3GPP TSG-RAN WG2 Meeting #116bis electronic R2-2201785

Online, January 17 – 25, 2022

Agenda Item: 8.9.2.1

Source: MediaTek Inc.

**Title: Summary of [Post116bis-e][080][ePowSav] Open Issues (Mediatek)**

Document for: Discussion and decision

# Introduction

This document is to summarize the following offline discussion:

|  |
| --- |
| * [Post116bis-e][080][ePowSav] Open Issues (Mediatek)

 Scope: Determine if Company input by Pre117-e discussions shall be used, and how many / which Pre-discussions shall be done. Capture Open Issues not captured in the CR email discussions and suggest how to treat. [After finalization, Merge open issues from other discussions into a WI OI list (OI for which company input is invited in some way shall be listed in the WI-list).  Intended outcome: Open Issues list, and organization of Pre117-e Company input discussions for the WI.  Deadline: Short (Jan 28 0800 UTC) |

NOTE: Each open issue should be associated with suggested treatment/handling.

1.       Company input into Pre117-e-offline (i.e. no company tdocs)

2.       Company tdocs invited.

3.       CR rapporteur handled issue (CR rapporteur will propose resolution as input to next meeting).

4.       Other, e.g. immature area, reference to dependency, unclear status etc.

NOTE: Some open issues may overlap with the discussions for running CRs. The WI rapporteur will merge the open issues into one list in the end.

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|  |  |
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# Discussion

## General open issue list

1. **PEI and Subgrouping**

OI 1.1 [Pre117-e-offline] How to indicate whether UE monitor PEI in last used cell or any other cells?

OI 1.2 [Pre117-e-offline]: Identify valid cases where UE is unable to monitor subgroup PEI configured by network. Then decide if there can be any rule for subgroup PEI monitoring, or UE simply monitor paging as per legacy.

OI 1.3 [CR rapporteur] How to capture the agreement about subgroup ID for UEID-based subgrouping in RAN2 TS

* UE belongs to k-th paging subgroup, where k = [floor (UE Identity/(N\*Ns)) mod Nsg-UEID] + Nsg-CN,

**Q1: Do you agree with the open issue list and suggested handling for PEI/subgrouping?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | 1.1 | 1.2 | 1.3 | Comments |
| Nokia | **Yes** | **Yes** | **Yes** | **If any impact for eDRX was left FFS, could be addd** |
| OPPO | **Yes** | **Yes** | **Yes** |  |
| CATT | **Yes** | **Yes** | **Yes** | Although 1.3 seems correctly addressed in current running 38.304 CR.Moreover, we would like to add another OI:At the moment, we have two configurations with same PHY behaviour in decoding DCI format 2\_7 (aka PEI):1) subgroupConfig is not configured2) subgroupConfig is configured with subgroupNumPerPO = 1In both cases, RAN1 considers K=1 in their formula which results in UE only using PEI for monitoring its PO.It is still unclear to us:- what is Companies intention in differentiating UE behaviour for 1) and 2)- which WG should discuss this, RAN1 or RAN2, since if different behaviours are expected, it will impact RAN1 formula?  |
| Huawei, HiSilicon | **Yes** | **Yes** | **Yes** | * Regarding OI1.3 we think that it is correctly addressed in current running 38.304 CR.
* Please add new OI1.X Company tdocs invited related to the gNB not being able to support CN controlled subgrouping within the RNA

For the case where the PEI mechanism is not restricted to a single cell, we think that there might be scenarios that certain gNB within a RNA does not support CN controlled subgrouping. How to handle such scenarios and how to avoid paging detection problems needs further discussion and might have cross group (RAN2 and RAN3) impacts as this relates to whether or not the last serving gNB is able to transfer CN subgrouping related information for RAN paging Since this discussion will involve both RAN 2 and RAN 3 hence we think it should be handled through Company tdocs invited |
| Xiaomi | **No** | **?** | **Yes** | For 1.1: We think the first question we need to discuss is who will be the node for configure this? CN or the gNB?Some people mentioned the gNB. But if UE gets the configuration from gNB, then when the UE reselect to another cell, it need to get the updated indication from the new cell?If the CN can be the node since it knows UE’s paging probability and stationary state, then CN can indicate to UE belonging to this group not to use the PEI during moving across the cells of a TA. And this may impact the CT1 and RAN3. So we think it should be handled through Company tdocs invited since it has been a bit difficult to conclude.For 1.2: Do you mean the invalid PEI monitoring occasions? Is this should be discussed in RAN1? |
| ZTE | **Yes** | **Yes** | **Yes** |  |

