the exampling reasons of companies preferring the LMF-initiated on-demand PRS request are listed as following:

* Obvious benefits (e.g. in terms of air interface signalling and UE power consumption) exist to justify support of the network based solution for PRS alignment to fixed DRX (Apple).
* PRS configuration is known by the LMF, as the LMF provides the PRS configuration to UE in positioning assistance data (Lenovo)

One company prefers that the on-demand PRS procedure is not needed. It is further clarified that the procedure for LMF to acquire the DRX information can be non-UE related, i.e. the procedure can be finished by coordination between LMF and gNB without UE, which can be achieved by a procedure like NRPPa TRP information exchange between gNB and LMF and it can be discussed in RAN3.

Considering the majority view (14/17) supports relying on on-demand PRS request procedure for the alignment of PRS to fixed (e)DRX, Rapporteur suggest to focus on the on-demand PRS request procedure, and discuss whether UE-initiated and/or LMF-initiated methods are supported or not. Rapporteur’s understanding is that both methods are reasonable. For UE-initialized method, UE could simply report the demanded PRS configuration according to the current serving cell (e)DRX configuration and UE-specific (e)DRX configuration. After reception of the UE report, the LMF could additionally collect the (e)DRX configuration of neighbour cells if it confirms that the UE belongs to a LPHAP type by receiving the LPHAP indication from the AMF during the positioning session. On the other hand, for LMF-initialized method, after receiving the LPHAP indication from the AMF during the positioning session, the LMF could collect the (e) DRX configuration of the neighbouring cells of the UE, besides the UE-specific (e)DRX configuration, in advance, before sending the PRS configuration as the assistance data towards the UE. In both ways, we could avoid performing the on-demand PRS request procedure frequently upon the UE performs the cell reselection. Therefore, considering each method has its own benefits, the following proposal is suggested.

**Proposal 2: RAN2 to agree that both of UE-initialized and LMF-initialized on-demand PRS request procedure are adopted for the alignment from the PRS configuration to the (e)DRX configuration.**

Regarding the UE-initialized PRS configuration request, the proposed enhancement to be made for the message are following:

1. to include the demanded PRS time offset associated with each requested PRS periodicity
2. setting the demanded separate PRS periodicities per PFL
3. to include two separate requested DL-PRS information in the on-demand PRS request
4. to include requested DL-PRS transmission activation periodicity/start offset/duration associated with each DL-PRS information
5. to include UE-related (e)DRX information and LPHAP indication
6. setting dl-prs-StartTime-and-Duration to indicate the demanded PRS reception within the PTW
7. setting the dl-prs-ResourceSetPeriodicityReq according to the configured LCS reporting activity and (e)DRX configuration

Obviously, the bullets 1) - 5) have spec impact, while the bullets 6) and 7) seem depending on the UE implementation.

Regarding the bullet 1), company thinks that, if UE requests a PRS periodicity larger than the DRX cycle value, since one PRS period may contain multiple DRX cycles, UE should also request more than one PRS time offset values regarding to the requested PRS periodicity, where each PRS time offset corresponds to a paging location in one DRX/eDRX cycle.

Regarding the bullet 2), company thinks that, if PTW is enabled by UE, the UE should request more than 1 PRS periodicity values in a on-demand PRS request for the alignment of paging cycle inside the PTW and outside the PTW, respectively.

Regarding the bullets 3) and 4), as mentioned by proponent, according to the agreements in eRedCap session until now, two separate PTWs for CN and RAN paging can be configured by the network and the UE performs paging monitoring with different DRX cycle in different PTWs. Thus, there seems the need of having two corresponding sets of the requested DL-PRS information in *NR-On-Demand-DL-PRS-Request* IE. Also, in that case, each requested DL-PRS information can be associated with different sets of activation periodicity/start offset/duration values.

Regarding the bullets 5), regarding the LPHAP indication, as mentioned by proponent, the purpose is for the LMF to coordinate with neighbouring gNBs for the on-demand PRS configuration related to other cells that UE may reselect in future besides the one for the current serving cell. In such a way, the UE does not need to transmit a new on-demand PRS configuration request for every time it performs cell reselection;

Therefore, Rapporteur proposes the following proposal on the UE-initiated on-demand request message.

