3GPP TSG-RAN WG2 Meeting #119 electronic R2-220xxxx

Online, August 17 – August 26, 2022

Source: MediaTek Inc.

**Title: Report of [Post119-e][043][ePowSav] paging early indication with paging subgrouping during emergency call**

Agenda Item: 6.9.2

Document for: Discussion and decision

# Introduction

This document is for the following post meeting – long email discussion:

* [Post119-e][043][ePowSav] paging early indication with paging subgrouping during emergency call (MediaTek)

Scope: Determine whether there are issues that need resolution, and if so, determine ways forward. Pave the way for agreements at next meeting

Intended outcome: Report

Deadline: long

which is motivated by the **Proposal 4** in the report of **[AT119-e][004][ePowSav] Subgrouping and PEI (MediaTek)** (see also rapporteur summary for Q4 in the report [R2-2209018](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119-e/Inbox/R2-2209018.zip))

Rapporteur reminds that legacy power saving is discussed only for the consensus and unified view consolidation, we do not intend to discuss further RAN2 impact for legacy techniques since they are not in the scope of this discussion.

Deadline: September 28th, 23:59 UTC

# Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

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# Discussion

## Legacy power saving techniques

### extended DRX

CT1 has discussed a scenario when an eDRX parameter had been negotiated between the UE and the network and after that a PDN connection for emergency bearer services is established. If the UE and the network will use the negotiated eDRX value then the MT paging for connection re-establishment might be delayed. [1]

According to current CT1 specification as quoted below, it has been clarified that UE shall not use eDRX if any emergency PDU session existed. And it also clarified that the UE and the network may still negotiate eDRX parameters during a registration procedure when the UE has an emergency PDU session. It could be the situation when the UE cannot know a MT call is for emergency service.

TS 24.501 v17.7.1 subclause 5.3.16:

The UE may request the use of eDRX cycle during a registration procedure by including the Requested extended DRX parameters IE (see 3GPP TS 23.501 [8] and 3GPP TS 23.502 [9]). The UE shall not request the use of eDRX during a registration procedure for emergency services. The UE may use the extended idle mode DRX cycle length stored in the USIM (see 3GPP TS 31.102 [22]) when requesting the use of eDRX.

The UE and the network may negotiate eDRX parameters during a registration procedure when the UE has an emergency PDU session.

The network accepts the request to use the eDRX by providing the Negotiated extended DRX parameters IE when accepting the registration procedure. The UE shall use eDRX only if it received the Negotiated extended DRX parameters IE during the last registration procedure and the UE does not have an emergency PDU session.

NOTE: If the UE wants to keep using eDRX, the UE includes the Extended DRX parameters IE in each registration procedure.

If the UE received the Negotiated extended DRX parameters IE during the last registration procedure, upon successful completion of the PDU session release procedure of the emergency PDU session, the UE shall resume eDRX.

If the network has provided the Negotiated extended DRX parameters IE during the last registration procedure, upon successful completion of the PDU session release procedure of the emergency PDU session, the network shall resume eDRX.

In RAN2 specification [2], there are no requirements to stop eDRX for established emergency PDU session in RRC INACTIVE case, but only the activation (eDRX operation) conditions are stated.

1. **An extended DRX cycle slows emergency procedure down and impacts lifesaving matters therefore eDRX shall not be used when a UE has an emergency PDU session no matter being achieved either by the network configuration, or up to UE implementation.**

### WUS / Group WUS

Similar requirements are also introduced for WUS/GWUS as quoted below, **the objective to be not used is not the WUS/GWUS, but the WUS assistance information**.

TS 24.501 v17.7.1 subclause 5.3.24:

A UE supporting reception of WUS assistance information indicates its capability for reception of WUS assistance information during registration procedure (see 3GPP TS 23.501 [8]). The UE supporting WUS assistance information may include its UE paging probability information in the Requested WUS assistance information IE in the REGISTRATION REQUEST message (see 3GPP TS 23.501 [8]). The UE shall not include its UE paging probability information during a registration procedure when the UE has an active emergency PDU session.