**Summary**

Based on companies’ inputs, rapporteur suggests that:

* OI 1.1 and 1.2 are included in the list. OI 1.1 is kept Pre117-e-offline since we’d like to see companies’ clear preferences before the meeting.
* OI 1.3 can be removed since it has been properly captured in the TS 38.304 running CR
* Add OIs for (1) clarification for PHY behaviour in decoding DCI format 2\_7 when K=1, and (2) gNB not being able to support CN controlled subgrouping within the RNA, both requires company tdocs.
1. **TRS/CSI-RS for Idle/inactive UE**

OI 2.1 [Pre117-e-offline] Whether / how to address the delay required for updating a TRS/CSI-RS configuration due to the eDRX acquisition period (1024 H-SFN)

OI 2.2 [Pre117-e-offline] A UE which acquired SIB-X with a TRS/CSI-RS configuration but didn’t yet receive an associated L1-based availability indication considers the configured TRS/CSI-RS as [FFS: “unavailable” or “available”]

**Q2: Do you agree with the open issue list and suggested handling for TRS/CSI-RS for Idle/inactive UE?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | 2.1 | 2.2 | Comments |
| Nokia | **Yes** | **Yes** |  |
| OPPO | **Yes** | **Yes** |  |
| CATT | **Yes** | **Yes** |  |
| Huawei, HiSilicon | **Yes** | **Yes** |  |
| Xiaomi | **Yes** | **Yes** |  |
| ZTE | **Yes** | **Yes** |  |

Summary

Based on companies’ inputs, rapporteur suggests that:

* OI 2.1 and 2.2 are included in the list. The support of eDRX for TRS/CSI-RS can also be confirmed with Pre-117-e-offline.
1. **RLM/BFD Relaxation**

OI 3.1 [CR rapporteur] How to capture criteria for RLM/BFD relaxation, and the corresponding evaluation procedures, in RAN2 TS

* This is related to RAN2/RAN4 spec split. RAN2 assumes criteria for RLM/BFD relaxation

OI 3.2 [Pre117-e-offline] Can UE start/stop RLM/BFD relaxation by itself if it meets/fails the relaxation criteria?

OI 3.3 [Pre117-e-offline] Should UE report fulfilment or not (entry/exit) to network for RLM/BFD relaxation?

**Q3: Do you agree with the open issue list and suggested handling for RLM/BFD Relaxation?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | 3.1 | 3.2 | 3.3 | Comments |
| Nokia | **Yes** | **Yes** | **Yes**  | Propose to add: OI 3.4 [Pre117-e-offline] Should NW be able to enable/disable RLM/BFD relaxation with explicit indication irrespective if the RLM/BFD relaxation criteria is configured or not? |
| OPPO | **Yes** | **Yes** | **Yes** |  |
| CATT | **Yes** | **Yes** | **Yes** |  |
| Huawei, HiSilicon | **Yes** | **Yes** | **Yes** |  |
| Xiaomi | **Yes** | **Yes** | **Yes** |  |
| ZTE | **Yes** | **Yes** | **Yes** |  |

Summary

Based on companies’ inputs, rapporteur suggests that:

* OI 3.1 is not included, since many details require RAN4 input. We capture the OIs from TS 38.331 running CR discussion instead.
* OI 3.2 to 3.3 is included in the OI list
* Add an OI “[Pre117-e-offline] Should NW be able to enable/disable RLM/BFD relaxation with explicit indication irrespective if the RLM/BFD relaxation criteria is configured or not?”
1. **PDCCH Skip**

OI 4.1 [Other] In case UE cannot monitor DCP due to PDCCH skipping, whether a) Physical layer of UE reports a value of 1 for Wake-up indication bit to higher layer or b) Physical layer of UE does not report Wake-up indication bit to higher layer.

