3GPP TSG-RAN WG2 Meeting #113 electronic R2-2102040

Online, January 25th – February 5th 2021

Source: CATT

Title: Summary of offline 109 - [REDCAP] eDRX cycles

Agenda Item: 8.12.3

Document for: Discussion and Decision

# Introduction

This contribution provides a summary of the following email discussion:

* [AT113-e][109][REDCAP] eDRX cycles (CATT)

Scope: Continue the discussion on eDRX cycles based on the proposals in [R2-2101242](file:///C%3A/Data/3GPP/Extracts/R2-2101242%20Summary%20of%20email%20discussion%20154%20-%20eDRX%20cycles.docx) marked as "continue in offline 109". Also discuss the 2.56s DRX operation in [R2-2101460](file:///C%3A/Data/3GPP/RAN2/Docs/R2-2101460.zip).

The intention of this offline is to describe options in the TR (possibly with pros and cons) and, whenever applicable/possible, also provide some recommendations (i.e. p4, p6 and p10 in [R2-2101242](file:///C%3A/Data/3GPP/Extracts/R2-2101242%20Summary%20of%20email%20discussion%20154%20-%20eDRX%20cycles.docx))

Initial intended outcome: Summary of the offline discussion with e.g.:

* + - List of proposals for agreement
		- List of proposals that require online discussions
		- Corresponding TP for the TR

Initial deadline (for companies' feedback): Monday 2021-02-01 16:00 UTC

Initial deadline (for rapporteur's summary in R2-2102019): Monday 2021-02-01 22:00 UTC

Proposals marked "for agreement" in R2-2102019 not challenged until Tuesday 2020-02-02 10:00 UTC will be declared as agreed by the session chair. For the rest the discussion will continue online.

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# Discussion

As a follow-up of the offline #111 [1][2], the following agreements on eDRX for REDCAP UEs were achieved in RAN2#111-e:

Agreements:

1. RAN2 study eDRX mechanism for both RRC\_IDLE and RRC\_INACTIVE in this SI. ‎
2. For RRC\_INACTIVE, the DRX cycle is extended to 10.24s as baseline.

Agreements via email - from offline 111:

1. For RRC\_IDLE, the DRX cycle is at least extended to 10.24s. FFS on further extension ‎beyond 10.24s.
2. For RRC\_IDLE and/or RRC\_INACTIVE, if the NR DRX cycle range is extended beyond 10.24s, the LTE ‎eDRX mechanism beyond 10.24s (e.g., PTW, PH, etc.) is used as baseline when NR eDRX cycle is configured beyond 10.24s.

FFS:

1. For RRC\_IDLE and/or RRC\_INACTIVE, FFS on baseline mechanism when the configured NR eDRX cycle is less or equal to 10.24s

Then, the above FFSs were further progressed in RAN2#112-e where the following agreements were achieved on eDRX for Idle and Inactive:

1. For UE in RRC IDLE/INACTIVE and eDRX cycle is less than 10.24s, paging monitoring does not use PTW and PH, if any.
2. RAN2 will study whether lower values than 5.12s for eDRX cycle for RRC\_IDLE and RRC\_INACTIVE REDCAP UEs, e.g. 2.56s, can also be considered.
3. eDRX cycle extension in RRC\_IDLE beyond 10.24s for REDCAP UEs will be studied in this SI/WI. For UE in RRC IDLE and eDRX cycle is equal to 10.24s, among the solution options, we start from the assumption that paging monitoring does not use PTW and PH.
4. the eDRX cycle in RRC\_IDLE is extended up to 2621.44s for REDCAP UEs, as a baseline (longer value e.g. 10485.76s can also be considered)

Then in the first online GTW session of RAN2#113-e, the summary of the email discussion #154 [3] was discussed resulting in the further agreements:

Agreements:

1. Capture in the TR that from RAN2 perspective it is recommended for UE in RRC IDLE and eDRX cycle is equal to 10.24s, that paging monitoring does not use PTW and PH. Send an LS to SA2 to check this
2. Capture in the TR the related pros/cons aspects listed below (the list can be further checked and amended if needed):

 Pros:

 • It enables longer eDRX cycles needed by some RedCap UEs and yet allow other UEs that do not need long eDRX cycles (>10.24s) to reuse NR R16 eDRX implementation without additional development work and without a need for an explicit capability signalling.

 • NR already has 10.24sec interval in C-DRX

 • For 10.24 s and RRC\_INACTIVE similar solution was adopted for LTE in eMTC

 Cons:

 • It is different from LTE solution for eDRX cycle = 10.24s in RRC\_IDLE

 • It will impact 5GC and RAN2 will need to inform/consult SA2/CT1

 • UE can no longer have multiple opportunities to receive its paging during an eDRX cycle

1. Regarding the support of eDRX value up to 10485.76s, capture in the TR the pros/cons aspects listed below:

 Pros

 • The upper limit of the H-SFN (10bit) already is 10485.76s

 • The CN already supports eDRX values up to 10485.76s

 • It is future-proof

 • No reason to artificially limit without technical concern

 Cons:

 • There are no REDCAP use cases that require eDRX cycles beyond 2621.44s

 • Little power saving gain beyond 2621.44s. Simulation results show that the gain is saturated at around 40mins.

1. Capture in the TR that RAN2 recommends supporting a common design for handling eDRX cycle = 10.24s in RRC\_IDLE and RRC\_INACTIVE.

Per Chairman’s recommendation we will continue discussing in this offline the remaining proposals from [3] captured as “Continue in offline 109” in Chairman’s notes [4]. Related TPs are proposed in each section and are captured in the draft TP uploaded on the server.

It should also be noted that an LS was formely agreed to be sent to SA2/CT1 as follows [4]:

Proposal 14: Send an LS to CT1/SA2 informing them about RAN2’s preference to support eDRX cycles >10.24s in RRC\_INACTIVE and asking about feasibility.

* No need to discuss the content of an LS to SA2/CT1 as part of offline 109. An LS is needed, but the exact content will be discussed after the conclusion of offline 109

So we do not address it in this email discussion.

# eDRX in idle

### Solution for 10.24s - TP

We propose to capture the agreements #1, #2 and #4 from online GTW session listed in Section 3 and [4] in the updated TR [7] as follows (Section 8.3.1):

|  |
| --- |
| From RAN2 perspective, extended DRX can be specified and configured for RedCap UEs so that eDRX cycles at least up to 10.24 seconds can be used in RRC\_IDLE and in RRC\_INACTIVE states. For RRC\_IDLE, the baseline for possible extension of configurable eDRX cycles is up to 2621.44 seconds. Longer values, e.g. 10485.76 seconds can be considered further. If extension of the eDRX cycles beyond 10.24 seconds is specified, a feasible extension mechanism is expected to be similar to what is specified for LTE. This mechanism would include the use of H-SFN, PH and PTW. For RedCap UEs in RRC\_IDLE or RRC\_INACTIVE, if the eDRX cycle is less than or equal to 10.24 seconds, the paging monitoring configuration does not use PTW and PH. Specifically for 10.24s, the pros and cons of not using PTW and PH are as follows:Pros:* It enables longer eDRX cycles needed by some RedCap UEs and yet allow other UEs that do not need long eDRX cycles (>10.24s) to reuse NR R16 eDRX implementation without additional development work and without a need for an explicit capability signalling.
* NR already supports 10.24sec interval in C-DRX
* For 10.24 s and RRC\_INACTIVE similar solution was adopted for LTE in eMTC

Cons:* It is different from LTE solution for eDRX cycle = 10.24s in RRC\_IDLE
* It will impact 5GC and RAN2 will need to inform/consult SA2/CT1
* UE can no longer have multiple opportunities to receive its paging during an eDRX cycle
 |

**Q1: Do companies agree with above text proposal added to Section 8.3.1?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes | Looks good |
| Vivo | Yes, with comment | Regarding the length of eDRX part: “RRC\_IDLE, the baseline for possible extension of configurable eDRX cycles is up to 2621.44 seconds. Longer values, e.g. 10485.76 seconds can be considered further. ”, we suggest to wait for the conclusion below, as we anyway need to update it based on the following discussion.  |
| Fraunhofer | Yes | Fine for us |
| Qualcomm | Yes | The TP looks fine to us. |
| Lenovo | Yes | Fine to us. |
| OPPO | Yes | The TP is fine to us. |
| Sharp | Yes |  |
| CATT | Yes | @ vivo: agree but this TP only captures agreements #1, #2 and #4. The discussion on upper bounds is in Section 3.1.3. I preferred to keep TPs independent of each other in this discussion. |
| Xiaomi | Yes | Fine to us. |
| Huawei | Yes |  |
| MediaTek | Yes |  |
| Convida | Yes |  |
| Futurewei | Yes |  |
| Ericsson | Yes | Looks fine, agree with vivo the earlier text may need to be updated depending on conclusion.Editorial suggestion: to match the style of preceding text, please use “X seconds” instead of “Xs” or “X secs”.If we want to further improve, we could add “feasibility” and “necessity” parts, e.g. “feasibility: Feasible from RAN2 side, need to be checked with SA2/CT1” and “necessity: Not strictly necessary but may help with UE implementation and is aligned with some earlier solutions” (previous points may be obvious in pro/con list already though). |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| Facebook | Yes |  |
| Nokia | Partly | We are OK with the first part without the pros and cons – we don’t really see what value these would bring compared to the preceding text. Furthermore, it is not clear why such are listed as pros and cons, one could consider many other things as well. Hence, we would prefer to remove that part. |
| CMCC | Yes |  |
| Thales | Yes |  |
| LGE | Yes |  |
| Sequans | Yes |  |

**Summary:**

23 companies participated to the discussion.

20/23 companies agree with the TP as is.

Two companies (vivo, Ericsson) suggest waiting for the conclusion of Section 3.1.2 for the sentence “Longer values, e.g. 10485.76 seconds can be considered further” from current TR. But Rapporteur suggests addressing TPs independently, so this sentence can indeed be revised based on outcome of Section 3.1.2, see related TP in there.