The UE and the network may negotiate the UE paging probability information during a registration procedure when the UE does not have an emergency PDU session. The UE paging probability information is an assistance information used to determine the WUS group for paging UE (see 3GPP TS 23.501 [8], 3GPP TS 36.300 [25B]).

**……(skipped)……**

When an emergency PDU session is successfully established after the UE received the Negotiated WUS assistance information IE during the last registration procedure, the UE and the AMF shall not use WUS assistance information until:

- the successful completion of the PDU session release procedure of the emergency PDU session;

- the UE receives WUS assistance information during a registration procedure with PDU session status IE or upon successful completion of a service request procedure, if the UE or the network locally releases the emergency PDU session; or

- the successful completion of the handover of the emergency PDU session to non-3GPP access.

In RAN2 specification [3], there are no requirements to stop WUS/GWUS for established emergency PDU session in RRC IDLE case, but only the activation (WUS/GWUS operation) conditions go with a ‘last used cell’ applicability condition are stated.

However, the WUS/GWUS technique does not prolong the paging cycle except for the grouping mechanism may introduce additional latency, which is comparatively trivial to the extended DRX, and the paging probability in the WUS assistance information is just an optional configuration for determining the WUS group.

1. **Even a UE has an emergency PDU session and WUS assistance information is not available, the UE could still use WUS/GWUS if conditions specified in TS 36.304 subclause 7.5.1 are met.**

**Q1: Do you agree the Observation 1 and 2? If NO, please specify the reason. Or share your view.**

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| **Company** | **Yes or No** | **Comments** |
| Xiaomi | Yes | Seems true according to TS 24.501.  Is that mean we also want to change TS 36.304? |
| Qualcomm | Yes |  |
| vivo | Yes | We just wonder why introducing the limitation for WUS assistance information in TS 24.501, since it could be observed that the limitation could not help to reduce the latency of emergency PDU sessions. And just as the rapporteur said, the delay of grouping is trivial and could be acceptable in our understanding. |
| OPPO | Yes |  |
| Ericsson | No | About O2:   * We think that this is more like an opinion then an observation * The NAS spec says that the UE and NW shall not use WUS during an emergency * While the AS spec does not say anything about an emergency. But if the NW does not use WUS and the UE monitors WUS it would not work, i.e. we assume that the UE does not use WUS during an emergency.   About WUS during an emergency:   * We have not been able to find out the motivation why in LTE WUS is not allowed during an emergency, i.e. reliability, latency, capability issue, …It would be good if this is understood better to guide our discussions * The UE and NW have to agree on whether WUS is used or not, and we wonder if there could be any timing issues when WUS is temporarily disabled? * I never made an emergency call in my life, i.e. power saving during an emergency is not going to give any significant power savings. When it is a really bad day: emergency call and low battery, then WUS is not going to save the day. * The latency introduced by eDRX is significant, but latency introduced by PEI is not. |
| Huawei, HiSilicon | See Comment | In general, we think that  1) There is no MT Emergency call in real world. All the emergency calls are MO calls made to the landline as most of the emergency numbers in different countries are land line numbers. Even if there is a call back facility that Public Safety Answering Point (PSAP) in US can call back the user who placed an emergency call (callback), this call will be a normal mobile terminated call.  2) Even if MT Emergency call exists, gNB and UE cannot know it in advance  Hence, we think that we need not change anything in the RAN 2 specs and let the UE follow the usual behavior as the latency introduced by PEI cannot be reduced. |
| CATT | Yes |  |
| MediaTek | Yes | For eDRX, since the essential (negotiated) configurations are from NAS and the whole framework functions across NAS and AS so that UE will not use it even there is nothing restricted for emergency service specified in RAN2 spec.  For WUS, we learnt the following statement from TS 23.401 clause 5.3.2.1:  The UE may include UE paging probability information if it supports the assignment of WUS Assistance Information from the MME to assist the eNodeB's Wake-Up Signal (WUS) group decision (see TS 36.300 [5]).  We also did not find corresponding RAN2 spec. change after SA2 LS (for WUS, R2-2000088) was noted in the A.I. NB-IoT of RAN2#109-e. To some extent, the WUS/GWUS framework is decoupled between NAS and AS, so we tend to agree that UE can still use WUS/GWUS if it is allowed by current RAN2 specification. |
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**Summary for offline discussion**

(TBD)

## PEI and subgrouping

CN and RAN interworking

Back to Rel-17 PEI and subgrouping, we also had very similar requirements as quoted below because SA2 policy is respected in CT1 specification. **The objectives to be not used are the NR-PSSI bit and the Requested PEIPS assistance information IE**.