* Will send LS to RAN1, depending on RAN1 decision

**Q4: Do you agree with the open issue list and suggested handling for PDCCH skip?**

|  |  |  |
| --- | --- | --- |
| Company | 4.1 | Comments |
| Nokia | **Yes** | **Q4 from the email discussion was postponed to next meeting, “Q4. Do companies agree that UE ignores PDCCH skipping (i.e. PDCCH skipping is cancelled) while UL HARQ reTx timer is running?”, propose to add it to the list** |
| OPPO | **Yes** |  |
| CATT | **Yes** |  |
| Huawei, HiSilicon | **Yes** |  |
| Xiaomi | **Yes** |  |
| ZTE | **Yes** | **To our understanding , this discussion maybe in CR stage since RAN1 would** |

Summary

Based on companies’ inputs, rapporteur suggests that:

* OI 4.1 is included in the OI list
* Add OI 4.2: [Company tdocs invited] Should UE ignore PDCCH skipping (i.e., PDCCH skipping is cancelled) while UL HARQ reTx timer is running?”
1. **UE capabilities**

OI 5.1 [CR rapporteur] How to capture UE AS capabilities for PEI/subgrouping in RAN2 TS?

OI 5.2 [Pre117-e-offline] UE AS capabilities for RLM/BFD relaxation

OI 5.3 [CR rapporteur] How to capture PDCCH monitoring adaptation capabilities in RAN2 TS?

**Q5: Do you agree with the open issue list and suggested handling for UE capabilities for ePowSav topics?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | 5.1 | 5.2 | 5.3 | Comments |
| Intel | **Y** | **Y** | **N** | For 5.1, we are just wondering whether it can be part of [Pre117-e-offline] since the open issues is quite clear (See offline 058 report (R2-2201910) or pre meeting summary 008 (R2-2201681)):FFS on whether the paging enhancement capability indicates support of PEI and subgrouping (as like R1 29-1) or should be split into 2 separate capabilities where one is for PEI support and another for subgrouping support.FFS if the paging enhancement capability indicates support of PEI and subgrouping (as like R1 29-1), whether the UE supporting the paging enhancement capability always indicate the support of UEID based subgrouping or indicate support of either CN assigned subgrouping or UEID based subgrouping or both.For 5.3, it is assumed that the UE cap for PDCCH monitoring adaptation capabilities are purely RAN1 features, hence 5.3 will be handled by mega CR. We have an agreement below:* [058] For UE capabilities of PDCCH monitoring adaptation, implement it as part of the UE capability rapporteur mega CRs from the R1 feature list

New OIIn addition, looking at the pre meeting summary 008, there is another open issue on whether the TRS/CSI-RS occasion support in Idle and inactive mode should be known to the gNB. Please add the following new OI to UE capabilities:OI5.4: For TRS/CSI-RS occasion support in Idle and inactive mode, should gNB need to know UE support it?We also think OI5.4 can be discussed as part of [Pre117-e-offline] |
| Nokia | **comment** | **Yes** | **Yes** | Agree with Intel more discussion is needed on paging enhancement capabilities. It could also be categories as Company tdocs invited since it has been a bit difficult to conclude. |
| OPPO | **No** | **Yes** | **Yes** | For 5.1, it should be handled in Pre117-e-offline since we have not reached conclusion on whether to introduce a combined UE capability or separate UE capabilities for PEI and subgrouping. |
| CATT | **comment** | **Yes** | **No** | We agree with Intel and OPPO that 5.1 should be discussed in Pre117-e-offline and 5.3 would be handled in mega CR.  |
| Huawei, HiSilicon | **Yes** | **Yes** | **Yes** |  |
| Xiaomi | **No** | **Yes** | **Yes** | Agree with Intel more discussion is needed so can be treated as Company tdocs invited . |
| ZTE | **No** | **Yes** | **Yes** | Agree with Nokia on the first issue, the OI5.1 cannot be concluded we suggest this shall be Company tdocs invited.  |

Summary

Based on companies’ inputs, rapporteur suggests that:

* OI 5.1 be considered as Pre117-e-offline.
* OI 5.2 and 5.3 are included in the OI list.
* Add an OI about TRS/CSI-RS capability

## Input from running CR discussions

We also have inputs from running CR discussions. The lists are copied below.