**Proposal 3: RAN2 to discuss whether following IEs are needed to be included or enhanced in the UE-initiated on-demand request message:**

* **to include the demanded PRS time offset associated with each requested PRS periodicity, to align with PO location>**
* **to include the demanded PRS time duration associated with each requested PRS periodicity, to align with PO location.**
* **to include more than one of the demanded PRS periodicities per PFL, to align with PO locations within and outside the PTW, respectively.**
* **to include requested DL-PRS activation periodicity/start offset/duration, to align with periodic PTW location.**
* **to include UE-related (e)DRX information and LPHAP indication**

In addition, some LSs are proposed to be sent to other working groups.

Firstly, one company thinks that since the PRS needs to align to the DRX of neighbour cell, the DRX of neighbour cell should be obtained by the serving gNB via Xn interface or be obtained by the LMF from the gNB and/or AMF. The details should be further discussed in the RAN3. To trigger the discussion in the RAN3, RAN2 agreement should be sent to RAN3. In Rapporteur opinion, we need to discuss firstly whether or not the DRX of neighbour cells should be aligned with the PRS.

Next, one company thinks that it is necessary for the LMF to retrieve the (e)DRX cycle info from the gNB via the NRPPa interface. The rapporteur think that it is useful at least for the LMF-initiated on-demand PRS request procedure, and could be useful also for the UE-initialized cases wherein that LMF collects the (e)DRX cycle info from the neighbour cells after the LMF receives the UE on-demand PRS request message.

**Proposal 4: RAN2 to discuss whether a LS needs to be sent to RAN3 to trigger them for discussion of how to align the PRS with the DRX of serving cell and/or neighbour cell.**

It is also proposed by a company that a LS should be sent to RAN4 for gNB to configure suitable Paging time window for the UEs to complete the PRS measurement in one PTW. The intention is to let LPHAP UEs wake up at the same time. However, the company also proposes that another feasible solution configuring a common UE\_ID for paging for LPHAP users present in the factory. So Rapporteur thinks whether or not this LS should be sent out should depend on the discussion result of whether it is needed to and if the answer is yes, FFS how.

**Proposal 5: RAN2 to discuss whether it is needed to align the LPHAP UEs waking up time and if the answer is yes, FFS how.**

## 2.2 Extending eDRX cycle beyond 10.24s in RRC\_INACTIVE

There are the following proposals in this area:

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| R2-2307428vivo | Proposal 15: RAN2 to consider aligning SRS configuration with fixed eDRX (especially for the eDRX cycle beyond 10.24s). The solution can be:- LMF acquires the eDRX configuration and takes it into account when setting the periodicity of the requested SRS.- LMF indicates the serving gNB to configure the SRS close to the paging occasion.Proposal 16: LS to RAN1/RAN3 to trigger further discussion on aligning SRS configuration with fixed eDRX when RAN2 reaches a consensus on the requirements and initial solutions. |
| R2-2308135ZTE | Proposal 16: Support to extend the PRS periodicity larger than 10240ms to suit the eDRX cycle value for eDRX paging cycle in RRC\_INACTIVE and/or RRC\_IDLE. |

**Rapporteur’s summary:**

Regarding proposals on the alignment between SRS and eDRX in R2-2307428, since the alignment of SRS configuration with the fixed eDRX is outside the scope of objective given in WID RP-231460, Rapporteur thinks it is better to postpone to the future release.

Regarding the above proposal in R2-2308135, as one of the objective of the WID is to specify solutions for alignment between (e)DRX in RRC\_INACTIVE and PRS configurations, and bearing in mind that RAN2#121 RedCap AI has made the following agreements regarding the Long eDRX cycle: Long eDRX cycle (>10.24 s) value range of enhanced INACTIVE eDRX is same as IDLE eDRX from 20.48s to 10485.76s, i.e., hf2, hf4, hf8, hf16, hf32, hf64, hf128, hf256, hf512, hf1024, it is reasonable to extend the PRS periodicity larger than 10240ms. Meanwhile, Rapporteur thinks that such proposal should be confirmed with RAN1 in terms of the feasibility.