One company, Ericsson, proposes an editorial correction, which is fine, and also adding further feasibility/necessity aspects. We think the feasibility can be further emphasized in the bullet “It will impact 5GC and RAN2 will need to consult SA2/CT1 on the feasibility” and the necessity is also clear from the “pros” bullet.

One company, Nokia, suggests capturing the first part only, without pros and cons.

Rapporteur spotted offline a typo to be fixed in the pros list: “It enables longer eDRX cycles needed by some RedCap UEs and yet allow other UEs that do not need long eDRX cycles (>10.24s) to reuse NR R16 ~~e~~DRX implementation without additional development work and without a need for an explicit capability signalling”

Given the vast majority of companies supporting the TP, it is proposed to agree the below TP, reflecting editorial corrections/fixes from comments:

**Proposal 0 (20/23): Agree the below TP for capturing agreements #1, #2 and #4 from online GTW session (further update according to the conclusions on P2 and P4):**

|  |
| --- |
| From RAN2 perspective, extended DRX can be specified and configured for RedCap UEs so that eDRX cycles at least up to 10.24 seconds can be used in RRC\_IDLE and in RRC\_INACTIVE states. For RRC\_IDLE, the baseline for possible extension of configurable eDRX cycles is up to 2621.44 seconds. Longer values, e.g. 10485.76 seconds can be considered further. If extension of the eDRX cycles beyond 10.24 seconds is specified, a feasible extension mechanism is expected to be similar to what is specified for LTE. This mechanism would include the use of H-SFN, PH and PTW. For RedCap UEs in RRC\_IDLE or RRC\_INACTIVE, if the eDRX cycle is less than or equal to 10.24 seconds, the paging monitoring configuration does not use PTW and PH. Specifically for 10.24 seconds, the pros and cons of not using PTW and PH are as follows:Pros:* It enables longer eDRX cycles needed by some RedCap UEs and yet allows other UEs that do not need long eDRX cycles (>10.24 seconds) to reuse NR R16 DRX implementation without additional development work and without a need for an explicit capability signalling.
* NR already supports 10.24 seconds interval in C-DRX
* For 10.24 seconds and RRC\_INACTIVE similar solution was adopted for LTE in eMTC

Cons:* It is different from LTE solution for eDRX cycle = 10.24 seconds in RRC\_IDLE
* It will impact 5GC and RAN2 will need to consult SA2/CT1 on the feasibility
* UE can no longer have multiple opportunities to receive its paging during an eDRX cycle
 |

### eDRX lower bound

For the lower bound, a first motivation to support down to 2.56s was that (at least some) REDCAP UEs should be able to support the reception of emergency broadcast services (e.g. ETWS primary notification) within the required delay budget (of 4 seconds), which is not possible with 5.12s eDRX cycle lengths (e.g. [9]). Then, although all companies indeed agreed in Q2-3 of [3] that (at least some) REDCAP Ues should be able to support the reception of emergency broadcast services, whether this requires that the eDRX cycle supports a lower bound of 2.56s was not the majority of views. Indeed, as expressed in the inputs to Q2-3 of [3] this could be achieved in a different manner, which we discuss below. In addition, [6] suggests a variant solution from using eDRX as follows: *For RedCap Ues if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter*.

Therefore we think it is worth first capturing the *in-principle* common view that (at least some) REDCAP Ues should be able to support the reception of emergency broadcast services.

**Proposal 1 (all): It should be possible for (at least some) REDCAP Ues to receive emergency broadcast services.**

**Companies who do not agree with the above proposal are invited to express their concerns.**

|  |  |
| --- | --- |
| Company | Argument(s) |
| Apple | Agree that atleast some should be able to receive EM broadcast |
| vivo | We agree with this high level principle. |
| Fraunhofer | We agree to this proposal |
| Qualcomm | We are fine with this proposal and think both cases (i.e. some RedCap Ues do not need to receive emergence broadcast) should be supported. |
| OPPO | Agree with this proposal. |
| Xiaomi | Agree |
| Huawei | Agree |
| MediaTek | Agree |
| Convida | We agree to this proposal |
| Ericsson | Agree in principle, however it is not exactly clear why this would not be supported (for such Ues which do want to receive the indications?). Note that even Ues configured (with any length) of eDRX can support reception of such indications, that would be up to the UE. |
| Samsung | Share with Qualcomm. Some REDCAP Ues do not need it. Recall that ETWS/CMAS reception is not a requirement for eDRX Ues. |
| ZTE | Agree |
| Intel | Agree |
| Facebook | Agree |
| Nokia | Yes, this can be possible. |
| CMCC | Agree |
| Thales | Agree, and one comment: A UE supporting ETWS/CMAS reception need to receive emergency broadcast regardless what type and whether they have requested for certain configuration. The Ue needs to listen to EM broadcast. |
| LGE | Agree |

**Summary:**

17 provided inputs to this question and all companies agree with Proposal #1. Some companies (Qualcomm, Samsung) commented that it is also understood that some REDCAP UEs do not need to receive emergency broadcast but Rapporteur thinks it is clear from Proposal #1 (“at least some”). Hence it is proposed to agree Proposal #1.

Then, different ways of receiving emergency broadcast services with, possibly, some power saving, were expressed in inputs to Q2-3 of [3] as well as in [6] which can be classified as follows:

Option 1: eDRX supports a lower bound of 2.56s.

Option 2: For RedCap UEs, if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter [6]. eDRX lower bound can be kept to baseline 5.12s.

Option 3: gNB can configure 2.56s default broadcasted DRX cycle for those RedCap Ues that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for Ues with tighter latency requirements (e.g. smartphones). eDRX lower bound can be kept to baseline 5.12s.

Option 4: RedCap Ues that need to receive emergency broadcast services are not expected to request to be configured with eDRX, and no specific handling/configuration is required for those Ues. eDRX lower bound can be kept to baseline 5.12s.

Option 5: REDCAP UE can request an eDRX configuration while still monitoring in between for ETWS and CMAS. eDRX lower bound can be kept to baseline 5.12s.

Option 2 has in common with Option 1 that the UE does not need to follow shorter RAN (dedicated or default) paging cycle. Therefore we list the pros and cons for both together:

Options 1-2:

Pros

* It enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them.

Cons:

* This solution assumes such REDCAP Ues do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles, thus resulting in network not being able to reach such RedCap Ues by using default broadcasted paging cycles and/or UE-specific RAN paging cycles. This may result e.g. in a potential risk of UE missing SI change indicator.
* Specifically for Option 2, it requires a different way to determine the UE DRX cycle for REDCAP Ues in both the UE and the gNB.

Option 3:

Pros

* Consistent with the LTE solution.
* Solution based on Network implementation and there is no additional impact.

Cons:

* A default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones and requires configuring on top a UE-specific RAN paging cycle for each such smartphones.

Option 4:

Pros

* No specification or configuration impact.

Cons:

* Those REDCAP Ues do not benefit from eDRX power saving.

**Proposal 2: Capture in the TR the above five options allowing REDCAP Ues to receive emergency broadcast services (and resulting recommended eDRX lower bound) and the associated pros/cons.**

**Companies who do not agree with the above proposal are invited to express their concerns.**

|  |  |
| --- | --- |
| Company | Argument(s) |
| Apple | First, we thank the rapporteur for considering this into email discussion!!We agree to the options provided above. Another variant of option -3 is that gNB can configure a “separate” default RAN paging cycle for RedCap Ues (a new SI field), and this way, the legacy Ues do not need to follow the RAN paging cycle meant for RedCap (which can be longer). Which would essentially be option -2 for 2.56DRX ☺. Our main aim is that there can be RedCap Ues which do not necessarily need to carry the overhead associated with eDRX (wearables) but benefit greatly from using 2.56 DRX, and so if NAS allows such config, these RedCap Ues would want to follow this DRX cycle. This would be completely independent from the NR RedCap eDRX feature altogether. SI reception and emergency broadcast “might” be missed in rare cases, but we can discuss if this needs addressing or not in work-item stage.[Apple v2] As mentioned on the email reflector, we would also propose to capture the usefulness of lower bound of eDRX for power-saving purposes for RedCap Ues which are not very delay tolerant but do benefit greatly from longer DRX cycle. Pls see our edits (text proposal for the TR) for this section in the below for Q2.  |
| Vivo | In our understanding, RedCap devices supporting PWS are not expected to be configured with eDRX (e.g. for wearable devices). We could be fine to capture the above solutions in the TR if majority agree.  |
| OPPO | For option 1, we think a ETWS or CMAS capable UE is not expected to be configured with eDRX. So we see no need to introduce lower bound for eDRX cycle.For option 2, the UE may miss the SI modification.For option 3, it would bring restriction on NW implementation.In our view, the existing DRX mechanism could be used for RedCap Ues that expect to receive emergency broadcast services. |
| Sharp | We have no strong view on the options. Whether to ignore RAN paging cycle if eDRX is configured could be discussed separately, since it seems a common issue to reduce power, not related to the delay budget requirement of emergency broadcast services.  |
| CATT | @vivo/OPPO: I suggest addressing your comment with adding Option 4. |
| Xiaomi | We are a little confused about the difference of option1 and option2. It seems UE’s behavior is the same, i.e., if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX. Can rapporteur help us to clarify?[CATT] The key difference (in my understanding) is that the 2.56s cycle is set, for option 1, by the eDRX cycle (e.g. TeDRX cycle of 256 radio frames, as in clause 7.3 of 36.304), and, for option 2, by the DRX cycle configured by NAS (UE specific DRX value configured by upper layers in 38.304 clause 7.1). The difference with clause 38.304 7.1 would be that, for RedCap Ues, the DRX cycle T would no longer be determined by the shortest of the UE specific DRX value(s), if configured by RRC and/or upper layers, and a default DRX value broadcast in system information, but would only be determined by the UE specific DRX value configured by upper layers. I agree with you that, as far as I understand, the main difference between both options is the configuration aspects but the two solutions are similar in the behavior. Apple is welcome to further comment/clarify/correct if I misinterpreted the proposal in [6]. |
| Huawei | We agree with above proposal but with some comments. Option 2 requires a different way to determine the UE DRX cycle for REDCAP Ues in both the UE and the eNB. Potential risk of missing SI change indicator should be well handled for REDCAP Ues as stated in the cons. In our understanding, option 3 is network implementation and NR supports this configuration. We think that the pros of option 3 is “There is no additional impacts”.For Option 4, we think the motivation of UE specific DRX is latency reduction instead of UE power saving since LTE. Thus we do think only “eDRX” should be included in Cons.Cons:• Those REDCAP Ues do not benefit from ~~any specific DRX/~~ eDRX power saving. |
| MediaTek | We agree with the proposal to list the options in the TR.From our perspective, regardless of which option is selected, it is preferable for the network to have the option to configure a RedCap UE with 2.56s paging cycle, while also configuring eMBB Ues with a lower value. |
| Convida | Agree with Huawei and OPPO. Option 2 requires a different way to determine the UE DRX cycle for REDCAP Ues in both the UE and the eNB. The UE may miss the SI modification. Option 3 variation proposed by Apple has spec impact since gNB can configure a “separate” default RAN paging cycle for RedCap Ues other than legacy Ues. Therefore, I think Option 3 needs some clarifications.  |
| Ericsson | We don’t fully agree that the solutions are “different ways of achieving this” referring to the previous question as nothing in our understanding prevents a UE from monitoring ETWS/CMAS indications even if configured with eDRX? Additionally, we would like to point to a proposal in power saving WI by Samsung in [R2-2100144](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_113-e/Docs/R2-2100144.zip) where UE configured with UE-specific DRX cycle would follow this cycle for paging, whereas e.g. ETWS / CMAS indications would be received as in legacy. This seems to provide some benefit for the UE power consumption. Especially as in this solution the UE would receive possible emergency indications as fast as possible, which seems to be the use case. This should be added as solution and coordinated with the power saving WI. This seems to be close to Option 2 above?We would modify the “con” for solns 1-2 as follows:Cons:* This solution results in network not being able to reach RedCap Ues configured with such eDRX by using default broadcasted paging cycles and/or UE-specific RAN paging cycles. This may result e.g. in a potential risk of UE missing SI change indicator.

