3GPP TSG-RAN WG2 Meeting#113-e Draft\_R2-201xxxx

Online, 25th Jan. - 5th Feb. 2021

Agenda Item: x.x.x.x

Source: Huawei

Title: [Draft] Summary of email discussion [351] (N)RSRP reference for TA validation for PUR

Document for: Discussion and Decision

# Introduction

In RAN2#112-e, the following CR on the (N)RSRP reference for the first TA validation for PUR was discussed in offline [AT112-e][304].

[R2-2009730](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_112-e/Docs/R2-2009730.zip) Clarification on the reference (N)RSRP for the first TA validation for PUR Huawei, HiSilicon CR Rel-16 36.331 16.2.1 4480 - F NB\_IOTenh3-Core, LTE\_eMTC5-Core

- QC thinks the added description is clear from the procedure text. Huawei and Ericsson think the clarification is useful for the first TA validation. Ericsson thinks the wording could be improved.

* Postponed
* [AT112-e][304][NBIOT/eMTC R16] Clarification on the reference (N)RSRP for the first TA validation for PUR (Huawei)

 Scope: Improve the wording of the change.

 Intended outcome: Agreed CR in R2-2010909

 Deadline: Tuesday 10th 1200 UTC

* Rapporteur reports there are different understandings and suggests an email discussion.
* QC agrees with this summary and think we should ensure a common understanding.

During the offline discussion, 4 cases were raised for the potential (N)RSRP reference update but there was no consensus on whether (N)RSRP reference should be updated in all the 4 cases. The following email discussion was assigned to further discuss the 4 cases and try to reach a common understanding:

* [Post112-e][351][NBIOT/eMTC R16] (N)RSRP reference for the TA validation for PUR (Huawei)

 Scope: To come to common understanding of the different cases

 Intended outcome: Report and possibly CR to the next meeting

 Deadline: Tuesday Jan 12 1100 UTC

# Discussion

For (N)RSRP based TA validation in PUR, whether TA should be considered as (re-)validated and the (N)RSRP reference should be updated in the following cases was discussed but there was no consensus:

* Case 1: Upon reception of RRC release message including pur-Config(-NB) in RRC\_CONNECTED mode;
* Case 2: Upon reception of RRC release message in response to uplink transmission using PUR;
* Case 3: Upon reception of Timing Advance Command MAC CE;
* Case 4: Upon reception of (N)PDCCH indicates timing advance adjustment as specified in TS 36.212.

For each case, companies are invited to provide comments on whether TA should be considered as (re-)validated and the (N)RSRP reference should be updated. Based on the reply, companies are further invited to comment if anything needs to be clarified in the specification.

**Case 1: Upon reception of RRC release message including pur-Config(-NB) in RRC\_CONNECTED mode**

**Question 1a.** For case 1, do you think TA should be considered as (re-)validated and the (N)RSRP reference updated? If yes, please also indicate whether it depends on the following cases raised in the offline discussion:

* whether it depends on pur-Config explicitly included (need ON)
* whether it depends on what is included in pur-Config. e,g, pur-RSRP-ChangeThreshold-r16 (Need ON) and/or pur-TimeAlignmentTimer-r16 (Need OR)

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | Yes | Thanks for the CR and all the discussion during offline in last meeting. Now we agree with QC’s comments mentioned in last meeting, e.g., if RSRP-based TA validation is configured (*pur-RSRP-ChangeThreshold* is set to “setup”), the RSRP reference should be updated by the UE after every TA validation.According to the current specification, the straightforward understanding (#1) could be that TA validation only means the actions in 5.3.3.19 which is only invoked when UE initiates transmission using PUR. But during the offline discussion, we can see other understanding (#2) that TA validation also means (re)acquiring valid TA or guaranteeing the validity of TA, e.g., TA value validation.With the following reason, we prefer the #2 understanding:* If the TA value is (re-)validated but RSRP reference is not updated, we can see the risk of inaccurate TA validation during the future PUR initiation. This may cause incorrect judgement on whether PUR can be initiated. In other words, when the UE performs the actions in 5.3.3.19 when it later initiates transmission using PUR, the stored RSRP reference doesn't correspond to the latest TA value. This would cause the calculated RSRP change cannot reflect the actual change of TA value.