**Proposal 6: RAN2 to agree that the PRS periodicity is extended to be larger than 10240ms to suit the eDRX cycle value for eDRX paging cycle in RRC\_INACTIVE and/or RRC\_IDLE. LS to RAN1 for confirmation of the feasibility.**

## 2.3 Measurement in RRC\_IDLE and report in RRC\_CONNECTED

There are the following proposals in this area

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| R2-2308135ZTE | Proposal 22: Support UE to utilize the positioning assistance data through posSIB or pre-configured assistance data in RRC\_CONNECTED when UE is to perform positioning in RRC\_IDLE. |
| R2-2308618InterDigital | Proposal 5: Study when the UE can transition to RRC\_CONNECTED to send the measurement report that contains measurements made during RRC\_IDLE |

**Rapporteur summary:**

As mentioned in R2-2308135, since the UE in the RRC\_IDLE state cannot perform SDT, when the UE performs the positioning in RRC\_IDLE state, the UE can only utilize the positioning assistance data through posSIB or pre-configured AD when UE in RRC\_CONNECTED rather than the DL SDT message. Rapporteur thinks this proposal looks reasonable and as previously for the RRC\_Inactive positioning, RAN2 needs to confirm how the positioning assistance data can be delivered to UE.

**Proposal 7: RAN2 to agree to support UE to utilize the positioning assistance data through posSIB or pre-configured assistance data in RRC\_CONNECTED when UE is to perform positioning in RRC\_IDLE.**

As mentioned in R2-2308618, triggered event for the positioning in the RRC\_IDLE state has not been discussed before. For the positioning in RRC\_Inactive state, triggered event could be a periodic event, a arear event or a motion event. In Rapporteur’s opinion, triggered event for the positioning in the RRC\_IDLE state could be defined in a way similar with the RRC\_Idle positioning. However, the legacy operation is AS context is not stored when the UE enters the RRC\_IDLE state. If such tradition is followed, triggered event may not be able to be defined for the positioning in the RRC\_Idle state.

**Proposal 8: RAN2 to discuss whether or not triggered event(s) should be defined for the positioning in the RRC\_IDLE state for the UE to transit to RRC\_Connected state for the measurement reporting. FFS what kind of triggered event should be introduced.**

## 2.4 UE Capability for LPHAP

There are the following proposals in this area

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| [R2-2307121](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_122/Docs/R2-2305483.zip)Huawei | Proposal9. Introduce UE capability of whether to support SRS with validity area in RRC\_INACTIVE to LPP and RRC. Proposal10 Introduce UE capability of whether to support SRS pre-configuration in RRC\_INACTIVE to LPP and RRC. |

**Rapporteur:**

This contribution suggests to start the discussion on UE capability for LPHAP. In detail, the proponent proposes to introduce UE capability for SRS with validity area and preconfigured SRS respectively, since in the WID of the LPHAP, SRS with validity area and preconfigured SRS have been listed as two independent objectives which means that one of them can work on its own or the two features can work together.

From Rapporteur perspective, it is still not clear regarding the difference between SRS with validity area and SRS pre-configuration. Considering it will be further discussed during this meeting, hopefully, we can start the discussion on UE capability for LPHAP after we have more further conclusions on the details of SRS pre-configuration in this RAN2 meeting.

**Proposal 9: RAN2 to discuss whether to introduce following two UE capabilities in the LPP and RRC spec, after more conclusions are made for** **SRS with validity area and SRS pre-configuration:**

* **supporting SRS with validity area in RRC\_INACTIVE**
* **supporting SRS pre-configuration in RRC\_INACTIVE**

## 2.4 Relaxed PRS measurement for LPHAP

There are the following proposals in this area

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| R2-2308135ZTE | Proposal 23: Support relaxed PRS measurement for LPHAP by reducing the PRS reception chance according to some criteria, e.g., UE not at cell edge criteria or low mobility criteria for relaxed RRM measurement can be reused. |

**Rapporteur:**

As the relaxed PRS measurement is not in the R18 positioning WID scope, this proposal is suggested to be not pursed in this Release.

