3GPP TSG-RAN WG3 #114-e R3-215877
Online, 1-11 November 2021

Agenda Item: 19.2.2

Source: Ericsson (moderator)

Title: CB: # 1902\_Pos\_RRC\_INACTIVE

Document for: Discussion

# Introduction

**CB: # 1902\_Pos\_RRC\_INACTIVE**

**- How to handle positioning information exchange while UE is in Inactive**

**- Consider UL, UL+DL?**

**- Keeping positioning context at gNB-DU?**

**- Positioning context transfer resume RAN node?**

**- at AP level, at RRC level?**

**- Indication of served cell changed to LMF?**

**- If possible agree to TPs for Stg3**

(E/// - moderator)

# To the chair’s notes

1. Xn impacts to support positioning in SDT without anchor relocation pertain to the SDT WI final signalling solutions.
2. Potential F1 impacts regarding the reservation of the UL PRS (e.g. SRS) resources to support UL positioning when the UE is in RRC\_INACTIVE state are pending RAN1/RAN2 discussions and the final signalling design of the SDT WI
3. Agree to add a new cause value in NRPPa when the UE has moved to another serving gNB node.
4. Agree to support forwarding the positioning context over Xn, when UE resumes in a new gNB in response to RAN paging. The details of the signalling and the content of the positioning context are FFS (including e.g. which SRS configuration to send to the target, the one recommended by the LMF or the one adopted in the source)?
5. Agree to add a new assistance information from LMF to gNB, which can include e.g. the UE expected periodical reporting. Content and signalling details are FFS
6. **R3-216002 revision of R3-215438 is agreed**
* **Proposition to discuss online: whether companies can progress on P4 regarding the positioning context information? Forward the recommended SRS characteristics by the LMF (as proposed in R3-215391) or the SRS configuration adopted in the source? Or postpone the discussion to next meeting?**

# Discussion – handling of positioning while UE is in inactive

## Positioning with SDT and LPP UL/DL messages transfer

In the case of Small Data Transmission (SDT) without context relocation, [7] propose to discuss how the UL/DL LPP Information Transfer message is relayed over Xn via the anchor node. Whether a new message should be defined, or any existing message can be enhanced to support this purpose. F1AP and RRC impacts are foreseen.



Figure 3-1 Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT (DL-only and RAT-Independent positioning). Without Context relocation, Anchor gNB is responsible for LPP message transfer [7]

* **Do companies have any view on the above proposal, whether any impacts to Xn are needed to support positioning in SDT w/o anchor relocation?**

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| **Company** | **Yes/No** | **Comment** |
| Ericsson | No, but can be discussed in R18 | We should wait for the SDT WI to finish in RAN2 and RAN3. SDT just started this meeting in RAN3 and there are proposals on Xn enhancement for SDT w/o anchor relocation. It is not clear how the final Xn design in general is going to look like, as the framework is quite complex. Also, RAN3 cannot decide on the solution alone without RAN2 involvement. We can come back to this proposal as part of Rel-18/TEI18. |
| Samsung | Yes, but can wait for SDT discussion | We noticed that SDT group is also discussing signalling delivery issue, so we are fine to wait SDT discussion. |
| CATT | Yes, but can wait for SDT discussion | The overall procedures and the details are all pending to the solutions defined in SDT. |
| Huawei | Yes | Same view as Samsung and CATT |
| Qualcomm | Maybe | If possible, transfer of NAS messages containing location supplementary services or LPP messages should be supported in the same way as transfer of NAS messages containing other messages or data. Maybe there will be Xn impacts. If so, these should be defined and supported as part of the SDT WI. |
| Nokia | No? | Impacts to Xn for this location scenario may be solved by the SDT WI, so we can wait for further SDT WI progress. |
| ZTE | Wait for SDT progress | SDT is discussed in the RAN3 now. Prefer to wait for SDT progress. |
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| **Moderator’s conclusion:*** Xn impacts to support positioning in SDT without anchor relocation depend on the SDT WI final signalling solutions. Most companies think this can be addressed as part of the SDT WI.
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## reservation of SRS resources to support UL Positioning

In the last RAN3 meeting, it was discussed that the gNB-CU should notify the gNB-DU to retain the UE context such as SRS configurations when the UE enters the RRC inactive state.