Option 3 con is a deployment-dependent statement and not a universal fact, thus it should be presented as such. Option 4 could perhaps be clarified that such Ues do not ask for eDRX to be configured (as NW would not configure eDRX without UE asking).  |
| ZTE | For option 2/3/4, we share Huawei’s comments. We think a RedCap device expecting to receive ETWS and CMAS should not be configured with eDRX. Thus option 4 is preferred. |
| Intel | Agree to capture the solution and corresponding pros/cons in the TR.  |
| Facebook | We agree to capture the options in the TR. However, we share the same view as MediaTek, regardless option is being selected in the WI phase, it’s important for RedCap UEs to be able utilize 2.56s cycle for optimizing power saving/latency while simultaneously allowing eMBBs UEs with lower value.  |
| Nokia | We would be fine to capturing that in case RedCap UE is supposed to receive emergency broadcast, then it is not configured with eDRX. It seem not good to add the options listed as it seems unclear how those would solve the issue for emergency broadcast reception in eDRX. |
| CMCC | We agree with the proposal to capture the options.From our point of view, ETWS/CMAS capable RedCap UEs could not be expected to be configured with eDRX, we don’t see the need to introduce lower bound for eDRX cycle. |
| Thales | In principle, we agree with the proposals to list the options in the TR. However, we should clearly indicate the motivation and whether really needed. I. e. concerning option1, eDRX is a configuration provided by the network upon UE request, and the network should not configure any larger eDRX value, than requested by the device, as it could otherwise violate maximum delay tolerance of a specific service to be received. However, a UE configured with eDRX is not precluded from monitoring in between for ETWS and CMAS, means regardless whether it has requested eDRX or not ETWS / CMAS indications would need to be monitored, as in legacy. So eDRX requested values should just depend on the UE service/request. |
| Sequans | Agree with capturing the options.For option 4, it is dependent on UE eDRX cycle request, NW would not configure eDRX without it.  |

**Summary:**

17 companies reacted to proposal#1.

On the Options:

In general most companies agree with the 4 options, with only Nokia, supporting Option 4, who would prefer not capturing any options. Ericsson suggest clarifying that, for Option 3, such Ues do not ask for eDRX to be configured, which we clarify with revision marks in the original description of Option 3 above. Ericsson also suggests adding another solution proposed in Power Saving WI [R2-2100144] where UE monitors UE specific DRX cycle when it is greater than default DRX cycle, but that looks very close to Option 2, so Rapporteur suggests treating it as part of Option 2 in the WI. We also clarified, following Apple’s comments, that the different solutions aim at receiving emergency broadcast services with, possibly, some power saving.

Ericsson and Thales also mention that a UE configured with eDRX (per its request) is not precluded from monitoring in between for ETWS and CMAS. Rapporteur suggests capturing this approach as Option 5, added to the list.

On the pros/cons:

Rapporteur made an attempt to capture companies’ comments with revision marks in the original pros/cons list above.

Taking all above comments into account via the above adjustments of options description and pros/cons, Rapporteur suggests agreeing Proposal #2.

**Text proposal:**

We propose to capture proposal #2 in the updated TR [7] as follows (Section 8.3.1):

|  |
| --- |
| 8.3.1.1 eDRX in RRC\_IDLEFor the lower bound of the eDRC cycle, one motivation to support down to 2.56s is that (at least some) REDCAP UEs should be able to support the reception of emergency broadcast services (e.g. ETWS primary notification) within the required delay budget (of 4 seconds), which is not possible with 5.12s eDRX cycle lengths. However other solutions exist allowing REDCAP UEs to receive emergency broadcast services without requiring eDRX to support lower cycle values than legacy LTE (5.12s): * For RedCap UEs, if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter.
* gNB can configure 2.56s default broadcasted DRX cycle for those RedCap UEs that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for UEs with tighter latency requirements (e.g. smartphones)

The former solution is similar to supporting eDRX cycle of 2.56s in that the UE does not need to follow shorter RAN (dedicated or default) paging cycle, and therefore has the same pros/cons: it enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them. However, these solutions assumes such REDCAP UEs do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles which presents a potential risk of UE missing SI change indicator.The latter solution is consistent with the LTE solution, but a default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones and requires configuring on top a UE-specific RAN paging cycle for each such smartphones.An even simpler solution consists in considering that RedCap UEs that need to receive emergency broadcast services are not expected to be configured with eDRX, and no specific handling/configuration is required for those UEs. But then, such REDCAP UEs do not benefit from any specific DRX/eDRX power saving. |

**Q2: Do companies agree with above text proposal added to Section 8.3.1?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes | Agree. Pls see if our comments in the previous response can be added as well. |
| vivo |  | See above question.  |
| Fraunhofer | Yes |  |
| Qualcomm | Yes |  |
| Lenovo | Yes |  |
| OPPO | No | See our comment to P2. |
| CATT | Yes | @vivo/OPPO: see above TP update. |
| Xiaomi | Yes |  |
| Huawei | partially  | Please see our comment for P2. ‘any specific DRX’ should be removed in the last sentence. |
| MediaTek | Yes |  |
| Convida | Yes with comments | Please see the comments for above question.  |
| Futurewei | Yes |  |
| Apple  | Yes with some more comments | [Apple v2] We would like to request that the below be captured in the TR.8.3.1.1        eDRX in RRC\_IDLEFor the lower bound of the eDRC cycle, one motivation to support down to 2.56s is that (at least some) REDCAP UEs should be able to support the reception of emergency broadcast services (e.g. ETWS primary notification) within the required delay budget (of 4 seconds), which is not possible with 5.12s eDRX cycle lengths. Another motivation to support down to 2.56s is to allow (at least some ) REDCAP UEs that are not very delay tolerant to save power by operating in a 2.56sec eDRX cycle even when the RAN default paging cycle is shorter than 2.56s. However other solutions exist allowing REDCAP UEs to receive emergency broadcast services or save power by operating with a 2.56s DRX without requiring eDRX to support lower cycle values than legacy LTE (5.12s):        For the power saving case, if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter.       For the reception of emergency broadcast services case, the gNB can configure 2.56s default broadcasted DRX cycle for those RedCap UEs that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for UEs with tighter latency requirements (e.g. smartphones)The former solution is similar to supporting eDRX cycle of 2.56s in that the UE does not need to follow shorter RAN (dedicated or default) paging cycle, and therefore has the same pros/cons: it enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them. However, these solutions assumes such REDCAP UEs do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles which presents a potential risk of UE missing SI change indicator.The latter solution is consistent with the LTE solution, but a default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones and requires configuring on top a UE-specific RAN paging cycle for each such smartphones.For the reception of emergency broadcast services case,  another solution consists ~~in~~ of considering that RedCap UEs that need to receive emergency broadcast services are not expected to be configured with eDRX, ~~and no specific handling/configuration is required for those UEs.~~ But then, such REDCAP UEs do not benefit from any specific DRX/eDRX power saving. |
| Ericsson | Partially | We think the text needs clarifications: The requirement of 4 seconds in our understanding is on the NW side and it is not a UE requirement. Also, we don’t think anything prevents UE from monitoring for such indications even if configured with eDRX. Thus it is not correct to say e.g. UE is not allowed to receive such notifications with longer eDRX cycles. Similar comments as for earlier question – for the last addition the UE can simply not ask for eDRX configuration.Editorial comments: “X seconds” to match with style, REDCAP -> RedCap, eDRC -> eDRX. |
| Samsung | Yes |  |
| ZTE | Yes with comment | Please see our comments to P2. |
| Intel | Yes with comments | Why the clause title is for IDLE “eDRX in RRC\_IDLE”? We assume it should be applied for both IDLE and INACTIVE state.  |
| Facebook | Yes |  |
| Nokia | No | As it seemed clear most of the companies are fine to support eDRX cycle stating from 5.12s, it seems unnecessary to list this into the TR. |
| CMCC |  | Please see the comments for above question. |
| Thales | Yes, with comments. | Please see our comments above. |
| LGE | Yes |  |
| Sequans | Yes |  |

**Summary:**

Given the many above comments on the options and associated pros/cons, it is suggested to align on those first before reworking the above TP.