## 2.5 Enhancement of UE entering sleeping mechanism

There are the following proposals in this area

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| R2-2307186Fraunhofer | Proposal 1: RAN2 to agree that the UE shall only enter the sleep phase after the UE has received some form of feedback from the network that the NW has obtained the UE position with the required accuracy.Proposal 2: A feedback, where a positive confirmation of completion of positioning procedure shall be transmitted to the UE from the LMF (via gNB), signalling the UE to go into sleep phase of the DRX cycle. FFS: How the feedback is incorporated? LPP? MAC-CE?FFS: Should there be a threshold value of DRX cycle beyond which the UE needs to wait for feedback from network before going to sleep?  |

**Rapporteur:**

 This contribution suggests to introduce a mechanism that UE does not really enter sleep mode, before receiving a confirmation indication from the LMF or the serving gNB, in order to make sure that all TRPs and optionally the UE have already completed the SRS/PRS measurement before entering the sleep mode. In Rapporteur opinion, this issue seems outside the scope of the current WI objective and hence suggest not to be pursued in this release.

## 2.6 Obvious SRS parts not overlapped with the email discussion report of [Post 122][401]

### 2.6.1 Release of SRS Configurations

There are the following proposals in this area:

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| R2-2307121Huawei | Proposal2: SRS configuration with area validity is released when the area-specific TAT expires and SRS pre-configuration is not configured.Proposal3: SRS configuration with validity area is released when it reselects to a cell out of the validity area and SRS pre-configuration is not configured.Proposal6: Support NW-initiated release for preconfigured-SRS.  |
| R2-2307394CATT | Proposal 1: Exclude the method of using area-specific TA timer to release the SRS configuration.Proposal 2: Introduce a separate validity time to control how long the SRS resource is reserved for the UE within the validity area.Proposal 3: When the new validity time expires, the UE releases the SRS resource.Proposal 4: Support the following stop/(re)start conditions for validity-area specific TA timer.- The UE stops the validity-area specific TA timer when RRCResume or RRCSetup is received in response of RRCResumeRequest.- The UE starts the validity-area specific TA timer when receives the RRCRelease contains SRS configuration with validity area. |
| R2-2307428vivo | Proposal 1: UE will release the SRS (pre)configuration in the following scenarios:- Scenario 1: When receiving the explicit release from the network.- Scenario 2: When receiving RRCSetup, RRCResume or RRCRelease without suspendConfig message.Proposal 2: UE maintains the SRS (pre)configuration to support delta configuration in the following scenarios:- Scenario 1: When area-specific TA timer expires.- Scenario 2: When UE reselects out of the positioning validity area.Proposal 3: The UE stops the area-specific TA timer when it receives RRCResume or RRCSetup or RRCRelease without suspendConfig message.Proposal 4: R18 positioning SRS configuration won’t be simultaneously configured with R17 positioning SRS configuration to RRC\_INACTIVE UE.R17 positioning SRS configuration is cell-specific, which is not beneficial for LPHAP. So, if R18 positioning SRS configuration is configured, no need to configure R17 positioning SRS configuration. |
| R2-2307665Intel | Proposal 3: Do not introduce validity timer for SRS validity area configuration. The UE will release the SRS configuration for the area when area-specific TA timer expires or upon receiving the explicit release from the network. To our understanding, if TA timer is expired, the UE cannot use the SRS configuration, therefore the only issue is when the SRS configuration should be release. It can be done by either explicit release from network or TA timer expires. And therefore additional validity timer is not needed. Proposal 4: The UE stops the area-specific TA timer when it moves to RRC\_CONNECTED/RRC\_IDLE or when the corresponding area-specific SRS configuration is released.  |
| R2-2308000Lenovo | Proposal 5: UE should release the area-specific SRS configuration when the area-specific TA timer expires.Proposal 6: UE (re)starts or stops the area-specific TA timer when it receives the indication from network.Proposal 7: Cell specific SRS configuration and validity area specific SRS configuration are not configured simultaneously for the UE, RAN2 does not need to discuss the interaction of the Rel-17 cell specific TA timer and Rel-18 validity area specific TA timer. |