Therefore, we think a high level rule should be that, the RSRP reference value should be updated accordingly when the first time and every subsequent TA value validation (e.g., every time the TA timer (re)starts or the TA value is updated).Moreover, although *pur-Config* and *pur-RSRP-ChangeThreshold* are “need ON” type IE, because they use the definition of SetupRelease{}, they can still be set to release, which is equivalent to the case that the IE is absent for the IE type of “need OR”. With the above comments, the explicit description for our thinking on such high level rule can be as following:* If the *pur-TimeAlignmentTimer* IE is included in *pur-Config(-NB)* and the *pur-TimeAlignmentTimer* is not running and/or if the *pur-RSRP-ChangeThreshold* IE is set to “setup” in *pur-Config(-NB)* and there has no stored (N)RSRP reference, this can be seen as the first time TA value validation and the current serving cell RSRP value should be stored as RSRP reference.
* If *pur-TimeAlignmentTimer* is already running, reception of TAC MAC CE (this triggers restart of *pur-TimeAlignmentTimer*) can be seen as another TA value validation and RSRP reference should also be updated.
* If the *pur-TimeAlignmentTimer* is already runningand the *pur-TimeAlignmentTimer* IE is included in *pur-Config(-NB),* as this triggers restart of *pur-TimeAlignmentTimer*, this also can be seen as another TA value validation and RSRP reference should also be updated.
* If there already has stored (N)RSRP reference and only the *pur-RSRP-ChangeThreshold* IE is set to “setup” in *pur-Config*(-NB), we think this is not TA value validation. Therefore, the stored (N)RSRP reference should be maintained, e.g., not updated. (With reference to relaxed monitoring, the *SrxlevRef* would not be updated when *s-SearchDeltaP* is (re)provided in SIB).
* If there already has stored (N)RSRP reference, and the *pur-RSRP-ChangeThreshold* IE is set to “release” in *pur-Config(-NB)*, it can be seen as RSRP-based TA validation is not configured and the RSRP reference can be released, if stored.
 |
| Qualcomm | Yes, see comments | Thank you ZTE for the nice explanation. With respect to the ZTE response above:* While pur-TimeAlignmentTimer based and (N)RSRP-based TA validation are two independent TA validation procedures for PUR, we tend to agree with “If the *pur-TimeAlignmentTimer* is already runningand the *pur-TimeAlignmentTimer* IE is included in *pur-Config(-NB),* as this triggers restart of *pur-TimeAlignmentTimer*, this also can be seen as another TA value validation and RSRP reference should also be updated”.
* We **disagree** with “If there already has stored (N)RSRP reference and only the *pur-RSRP-ChangeThreshold* IE is set to “setup” in *pur-Config*(-NB), we think this is not TA value validation. Therefore, the stored (N)RSRP reference should be maintained, e.g., not updated.”