### eDRX upper bound

From companies’ inputs in [3] the following summary was derived:

|  |
| --- |
| **Summary from email disc #154:**22 companies provided inputs on the topic of eDRX upper bound.5/22 companies (Qualcomm, Intel, ZTE, Xiaomi, vivo) expressed concerns on supporting eDRX cycles higher than 2621.44s, mainly arguing REDCAP are not LPWA, so there is no requirement today for supporting larger eDRX values than 2621.44s. On the other hand, all other companies do not see any technical issue in supporting up to 10485.76 s eDRX value, which is already supported by CN.Hence it is proposed to recommend supporting eDRX value up to 10485.76 s in the TR.Pros/Cons can be summarized as follows based on companies’ inputs:Pros* The upper limit of the H-SFN (10bit) already is 10485.76s
* The CN already supports eDRX values up to 10485.76s
* It is future-proof
* No reason to artificially limit without technical concern

Cons:* There are no REDCAP use cases that require eDRX cycles beyond 2621.44s
* Little power saving gain beyond 2621.44s. Simulation results show that the gain is saturated at around 40mins.

**Proposal 3: Capture in the TR that it is recommended to support eDRX value up to 10485.76 s.****Proposal 4: Capture in the TR the related pros/cons aspects listed above.** |

Then, during the online discussion, it could only be agreed to capture the pros/cons (above proposal #4). One specific concern was raised by vivo regarding the issue of the RRM relaxation in this case [4]. More precisely, in legacy eDRX in LTE, there is no RRM requirement outside the PTW [TS 36.331 Clauses 4.2.2.1/4.2.2.3]. It means that, RRM on serving cell is required to be performed only in the PTW. In this way, there is RRM relaxation on the serving cell in eDRX case (more specifically, outside PTW). So vivo’s concern is whether for such large eDRX values, the assumption still is that there is such RRM relaxation for serving cell (i.e. no RRM measurement requirement outside PTW) in NR as well.

From rapporteur’s perspective, this issue should rather be discussed in the RRM email discussion and there seems anyways to be not much difference, from RRM measurement perspective, between 2621.44s and 10485.76s. In other words, whatever RRM solution is eventually agreed in NR outside PTW (same or different than LTE, if/how early UE needs to wake-up to re-sync before PTW, …) for 2621.44s should likely also apply to 10485.76s.

Thus we would like to progress this issue, aiming at agreeing on a recommendation. So we propose to check with other companies the potential impact of serving cell RRM measurements on the selection of 10485.76s as upper bound eDRX value.

**Q3: Do you think the solution and requirements for serving cell RRM measurements in Idle outside PTW which will be selected in NR have an impact on the choice of the upper bound of eDRX cycle (2621.44s extended to 10485.76s)?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | No | We think RRM relaxation is not connected to the eDRX based serving cell measurement. We agree that the UE serving cell measurement might be spread far across (only during PTW), but that should be ok, and the UE is not required to measure serving cell between PTW (spec doesn’t prevent the UE from doing so). |
| Vivo |  | We are not intending to link RRM relaxation with eDRX. But if there is no RRM relaxation for serving cell outside PTW, there is marginal power saving benefit for eDRX. In this way, there is no motivation to support longer eDRX values, e.g. 2621.44s or 10485.76s. Thus, before clarifying the RRM requirement for eDRX (i.e. whether there is RRM relaxation for serving cell outside PTW), we cannot accept the longer eDRX values here. If all companies agreed that there is no RRM requirement outside PTW in eDRX, we could at least conclude that RRM relaxation for serving cell is feasible. But actually, in another email discussion on RRM relaxation, some companies (e.g. even same companies supporting eDRX) mentioned that the RRM relaxation for serving cell has some unacceptable performance degrading, so it is proposed that serving cell RRM relaxation for Redcap UEs is not considered in Rel-17. We just want to make this clarification on technique, i.e. what is the true understanding from proponent point of view. We think we should at least correctly capture the potential technique issues in the TR in SI phase.  |
| Qualcomm | No |  |
| Lenovo | Yes |  |
| OPPO | No | The upper bound of eDRX cycle and RRM relax should be discussed separately. |
| Sharp | No | Agree with the rapporteur, whether LTE eDRX measurement rule is reused for NR can be discussed in RRM discussion. |
| CATT | No | Assuming the LTE behavior as baseline for RRM (no requirement outside PTW), there is clear benefit in increasing the eDRX cycle. But even if different behavior is concluded for NR, RRM is not the only source of power consumption, Pos monitoring also is, so there will still be some gain. And as mentioned repeatedly, no technical concerns have been raised, so such proposal is harmless while still promising in terms of gains.  |
| Xiaomi | No | We need to first clarify “there is no RRM relaxation for serving cell outside PTW” is a RAN4 “RRM requirement for eDRX” or “RRM relaxation” , e.g., perform serving cell measurement every four paging cycle .In our understanding , “there is no RRM relaxation for serving cell outside PTW” is more of a RAN4 “RRM requirement for eDRX”. We agree with the rapporteur’s view whatever RRM solution is eventually agreed in NR outside PTW for 2621.44s should likely also apply to 10485.76s. |
| Huawei | No | We have similar view as Apple. A UE is configured with eDRX only if it is delay tolerant. Hence, stopping serving cell RRM measurements for some time will be ok. However, for those Ues with DRX or short eDRX, serving cell RRM measurement relaxation may have impact on UE’s performance. |
| MediaTek | No | RRM requirements for eDRX will be defined by RAN4. This will follow the same principle regardless of the upper bound for the eDRX cycle being 2621.44s or 10485.76s.  |
| Convida | No | The upper bound of eDRX cycle and RRM relax should be discussed separately. |
| Futurewei | No |  |
| Ericsson | No | Agree with Apple.  |
| Samsung | No |  |
| ZTE | No | The upper bound of eDRX cycle and RRM measurement requirement for eDRX should be discussed separately. We see no issue to apply same RRM requirement for eDRX cycle 2621.44s and 10485.76s. |
| Intel |  | We have sympathy with VIVO. Companies in RRM mentioned relaxation of RRM for serving cell will impact performance and cannot be accepted. But here, people seems do not have concern on this.  |
| Nokia | No |  |
| CMCC | No |  |
| Thales | No | eDRX and RRM relaxation should be kept separate. Agree with Apple. |
| LGE | No | In our view, PTW should not be related to RRM relaxation. |
| Sequans | No | Agree with above that these are separate issues. |

**Companies who do not agree with the above proposal 3 are invited to express their concerns.**

|  |  |
| --- | --- |
| Company | Argument(s) |
| Apple | Pls see our comments above. |
| Vivo | Pls see our comments above. |
| Huawei | Pls see our comments above. |
| MediaTek | Pls see our comments above. |
| Convida | Pls see our comments above. |
|  |  |

**Summary:**

21 companies provided inputs to proposal 3 and Q3. Only three companies (vivo, Lenovo, Intel) think the solution and requirements for serving cell RRM measurements in Idle outside PTW which will be selected in NR have an impact on the choice of the upper bound of eDRX cycle.

Only vivo do not agree with proposal 3.

Rapporteur suggests following the majority and agree proposal 3 (18/21).

**Text proposal:**

We propose to capture proposals #3-4 in the updated TR [7] as follows:

Section 8.3.1:

|  |
| --- |
| From RAN2 perspective, extended DRX can be specified and configured for RedCap Ues so that eDRX cycles can be used in RRC\_IDLE and in RRC\_INACTIVE states.  |

Section 8.3.1.1:

|  |
| --- |
| For the upper bound, the eDRX cycle should support up to 10485.76s, since the upper limit of the H-SFN (10bit) already is 10485.76 seconds, and CN already supports eDRX values up to 10485.76 seconds. Although little power saving gain has been observed beyond 2621.44 seconds (simulation results show that the gain is saturated at around 40mins), there is no reason to artificially limit without technical concern.  |

**Q4: Do companies agree with above text proposals?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | We are ok with it, but | The SI has requirement to support battery life for multiple years! And long eDRX is needed in such a case. The industrial sensors can have use cases where only periodic easurements of the application and reporting during even longer periods (if a condition satisifies) can mean that there is technical justification to have large eDRX cycle (atleast in IDLE). |
| Vivo |  | Before clarifying the RRM requirement for eDRX (i.e. whether there is RRM relaxation for serving cell outside PTW), we cannot accept the longer eDRX values and corresponding TP here, since there may be no power saving gain for eDRX. In this way, there is no motivation to introduce longer eDRX values. |
| Fraunhofer | Yes, with comments | Agree with Apple.The use case for IWSN (battery powered industrial sensors) clearly benefits from longer eDRX cycles. We would like to point out the difference between DL reachability (paging) and UL latency (wake up+transmission) within the RedCap use cases. Industrial sensors (unlike LPWAN) may require a short latency but on the other hand do not need to be “pulled” for information or have information sent to them. So we do not agree to the statement, that no use cases have been identified. We agree with the conclusion, that there is no technical reason to not have 10485.76s. |
| Qualcomm | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes | The TP is fine to us. |
| Sharp | Yes |  |
| CATT | Yes | And regarding Apple and Fraunhofer’s comments, we would be OK to remove “no REDCAP use cases that require eDRX cycles beyond 2621.44s have been identified yet and”. |
| Xiaomi | - | We are hesitating to accept this as little power saving gain can be seen beyond 2621.44s |
| Huawei | Yes |  |
| MediaTek | Yes, but | Agree with Apple and Fraunhofer that uplink-centric IWSN use cases can clearly benefit from long eDRX cycles. There is significant scope to improve power saving gain during eDRX sleep by implementation (as seen in NB-IoT).We therefore agree with CATTs suggestion to remove the statement “no REDCAP use cases that require eDRX cycles beyond 2621.44s have been identified”. |
| Convida | Yes but | The use case for IWSN (battery powered industrial sensors) clearly benefits from longer eDRX cycles. |
| Futurewei | Yes |  |
| Ericsson | Yes | Agree with the intention and with CATT comment, and that IWSN requires longer eDRX cycles. Note that in any case the eDRX cycle extension will be need to be discussed with other WGs, as has been mentioned several times, and for vivo’s concern RAN4 will need to work with requirements for eDRX (especially as eDRX is not yet supported for NR). This does not however mean that there is no use case or benefit from RAN2 point of view, which should be the focus of the discussion in RAN2. Also note that final normative work would be in any case conducted in WI phase (i.e. above is not binding) thus the observation as captured above is fine as the result of the study. |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| Facebook | Yes |  |
| Nokia | Yes |  |
| CMCC | Yes | We are OK to supports eDRX values up to 10485.76s since it is not a technical issue, but depends on the requirements, while there’s use case for IWSN mentioned by Apple and Fraunhofer. |
| Thales | Yes |  |
| LGE | Yes |  |
| Sequans | Yes |  |

**Summary:**

23 companies provided inputs to Q4. 21 companies agree with the TP with 7 suggesting removing “*no REDCAP use cases that require eDRX cycles beyond 2621.44s have been identified yet and*” considering use case for IWSN (battery powered industrial sensors) would benefit from the 10485.76s extension. With this change captured in the above TP with revision marks, rapporteur suggests agreeing the above TP.