TS 24.501 v17.7.1 subclause 5.3.25:

A UE may indicate its capability to support NR paging subgrouping during registration procedure when the UE:

- initiates a registration procedure with 5GS registration type IE not set to "emergency registration"; and

- does not have an active emergency PDU session.

**……(skipped)……**

When an emergency PDU session is successfully established over 3GPP access after the UE received the Negotiated PEIPS assistance information IE during the last registration procedure, the UE and the AMF shall not use PEIPS assistance information until:

- the successful completion of the PDU session release procedure of the emergency PDU;

- the UE receives PEIPS assistance information during a registration procedure with PDU session status IE or upon successful completion of a service request procedure, if the UE or the network locally releases the emergency PDU session;

- the successful completion of handover of emergency PDU session to non-3GPP access; or

- the successful transfer of the emergency PDU session in 5GS to the EPS or ePDG connected to EPC.

According to TS 24.501 v17.7.1 subclause 9.11.3.80, there are two IEs in the PEIPS assistance information, the (CN) Paging subgroup ID and the UE paging probability information. Both are not the necessary configurations for PEI reception and for determining UE ID based subgroupID as specified in TS 38.304, and it indicates that CN assigned subgrouping is not used.

There are two scenarios during emergency related procedures we need to inspect:

Scenario 1: UE does not indicate its CN subgrouping capability and PEIPS assistance information during registration procedure

Scenario 2: UE already received the Negotiated PEIPS assistance information IE (before the emergency PDU session is established).

For the Scenario 1, by the agreements in RAN2#115e and current RAN2 specification, at least for UE ID based subgrouping method, the total number and the *subgroupsNumForUEID* of supported subgroups is controlled on a cell basis by RAN and broadcasted in System Information.

1. **Even the AMF does not send PEIPS assistance information, and CN assigned subgrouping is not used in the beginning, it does not stop the RAN from using PEI and UE ID based subgrouping.**

**Q2: Do you agree the Observation 3? If NO, please specify the reason. Or share your view.**

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| **Company** | **Yes or No** | **Comments** |
| Xiaomi | Yes | Using PEI based on UE-id based subgrouping is independent of the AMF.  A question:  the UE and the AMF shall not use PEIPS assistance information until:  the UE receives PEIPS assistance information during a registration procedure with PDU session status IE or upon successful completion of a service request procedure, if the UE or the network locally releases the emergency PDU session;  If NW locally release the emergency PDU session, I guess this will not notify UE. How the UE knows not to use PEI? Then if NW not using the PEI while UE does, the UE will miss the paging.  However, if UE not using the PEI while NW does, the UE will not miss the paging. Seems no huge problem. |
| Qualcomm | Yes |  |
| vivo | - | We want to clarify that observation3 is only valid for the case that the cell support both CN assigned subgrouping and UE\_ID based subgrouping. If the cell only supports the CN assigned subgrouping, then the UE will not use PEI if the AMF doesn’t send PEIPS assistance information.  Besides, we think the configuration for PEI-O from RAN node should ensure there is no impact to additional delay for paging when there is emergence PDU session. |
| OPPO | Yes |  |
| Futurewei | No. | What is stated in Observation 3 may be true based on the current RAN2 spec. But we question whether it is desirable to continue using PEI with UE ID based subgrouping during emergence call, for the following reason:  The use of PEI increases the average paging queuing delay by an amount roughly equal to the time interval between the PEI-O and the associated PO, e.g., 10, 30, or 50 msec, depending on whether the PEI-O is configured right after the 1st, 2nd, or 3rd SSB (i.e., when L=1, 2, or 3) before the associated PO, assuming the closest SSB is 10 msec ahead of the PO. This much of extra paging queuing delay may be unacceptable or at least undesirable for certain emergence PDU session.  In this case, maybe the use of PEI should be stopped entirely (not just the CN assigned subgrouping) for this UE until the emergency PDU session is successfully released or transferred. |
| Ericsson | See comment | Yes, but also see answers to Q1. |
| Huawei, HiSilicon | See  Comment | Yes, but see the response to Q1. |
| CATT | Yes |  |
| MediaTek | Yes |  |
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**Summary for offline discussion**

(TBD)

For the Scenario 2, according to subclause 7.3.2 of TS 38.304:

Paging with UE\_ID based subgrouping is used in the cell which supports UE\_ID based subgrouping, as described in clause 7.3.0.