So, in our view, upon reception of RRC release message including pur-Config(-NB)* 1. When (N)RSRP based TA validation and/or *pur-TimeAlignmentTimer* is explicitly configured by current signalling: the (N)RSRP reference should be updated.
	2. In the case of PUR reconfiguration where (N)RSRP based TA validation was previously configured but pur-RSRP-ChangeThreshold-r16 is not explicitly included in the current signalling: because of need ON, this means the (N)-RSRP based TA validation is still configured and previous threshold values still apply. On whether this should constitute a TA revalidation, while both options can work, we can consider this as the case of **not** revalidated, which means the network has the option to explicitly signal the value again if TA revalidation is desired.
	3. If the pur-Config(-NB) explicitly releases (N)RSRP based TA validation by the current signalling, the discussion is moot.
 |
| Huawei, HiSilicon | Yes for some cases | We have similar understanding with the high level principle mentioned by ZTE. But we think one case has been missed:If only pur-RSRP-ChangeThreshold has been configured at the beginning, and then PUR reconfiguration is received by the UE in which pur-TimeAlignmentTimer IE is included in pur-Config(-NB), in this case, pur-TimeAlignmentTimer is started instead of re-started. We think RSRP reference should be updated for this case also. Based on above, we think RSRP reference should be updated when:1. pur-RSRP-ChangeThreshold is configured for the first time (the case discussed in CR R2-2009730)
2. When PUR TA timer is (re-)started
 |
| Ericsson | Yes, see comments | Yes, we think the RSRP reference value should be updated when receiving RRCConnectionRelease with pur-Config in the following cases:1. When PUR TA timer is (re-)started.
2. When RSRP change threshold is configured for the first time, and also subsequently whenever pur-RSRP-ChangeThreshold is included in pur-Config.
 |
| Nokia | Yes with comments | The RSRP reference value update should happen in the following cases and applicable only when TA validation based on RSRP is configured.1. At the time of RRC Connection Release for the first time containing PUR configuration.
2. After successful PUR transmission (reception of acknowledgment for PUR transmission).
3. After RRC connection release followed by PUR transmission.

In our view PUR TA timer is not applicable if RSRP based TA validation is configured. The RRC can either configure one of the method as per TA Validation configuration |
|  |  |  |
|  |  |  |

**Question 1b.** According to your reply to Question 1a, for case 1, is there anything to be clarified in current specification?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | Yes | Based on the above comments for Q1a, we think the issue “*it is not specified what is the reference value for the first TA validation*” mentioned in CR [R2-2009730] exists and therefore clarification is needed.Based on the proposed change in CR[R2-2009730], we have the following example change (highlight yellow texts):

|  |
| --- |
| ***pur-RSRP-ChangeThreshold***Indicates the threshold(s) of change in serving cell RSRP in dB for TA validation. Value dB4 corresponds to 4 dB, value dB6 corresponds to 6 dB and so on. When *pur-RSRP-ChangeThreshold* is set to *setup*, if *decreaseThresh* is absent the value of *increaseThresh* is also used for *decreaseThresh*. If there is no stored RSRP reference, t~~T~~he RSRP of the serving cell at the time the field is received is used as the reference for the first TA validation, see clause 5.3.3.19. |

 |
| Qualcomm | See Q2 |  |
| Huawei, HiSilicon | Yes | Agree with the change proposed by ZTE. |
| Ericsson | Yes | We support the text proposal from Qualcomm2 in Question 5, as that would be consistent across the different cases and result in clear behaviour.  |
|  |  |  |
|  |  |  |

**Case 2: Upon reception of RRC release message in response to uplink transmission using PUR**

**Question 2a.** For case 2, do you think TA should be considered as (re-)validated and the (N)RSRP reference updated?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | - | In this case, if PUR TA timer is not restarted, RSRP reference also doesn’t need to be updated. But if PUR TA timer is restarted due to some conditions, RSRP reference needs to be updated.  |
| Qualcomm | Depends | If the RRC release message includes pur-Config(-NB), the case is same as discussed in Q1 above.If the RRC release message does not include pur-Config(-NB), TA can be considered as **not** revalidated for the purpose of (N)RSRP based TA validation. |
| Huawei, HiSilicon | Depends | Agree with ZTE, if RSRP based TA validation has been configured and PUR TA timer is (re-)started, the RSRP reference should be updated. |
| Ericsson | Depends | Agree with ZTE, according to our Q1 reply.  |
| Nokia | Yes | As the UE TA is implicitly validated by successful uplink transmission without any TA value or in case if the TA was changed, it would have been updated via TA value sent in downlink in response to PUR. So the recent RSRP condition should be the reference for validation of next PUR. |
|  |  |  |