**Proposal 4 (21/23): Agree the above TP on eDRX upper bound.**

# eDRX in inactive

### On the need for eDRX cycle > 10.24s in inactive

Whether to support eDRX cycle in RRC\_INACTIVE beyond 10.24s for REDCAP UEs was discussed in the email discussion #154 to RAN2#113-e [3], resulting in the following summary:

|  |
| --- |
| **Summary from email disc #154:**22 companies provided inputs to this question.A majority of companies (15/22) see a benefit in extending the eDRX cycle in RRC\_INACTIVE beyond 10.24s for REDCAP Ues, 4/21 (Sharp/Qualcomm/Intel/Sequans) are neutral and 2 companies (MediaTek/vivo) see no benefit.Hence it is proposed to capture that RAN2 sees a benefit and recommends extending the eDRX cycle in RRC\_INACTIVE beyond 10.24s for REDCAP Ues in the TR.The benefits can be summarized as follows based on companies’ inputs:Benefits* It is very beneficial to have >10.24 sec in RRC\_INACTIVE to effectively support the usage of SDT (small data transfer) for e.g. use cases with periodic uplink data with periodicity > 10.24 s. TS 22.104 provides such usecases, e.g. some industrial wireless sensors need to transfer small packets while they are not very sensitive to DL traffic delay, but they have strict battery lifetime requirement.
* Based on the results in the Appendix of the TR, there is a clear power saving gain vs eDRX in RRC\_IDLE at least for eDRX cycles of 10.24 s – couple of minutes, where the UE in eDRX in RRC\_INACTIVE additionally benefits from less signaling. Based on these results, lifetime of several years would not be achievable in some cases (e.g. 1 minute IAT) if only RRC\_IDLE can be used, because of the signaling overhead.
* Signaling reduction is an additional benefit from network point of view – there is need for less RRC signaling

Issues: no new issues were brought up on top of those already listed by Rapporteur in the introduction of this section (and which are addressed in the following sections), so we replicate them below:* Impact on NAS retransmission, SA2/CT1 must be consulted on the feasibility
* Potential handling of different eDRX cycles > 10.24s and/or PTWs, one for IDLE the other for INACTIVE
* Need to study which Node decides the eDRX cycle for RRC\_INACTIVE

**Proposal 5 (15/22): Capture in the TR that RAN2 sees a benefit and recommends extending the eDRX cycle in RRC\_INACTIVE beyond 10.24s for REDCAP Ues.****Proposal 6: Capture in the TR the justifying benefits listed above and associated issues to solve.** |

Given the vast majority of companies supporting proposal #5, and considering the agreement that we will consult SA2/CT1 about it (see Section 3), we propose to adopt it along with the associated proposal #6 capturing the related pros/cons.

**Companies who do not agree with the above proposals 5-6 are invited to express their concerns.**

|  |  |  |
| --- | --- | --- |
| Company | Proposal(s) | Argument(s) |
| Apple | Agree to 5 and 6. |  |
| Vivo | No | We donot see strong need to support eDRX >10.24 in inactive mode. If Ues want to save power for a long period, idle mode could be a better choice. Could proponent provide what kind of RedCap Ues or use case will stay in RRC inactive but configured with eDRX>10.24s? |
| Fraunhofer | Agree | The benefit of RRC\_INACTIVE is the reduced latency for the transition from INCACTIVE to CONNECTED. Compared to LPWAN use cases, IWSN use cases have usually more strict requirements regarding latency while on the other hand still have periodic small data transmission or even event-based data transmissions (alarm messages). Thus we support the proposal. |
| Huawei | Agree to P5 and P6 |  |
|  |  |  |
|  |  |  |

**Summary:**

All companies except vivo agree with proposals 5 and 6.

We updated the issue list with revision marks to clarify that SA2/CT1 must be consulted on the feasibility, based on companies feedback on the below TP (Q5). Rapporteur suggests agreeing proposals 5 and 6.

**Text proposal:**

We propose to capture proposals #5-6 in the updated TR [7] as follows (Section 8.3.1):

|  |
| --- |
| 8.3.1.2 eDRX in RRC\_INACTIVERAN2 sees a benefit extending the eDRX cycle in RRC\_INACTIVE beyond 10.24 seconds for REDCAP Ues for the following reasons:* It is very beneficial to have >10.24 seconds in RRC\_INACTIVE to effectively support the usage of SDT (small data transfer) for e.g. use cases with periodic uplink data with periodicity > 10.24 seconds. TS 22.104 provides such usecases, e.g. some industrial wireless sensors need to transfer small packets while they are not very sensitive to DL traffic delay, but they have strict battery lifetime requirement
* Based on the results in the Appendix, there is a clear power saving gain vs eDRX in RRC\_IDLE at least for eDRX cycles of 10.24 seconds – couple of minutes, where the UE in eDRX in RRC\_INACTIVE additionally benefits from less signaling. Based on these results, lifetime of several years would not be achievable in some cases (e.g. 1 minute IAT) if only RRC\_IDLE can be used, because of the signaling overhead
* Signaling reduction is an additional benefit from network point of view – there is need for less RRC signaling

The resulting issues are:* Impact on NAS retransmission, SA2/CT1 must be consulted on the feasibility
* Potential handling of different eDRX cycles > 10.24 seconds and/or PTWs, one for IDLE the other for INACTIVE
* It needs to be studied which Node decides the eDRX cycle for RRC\_INACTIVE

SA2/CT1 must be consulted on the feasibility prior to the introduction of eDRX cycles longer than 10.24 seconds in RRC Inactive. |

**Q5: Do companies agree with above text proposal added to Section 8.3.1?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes |  |
| vivo |  | See above. |
| Fraunhofer | Yes |  |
| Qualcomm | No | The way that the second paragraph is worded implies that RAN2 have agreed to extend eDRX cycle beyond 10.24s and we only need some help from SA2/CT1 to resolved the described issues. We think SA2/CT1 play a more deciding role in this discussion, i.e. the final decision on whether eDRX cycles beyond 10.24s should be adopted or not should be made by SA2/CT1. We’d suggest to add a sentence after the second paragraph in the above TP as follows:The final decision on whether to adopt eDRX cycles longer than 10.24s in RRC Inactive will be made by SA2/CT1. |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Sharp | Yes |  |
| CATT | Yes | @Qualcomm. OK with the comment. How about: “SA2/CT1 must be consulted on the feasibility”? |
| Xiaomi | Yes |  |
| Huawei | Yes |  |
| MediaTek | Yes, but | Agree with the addition from Qualcomm, we are okay with CATT’s suggestion modified as below:SA2/CT1 must be consulted on the feasibility prior to the introduction of eDRX cycles longer than 10.24s in RRC Inactive. |
| Convida | Yes | We are ok to consult feasibility from SA2/CT1 |
| Futurewei | Yes |  |
| Ericsson | Yes | Regarding QC comment, RAN2 can agree from RAN2 perspective that such can be introduced if feasibility is confirmed by other relevant WGs from their side. RAN2 should also communicate preference to do so. (Same editorial comments as before) |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Intel | Yes but | Agree QC’s comments, and ok with Mediatek/CATT’s suggestionSA2/CT1 must be consulted on the feasibility prior to the introduction of eDRX cycles longer than 10.24s in RRC Inactive. |
| Facebook | Yes |  |
| Nokia | Yes | OK with CATT’s latest wording in the comment. |
| CMCC | Yes |  |
| Thales | Yes |  |
| LGE | Yes |  |
| Sequans | Yes, but | Agree with Intel |

**Summary:**

23 companies provided inputs to the question. All companies but vivo agree with the TP. Six companies propose to clarify that SA2/CT1 must be consulted on the feasibility. Rapporteur updated the above TP accordingly with revision marks.

**Proposal 6b (22/23): Agree the above TP for eDRX > 10.24s in Inactive.**

### Addressing the impacts of eDRC cycle >10.24s in inactive

### Handling of two PTWs and PHs

Whether to support a common PTW and eDRX cycle configuration for RRC\_IDLE and RRC\_INACTIVE as one of the possible solutions to consider during the WI phase was discussed in the email discussion #154 to RAN2#113-e [3], resulting in the following summary:

|  |
| --- |
| **Summary:**20 companies provided inputs to this question.A majority of companies (17/20) support a solution based on a common PTW and eDRX cycle configuration for RRC\_IDLE and RRC\_INACTIVE. 4 companies (OPPO/Sharp/ZTE/Convida) are OK with a common PTW for RRC\_IDLE and RRC\_INACTIVE but would prefer to have the flexibility to support a shorter eDRX cycle in RRC\_INACTIVE than in RRC\_IDLE. ZTE also think it is too early to decide and the practical feasibility from CN perspective needs to be checked. Two companies (Huawei/Sequans) would also like to study more flexible solutions. **Proposal 7 (17/20): Capture in the TR that RAN2 will consider as a starting point a common PTW and eDRX cycle configuration for RRC\_IDLE and RRC\_INACTIVE, justified by its simplicity. More flexible solutions can be considered if shown beneficial.** |

Given the vast majority of companies supporting proposal #7, we propose to adopt it.