In [6], it is claimed that this is pending on whether gNB has already configured the SRS configuration for UE in RRC\_INACTIVE state. In [1], it is proposed to wait first for the SDT WI to finish the design of CG-SDT and re-use the same procedure for SRS configurations. In [2], it is claimed that nothing prevents the Inactive UE from resuming in another node in the RNA, and thus the reservation of resources would have been wasted.

Meanwhile, in the response paper from [8] it is claimed that:

1. even UE is in RRC\_INACTIVE, the current serving gNB should reserve the configured SRS resources;
2. there’s no need to wait for the conclusion of SDT WI and that RAN3 can agree that reservation of SRS resource to support RRC\_INACTIVE positioning should be discussed in Positioning agenda item.

Below a figure with the signalling as described in [8]:



* **Do companies have any view on the above proposal, should gNB keep the Positioning relating configuration or resources by letting the CU inform the DU not to do so?**

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| **Company** | **Yes/No** | **Comment** |
| Ericsson |  | We are a bit surprised with the “do not release any resource” part in [8]. If the UE goes to inactive, surely not all the SRS resources have to be kept… RAN1/RAN2 are still discussing whether a completely new config can come in the RRC release message, or a new reconfiguration to retain some of the connected resources in inactive, etc. Either way it is too early to decide on this in RAN3. So perhaps the proposal from Samsung can be revised as: **"the serving gNB ~~should~~ could reserve the configured UL PRS (e.g. SRS) resources."** |
| Samsung | Yes | Just to clarify, [8] hadn’t mentioned “do not release any resource”, we only mentioned “reserve the assigned SRS configuration and resource for the UE who is in RRC\_INACTIVE and UL positioning is also required”. RAN1/RAN2 is discussing the Type(s) of SRS for positioning and Details of validation criteria, but these discussions will not affect the fact the SRS resource assigned to RRC\_INACTIVE UE should be reserved. To compromise, we are fine with E///’s revision, so proposal would be “**if the UL Positioning is required to be supported when UE is in RRC\_INACTIVE state, the serving gNB could reserve the configured UL PRS (e.g. SRS) resources**” |
| CATT | Yes, with comments | To support positioning in Inactive, gNB should keep the full UE context, including the Positioning related configuration.In case of CU-DU split, whether to keep the UE context in DU, and what information should be kept are pending to the progress of RAN1/RAN2, and it’s also pending to the design of SDT.Anyway, we are fine with the compromise proposal provided by Samsung. |
| Huawei |  | In order to support the SRS transmission in INACTIVE, the DU should reserve the SRS resource to avoid assigning the resource to other UEs causing interference. It is notable that CG-SDT is also discussing that CU to notify DU to reserves the CG resources. Thus, we can wait for SDT WI to align the signalling design. We also have doubt on “could” is good wording for stage 3 … |
| Qualcomm | Yes | We think the UL PRS *can* be reserved, and it should not be too hard to find the right formulation. |
| Nokia | Yes | We agree that DU should not release the resources when the UE state is changed to RRC Inactive, but how the CU notifies the DU needs to be discussed, and it could follow the same scheme as for the CG resources, as Huawei is proposing. |
| ZTE | Yes  | We agree that gNB could keep the Positioning relating configuration or resources. We are fine with E///’s rewording. |
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| **Moderator’s conclusion:*** The potential F1 impacts regarding the reservation of the UL PRS (e.g. SRS) resources to support UL positioning when the UE is in RRC\_INACTIVE state are pending RAN1/RAN2 discussions and the final signalling design of the SDT WI
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## Failure with cause values

The proposal in [2] consider adding the following cause values in NRPPa:

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| **Radio Network Layer cause** | **Meaning** |
| Unspecified | Sent when none of the above cause values applies but still the cause is Radio Network Layer related |
| Requested Item not Supported | The NG-RAN node does not support the requested measurement object, or cannot provide the requested information item. |
| Requested Item Temporarily not Available | The NG-RAN node can temporarily not provide the requested measurement object or information item. |
| UE context released | UE context has been released or deleted from the NG-RAN node. |
| Serving cell changed | The serving cell has changed |