**Question 2b.** According to your reply to Question 2a, for case 2, is there anything to be clarified in current specification?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | No |  |
| Qualcomm | Yes | From Q1 and Q2 response, one common criterion for considering the TA is revalidated is when pur-RSRP-ChangeThreshold-r16 is included and set to setup, and/or *pur-TimeAlignmentTimer* is included. |
| Huawei, HiSilicon | Yes | Changes are needed but have already been covered by our TP in Q1a. |
| Ericsson | Yes | See Q1b |
| Nokia | Yes | The described behaviour in our answer needs to be clarified for RSRP based TA validation in the description of the field. |
|  |  |  |

**Case 3: Upon reception of Timing Advance Command MAC CE**

**Question 3a.** For case 3, do you think TA should be considered as (re-)validated and the (N)RSRP reference updated?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | Yes | According to our high level comments for Q1a, upon reception of TAC MAC CE, the TA value can be considered revalidated and therefore the RSRP reference should also be updated to the current serving cell RSRP value (if the *pur-RSRP-ChangeThreshold* is previously set to “setup”).We think this needs some clarification in MAC spec. |
| Qualcomm | Yes | Following is currently captured in MAC spec:when a Timing Advance Command MAC control element is received or PDCCH indicates timing advance adjustment as specified in TS 36.212 [5]:- apply the Timing Advance Command or the timing advance adjustment;So, reception of TA command MAC CE (Q3) OR reception of PDCCH indicates timing advance adjustment as specified in TS 36.212 (Q4) revalidates the TA value. Then for the (N)RSRP-based TA validation, “since the last TA validation” should be based on the comparison against “serving cell (N)RSRP” at such time. |
| Huawei, HiSilicon | Yes | In this case, TA value is updated at the UE and the (N)RSRP reference should be updated. |
| Ericsson | Yes |  |
| Nokia  | Yes |  |
|  |  |  |

**Question 3b.** According to your reply to Question 3a, for case 3, is there anything to be clarified in current specification?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | Yes | According to our comments for Q1a and Q3a, we have the following example change:

|  |
| --- |
| TS 36.3215.4.7.2 Maintenance of PUR Uplink Time Alignment……- when a Timing Advance Command MAC control element is received or PDCCH indicates timing advance adjustment as specified in TS 36.212 [5]:- apply the Timing Advance Command or the timing advance adjustment;- start or restart the *pur-TimeAlignmentTimer*, if configured.- MAC entity indicates to upper layers the UE shall set the stored RSRP reference value to the current RSRP value of the serving cell. |

 |
| Qualcomm | Yes | The MAC spec text shown above covers both Q3 and Q4 and clearly indicates that TA is indeed revalidated. However, currently the TA revalidation due to MAC CE is based on MAC spec/layer, whereas (N)RSRP based validation is captured in RRC. There should be some kind of indication from MAC to RRC, for the case of (N)RSRP based TA validation is configured, to indicate that TA has been revalidated, so that RRC can update the reference. Such indication (from MAC to RRC) could be added in MAC spec in the same section shown above.So, we agree with ZTE’s intention with some wording suggestion:- when a Timing Advance Command MAC control element is received or PDCCH indicates timing advance adjustment as specified in TS 36.212 [5]:- apply the Timing Advance Command or the timing advance adjustment;- start or restart the *pur-TimeAlignmentTimer*, if configured.- indicate to upper layers that the Timing Advance value has been updated.Then RRC spec should also specify, among other things, handling of such MAC indication. See Q5. |
| Huawei, HiSilicon | Yes | We agree with the intention and also agree with Qualcomm that the following is enough as in RRC we already have “since the last TA validation, the serving cell (N)RSRP…”:- indicates to upper layers that the validated timing advance has been updated. |
| Ericsson | Yes | Agree with the intention and with the Qualcomm text proposal. Regarding ZTE proposal, the (N)RSRP value is stored and maintained in RRC and MAC should not refer to such directly. An indication of TA validation from MAC to RRC is enough. |
| Nokia | Yes | Agree with proposed changes of QC |
|  |  |  |