**Companies who do not agree with the above proposal #7 are invited to express their concerns.**

|  |  |
| --- | --- |
| Company | Argument(s) |
| Apple | We agree. |
| vivo | Agree if eDRX cycle >10.24s in inactive mode was agreed. |
| Qualcomm | We’d like to change our previous position and think UE should have the flexibility to negotiate different eDRX configurations for RRC Idle and RRC Inactive. For example, it is more efficient for UE to enter RRC Inactive instead of RRC Idle when it expects new data in not-so-distant future but still see opportunity to sleep before the data arrive. In this case, which we believe is one of the motivating scenario for RRC Inactive, it is important for UE to have a different eDRX configuration than the one for its RRC Idle.We’d propose not to capture any conclusion on this topic and study the issue in more details in the WI phase. |
| OPPO | We prefer to support separate eDRX cycle configuration for CN paging and RAN paging, which could provide more flexible configuration.We propose to capture both options in the TR rather than considering common PTW and eDRX cycle configuration as a starting point. |
| Sharp | Both common PTW and eDRX cycle configuration and some simple flexible method have been proposed can be included.  |
| Huawei | We agree but with some comments. The common PTW and eDRX cycle could be the simplest way but not necessarily the most efficient, as the requirements in RRC\_IDLE and RRC\_INACTIVE may be different in terms of latency or power consumption. Besides, Proposal 7 is related to the options in Proposal 8. A common PTW and eDRX cycle configuration is more likely to be decided by the CN. To address the possible solutions on handling of two PTWs and PHs, we suggest to add the following options in the TR for future discussion:* A common PTW but with different eDRX cycle
* A common eDRX cycle but with different PTW length
* Different eDRX cycle and different PTW length
 |
| Convida | Agree with Huawei to capture all options on the table. |
| Ericsson | Agree with QC and Huawei – for the study phase let’s focus on capturing the options, although at the moment we have preference for the common window case. But, for this particular discussion it is early to decide anything conclusive thus prefer to capture options and continue discussion on the details during WI phase, if the feature is included.  |
| ZTE | We prefer to capture all the options to the TR. Common PTW and eDRX cycle with long eDRX cycle is suitable for IWSN (battery powered industrial sensors) where transmission is triggered by uplink data. However, as Qualcomm indicated, there are scenarios where different eDRX cycle in RRC INACTIVE is beneficial. We should not exclude these scenarios at this stage. |
| Nokia | We are OK with common PTW but don’t see why we should restrict in terms of eDRX cycle at this phase. |
| CMCC | Agree with Huawei to capture all options on the table. |
| Thales | We have preference for the common window size and eDRX cycle for simplicity reasons but would also be OK to include different eDRX cycle. |
| Sequans | Agree to capture all options. |

**Summary:**

11 companies think proposal 7 is too restrictive and would prefer listing explicitly all options in the TR. vivo consider the proposals are conditional to the acceptance that eDRX cycle >10.24s in inactive mode was agreed. We therefore propose updating proposal 7 as follows, and agreeing P7 conditional to P5 agreement:

**Proposal 7: Capture in the TR that RAN2 will consider the following configurations for the PTW and eDRX for RRC\_IDLE and RRC\_INACTIVE:**

* **Common PTW and eDRX cycle configuration**
* **A common PTW but with different eDRX cycle**
* **A common eDRX cycle but with different PTW length**
* **Different eDRX cycle and different PTW length**

**Text proposal:**

We propose to capture proposals #7 in the updated TR [7] as follows (Section 8.3.1.2):

|  |
| --- |
| The following solutions can be considered for PTW and eDRX cycle configuration for RRC\_IDLE and RRC\_INACTIVE:* A common PTW and eDRX cycle
* A common PTW but with different eDRX cycle
* A common eDRX cycle but with different PTW length
* Different eDRX cycle and different PTW length
 |

**Q6: Do companies agree with above text proposal added to Section 8.3.1.2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes | agree |
| vivo |  | See above. |
| Fraunhofer | Yes |  |
| Qualcomm | No | See our comments above |
| Lenovo | Yes |  |
| OPPO | No | See our comments to P7. |
| CATT | Yes | @Qualcomm: the TR is a picture of the progress at the time of SI closure and we haven’t seen yet a contribution describing your solution. But that’s OK, we think nothing is closed at the moment and the 2nd sentence is precisely there to leave the door open to other solutions, if sufficient motivation is shown in the WI phase. @OPPO: similar comment. |
| Xiaomi | Yes |  |
| Huawei | Yes with comment | Please see our comments on P7. |
| MediaTek | Yes |  |
| Convida | No with comments | All options should be captured.  |
| Futurewei | Yes |  |
| Ericsson | Yes | See above, perhaps a recommendation regarding this detail is not needed from the SI phase as it depends on other recommendations / scope. However, we are not against adding this as “starting point”. |
| Samsung | Yes |  |
| ZTE | Yes with comments | Please see our comments to P7. |
| Intel | Yes |  |
| Facebook | Yes |  |
| Nokia | No | We are OK with common PTW but the eDRX cycle should be FFS. |
| CMCC | Yes with comments | All options should be captured. |
| Thales | Yes, with comments. | If there is majority also for flexibility in PTW, we would be also Ok with that. |
| LGE | Yes |  |
| Sequans | Yes, and | Include the other options |

**Summary:**

Similar to P7, the TP is found too restrictive by companies and a more open TP is proposed reflecting the above updated P7. The above TP is updated accordingly with revision marks.

vivo consider the proposals are conditional to the acceptance that eDRX cycle >10.24s in inactive mode was agreed.

It is proposed to agree the updated TP conditional to P5 agreement.

**Proposal 7b: Agree the updated TP on configuration solutions for the PTW and eDRX for RRC\_IDLE and RRC\_INACTIVE.**

### Which node is responsible for configuring the eDRX cycle in inactive?

In the email discussion #154 to RAN2#113-e [3], it is proposed to capture the following options in the TR to be considered for the deciding node for the eDRX configuration for inactive:

* Option 1: CN decides the eDRX parameters for RRC\_INACTIVE
* Option 2: RAN decides the eDRX parameters for RRC\_INACTIVE

Companies’ inputs resulted in the following summary:

|  |
| --- |
| **Summary:**20 companies provided inputs to this question.All companies support capturing both options in the TR and performing the down-selection during the WI phase. 5 companies (CATT/Apple/Ericsson/Qualcomm/LGE) would prefer Option 1 and 3 companies (Sharp/Huawei/Convida) would prefer Option 2. 2 companies (Sharp/Convida) comment that for R16 eMTC connected to 5GC, these options were also discussed in SA2 and in the end it is NG-RAN that choses and configures the final eDRX cycle for RRC\_INACTIVE, based on idle mode eDRX cycle as provided by the AMF. So, in any case, SA2/CT1 should be consulted on this.The arguments in favour of each option can be summarized as follows based on companies’ inputs:Option 1: CN decides the eDRX parameters for RRC\_INACTIVE* CN has better insight on UE traffic profile
* Better for addressing potential core network impacts
* CN is responsible for eDRX in RRC\_IDLE (and UE needs to monitor for CN paging also in RRC\_INACTIVE)
* If RAN2 agrees to consider a common PTW and eDRX cycle configuration, CN based eDRX configuration can be supported with minimum impact to specifications where RAN follows the CN configured cycle justified by its simplicity and less impact expected to other WGs

Option 2: RAN decides the eDRX parameters for RRC\_INACTIVE* It provides more flexibility to the RAN node in the configuration of the eDRX parameters
* It allows RAN to configure different eDRX cycle for RRC INACTIVE
* In R16 eMTC connected to 5GC, it is already NR-RAN that choses and configures the final eDRX cycle for RRC\_INACTIVE, based on idle mode eDRX cycle as provided by the AMF

**Proposal 8: Capture in the TR the two options for the deciding node for the eDRX configuration for RRC INACTIVE: RAN or CN.****Proposal 9: Capture in the TR the above arguments in favour of each option.** |

Given all companies supported proposal #8, we propose to adopt it along with the associated proposal #9 capturing the related arguments for each.

**Companies who do not agree with the above proposals 8-9 are invited to express their concerns.**

|  |  |  |
| --- | --- | --- |
| Company | Proposal(s) | Argument(s) |
| Apple | Agree to 8 and 9 | We can decide in WI phase which among RAN/CN can configure. |
| Vivo |  | Agree with P8 and P9 if eDRX cycle >10.24s in inactive mode was agreed. |
| Huawei | Agree to P8 and P9 |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Summary:**

No concerns are raised on proposals 8 and 9.

vivo consider the proposals are conditional to the acceptance that eDRX cycle >10.24s in inactive mode was agreed. We update the pros of Option 1 based on Ericsson’s suggested changes below in Q7 captured with revision marks.

Rapporteur proposes agreeing proposals 8 and 9 conditional to P5 agreement.