**From [Post116bis-e][065][ePowSav] 38304 Running CR (vivo):**

1. **PEI/Subgrouping**

|  |  |  |  |
| --- | --- | --- | --- |
| **OI Index** | **Open issue** | **Rapporteur comment** | **OI Type** |
| **1-1** | How to configure whether UE monitors PEI in the last used cell or any other cell |  | Type 1 |
| **1-2** | RAN2 assumes that PEI can be used “without” subgrouping. FFS whether the bits in the PEI for subgrouping then need to have any particular meaning, or whether this would be done by just having one subgroup. |  | Type 1 |
| **1-3** | For the cases when UE cannot determine its subgroup based on the configuration of a cell, or cannot find the corresponding bit for its subgroup in the PEI, e.g. UE only supports UEID-based and the cell only supports CN-assigned, FFS whether these cases are valid, how to determine UE subgrouping, or how to monitor paging for these cases. |  | Type 2 or Type 1? |
| **1-4** | As a baseline RAN2 has a preference to support PEI with both DRX and eDRX, but potential issues (e.g. PEI and PTW) are FFS. |  | Type 2 |
| **1-5** | FFS on the detailed NAS signalling between AMF and UE for CN assigned subgrouping.  | The design and procedure are up to SA2/CT1. | Type 2 |
| **1-6** | When AMF has assigned a UE with a Paging subgroup, some signaling should be supported between AMF and gNB(s) to inform gNB(s) about the related subgroup information for paging a UE in RRC\_IDLE/RRC\_INACTIVE. Exact information is FFS. The message(s) and associated design are up to RAN3. | The design and procedure are up to RAN3 | Type 2[Rapp]: any impact on TS 38.304 |
| **1-7** | It is FFS when a UE in RRC\_INACTIVE has been assigned by CN a Paging subgroup, whether some signaling should be introduced between gNBs to inform each other about the UE’s subgroup for RAN paging. | The design and procedure are up to RAN3 | Type 2[Rapp]: any impact on TS 38.304 |
| **1-8** | Whether to add the note according to RAN1 agreement: PEI-O can be configured by network to be placed close to or overlapped with an earlier SS burst before its associated POs. | This is related to running CR | Type 3 |
| **1-9** | FFS how to number the PDCCH monitoring occasions for PEI. | This is related to running CR | Type 3 |
| **1-10** | FFS: Whether to have a separate clause for subgrouping or merge it into the previous clause for PEI in 7.x as a subclause (e.g. 7.x.y). | This is related to running CR | Type 3 |
| **1-11** | The detailed parameters align with RRC specification | This is related to running CR | Type 3 |
| 1-12 | Whether need a note in spec on this agreement:“*R2 assumes that all the cells within the registration area supports the same number of CN assigned subgroups, i.e. no remapping of CN assigned group ID to RAN subgroup ID*” | This is related to running CR | Type 3 |

1. **TRS/CSI-RS**

|  |  |  |  |
| --- | --- | --- | --- |
| **OI Index** | **Open issue** | **Rapporteur comment** | **OI Type** |
| **2-1** | A UE which acquired SIB-X with a TRS/CSI-RS configuration but didn’t yet receive an associated L1-based availability indication considers the configured TRS/CSI-RS as FFS “unavailable” or “available”. |  | Type 1 |
| **2-2** | Whether to have UE capability on TRS/CSI-RS would be further decided. |  | Type 1 |
| **~~2-3~~** | ~~When the idle/inactive TRS configuration update, whether DRX UE follow the legacy SI update procedure? Or any enhancement?~~ |  | ~~Type 1~~ |
| **2-4** | RAN2 confirm TRS/CSI-RS can be applied to eDRX UEs. Any impact FFS |  | Type 2 |
| **2-5** | Whether/Which part related to TRS/CSI-RS needs to be captured in TS 38.304. | This is related to running CR | Type 3 |
| **2-6** | The detailed parameters align with RRC specification | This is related to running CR | Type 3 |
|  |  |  |  |

**From [Post116bis-e][066][ePowSav] 38331 Running CR (CATT):**

1.       **Company input into Pre117-e-offline (i.e. no company tdocs)**

OI 1.1: *pei-Config-*r17 is currently captured in *DownlinkConfigSIB* but it is FFS if it would be captured in another SIB instead.