**Case 4: Upon reception of (N)PDCCH indicates timing advance adjustment as specified in TS 36.212**

**Question 4a.** For case 4, do you think TA should be considered as (re-)validated and the (N)RSRP reference be updated?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | Yes | This case is similar as case 3 in which TA value also can be considered revalidated and therefore the RSRP reference should also be updated. |
| Qualcomm | Yes | See Q3 |
| Huawei, HiSilicon | Yes | Same as case 3. |
| Ericsson | Yes | Same as case 3. |
| Nokia | Yes |  |
|  |  |  |

**Question 4b.** According to your reply to Question 4a, for case 4, is there anything to be clarified in current specification?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | Yes | See our comments for Q3b. |
| Qualcomm | Yes | See Q3 |
| Huawei, HiSilicon | Yes | See Q3b. |
| Ericsson | Yes | See Q3b.  |
| Nokia | Yes | See Q3b |
|  |  |  |

**Other clarification needed in the specification**

**Question 5** Regarding TA validation and (N)RSRP reference update, apart from the changes commented in above questions for the 4 cases, is there any other change needed in current specification?

|  |  |  |
| --- | --- | --- |
| ***Company name*** | ***Opinion*** | ***Comments*** |
| ZTE | No |  |
| Qualcomm | Yes | The MAC changes are shown above in Q3b.For RRC, based on above discussion, there are following conditions to be clarified. (It is better to clarify the full procedure in the procedural text than partly in a field description.)5.3.3.19 Timing alignment validation for transmission using PURIf *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is configured, the UE shall store, or update if already stored, its serving cell reference (N)RSRP value when any of the following conditions is fulfilled:* upon reception of indication from lower layers that Timing Advance value has been updated; or
* upon reception of *RRCConnectionRelease* message when *pur-TimeAlignmentTimer* is included; or
* upon reception of *RRCConnectionRelease* message when *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is included and set to *setup.*

The UE shall consider the timing alignment value for transmission using PUR to be valid when all of the following conditions are fulfilled:1> if *pur-TimeAlignmentTimer* is configured:2> *pur-TimeAlignmentTimer* is running as confirmed by lower layers;1> if *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is configured:2> compared to the stored serving cell reference (N)RSRP value, the serving cell (N)RSRP has not increased by more than *increaseThresh*; and2> compared to the stored serving cell reference (N)RSRP value, the serving cell (N)RSRP has not decreased by more than *decreaseThresh*; |
| Huawei, HiSilicon | No | Above TP from Qualcomm could be an alternative for RRC if the case for pur-RSRP-ChangeThreshold reconfiguration is excluded in the following bullet:* upon reception of *RRCConnectionRelease* message when *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is included and set to *setup.*