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Some other proposals are related to the second cause, where the last serving node notifies the LMF by a failure message. Specifically:

* In [6]: The two options that the last serving RAN notifies **the LMF by the cause value** or the last serving RAN forwards the NRPPa message to the new serving RAN **are both acceptable**.
* In [5]: For the pending NRPPa message in the last serving gNB, the last serving gNB could notify the LMF by a failure response with a proper cause value when UE response the RAN paging in a gNB different from the last serving gNB.
* Study the feasibility [1]
* The proposal in [2]
* **Since there are four proposals in favour of this and for the sake of progress, moderator proposes whether just the cause value “serving cell changed” can be agreed to be added in NRPPa?**

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| **Company** | **Yes/No** | **Comment** |
| Ericsson | Yes | To address an observation from [1] claiming that “Option 1 may fail because the anchor relocation cannot be guaranteed and the re-sent NRPPa message may still be transferred to the old anchor node by the AMF.”… Well, the same can be said for option 2 where the UE context transfer over Xn can fail! We have even a dedicated message for this case 😉We are open to discuss the naming as CATT proposed: e.g. “UE Context transferred”, to be more specific. |
| Samsung | Yes with comment | Generally, we are OK with the consolidated proposal from moderator, but we think by knowing the cause “**serving cell changed**”, what’s the next step the LMF expected to do? We think the next step could be setup a new NRPPa transaction with the new serving cell to keep the on-going positioning procedure. So if this new cause value is introduced, additional information is also needed for the next step, otherwise, we don’t understand the meaning of this new cause value.So we suggest revise the proposal as below:**Add a new cause value “serving cell changed” with additional new serving cell ID from source node to LMF** |
| CATT | Yes with comment | Among the two new cause values, **only “serving cell changed” is needed** for the case where UE resumes from a gNB different with the last serving gNB.And we understand **it’s not necessary to add an additional new serving cell ID** to the LMF. When UE resumes in a gNB different from the anchor, after UE context relocation, the new gNB will initiate Path switch procedure, the new serving cell ID is included in the ULI of the PATH SWITCH REQUEST message. AMF is responsible for the coordination with the LMF. |
| Huawei | See comments | We should firstly clarify that the 3.3 & 3.4 are for the scenario that the UE resumes in a new node in response to RAN paging for pending UE associated NRPPa message at the anchor node. That is, UE is already in INACTIVE when there is a Positioning NRPPa message arrives.Only in the scenario above, we prefer to forward positioning related information to the new RAN for lower latency. We are ok for the failure causes, and slightly prefer “serving cell changed”. We also support the new serving cell ID to be included. **Note** that we do not agree the view in [2] that “When the UE transits to RRC\_INACTIVE state, or is put to RRC\_INACTIVE state by the serving gNB (in the latter case for gNB implementation reasons), the positioning session will fail”. Positioning session will NOT fail when there is a positioning session ongoing and UE entering INACTIVE, as this is what we do in R17 WI. |
| Qualcomm | Yes | This proposal seems fine on its own. In fact, should it be “serving node changed” ? No need for any further signalling as AMF will do routing.By the way, there should be something like this for failure due to handover in LPPa, but seems never to have been defined. Presumably in LTE this would be a rare case / race condition. |
| Nokia | Yes | Agree with Qualcomm that “serving node changed” may be more appropriate. Regarding whether to include the new serving cell, this can be further discussed but not convinced at this time. |
| ZTE | Yes | Agree the cause value “serving cell changed”. |
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| **Moderator’s conclusion:*** Companies agree to add a new cause value in NRPPa denoting that the UE has moved to another serving gNB node.
* Majority of companies do not see need for additional signalling
* R3-216002 revision of R3-215438 is agreed
 |

## Xn impacts

There Xn related Impacts for positioning inactive mobility:

* Option 1: The last serving node forwards the NRPPa message or positioning related information to the new serving node via Retrieve UE context retrieve procedure. Further details are FFS.
* Option 2: Option 1 and available positioning measurements, either signalled explicitly or part of the UE RRC context.
* Option 3: none
* **Companies are invited to provide their views on the above options to support mobility when UE is in RRC\_INACTIVE with ongoing positioning session?**