If the UE is not configured with a CN assigned subgroup ID, or if the UE configured with a CN assigned subgroup ID is in a cell supporting only UE\_ID based subgrouping, the subgroup ID of the UE is determined by the formula below:

SubgroupID = (floor(UE\_ID/(N\*Ns)) mod subgroupsNumForUEID) + (subgroupsNumPerPO - subgroupsNumForUEID),

In rapporteur understanding that AMF can only update the latest decision (i.e. suspend/stop the CN assigned subgrouping usage) to RAN when CN sends paging notification to RAN. In UE side, the upper layer (NAS) shall notify the AS the CN subgrouping is no longer used and the most reasonable implementation is to behave like the CN assigned subgrouping is not configured (or even not supported). Then UE could still use UE ID based subgrouping if related conditions in TS 38.304 are met.

On the other hand, it seems unreasonable to have the serving cell updates its SIB to notify the UE that CN assigned subgrouping is no longer support so that additional latency is introduced for emergency service.

1. **UE NAS layer stops using CN assigned and notifies the same to the AS (up to UE implementation). UE could switch to use UE ID based subgrouping if related conditions specified in TS 38.304 are met. Also, UE could switch back to use CN assigned subgrouping if NAS layer notifies to resume the CN assigned subgrouping usage (up to UE implementation) after emergency PDU session is released, and related conditions specified in TS 38.304 are met.**

**Q3: Do you agree the Observation 4? If NO, please specify the reason. Or share your view.**

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| **Company** | **Yes or No** | **Comments** |
| Xiaomi | - | Question for observation4:  Seems it is all UE implementation.  Do we need to specify this? And what if a UE is not well implemented? How to test? |
| Qualcomm | - | In theory maybe what’s described in Observation 4 can be done. But the question is whether it is necessary. If companies agree to suspend the use of CN based subgrouping due to emergency service, then companies can discuss whether/how it can be done. |
| vivo | Yes, if observation 3 is agreeable | Just as TS 24.501 v17.7.1 subclause 5.3.25 said:  *“When an emergency PDU session is successfully established over 3GPP access after the UE received the Negotiated PEIPS assistance information IE during the last registration procedure, the UE and the AMF shall not use PEIPS assistance information until:”*  Hence when the emergency PDU session is successfully established over 3GPP access, the UE will stop using CN assigned subgroup, and the UE will go back to use UE\_ID based subgroup if the cell also supports UE\_ID based subgrouping. And the resume procedure of the CN assigned subgroup is similar.  The observation 4 is just a natural UE implementation of the procedure pointed in TS |
| OPPO | - | We want to clarify whether observation 4 is to address the issue of mismatch between UE AS and RAN on which subgrouping method to be used during emergency service.  Actually, we don’t see any difference for using CN based subgrouping and UE ID based subgrouping since they both work together with PEI and their impacts on latency for emergency service are the same. |
| Futurewei | No | For the same reason expressed in our response to Q2 (i.e., the use of PEI increases the average paging queuing delay, which may be unacceptable or at least undesirable for certain emergence PDU session), we think the use of PEI should be stopped entirely (not just the CN assigned subgrouping) for this UE until the emergency PDU session is successfully released or transferred. |
| Ericsson | No | It is not clear to us what problem we are trying to solve, i.e. a lot of things are possible. In our view the solution should be kept simple. |
| Huawei, HiSilicon | No | We don’t think this is needed for the reasons given in response to Q1. Furthermore we don’t see the difference/benefits for using one type of subgrouping over the other. |
| CATT | - | The intention of suspend the use of CN-assigned subgroup during emergency service is unclear to us. In addition, if CN has the requirement, observation 4 is UE/AMF implementation and no specification impact on TS 38.304, right? |
| MediaTek | Yes | It has been already specified in NAS specifications about CN assigned subgrouping shall be stopped during established emergency PDU session, and it affects the paging strategy determination in AMF. Then the CN assigned subgrouping usage could be resumed after emergency service is released. In this regard, it would be a problem if UE keeps using CN assigned subgrouping, but the network does not do the same for paging transmission during emergency service. |
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Service requirement aspects