| R2-2308051OPPO | Proposal 6: UE releases the SRS configuration when the validity area-specific TA timer is expired.Proposal 7 : UE releases the SRS configuration when the validity area-specific TA timer is stopped due to the reception of RRCSetup/RRCResume or the reselection to a cell out of the SRS validity area.Proposal 3: UE starts/restarts the validity area-specific TA timer when it receives the configuration of SRS for positioning with validity area in RRCRelease with suspendConfig.Proposal 4 : UE stops the validity area-specific TA timer if RRCSetup or RRCResume is received.Proposal 5 : UE stops the SRS transmission when the area-specific TA timer is not running, i.e., the timer is expired or stopped. |
| R2-2308135ZTE | Proposal 11: Support UE to release the Rel-18 SRS configuration when the Rel-18 TA timer is expired.Proposal 12: Support UE to release the Rel-18 SRS configuration when UE switches to a cell that is not pre-configured to UE before.Proposal 10: Support additional TA timer stop condition: if RRCSetup or RRCResume is received, UE stops the Rel-18 SRS TA timer.In Rel-17, according to TS 38.331, except for the cell reselection case, the TA timer will be stopped (if running) at the following conditions:* If the RRCSetup is received in response to an RRCResumeRequest or RRCResumeRequest1, and srs-PosRRC-InactiveConfig is configured;
* Upon reception of the RRCResume, and srs-PosRRC-InactiveConfig is configured.
 |
| R2-2308261Xiaomi | Proposal 2: When the area-specific TA timer expires, UE does not release the SRS configuration and continue SRS transmission when the area-specific TA timer is restart. |
| R2-2308317CMCC | Proposal 1: The validity timer of the configuration could be introduced for LPHAP. Some companies tend to reuse the TA timer to monitor the validity of the configuration. Based on our understanding, the configuration may be still valid if the TA is not valid. In this case, TA could be required and the UE could continue the UL position with the new TA without releasing the pre-configured RS configuration |
| R2-2308618Interdigital | Proposal 1: Wait for RAN1 progress on the area-specific TA timer before making any RAN2 progress.According to the RAN1 agreements, RAN1 confirms that area-specific TA timer can be supported. However, there are still some ambiguities for the support of area-specific TA timer.For transmission timing, spatial information and pathloss determination for SRS for positioning (SRSp), RAN1 needs to make further progress on down selection of the options identified in RAN1#112.**Observation 1:** RAN2 should wait for RAN1 to finalize details for configurations of UL timing of transmission of SRSp, spatial relationship for SRSp and pathloss determination of SRSp. On the other hand, RAN2 made the following agreement in RAN2#121bis-e meeting.Agreement:The SRS validity area configuration contains a list of cells in which it is valid. FFS validity timer or if we would depend only on explicit release by the network.The FFS part wasn’t agreed because companies in RAN2 were not sure how the area-specific TA timer really works. Thus, the following proposal is made.Proposal 1: Wait for RAN1 progress on the area-specific TA timer before making any RAN2 progress. |
| R2-2308694Samsung | On the other hand, in Rel-18 LPHAP, the motivation of introducing the validity area in SRS configuration is to allow the UE to continue SRS transmission in RRC\_INACTIVE state while consuming minimum energy. Considering the motivation, it seems reasonable to allow the UE to keep the SRS configuration even after expiry of the area-specific TA timer and restart the SRS transmission after having a new TA value.Proposal 2: The UE does not release the SRS configuration when the area-specific TA timer expires. |

**Rapporteur’s summary:**

regarding the condition of releasing the pre-configured SRS configuration, companies’views/preferences are summarized as follows:

* Network-initiated message: 3(Huawei, vivo, Intel, OPPO)
* New TA timer to be introduced controlling how long the SRS resource is reserved for the UE within the validity area: 3(CATT, Xiaomi, CMCC)
* Area-specific TA timer expiration: 4(Intel, Lenovo, OPPO, ZTE); explicitly against area-specific TA: 4(Samsung, CATT, vivo, Intel, Xiaomi)
* Reselection to other cell out of the SRS validity area: 2(OPPO, ZTE); explicitly against (vivo)

Also, one company suggest to wait for RAN1 progress on the area-specific TA timer before making any RAN2 progress, since RAN1 needs to make further progress on down selection of the options identified in RAN1#112 for transmission timing, spatial information and pathloss determination for SRS for positioning (SRSp), and RAN2 were not sure how the area-specific TA timer really works.