OI 1.2: Finalizing aspects on SIB-X sizing and segmentation:

 - Currently, SIB-X is just a bit bigger than the threshold. Could segmentation be avoided if further signalling optimization is introduced in ASN.1?

 - If segmentation is required, how to segment? Reuse SIB12 mechanism?

2.       Company tdocs invited.

3.       CR rapporteur handled issue (CR rapporteur will propose resolution as input to next meeting).

OI 3.1: RAN2 to wait for further RAN1 input on whether TRS/CSI-RS configuration can be split as common and TRS specific part

OI 3.2: FFS if scramblingID is per TRS resource set, or per TRS resource

OI 3.3: FFS: the number of configured TRS resource sets is not larger than the number of actual transmitted SSBs determined according to ssb-PositionsInBurst in SIB1.

OI 3.4: More configurations for PEI should be further considered based on RAN1 progress.

OI 3.5: How to capture *searchSpaceSwitchTimer-r17* is FFS as the granularity is FFS.

OI 3.6: How to capture *PDCCHSkippingDurationList* and *PDCCHSkippingDuration* are FFS as the granularity is FFS.

OI 3.7: It is FFS how to extend for DCI\_format 2\_7. Wait for further RAN1 input.

4.       Other, e.g. immature area, reference to dependency, unclear status etc. WAIT FOR RAN4 CONCLUSIONS:

OI 4.1: Granularity for RLM/BFD relaxation enable/disable (e.g. per-UE/CG/Serving cell)

OI 4.2: How to provide the criteria configuration for RLM relaxation and BFD relaxation for low mobility criterion?

OI 4.3: How to provide the criteria configuration for RLM relaxation and BFD relaxation for serving cell quality criterion?

OI 4.4: How to evaluate the low mobility criterion for RLM/BFD relaxation?

OI 4.5: How to evaluate the serving cell quality criterion for RLM/BFD relaxation?

# Conclusion

Rapporteur merges and reorganized the open issues listed in the three email discussions ([065], [066] [080]), and proposes the following list of open issues.

1. **PEI and Subgrouping**

Company input into Pre117-e-offline

OI 1.1: How to indicate whether UE monitor PEI in last used cell or any other cells?

OI 1.2: Identify valid cases where UE is unable to monitor subgroup PEI configured by network. Then decide if there can be any rule for subgroup PEI monitoring, or UE simply monitor paging as per legacy.

OI 1.3: RAN2 assumes that PEI can be used “without” subgrouping. FFS whether the bits in the PEI for subgrouping then need to have any particular meaning, or whether this would be done by just having one subgroup.

Company tdocs invited

OI 1.4: RAN2 has a preference to support PEI with both DRX and eDRX; FFS on potential issues (e.g., PEI and PTW).

OI 1.5: FFS on the detailed NAS signalling between AMF and UE for CN assigned subgrouping.

OI 1.6: When AMF has assigned a UE with a Paging subgroup, some signaling should be supported between AMF and gNB(s) to inform gNB(s) about the related subgroup information for paging a UE in RRC\_IDLE/RRC\_INACTIVE. Exact information is FFS. The message(s) and associated design are up to RAN3.

OI 1.7: It is FFS when a UE in RRC\_INACTIVE has been assigned by CN a Paging subgroup, whether some signaling should be introduced between gNBs to inform each other about the UE’s subgroup for RAN paging.

OI 1.8: Handling in scenarios where certain gNB within a RNA does not support CN controlled subgrouping

OI 1.9: When K=1, the PEI configuration can be either (1) *subgroupConfig* is absent (i.e., PEI without subgrouping) or (2) *subgroupConfig* is present and *subgroupNumPerPO*=1. FFS if UE PHY processing for DCI format 2\_7 is the same.

CR rapporteur handled issue

OI 1.10: Modifications of the content and location of PEI configurations (based on RAN1 progress)

OI 1.11: It is FFS how to extend for DCI\_format 2\_7. Wait for further RAN1 input.

OI 1.12: Whether to add the note according to RAN1 agreement: PEI-O can be configured by network to be placed close to or overlapped with an earlier SS burst before its associated POs.

OI 1.13: FFS how to number the PDCCH monitoring occasions for PEI.

OI 1.14: FFS whether to have a separate clause for subgrouping or merge it into the previous clause for PEI in 7.x as a subclause (e.g. 7.x.y).