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| **Company** | **Options** | **Comment** |
| Ericsson | 2 or 3 | As CATT have described, the SRS requested characteristics are local gNB information that LMF had initially provided based on the old gNB’s own TRPs and its positioning capabilities. It is therefore a very “local view” that may not even be useful to other nodes. That’s why we think that, if we have to support such optimization, it should come with the previous gNB’s early measurements (AoA, gNB Rx-Tx, etc..). Otherwise, the new gNB may not even understand/use the LMF’s recommendation for the old node and just ask again LMF for a new recommendation based on its own TRPs capability information, etc., thereby more signalling over NRPPaAt the end this is a sub-optimal approach that will cause more latency than just waiting for the path switch request at CN and starting a new positioning procedure between LMF and gNB.But to limit the damage of this sub-optimization, we think that we should do it like for mobility: where the previous (positioning) measurement are signalled to help fine-tune the new SRS configuration in the new gNB. The new gNB can know for instance which spatial relation information can be better suited for the UE upon analyzing the previous measurements. If the positioning accuracy required is low, then new gNB can proceed with the SRS configuration without asking for further information from LMF. |
| Samsung  | 1 | Firstly, we don’t think Requested SRS Transmission Characteristics are local gNB information, it’s the configuration requirement for the UE from LMF, the serving gNB will consider this requirement to assign UL positioning resource for the UE.Furthermore, we don’t think option 1 will cause more latency, instead, it will have lower latency than option 2 and 3, it can save positioning information request/response procedure which will be exchanged through three nodes (gNB, AMF, LMF). If the serving gNB is changed, no matter context is relocated or not, there will be context retrieve procedure, we can use this procedure replace the positioning information exchange procedure in this case, the latency is definitely reduced. If context is relocated, path switch latency will impact all the options. If latency really matters, we think enhance path switch procedure can also be considered in the next meeting. |
| CATT | 3 is preferred | The issue to be discussed here is how to proceed with the pending NRPPa message in the anchor gNB. The baseline solution could be: * Fails the pending NRPPa procedure with appropriate cause value (as been discussed in 3.3), relocates the UE context, upon reception of the Path switch Request by the AMF, 5GC may start a new positioning procedure between LMF and gNB.

Whether and how to optimize the Xn procedures need to be further discussed. |
| Huawei | 1 | Firstly, to clarify on the view of CATT in paper R3-215606, which is mentioned by Ericsson above: Only UE-associated NRPPa would be forwarded, which is related to the UE. The TRP Information Request message mentioned in the CATT paper is non-UE-associated and would not trigger paging UE at all. To Ericsson, CATT is talking about that the TRP information is local gNB information, rather than the SRS transmission characteristic.Considering that the serving gNB received a request of context relocation from a neighbouring gNB, they are in this debate, one information for us where we can have agreement, transfer the Routing ID information to keep the LMF UE association for better latency, then maybe the SRS Transmission Characteristics could be agreed, as Samsung explained, to avoid retransmission of positioning information exchange procedure. Other positioning information for UE-associated NRPPa message can also be discussable. The fact that the serving gNB provide to the LMF the CGI of the new cell is also necessary to enable the LMF to know the new cell for selecting the measuring TRP.About the measurements we are skeptical … The proponent did not explain how to use the measurements, or what the measurements used for? Because that gNB measurements for UL positioning are non-UE-associated and gNB may not know which UE the measurements belongs to. For E-CID measurements, then what gNB can do with the old gNB measurement? The new gNB would only need to report the E-CID measurements at the new cell to the LMF..  |
| Qualcomm | 1 | Will not repeat Huawei / Samsung arguments, we fully support the sending of the positioning context in Xn, details of the context can be FFS. The information is not related to local configuration. |
| Nokia | 1 | The positioning related information requires further discussion (FFS). |
| ZTE | 1 | We support to send the SRS Transmission Characteristics. |
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| **Moderator’s conclusion:*** Majority of companies agree forwarding the positioning context over Xn, when UE resumes in new gNB after responding to RAN paging.
* The details of the signalling and the content of the positioning context are FFS (whether to send the source configuration or the LMF recommendation to the new node?)
 |

## Deferred positioning periodicity

There are two proposals from [2] and [5] proposing that an indication or period of deferred positioning should be provided from LMF to gNB to assist the gNB to decide whether to release the UE into RRC\_INACTIVE.