The pros and/or cons for each option are list as follows:

|  |  |  |
| --- | --- | --- |
|  | Pros/reasons for supporting | Cons/reasons for against |
| Network-initiated | * the UE may stay within an area for a long time, and the UE would never release the SRS configurations, follow the legacy that suspendConfig will be released when receiving RRCSetup/RRCResume/RRCRelease without suspendConfig message.
 | * additional signaling overhead is introduced, especially the paging overhead.
 |
| New TA timer to be introduced | * Such method can easily ensure SRS configuration to be valid if the Area-specific TA expires.
 | * Additional spec impact
* The scenario of keeping the SRS configuration after the expiration of the Area-specific TA timer is not valid
 |
| Area-specific TA timer expiration | * If UE just stops the SRS transmission and still keeps the SRS configuration in the memory, there seems no use case for this.
* Follow the legacy behavior as defined for Rel-17 inactivePosSRS-TimeAlignmentTimer
 | * All the cells within the validity area need to extend the validity time for SRS, if UE starts/restarts the timer by the TA upadate. Xn or NRPPa needs to be enhanced.
* UE stops the timer when it reselects out of the SRS validity area. The UE cannot use the SRS when it reselects back to the validity area, but the network may reserve the SRS for the UE until the timer expires. This will result in waste of resource.
 |
| Reselection to other cells out of the validity area | * Follow the legacy behavior
 | * UE should maintain R18 positioning SRS configuration to support the delta configuration, and in this way signaling overhead could be saved.
 |

Since companies’ view are diverge on this topic, Rapporteur think that RAN2 needs to discuss which option(s) to be adopted as the criteria to release the pre-configured SRS configuration.

**Proposal 10: RAN2 to discuss which option(s) to be adopted as the criteria to release the pre-configured SRS configuration:**

* **Network-initiated message:**
* **New TA timer to be introduced controlling how long the SRS resource is reserved for the UE within the validity area**
* **Area-specific TA timer expiration**
* **Reselection to other cell out of the SRS validity area**

### 2.6.1 Start/re-start condition of the area-specific TA timer

There are the following proposals in this area:

|  |  |
| --- | --- |
| R2-2307394CATT | Proposal 4: Support the following stop/(re)start conditions for validity-area specific TA timer.- The UE stops the validity-area specific TA timer when RRCResume or RRCSetup is received in response of RRCResumeRequest.- The UE starts the validity-area specific TA timer when receives the RRCRelease contains SRS configuration with validity area. |
| R2-2307428vivo | Proposal 3: The UE stops the area-specific TA timer when it receives RRCResume or RRCSetup or RRCRelease without suspendConfig message. |
| R2-2307665Intel |  Proposal 4: The UE stops the area-specific TA timer when it moves to RRC\_CONNECTED/RRC\_IDLE or when the corresponding area-specific SRS configuration is released.  |
| R2-2308000Lenovo | Proposal 6: UE (re)starts or stops the area-specific TA timer when it receives the indication from network. |
| R2-2308051OPPO | Proposal 3: UE starts/restarts the validity area-specific TA timer when it receives the configuration of SRS for positioning with validity area in RRCRelease with suspendConfig.Proposal 4 : UE stops the validity area-specific TA timer if RRCSetup or RRCResume is received. |
| R2-2308135ZTE | Proposal 10: Support additional TA timer stop condition: if RRCSetup or RRCResume is received, UE stops the Rel-18 SRS TA timer. |
| R2-2308694Samsung | On the other hand, in Rel-18 LPHAP, the motivation of introducing the validity area in SRS configuration is to allow the UE to continue SRS transmission in RRC\_INACTIVE state while consuming minimum energy. Considering the motivation, it seems reasonable to allow the UE to keep the SRS configuration even after expiry of the area-specific TA timer and restart the SRS transmission after having a new TA value.Proposal 2: The UE does not release the SRS configuration when the area-specific TA timer expires. |

It can be concluded from contribution proposals the companies ‘views/preferences are summarized as follows:

* Support of RRCRelease containing the SRS configuration as start/re-start condition: 2(CATT, OPPO)
* Support of RRCResume as stop condition: 5(CATT, vivo, Intel, OPPO, ZTE)
* Support of RRCSetup as stop condition: 5(CATT, vivo, Intel, OPPO, ZTE)
* Support of RRCRelease as stop condition: 1(Intel)
* Support of indication received from the RRC signaling: 1 (Lenovo)