OI 1.15: Whether we need a note in spec on this agreement: “R2 assumes that all the cells within the registration area supports the same number of CN assigned subgroups, i.e. no remapping of CN assigned group ID to RAN subgroup ID”

OI 1.16: Detailed parameter alignment between TS38.304 and TS 38.331.

1. **TRS/CSI-RS**

Company input into Pre117-e-offline

OI 2.1 RAN2 to confirm TRS/CSI-RS can be applied to eDRX UEs.

OI 2.2: Whether / how to address the delay required for updating a TRS/CSI-RS configuration due to the eDRX acquisition period (1024 H-SFN)

OI 2.3: A UE which acquired SIB-X with a TRS/CSI-RS configuration but didn’t yet receive an associated L1-based availability indication considers the configured TRS/CSI-RS as [FFS: “unavailable” or “available”]

OI 2.4: Aspects on SIB-X sizing and segmentation: Can segmentation be avoided? If not, how to segment?

OI 2.5: If a UE acquired SIB-X with a TRS/CSI-RS configuration but didn’t yet receive an associated L1-based availability indication, should UE consider the configured TRS/CSI-RS as “unavailable” or “available”?

CR rapporteur handled issue

OI 2.6: RAN2 to wait for further RAN1 input on whether TRS/CSI-RS configuration can be split as common and TRS specific part

OI 2.7: FFS if scramblingID is per TRS resource set, or per TRS resource

OI 2.8: FFS: the number of configured TRS resource sets is not larger than the number of actual transmitted SSBs determined according to ssb-PositionsInBurst in SIB1.

OI 2.9: Whether/Which part related to TRS/CSI-RS needs to be captured in TS 38.304.

OI 2.10: Detailed parameter alignment between TS38.304 and TS 38.331.

1. **RLM/BFD relaxation**

Company input into Pre117-e-offline

OI 3.1: Can UE start/stop RLM/BFD relaxation by itself if it meets/fails the relaxation criteria?

OI 3.2: Should UE report fulfilment or not (entry/exit) to network for RLM/BFD relaxation?

OI 3.3: Should NW be able to enable/disable RLM/BFD relaxation with explicit indication irrespective if the RLM/BFD relaxation criteria is configured or not?”

Other (wait for RAN4)

OI 3.4: Granularity for RLM/BFD relaxation enable/disable (e.g. per-UE/CG/Serving cell)

OI 3.5: How to provide the criteria configuration for RLM relaxation and BFD relaxation for low mobility criterion?

OI 3.6: How to provide the criteria configuration for RLM relaxation and BFD relaxation for serving cell quality criterion?

OI 3.7: How to evaluate the low mobility criterion for RLM/BFD relaxation?

OI 3.8: How to evaluate the serving cell quality criterion for RLM/BFD relaxation?

1. **PDCCH skip**

Company tdocs invited

OI 4.1: Should UE ignore PDCCH skipping (i.e., PDCCH skipping is cancelled) while UL HARQ reTx timer is running?”

CR rapporteur handled issue

OI 4.2: How to capture *searchSpaceSwitchTimer-r17* is FFS as the granularity is FFS.

OI 4.3: How to capture *PDCCHSkippingDurationList* and *PDCCHSkippingDuration* are FFS as the granularity is FFS.

Other (Wait for RAN1)

OI 4.4: In case UE cannot monitor DCP due to PDCCH skipping, whether a) Physical layer of UE reports a value of 1 for Wake-up indication bit to higher layer or b) Physical layer of UE does not report Wake-up indication bit to higher layer.

1. **UE capability**

Company input into Pre117-e-offline

OI 5.1: How to capture UE AS capabilities for PEI/subgrouping in RAN2 TS?

OI 5.2: For TRS/CSI-RS occasion support in Idle and inactive mode, should gNB need to know UE support it?

OI 5.3: UE AS capabilities for RLM/BFD relaxation

CR rapporteur handled issue

OI 5.4: How to capture PDCCH monitoring adaptation capabilities in RAN2 TS?

# Reference

1. Discussion material for [Post116bis-e][065][ePowSav] 38304 Running CR (vivo)
2. Discussion material for [Post116bis-e][066][ePowSav] 38331 Running CR (CATT)