From RAN2 point of view, PEI and subgrouping is a NR analogue of WUS/GWUS, they shared very similar technical concept. PEI and subgrouping also do not prolong the paging cycle except for a possible relatively low latency introduced by grouping mechanism. So, if the RAN decision is to use UE ID based subgrouping during an emergency PDU session, UE has no reason to refuse.

1. **As long as the conditions specified in TS 38.304 are met for PEI and UE ID based subgrouping, it means that RAN tends to send paging for emergency service by using PEI and UE ID based subgrouping, so UE has to use the same to avoid missing the paging.**

**Q4: Do you agree the Observation 5? If NO, please specify the reason. Or share your view.**

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| **Company** | **Yes or No** | **Comments** |
| Xiaomi | - | Then RAN’s behavior is not aligned with AMF. Does SA2 expect the RAN will not use PEI or WUS during an emergency PDU session? |
| Qualcomm | No | We do not think it is necessary to suspend the use of CN-assigned subgroup during emergency service, because it does not affect UE’s access latency. |
| vivo | Yes, if observation 3 is agreeable | In our understanding, the premise of UE going back to use UE\_ID based subgrouping from CN assigned subgrouping is that the UE and the network have successfully established the emergency PDU session. Hence both the UE and the network know the UE will stop using CN assigned subgroup. And after the emergence PDU session establish procedure, RAN will send paging no matter for normal service or emergency service using PEI and UE ID based subgrouping. |
| OPPO | - | See our comments to observation 4. We are not sure what is the intention to differentiate the two subgrouping methods as subgrouping as such does not introduce any latency to paging. Or was the intention to stop using PEI for emergency PDU session? |
| Futurewei | No | What is stated in Observation 5 may be true based on the current RAN2 spec. But for the same reason expressed in our response to Q2, we think the use of PEI should be stopped entirely (not just the CN assigned subgrouping) for this UE until the emergency PDU session is successfully released or transferred. |
| Huawei, HiSilicon | - | We think that we need not change anything in the RAN 2 specs and let the UE follow the usual behavior as the latency introduced by PEI cannot be further reduced for so called “MT emergency call” as it cannot be identified by the UE or the gNB due the reasons described in response to Q1. |
| CATT | - | Same as comments to observation 4, the intention is unclear. Furthermore, it is up to UE /AMF implementation and no impact on TS38.304. |
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**Summary for Offline discussion**

(TBD)

Others

**Q5: You could specify if any aspect uncovered in this discussion, or any cross WG action is needed for some reasons.**

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| **Company** | **Comments** |
| Futurewei | When an emergency PDU session is established for a UE, the AMF should inform RAN to suspend/stop the use of PEI entirely (not just the CN assigned subgrouping) on this UE until the emergency PDU session is successfully released or transferred, for the same reason expressed in our response to Q2. And, the UE’s NAS layer should inform the UE’s AS layer to do the same, via UE implementation. |
| Ericsson | The discussion was focused on PEI during an emergency. But we assume that eDRX should also not be used during an emergency, i.e. we should also conclude on that. Furthermore for eDRX we seem to say that it does not impact AS specification, i.e. why would/should there be impact on AS specification for PEI then? |
| MediaTek | We support to consolidate an unified/aligned RAN2 policy for emergency service, just like the SA2 policy we mentioned is always applied regardless of the target power saving techniques. And keep the RAN2 solution as simple as possible. |
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**Summary for Offline discussion**

(TBD)

# Conclusion

(TBD)

# Reference

1. S2-153757 Clarification on using eDRX in case of emergency bearer services
2. TS 38.304
3. TS 36.304