As a result, Rapporteur propose RAN2 to make two agreements as indicated as follows:

**Proposal 11: RAN2 to agree that the following criteria needs to be defined for the start/re-start of the area-specific TA timer:**

* **Reception of RRCRlease message containing the SRS configuration**

**Proposal 12: RAN2 to agree that following criteria needs to be defined for the stop of the area-specific TA timer (FFS other conditions):**

* **Reception of RRCResume message**
* **Reception of RRCSetup message**

# 3 Conclusion

The following proposals are to be agreed (potentially long-time discussion is needed for proposal 2):

**Proposal 1: RAN2 to agree that alignment of PRS to fixed (e)DRX should be adopted to ensure the alignment between PRS and (e)DRX.**

**Proposal 2: RAN2 to agree that both of UE-initialized and LMF-initialized on-demand PRS request procedure are adopted for the alignment from the PRS configuration to the (e)DRX configuration.**

**Proposal 6: RAN2 to agree that the PRS periodicity is extended to be larger than 10240ms to suit the eDRX cycle value for eDRX paging cycle in RRC\_INACTIVE and/or RRC\_IDLE. LS to RAN1 for confirmation of the feasibility.**

**Proposal 7: RAN2 to agree to support UE to utilize the positioning assistance data through posSIB or pre-configured assistance data in RRC\_CONNECTED when UE is to perform positioning in RRC\_IDLE.**

**Proposal 10: RAN2 to agree that the following criteria needs to be defined for the start/re-start of the area-specific TA timer:**

* **Reception of RRCRlease message containing the SRS configuration=**

**Proposal 11: RAN2 to agree that following criteria needs to be defined for the stop of the area-specific TA timer (FFS other conditions):**

* **Reception of RRCResume message**
* **Reception of RRCSetup message**

The following proposal is to be discussed:

**Proposal 3: RAN2 to discuss whether following IEs are needed to be included or enhanced in the UE-initiated on-demand request message:**

* **to include the demanded PRS time offset associated with each requested PRS periodicity, to align with PO location>**
* **to include the demanded PRS time duration associated with each requested PRS periodicity, to align with PO location.**
* **to include more than one of the demanded PRS periodicities per PFL, to align with PO locations within and outside the PTW, respectively.**
* **to include requested DL-PRS activation periodicity/start offset/duration, to align with periodic PTW location.**
* **to include UE-related (e)DRX information and LPHAP indication**

**Proposal 4: RAN2 to discuss whether a LS needs to be sent to RAN3 to trigger them for discussion of how to align the PRS with the DRX of serving cell and/or neighbour cell.**

**Proposal 5: RAN2 to discuss whether it is needed to align the LPHAP UEs waking up time and if the answer is yes, FFS how.**

**Proposal 8: RAN2 to discuss whether or not triggered event(s) should be defined for the positioning in the RRC\_IDLE state for the UE to transit to RRC\_Connected state for the measurement reporting. FFS what kind of triggered event should be introduced.**

**Proposal 9: RAN2 to discuss whether to introduce following two UE capabilities in the LPP and RRC spec, after more conclusions are made for** **SRS with validity area and SRS pre-configuration:**

* **supporting SRS with validity area in RRC\_INACTIVE**
* **supporting SRS pre-configuration in RRC\_INACTIVE**

**Proposal 10: RAN2 to discuss which option(s) to be adopted as the criteria to release the pre-configured SRS configuration:**

* **Network-initiated message:**
* **New TA timer to be introduced controlling how long the SRS resource is reserved for the UE within the validity area**
* **Area-specific TA timer expiration**
* **Reselection to other cell out of the SRS validity area**

**Proposal 11: RAN2 to agree that the following criteria needs to be defined for the start/re-start of the area-specific TA timer:**

* **Reception of RRCRlease message containing the SRS configuration**

**Proposal 12: RAN2 to agree that following criteria needs to be defined for the stop of the area-specific TA timer (FFS other conditions):**

* **Reception of RRCResume message**
* **Reception of RRCSetup message**