* **Do companies agree and have any view on the above proposal?**

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| **Company** | **Yes/No** | **Comment** |
| Ericsson | Yes | We think that this proposal is beneficial and can also address SS’ concerns mentioned in [8] |
| Samsung  | Yes | This proposal is aligned the proposal in 3.2 |
| CATT | Yes |  |
| Huawei |  | It seems RAN2 is discussing how to let the gNB to know the periodicity. Seems better to wait.If there is majority view to add it now, we add it as FFS. |
| Qualcomm |  | In principle this is useful in a particular use case (deferred MT-LR) and may need to be generalized. Also, our expectation is that there will be more “assistance information” from LMF to gNB coming from RAN1 or RAN2. With that, there may be a need for a new general NRPPa “NG-RAN assistance information” message, which may or may not need to include this IE. With that, we would prefer to keep this open rather than rush into a TP. Could also have this as FFS provided the FFS explains that both the contents and the transport of information are FFS, |
| Nokia |  | OK to add with FFS. |
| ZTE |  | Share same view as HW. Add with FFS |
|  |  |  |
| **Moderator’s conclusion:*** Majority of companies agree to add a new assistance information from LMF to gNB, which can include e.g. the UE expected periodical reporting. Content and signalling details are FFS
 |

# Conclusion

Xn impacts to support positioning in SDT without anchor relocation depend on the SDT WI final signalling solutions. Most companies think this can be addressed as part of the SDT WI.

The potential F1 impacts regarding the reservation of the UL PRS (e.g. SRS) resources to support UL positioning when the UE is in RRC\_INACTIVE state are pending RAN1/RAN2 discussions and the final signalling design of the SDT WI

Companies agree to add a new cause value in NRPPa denoting that the UE has moved to another serving gNB node. Majority of companies do not see need for additional signalling

* R3-216002 revision of R3-215438 is agreed

Majority of companies agree forwarding the positioning context over Xn, when UE resumes in new gNB after responding to RAN paging. The details of the signalling and the content of the positioning context are FFS (whether to send the source configuration or the LMF recommendation to the new node?)

Majority of companies agree to add a new assistance information from LMF to gNB, which can include e.g. the UE expected periodical reporting. Content and signalling details are FFS

# References

|  |  |  |  |
| --- | --- | --- | --- |
| **[1]** | [R3-215391](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215391.zip) | (TP for POS BL CR for TS 38.423, TS 38.455, TS 38.473) Discussion on RRC Inactive positioning (Huawei) | OtherResp in [R3-215849](file:///C%3A%5CUsers%5Clisi.li%5CDownloads%5CInbox%5CR3-215849.zip) (Samsung) |
| **[2]** | [R3-215438](file:///D%3A%5CNEXT%5CTSG3_114%5CMeeting%5CDocs%5Cdocs%5CR3-215438.zip) | Discussion on support of RRC-Inactive Positioning (Ericsson) | DiscussionResp in [R3-215849](file:///C%3A%5CUsers%5Clisi.li%5CDownloads%5CInbox%5CR3-215849.zip) (Samsung) |
| **[3]** | [R3-215439](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215439.zip) | Addition of positioning measurements over Xn (Ericsson) | CR0702r, TS 38.423 v16.7.0, Rel-17, Cat. B |
| **[4]** | [R3-215440](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215440.zip) | TP to F1AP BL CR: Mirror impacts to NRPPa (Ericsson) | other |
| **[5]** | [R3-215606](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215606.zip) | Positioning for UEs in RRC\_INACTIVE state (CATT) | discussion |
| **[6]** | [R3-215681](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215681.zip) | Discussion on RRC INACTIVE State Positioning (CMCC) | discussion |
| **[7]** | [R3-215553](file:///D%3A%5CNEXT%5CTSG3_114%5CMeeting%5CDocs%5Cdocs%5CR3-215553.zip) | Positioning in RRC inactive state (Samsung) | DiscussionMove to 19.2.2 |
| **[8]** | [R3-215](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215553.zip)849 | Response to R3-215391, R3-215438 |  |