We think the RRC change proposed by ZTE and Huawei (update the field description only) is simpler, but we are also fine to go with majority view. |
| Qualcomm2 | See comments | It seems the main contention above is whether to update the (N)RSRP reference at the UE upon reconfiguration of the change threshold by the network. We fail to understand why network would provide a new change threshold but would not want the UE to compare that threshold with the newer (N)RSRP value but with the older one (which was stored at the time of first change threshold configuration). We should avoid the inconsistency. Why should the UE update the (N)RSRP reference threshold when it receives (arguably unrelated) PUR TAT value by RRC, but not the actual change threshold value by RRC itself which is in fact intended to be directly compared with the (N)RSRP reference? In fact, we would be ok to NOT update the (N)RSRP reference upon reception of PUR TAT value, because they are not directly related.Therefore, the text update in field description alone is not sufficient in RRC.After thinking a bit further, it seems, we can have a cleaner approach as below for RRC. (The suggested MAC changes are as shown in Q3b.)5.3.3.19 Timing alignment validation for transmission using PURThe UE shall consider the timing alignment value for transmission using PUR to be valid when all of the following conditions are fulfilled:1> if *pur-TimeAlignmentTimer* is configured:2> *pur-TimeAlignmentTimer* is running as confirmed by lower layers;1> if *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is configured:2> compared to the stored serving cell reference (N)RSRP value, the serving cell (N)RSRP has not increased by more than *increaseThresh*; and2> compared to the stored serving cell reference (N)RSRP value, the serving cell (N)RSRP has not decreased by more than *decreaseThresh*;..5.3.3.3d UE actions upon receiving PUR indications from lower layersThe UE shall:1> if repetition adjustment is indicated by lower layers:2> update *numRepetitions* (*npusch-NumRepetitionsIndex* in NB-IoT) in previously stored *pur-Config* in accordance with the received indication;Upon reception of indication from lower layers that Timing Advance value has been updated, the UE shall:1> if the UE is configured with *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT):2> store, or update if already stored, the current serving cell (N)RSRP value as serving cell reference (N)RSRP value (see 5.3.3.19);For CP transmission using PUR, upon indication from lower layers that transmission using PUR is successfully completed, the UE shall perform the actions as specified in 5.3.3.4b as if an empty *RRCEarlyDataComplete* message was received.Upon reception of PUR fallback or PUR failure indication from lower layers, the procedure ends.NOTE: For transmission using PUR, further UE actions upon reception of PUR fallback or PUR failure indication from lower layers (see TS 36.321 [6]) is left up to implementation...5.3.8.3 Reception of the *RRCConnectionRelease* by the UEThe UE shall:<<skip>>1> if the *RRCConnectionRelease* message includes the *pur-Config*:2> if *pur-Config* is set to *setup*:3> store or replace the PUR configuration provided by the *pur-Config*;3> if *pur-RSRP-ChangeThreshold* (*pur-NRSRP-ChangeThreshold* in NB-IoT) is included and set to *setup*:4> store, or update if already stored, the current serving cell (N)RSRP value as serving cell reference (N)RSRP value (see 5.3.3.19);3> if *pur-TimeAlignmentTimer* is included in the received *pur-Config*:4> configure lower layers in accordance with *pur-TimeAlignmentTimer*;3> else:4> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;3> start maintenance of PUR occasions as specified in 5.3.3.20;2> else:3> if *pur-TimeAlignmentTimer* is configured, indicate to lower layers that *pur-TimeAlignmentTimer* is released;3> release *pur-Config*, if configured;3> discard previously stored *pur-Config*;<<skip>> |
| Ericsson | Yes | We support the TP provided by Qualcomm2. We think it would be better to capture the behaviour w.r.t. “stored RSRP” explicitly to avoid ambiguities and possible misinterpretations for implementation.However, we should check whether “serving cell reference (N)RSRP” is well-defined and clear or whether it needs to be defined. Note that it seems in TS 36.133 captures updates for the reference values only when UE receives MAC CE or (N)PDCCH with TA update. Therefore, it is likely RAN4 changes are needed as well, unless the intention is that e.g. a MAC CE with TA update would always be provided when the threshold configuration changes. In this case, there would be need for fewer changes in the above suggestion.  |
| Nokia | Yes | We agree with proposal of QC2 which covers our understanding of updating of reference RSRP value. |

# Conclusion

This offline discussion focused on (N)RSRP based TA validation and (N)RSRP reference update for PUR:

**TBD**

# References

# Contact delegates

|  |  |  |
| --- | --- | --- |
| **Delegate** | **Company name** | **Email** |
| Baokun Shan | Huawei, HiSilicon | baokun.shan@huawei.com |
| Umesh Phuyal | Qualcomm | uphuyal@qti.qualcomm.com |
| Tuomas Tirronen | Ericsson | Tuomas.tirronen@ericsson.com |
| Srinivasan Selvaganapathy | Nokia | Srinivasan.selvaganapathy@nokia.com |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |