3GPP TSG-RAN WG1 Meeting #109-e R2-200xxxx

Electronic meeting, February 24th – March 6th, 2020

Agenda Item: 7.2.4

Source: Ericsson (Rapporteur)

Title: Report of [AT109e][308][NBIOT] PUR RRC in general and L1 signalling impact to RRC (Ericsson )

Document for: Report

# Introduction

This report is intended for providing summary of the proposals not yet agreed from [R2-2002028](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2002028.zip) after the first treatment in RAN#109-e:

**[AT109e][308][NBIOT] PUR RRC in general and L1 signalling impact to RRC (Ericsson)**

      Status: Not started

      Scope: Progress the FFS not agreed above from [R2-2002028](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2002028.zip)

      Intended outcome: Report

      Deadline: Thursday 27th 0900 CET

The following have been agreed during RAN2#109-e so far:

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| Agreements:   * Similar to EDT, upon transmission using PUR, RRC configures PHY to use PUR. * EDT value for timer t300 applies when UL data is included in transmission using PUR. * When UL data is not included (i.e. only RRC message is included) in transmission using PUR, non-EDT value applies to t300. * PUR periodicity includes at least values of several minutes, tens of minutes, ~hour, several hours, ~one day. FFS exact minimum and maximum values and total number of values. |

Companies are asked to provide their views for the rest of the proposals moved to offline discussion and initially marked [FFS] in [R2-2002028](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Docs/R2-2002028.zip). The summary submitted to the meeting is used as baseline and tables for replies have been added. The intention is to identify possible proposals and way forward to be further agreed during RAN2#109-e.

Companies are also welcomed to provide comments on other issues, i.e. those marked with [ASN.1/CR] and [Postpone], which are grouped in separate sections with tables for possible company input.

# Discussion

## Details of procedural aspects of PUR in RRC

### PUR configuration for CP solution

Two submitted tdocs [5] and [21] include discussion on details of where to store PUR configuration for CP solution and implications of possible interactions. Additionally [6] is a draft LS to RAN3 related to discussion in [5]. The following proposals are included in these two tdocs:

* RAN2 assumes that part of the PUR configuration of the UE can be stored in the MME transparently and the eNB does not link the PUR configuration to each UE in IDLE mode [5] (Huawei)
  + Send the LS to RAN3 to ask the support of the signalling. [5] (Huawei)
* It’s suggested that eNB can tag the D-PUR resource configuration with S-TMSI for a UE using CP solution.[12] (ZTE)
  + Once the S-TMSI changes, UE using CP solution and with D-PUR configuration would immediately indicate the new S-TMSI to eNB (e.g. the S-TMSI change indicating is performed in the same RRC\_CONNECTED state as that the S-TMSI is changed by NAS).[12] (ZTE)

There are two open issues: Where the PUR configuration is stored when UE is in RRC\_IDLE (e.g. in eNB and/or in MME) and if and how the eNB links UE and its PUR configuration.

The above papers from Huawei and ZTE opposite views on the issues, thus the following proposals are likely to require more discussion:

1. [FFS] MME stores at least part of the UE's PUR configuration in RRC\_IDLE.
2. [FFS] RAN2 to discuss if and how eNB links PUR configuration to each UE in RRC\_IDLE.

Offline discussion

Companies are asked to provide their views on Proposals 1 and 2:

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| **Company** | **Is P1 agreeable?** | **Comments** |
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| **Company** | **Does eNB need to link PUR configuration and UE and if, how? Please elaborate on how the configuration for CP PUR would work (if not clear in above reply).** |
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Conditional on discussion on proposals 2 and 3, an LS to RAN3 might be needed:

1. [FFS, conditional on P2/P3] Send LS to RAN3 on supporting signaling for PUR configuration.

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| **Company** | **If P1 or similar is agreed, should RAN2 send LS to RAN3?** |
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Conclusion and proposal(s) for PUR configuration for CP solution: TBD

### L1 signalling impact

Huawei/HiSilicon [7] and Qualcomm [9] discuss PHY-RRC interaction in the case of the following RAN1 agreement:

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| **The dedicated PUR ACK DCI at least includes the NPUSCH repetition adjustment (absolute value as per legacy table), and the field is 3 bits.** |

Huawei brings up potential issue in updating the repetition number in case delta configuration is used for PUR configuration and number of PUSCH repetitions is an optional parameter with the following proposal:

* RAN2 to discuss how to handle parameter update triggered by L1 signalling. [7] (Huawei)

There is no explicit proposal in [9] but Qualcomm mentions RAN1 specifications (TS 36.213) has captured the case and that RRC configuration would not need to be updated because of this. TS 36.213 states:

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| * For a PUSCH transmission using preconfigured uplink resource, the UE shall use the repetition number determined by the repetition adjustment field according to Table 8-2b and Table 8-2c from the most recent MPDCCH DCI format 6-0A/6-0B with CRC scrambled by PUR C-RNTI for PUR ACK feedback indication (as defined in [4]) if detected, configured by higher layers otherwise. |

Based on above RAN2 should agree whether changes are required in RAN2 specifications and details of such changes, if needed:

1. [FFS] RAN2 to discuss if RAN1 agreement on repetition adjustment update triggered by L1 signalling requires any changes in RAN2 specifications.

Offline discussion

Companies are asked to provide comments for P4, i.e. whether changes would be needed in RAN2 specifications based on the L1 signaling discussed above:

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| **Company** | **P4: Are changes needed in RAN2?** | **Comments** |
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Conclusion and proposal(s) for PUR configuration for CP solution: TBD

### Handover or connection re-establishment

ASUSTeK provides discussion on handover and connection re-establishment procedures [22], and whether UE should always release PUR configuration when initiating RA procedure. The following proposals and options are discussed:

* RAN2 to discuss whether the UE should release D-PUR configuration due to a handover or a RRC connection re-establishment procedure.[22] (ASUSTeK)
* RAN2 to discuss which option among Opion1 to Option 3 to be adopted for releasing D-PUR configuration due to a handover or a RRC connection re-establishment procedure in RRC\_CONNECTED state.[22] (ASUSTeK)
  + **Option 1:** The UE releases the D-PUR when it does a RA procedure (due to handover or RRC connection re-establishment) on a new cell.
  + **Option 2:** The UE releases the D-PUR when it does a RA procedure (due to handover or RRC connection re-establishment), i.e. regardless of condition (b).
  + **Option 3:** The UE releases the D-PUR when it initiates a handover or a RRC connection re-establishment procedure, i.e. regardless of condition (a) and (b).
    - **Condition (a):** initiation of RA procedure
    - **Condition (b):** change to a new cell.

The following agreement has been made earlier which corresponds to Option 1, however, handover and connection re-establishment are not explicitly mentioned:

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| * TA validation criterion “Serving cell changes” is implicitly always enabled, which means that TA is considered invalid when the UE initiates RA procedure in a different cell than where TA was last validated. |

The intention of earlier agreement, also based on earlier email discussions, seems to be that PUR configuration needs only to be released in a new cell as PUR configuration is not coordinated between eNBs, that is, if cell is not changed, configuration could be kept (as long as TA is valid). It can be discussed further whether the earlier agreement needs to be updated or whether for HO and/or re-establishment should be treated differently:

1. [FFS] RAN2 to agree between Options 1-3 and update or clarify earlier agreement if needed.

Offline discussion

Companies are asked to provide their view of which option to go for based on P5:

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| **Company** | **Option 1-3?** | **Comments** |
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Conclusion and proposal(s) for TA validation criteria / handover and re-establishment: TBD

### Text proposals for procedural aspects

TA RSRP signaling

Sierra Wireless has text proposal on RSRP change TA validation criterion:

* Adopt the TP in section 3 as baseline for configuration of TA validation criteria based on serving cell RSRP change for both eMTC and NB-IoT.[3] (Sierra)

In the text proposal in [3] the approach seems to be to update the configuration of RSRP thresholds every time TA is updated e.g. by providing a table of mapping of TA value to RSRP threshold change value in PUR configuration. This approach has not yet been agreed in RAN2 and in the current running CRs the RSRP thresholds are signaled as part of the PUR configuration not related to TA values.

Before adopting the text proposal, RAN2 should decide whether the approach proposed in [3] is adopted:

1. [FFS] RAN2 to discuss whether the thresholds for RSRP change TA validation criteria need to be updated every time TA is validated or updated and whether signaling of RSRP thresholds needs to be optimized.

Offline discussion

Companies are asked to provide their view based on P6 and the text proposal in [3]:

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| **Company** | **Comments (on P6 and e.g. text proposal in [3])** |
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Conclusion and proposal(s) for TA RSRP signaling: TBD

## Details of PUR parameters and parameter ranges in RRC

### PUR periodicity

Four companies (Huawei/HiSilicon, Ericsson, ZTE/Sanechips, Sierra Wireless) have provided proposals on range and details of PUR periodicity, i.e., the following proposals:

* For both NB-IoT and eMTC, hsf is used as the unit for PUR periodicity and the value range is {hsf128 (about 22 minutes), hsf256, hsf512, hsf1024, hsf2048, hsf4096, hsf8192 (about 23.3 hours), spare} [8] (Huawei)
* PUR periodicity and start position are based on legacy counters: subframe, SFN, H-SFN.[10] (Ericsson)
* PUR periodicity of up to at most 3h is supported.[10] (Ericsson)
* The PUR periodicity parameter is quantized as a power of 2 to allow for multiplexing of PUR UEs.[10] (Ericsson)
* 3-bits or 4-bits is used for signaling PUR periodicity in the range from SFN=256 (2.5s) to SFN=1048576 (3h).[10] (Ericsson)
* It’s suggested that the requestedPeriodicity can be set up to several days, and the minimal granularity can be 1ms.[14] (ZTE)
* PUR periodicity configurations should be from one HSFN to 1024 HSFN counts in binary multiples and in binary multiples of complete HSFN counts up to at least 64.[21] (Sierra)
* The eNB should be able to configure offsets to enable interleaving of UEs that can have the shortest allowed periodicity.[21] (Sierra)

On possible range, Ericsson proposes range from 2.5 s up to 2.9 h, Huawei proposes from 22 min up to ~1 day, ZTE proposes from 1 ms up to several days and Sierra doesn't have explicit suggestion on min and max values, but based on discussion suggests at least periodicity of one day if not more. The proposed minimum and maximum values are different, most overlap can be found with values from tens of minutes, hours or multiple hours up to one day. The exact minimum and maximum need more discussion.

Huawei and Sierra suggest using multiple of H-SFN cycle as granularity, Ericsson proposes SFN-based granularity (min of 256) and ZTE proposes 1 ms as minimum granularity. Huawei, Sierra and Ericsson seem to base their proposals (if not explicitly) on powers of 2.

As a way forward, following are proposed:

1. PUR periodicity configuration granularity is based on counts of binary multiples of HSFN, i.e. full SFN cycles (= 10.24 s). FFS on exact count.

Offline discussion

In online web-session on Tuesday 24.2., above proposal was moved to be discussed offline. Also, following was agreed:

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| PUR periodicity includes at least values of several minutes, tens of minutes, ~hour, several hours, ~one day. FFS exact minimum and maximum values and total number of values. |

To fully understand what is needed to be captured e.g. in RRC regarding PUR periodicity, companies are asked to provide input to P7 and PUR periodicity in general, and possible suggestion for full value range:

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| **Company** | **Is P7 agreeable?** | **Comments (e.g. alternatives, how alternative would work, etc)** |
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| **Company** | **Suggestion for exact value range, including min, max value and number of values.** |
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Conclusion and proposal(s) for PUR peridiodicity: TBD

### TA timer

The following proposal from Huawei/HiSilicon, ZTE/Sanechips and Sierra Wireless have been submitted on possible values for the TA timer:

* For both NB-IoT and eMTC, hsf is used as basic unit for TA timer and the value range is {hsf256 (about 43 minutes), hsf512, hsf1024, hsf2048, hsf4096, hsf8192, hsf16384 (about 46.6 hours), spare} [8] (Huawei)
* It’s suggested that the value of pur-TimingAlignmentTimer can use the unit of PUR Period.[13]
* eNB should configure a D-PUR TA timer length to ensure that at least one D-PUR occasion occurs while the D-PUR TA timer is running.[23] (ASUSTeK)

Common assumption behind the proposals above is that TA timer value should at least allow one D-PUR occasion before TA is declared invalid. It should be noted that RAN2 has not yet agreed on exact starting location of the TA timer and based on the common assumption also PUR periodicity should be agreed first, therefore the proposal is to postpone the discussion until these aspects are agreed.

1. If eNB configures PUR, there should be at least one PUR opportunity before TA expiration.
2. TA timer range and values are discussed further and agreed once TA timer start location and PUR periodicity have been agreed.

Offline discussion

No progress on TA time value range was achieved during the online discussion, and companies are asked to provide input on TA Timer value range, if possible.

As indicated above, the exact conclusion may depend on the possible PUR periodicity and the exact time when TA timer would be started:

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| **Company** | **Comments on TA timer and value range** |
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Conclusion and proposal(s) for TA timer: TBD

### Time offset

For PUR time offset THALES, Huawei/HiSilicon, ZTE/Sanechips and Sierra Wireless have provided the following proposals:

* The UE may include a time offset for its PUR configuration into its request.[1] (THALES)
* The requested PUR timing offset shall be in the same range as the periodicity range.[1] (THALES)
* The eNodeB may provide in its PUR configuration a time offset.[1] (THALES)
* The configurable PUR timing offset shall be at least in the range of 1 to 2 times the periodicity range.[1] (THALES)
* For both NB-IoT and eMTC, a 2-level start offset is introduced for PUR:
  + Level 1: startHSF: {hsf128 (about 22 minutes), hsf256, hsf512, hsf1024, hsf2048, hsf4096, hsf8192 (about 23.3 hours), spare}
  + Level 2: startSubframe: INTEGER(0..2559), value is in number of sub-frames by step of (PUR periodicity / 2560). [8] (Huawei)
* The value range of requestedTimeOffset should be the same as that of the requestedPeriodicity, and it should not be described strictly at subframe level (e.g. the field description can be a little flexible and leave some space for eNB scheduling).[14] (ZTE)
* The value range of pur-TimeOffset should be the same as that of the requestedPeriodicity, and it should be described strictly at subframe level(e.g. start from which subframe).[14] (ZTE)
* PUR offset requests should be a limited range from a value of from HSFN127.[21] (Sierra)

First and third proposal above have already been agreed, i.e. time offset can be included in PUR configuration request and in PUR configuration [26]:

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| * PUR configuration request may contain a time offset request, i.e. requested time of the first PUR transmission. *Details FFS.* * PUR configuration may contain a time offset, i.e. time of the first PUR transmission. *Details FFS.* |

All proposals from companies indicate the range of the time offset should be (at least) the PUR periodicity. Whether smaller granularity than e.g. HSFN is needed or whether e.g. 2-level structure should be adopted can be discussed further. Therefore:

1. The PUR time offset has the same range as PUR periodicity.
2. [FFS] RAN2 to discuss the granularity of PUR time offset.

Offline discussion

P9 was briefly discussed online, but no agreement was reached. Companies are asked to provide input on P9 and P10, i.e. on possible range for PUR time offset and granularity or other suggested design principles:

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| **Company** | **Is P9 agreeable?** | **Comments (e.g. alternative suggestions)** |
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| **Company** | **Comments on P10 on granularity of PUR time offset, other related comments** |
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Conclusion and proposal(s) for time offset: TBD

### PUR response timer

The following have been proposed on PUR response timer/window by Huawei/HiSilicon, ZTE/Sanechips and Sierra Wireless. One proposal from LG Electronics relates to handling application layer response:

* The value range for PUR response timer in NB-IoT is {pp1, pp2, pp3, pp4, pp8, pp16, pp32, pp64} with upper boundary 10.24s [8] (Huawei)
* The value range for PUR response timer in eMTC is {sf240, sf480, sf960, sf1920, sf3840, sf5760, sf7680, sf10240} [8] (Huawei)
* The pur-ResponseWindowSize can use the same value range as that for the mac-ContentionResolutionTimer.[14] (ZTE)
* RAN2 is kindly asked to discuss whether the application layer response for D-PUR transmission will be considered in the D-PUR design.[17] (LGE)
* Enable configurable PUR response search space windows of 10ms to 2.56s[21] (Sierra)
* Enable the use of CDRX during the PUR SS window.[21] (Sierra)

Proposals from Huawei and ZTE suggest to use same value ranges as for *mac-ContentionResolutionTimer* for EDT. Sierra proposes somewhat shorter time range. As PUR procedures follow those of EDT, the following is proposed as way forward:

1. For NB-IoT: The value range for PUR response timer is same as in EDT (FDD): {pp1, pp2, pp3, pp4, pp8, pp16, pp32, pp64} with upper boundary 10.24s
2. For eMTC: The value range for PUR response timer is same as in EDT: {sf240, sf480, sf960, sf1920, sf3840, sf5760, sf7680, sf10240}.

LGE proposes for RAN2 to discuss whether application layer response is taken into account in PUR design. This discussion seems to be similar as RAN2 has had for EDT and contention resolution timer, i.e., PUR response timer should cover at least some cases, thus no proposal is made in this summary.

The last proposal on whether connected mode DRX should be used is likely contentious based on earlier discussion on similar features (e.g. EDT), and is not necessary to make Rel-16 PUR work. This discussion can be postponed:

1. [Postpone] RAN2 to discuss whether C-DRX should be used within PUR response window.

Offline discussion

The value ranges were briefly discussed online, some comments were received and it was decided to continue offline. Therefore, companies are asked to provide ranges for the timers and any other comments for both eMTC and NB-IoT:

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| **Company** | **Suggestions on PUR response timer / PUR SS window for NB-IoT** |
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| **Company** | **Suggestions on PUR response timer / PUR SS window for eMTC** |
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| **Company** | **Other comments (e.g. related to P13)** |
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Conclusion and proposal(s) for PUR response timer: TBD

### Number of grant occasions

The following issue is brought up in only one tdoc (ZTE/Sanechips):

* The number of PUR grant occasions in D-PUR request can be two values: one-shot or infinity.[14]

The following working assumption has been made earlier:

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| * Working assumption: Counter for D-PUR occasions, i.e., “n”, is not introduced and “indefinite” or “one-shot” are the only possible configurations. |

It should be possible for the UE to indicate whether it wants only one PUR occasion, according to an agreement:

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| * D-PUR request includes number of PUR grant occasions requested with possibility to request infinite. FFS other values. |

The working assumption considers configuration and the possible values which can be requested by the UE have not been agreed yet, therefore it seems necessary to discuss what values can be requested by the UE:

1. [FFS] RAN2 to discuss and agree the values for number of PUR grant occasions which can be requested by the UE.

Offline discussion

Companies are asked to provide views on P14 on number of PUR grant occasions which UE can explicitly request in PUR configuration request:

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| **Company** | **Suggestion for values** | **Comments** |
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Conclusion and proposal(s) for number of grant occasions in PUR request: TBD

## Proposals initially marked [ASN.1/CR]

The following proposals and discussions were initially tagged with [ASN.1/CR], i.e. to be discussed further when discussing the running CRs:

* Adopt the TP given in section 2.1 for RRC running CR section 5.3.3.3x.[9] (Qualcomm)
* Running CR on 36.331 should be updated as proposed in Annex regarding the condition of the PUR configuration request procedure.[16] (LGE)

First proposal relates to fallback indication handling, and proposal is to discuss this jointly including interactions between MAC and RRC:

1. [ASN.1/CR] RAN2 to discuss details of L1 fallback indication handling jointly in context with MAC and RRC specs.

The second proposal proposes to update reference to size of MAC PDU in PUR configuration request conditions to expected size of MAC PDU.

1. [ASN.1/CR] Update reference to MAC PDU size to expected MAC PDU size in conditions for initiating PUR configuration request.

The following proposal from Huawei/HiSilicon is about which parameters should support delta configuration:

* PHY parameters are grouped and delta configuration is supported for the group instead of individual PHY parameter. [8] (Huawei)

This can be discussed further together with the running CRs:

1. [ASN.1/CR] PHY parameters are grouped and delta configuration is supported for the group
2. [ASN.1/CR] FFS whether other PUR parameters can be grouped and details of delta signaling.

The following proposals from Huawei/HiSilicon and ZTE/Sanechips related to ASN.1 and PUR configuration:

* Capture parameters highlighted in yellow in the above tables in PUR-Config(-NB)-r16 for NB-IoT and eMTC. [8] (Huawei)
* Remove pur-TBS-r16 in NB-IoT RRC running CR. [8] (Huawei)
* newUE-Identity-r16 should be Cond PUR.[14] (ZTE)

1. [ASN.1/CR] Capture remaining parameters from RAN1 parameter list in PUR-config(-NB) in running TS 36.331 CRs
2. [ASN.1/CR] Remove pur-TBS-r16 in NB-IoT RRC running CR.
3. [ASN.1/CR] newUE-Identity-r16 should be Cond PUR.

In the following, companies may provide comments regarding above proposals e.g. if further discussions are needed before discussing these in context of running CRs:

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| **Company** | **Comments** |
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Summary of comments: TBD

## Proposals initially marked [Postpone]

Following proposals have initially been assigned for possible postponing:

* RAN2 analyze the security aspects of RRC signaling related to D-PUR configuration for CP solution. [4] (Nokia)
* RAN2 is kindly asked to discuss NAS-level D-PUR configuration request.[18] (LGE)
* RAN2 is kindly asked to discuss whether D-PUR can be used to send a paging response message.[19] (LGE)
* RAN2 is kindly asked to discuss shared preconfigured uplink resource transmission in RAN2 aspects.[20] (LGE)

1. [Postpone] RAN2 to analyze the security aspects of RRC signaling related to D-PUR configuration for CP solution.
2. [Postpone] RAN2 to discuss whether NAS-level D-PUR configuration request is supported.
3. [Postpone] RAN2 to discuss whether D-PUR can be used to send a paging response message.
4. [Postpone] RAN2 to discuss aspects of shared preconfigured uplink resource transmission.

In the following, companies may provide comments regarding above if needed:

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| **Company** | **Comments** |
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Summary of comments: TBD

# Summary

Summary TBD based on rapporteur proposals after company input

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