**Text proposal:**

We propose to capture proposals #8-9 in the updated TR [7] as follows (Section 8.3.1.2):

|  |
| --- |
| Two options should be considered for the deciding node for the eDRX configuration for inactive:Option 1: CN decides the eDRX parameters for RRC\_INACTIVE* CN has better insight on UE traffic profile
* Better for addressing potential core network impacts
* CN is responsible for eDRX in RRC\_IDLE (and UE needs to monitor for CN paging also in RRC\_INACTIVE)
* If RAN2 agrees to consider a common PTW and eDRX cycle configuration, CN based eDRX configuration can be supported with minimum impact to specifications where RAN follows the CN configured cycle justified by its simplicity and less impact expected to other WGs

Option 2: RAN decides the eDRX parameters for RRC\_INACTIVE* It provides more flexibility to the RAN node in the configuration of the eDRX parameters
* It allows RAN to configure different eDRX cycle for RRC INACTIVE
* In R16 eMTC connected to 5GC, it is already NR-RAN that choses and configures the final eDRX cycle for RRC\_INACTIVE, based on idle mode eDRX cycle as provided by the AMF
 |

**Q7: Do companies agree with above text proposal added to Section 8.3.1.2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes  | Ok with the content |
| Vivo |  | See above. |
| Fraunhofer | Yes | Agree.  |
| Qualcomm | Yes |  |
| Lenovo | Yes |  |
| OPPO | Yes |  |
| Sharp | Yes |  |
| CATT | Yes |  |
| Xiaomi | Yes |  |
| Huawei | Yes |  |
| MediaTek | Yes |  |
| Convida | Yes |  |
| Futurewei | Yes |  |
| Ericsson | Yes, with changes | We don’t agree with second bullet about “NAS retransmission timer issue” as the issue is not really about timer values but more generally about the NW knowledge whether UE is reachable or not. Any issues should be checked with SA2/CT1 in any case and RAN2 should not make assumptions. Suggest modifying the bullet e.g. to “Better for addressing potential core network impact” or similar. Suggestion on addition to Option 1 “pros”:* If RAN2 agrees to consider a common PTW and eDRX cycle configuration, CN based eDRX configuration can be supported with minimum impact to specifications where RAN follows the CN configured cycle justified by its simplicity and less impact expected to other WGs.
 |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
| Facebook | Yes |  |
| Nokia | Yes |  |
| CMCC | Yes |  |
| Thales | Yes |  |
| LGE | Yes |  |
| Sequans | Yes | OK with Ericsson suggestion for “NAS retransmission timer issue” |

**Summary:**

All companies agree with the TP. Ericsson and Sequans suggest some text changes rewording the “pros” of option 1.

vivo clarifies the TP is conditional to the acceptance that eDRX cycle >10.24s in inactive mode was agreed. With Ericsson’s suggested changes captured with revision marks, it is proposed to agree the above TP, conditional to P5.

**Proposal 10 (all): Agree the above TP on eDRX parameters configuring node.**

# Conclusion

# Proposals for agreement

Based on companies’ inputs to this email discussion, the following proposals are listed for agreement:

**Proposal 1 (all): It should be possible for (at least some) REDCAP Ues to receive emergency broadcast services.**

Proposals conditional to proposal 5:

**Proposal 8 (all): Capture in the TR the two options for the deciding node for the eDRX configuration for RRC INACTIVE: RAN or CN.**

**Proposal 9 (all): Capture in the TR the below arguments in favour of each option.**

Option 1: CN decides the eDRX parameters for RRC\_INACTIVE

* CN has better insight on UE traffic profile
* Better for addressing potential core network impacts
* CN is responsible for eDRX in RRC\_IDLE (and UE needs to monitor for CN paging also in RRC\_INACTIVE)
* If RAN2 agrees to consider a common PTW and eDRX cycle configuration, CN based eDRX configuration can be supported with minimum impact to specifications where RAN follows the CN configured cycle justified by its simplicity and less impact expected to other WGs

Option 2: RAN decides the eDRX parameters for RRC\_INACTIVE

* It provides more flexibility to the RAN node in the configuration of the eDRX parameters
* It allows RAN to configure different eDRX cycle for RRC INACTIVE
* In R16 eMTC connected to 5GC, it is already NR-RAN that choses and configures the final eDRX cycle for RRC\_INACTIVE, based on idle mode eDRX cycle as provided by the AMF

**Proposal 10 (all): Agree the below TP on eDRX parameters configuring node.**

|  |
| --- |
| Two options should be considered for the deciding node for the eDRX configuration for inactive:Option 1: CN decides the eDRX parameters for RRC\_INACTIVE* CN has better insight on UE traffic profile
* Better for addressing potential core network impacts
* CN is responsible for eDRX in RRC\_IDLE (and UE needs to monitor for CN paging also in RRC\_INACTIVE)
* If RAN2 agrees to consider a common PTW and eDRX cycle configuration, CN based eDRX configuration can be supported with minimum impact to specifications where RAN follows the CN configured cycle justified by its simplicity and less impact expected to other WGs

Option 2: RAN decides the eDRX parameters for RRC\_INACTIVE* It provides more flexibility to the RAN node in the configuration of the eDRX parameters
* It allows RAN to configure different eDRX cycle for RRC INACTIVE
* In R16 eMTC connected to 5GC, it is already NR-RAN that choses and configures the final eDRX cycle for RRC\_INACTIVE, based on idle mode eDRX cycle as provided by the AMF
 |

# Proposals for online discussion

**Proposal 0 (20/23): Agree the below TP for capturing agreements #1, #2 and #4 from online GTW session (further update according to the conclusions on P2 and P4):**

|  |
| --- |
| From RAN2 perspective, extended DRX can be specified and configured for RedCap UEs so that eDRX cycles at least up to 10.24 seconds can be used in RRC\_IDLE and in RRC\_INACTIVE states. For RRC\_IDLE, the baseline for possible extension of configurable eDRX cycles is up to 2621.44 seconds. Longer values, e.g. 10485.76 seconds can be considered further. If extension of the eDRX cycles beyond 10.24 seconds is specified, a feasible extension mechanism is expected to be similar to what is specified for LTE. This mechanism would include the use of H-SFN, PH and PTW. For RedCap UEs in RRC\_IDLE or RRC\_INACTIVE, if the eDRX cycle is less than or equal to 10.24 seconds, the paging monitoring configuration does not use PTW and PH. Specifically for 10.24 seconds, the pros and cons of not using PTW and PH are as follows:Pros:* It enables longer eDRX cycles needed by some RedCap UEs and yet allows other UEs that do not need long eDRX cycles (>10.24 seconds) to reuse NR R16 DRX implementation without additional development work and without a need for an explicit capability signalling.
* NR already supports 10.24 seconds interval in C-DRX
* For 10.24 seconds and RRC\_INACTIVE similar solution was adopted for LTE in eMTC

Cons:* It is different from LTE solution for eDRX cycle = 10.24 seconds in RRC\_IDLE
* It will impact 5GC and RAN2 will need to consult SA2/CT1 on the feasibility
* UE can no longer have multiple opportunities to receive its paging during an eDRX cycle
 |

**Proposal 2: Capture in the TR the below five options allowing REDCAP Ues to receive emergency broadcast services (and resulting recommended eDRX lower bound) and the associated pros/cons.**

**Option 1:** eDRX supports a lower bound of 2.56s.

**Option 2:** For RedCap UEs, if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter. eDRX lower bound can be kept to baseline 5.12s.

Options 1-2 pros/cons:

Pros

* It enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them.

Cons:

* This solution assumes such REDCAP Ues do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles, thus resulting in network not being able to reach such RedCap Ues by using default broadcasted paging cycles and/or UE-specific RAN paging cycles. This may result e.g. in a potential risk of UE missing SI change indicator.
* Specifically for Option 2, it requires a different way to determine the UE DRX cycle for REDCAP Ues in both the UE and the gNB.

**Option 3:** gNB can configure 2.56s default broadcasted DRX cycle for those RedCap Ues that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for Ues with tighter latency requirements (e.g. smartphones). eDRX lower bound can be kept to baseline 5.12s.

Pros

* Consistent with the LTE solution.
* Solution based on Network implementation and there is no additional impact.

Cons:

* A default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones and requires configuring on top a UE-specific RAN paging cycle for each such smartphones.

**Option 4:** RedCap Ues that need to receive emergency broadcast services are not expected to request to be configured with eDRX, and no specific handling/configuration is required for those Ues. eDRX lower bound can be kept to baseline 5.12s.

Pros

* No specification or configuration impact.

Cons:

* Those REDCAP Ues do not benefit from eDRX power saving.

**Option 5:** REDCAP UE can request an eDRX configuration while still monitoring in between for ETWS and CMAS. eDRX lower bound can be kept to baseline 5.12s.

**Proposal 3 (18/21): Capture in the TR that it is recommended to support eDRX value up to 10485.76 s.**

**Proposal 4 (21/23): Agree the below TP on eDRX upper bound.**

Section 8.3.1:

|  |
| --- |
| From RAN2 perspective, extended DRX can be specified and configured for RedCap Ues so that eDRX cycles can be used in RRC\_IDLE and in RRC\_INACTIVE states.  |

Section 8.3.1.1:

|  |
| --- |
| For the upper bound, the eDRX cycle should support up to 10485.76s, since the upper limit of the H-SFN (10bit) already is 10485.76 seconds, and CN already supports eDRX values up to 10485.76 seconds. Although little power saving gain has been observed beyond 2621.44 seconds (simulation results show that the gain is saturated at around 40mins), there is no reason to artificially limit without technical concern.  |

**Proposal 5 (20/21): Capture in the TR that RAN2 sees a benefit and recommends extending the eDRX cycle in RRC\_INACTIVE beyond 10.24s for REDCAP Ues.**

**Proposal 6 (20/21): Capture in the TR the justifying benefits listed below and associated issues to solve.**

Benefits

* It is very beneficial to have >10.24 sec in RRC\_INACTIVE to effectively support the usage of SDT (small data transfer) for e.g. use cases with periodic uplink data with periodicity > 10.24 s. TS 22.104 provides such usecases, e.g. some industrial wireless sensors need to transfer small packets while they are not very sensitive to DL traffic delay, but they have strict battery lifetime requirement.
* Based on the results in the Appendix of the TR, there is a clear power saving gain vs eDRX in RRC\_IDLE at least for eDRX cycles of 10.24 s – couple of minutes, where the UE in eDRX in RRC\_INACTIVE additionally benefits from less signaling. Based on these results, lifetime of several years would not be achievable in some cases (e.g. 1 minute IAT) if only RRC\_IDLE can be used, because of the signaling overhead.
* Signaling reduction is an additional benefit from network point of view – there is need for less RRC signaling

Issues:

* Impact on NAS retransmission, SA2/CT1 must be consulted on the feasibility
* Potential handling of different eDRX cycles > 10.24s and/or PTWs, one for IDLE the other for INACTIVE
* Need to study which Node decides the eDRX cycle for RRC\_INACTIVE

**Proposal 6b (22/23): Agree the below TP for eDRX > 10.24s in Inactive.**

|  |
| --- |
| 8.3.1.2 eDRX in RRC\_INACTIVERAN2 sees a benefit extending the eDRX cycle in RRC\_INACTIVE beyond 10.24 seconds for REDCAP Ues for the following reasons:* It is very beneficial to have >10.24 seconds in RRC\_INACTIVE to effectively support the usage of SDT (small data transfer) for e.g. use cases with periodic uplink data with periodicity > 10.24 seconds. TS 22.104 provides such usecases, e.g. some industrial wireless sensors need to transfer small packets while they are not very sensitive to DL traffic delay, but they have strict battery lifetime requirement
* Based on the results in the Appendix, there is a clear power saving gain vs eDRX in RRC\_IDLE at least for eDRX cycles of 10.24 seconds – couple of minutes, where the UE in eDRX in RRC\_INACTIVE additionally benefits from less signaling. Based on these results, lifetime of several years would not be achievable in some cases (e.g. 1 minute IAT) if only RRC\_IDLE can be used, because of the signaling overhead
* Signaling reduction is an additional benefit from network point of view – there is need for less RRC signaling

The resulting issues are:* Impact on NAS retransmission, SA2/CT1 must be consulted on the feasibility
* Potential handling of different eDRX cycles > 10.24 seconds and/or PTWs, one for IDLE the other for INACTIVE
* It needs to be studied which Node decides the eDRX cycle for RRC\_INACTIVE

SA2/CT1 must be consulted on the feasibility prior to the introduction of eDRX cycles longer than 10.24 seconds in RRC Inactive. |

Proposals conditional to proposal 5:

**Proposal 7: Capture in the TR that RAN2 will consider the following configurations for the PTW and eDRX for RRC\_IDLE and RRC\_INACTIVE:**

* **Common PTW and eDRX cycle configuration**
* **A common PTW but with different eDRX cycle**
* **A common eDRX cycle but with different PTW length**
* **Different eDRX cycle and different PTW length**

**Proposal 7b: Agree the below updated TP on configuration solutions for the PTW and eDRX for RRC\_IDLE and RRC\_INACTIVE.**

|  |
| --- |
| The following solutions can be considered for PTW and eDRX cycle configuration for RRC\_IDLE and RRC\_INACTIVE:* A common PTW and eDRX cycle
* A common PTW but with different eDRX cycle
* A common eDRX cycle but with different PTW length
* Different eDRX cycle and different PTW length
 |

# Phase II

# Proposal 2 on eDRX lower bound and emergency broadcast reception with power saving

This discussion focuses on Proposal 2 from Section 3.1.2, where the proposal, options, and pros/cons have been updated to accommodate the comments from companies.

**Proposal 2: Capture in the TR the below five options allowing REDCAP Ues to reduce paging power consumption and/or receive emergency broadcast services (and resulting recommended eDRX lower bound) and the associated pros/cons.**

**Option 1:** eDRX supports a lower bound of 2.56s.

**Option 2:** For RedCap UEs, if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter. eDRX lower bound can be kept to baseline 5.12s.

Options 1-2 pros/cons:

Pros

* It enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them.
* Specifically to option 2, it allows lower power consumption for page reception without any change to lower bounds of eDRX

Cons:

* This solution assumes such REDCAP Ues do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles, thus resulting in network not being able to reach such RedCap Ues by using default broadcasted paging cycles and/or UE-specific RAN paging cycles. This may result e.g. in a potential risk of UE missing SI change indicator.
* Specifically for Option 2, it requires a different way to determine the UE DRX cycle for REDCAP Ues in both the UE and the gNB.

**Option 3:** gNB can configure 2.56s default broadcasted DRX cycle for those RedCap Ues that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for Ues with tighter latency requirements (e.g. smartphones). eDRX lower bound can be kept to baseline 5.12s.

Pros

* Consistent with the LTE solution.
* Solution based on Network implementation and there is no additional impact.
* RedCap UEs can benefit from lower power consumption, as well as receive emergency broadcast.

Cons:

* A default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones requiring changes to the paging cycle in existing deployments and configuring on top a UE-specific RAN paging cycle for each such smartphones.
* A default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones, ~~and~~ requir~~es~~ing changes to the paging cycle in existing deployments and configuring on top a UE-specific RAN paging cycle for each such smartphones

**Option 4:** RedCap Ues that need to receive emergency broadcast services are not expected to request to be configured with eDRX, and no specific handling/configuration is required for those Ues. eDRX lower bound can be kept to baseline 5.12s.

Pros

* No specification or configuration impact.

Cons:

* Those REDCAP Ues do not benefit from eDRX power saving.

**Option 5:** REDCAP UE can request an eDRX configuration while still monitoring in between (by implementation) for ETWS and CMAS. eDRX lower bound can be kept to baseline 5.12s.

Pros

* No specification impact, no impact on network side.
* Uses existing LTE baseline.
* UE can be configured with long eDRX cycle for power saving. It is up to UE implementation how often it monitors for ETWS/CMAS information

Cons:

* Those REDCAP UEs do not benefit from eDRX power saving.

**Q8: Do companies agree with above Proposal 2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes  |  |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| OPPO | Yes |  |
| vivo | Yes |  |
| LGE | Yes |  |
| MediaTek | Yes, and | Under the cons for Option 3, we suggest the following change (to be reflected in the TR) to clarify the impact to existing deployments:A default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones, ~~and~~ requir~~es~~ing changes to the paging cycle in existing deployments and configuring on top a UE-specific RAN paging cycle for each such smartphones. |
| ZTE | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Apple | Yes | We thanks the rapporteur for accepting/handling this. We also echo MediaTek’s views. |
| Xiaomi | Yes |  |
| Ericsson | Yes | Option 2 seems to be same or similar as is discussed in Power saving WI (see our earlier comment about reference), can this be clarified? For Option 5 we can add following:* Pros:
	+ No specification impact, no impact on network side.
	+ Uses existing LTE baseline.
	+ UE can be configured with long eDRX cycle for power saving. It is up to UE implementation how often it monitors for ETWS/CMAS information.
* Cons:
	+ The solution is not specified, i.e. not captured in specifications, thus there are no requirements.
 |
| Convida | Yes | Agree with Ericsson that Option 2 is the same as discussed in Power saving WI. |

**Summary:**

All companies agree with Proposal 2, with some comments that rapporteur addressed/answered with updates with revision marks.

Rapporteur proposes agreeing proposal 2.

**Text proposal:**

We propose to capture proposal 2 in the updated TR [7] as follows (Section 8.3.1):

|  |
| --- |
| For the lower bound of the eDRX cycle, one motivation to support down to 2.56 seconds is that (at least some) RedCap UEs should be able to support the reception of emergency broadcast services (e.g. ETWS primary notification) within the required delay budget (of 4 seconds), while still saving power, which is not possible with 5.12 seconds eDRX cycle lengths. However other solutions exist allowing RedCap UEs to receive emergency broadcast services without requiring eDRX to support lower cycle values than legacy LTE (5.12s), while also saving power: * For RedCap UEs, if the NAS configures the UE with a 2.56 seconds DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter.
* gNB can configure 2.56 seconds default broadcasted DRX cycle for those RedCap UEs that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for UEs with tighter latency requirements (e.g. smartphones)

The former solution is similar to supporting eDRX cycle of 2.56 seconds in that the UE does not need to follow shorter RAN (dedicated or default) paging cycle, and therefore has the same pros/cons: it enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them. However, these solutions assumes such RedCap UEs do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles, thus resulting in network not being able to reach such RedCap UEs by using default broadcasted paging cycles and/or UE-specific RAN paging cycles. This may result e.g. in a potential risk of UE missing SI change indicator. Specifically for the solution in the first bullet, it requires a different way to determine the UE DRX cycle for RedCap UEs in both the UE and the gNB.The latter solution (2nd bullet) is consistent with the LTE solution, but a default broadcasted DRX value of 2.56 seconds is expected not widely used, e.g. in existing deployments supporting smartphones, requiring changes to the paging cycle in existing deployments and configuring a UE-specific paging cycle for each UE intended to follow a shorter paging cycle.Other solutions also exist that do not consider the power saving aspects for UEs receiving emergency broadcast services. For example a simple solution is that RedCap UEs that need to receive emergency broadcast services do not request to be configured with eDRX, and no specific handling/configuration is required for those UEs. But then, such RedCap UEs do not benefit from any specific eDRX power saving. Alternately, a RedCap UE could request an eDRX configuration while still monitoring in between for ETWS and CMAS. |

**Q9: Do companies agree with above text proposal capturing proposal 2?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes  |  |
| Qualcomm | Yes |  |
| Intel | Yes |  |
| OPPO | Yes |  |
| vivo | Yes |  |
| LGE | Yes |  |
| MediaTek | Yes, and | As outlined in Q8, we suggest clarifying the impact to existing deployments:The latter solution (2nd bullet) is consistent with the LTE solution, but a default broadcasted DRX value of 2.56 seconds is expected seldom used in existing deployments supporting smartphones, ~~and~~ requir~~es~~ing changes to the paging cycle in existing deployments and configuring on top a UE-specific RAN paging cycle for each such smartphones. |
| ZTE | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Apple | Yes | While we would have liked to list separately the power saving gains instead of linking with emergency broadcast reception, we are willing to accept this to close the SI and move on to WI phase.  |
| Xiaomi | Yes |  |
| Ericsson | Yes with comments (also in previous question) | Is the intention to introduce a new sub-clause in the TR? If so, then the header needs to be changed to be descriptive of the feature – now it seems we are describing the RRC\_IDLE eDRX solution which is not correct. The section could be called something like “lower bound of eDRX cycle length configuration” or something similar, and then explain that in LTE case the lowest value is 5.12 and then continue with describing what could be the benefits of 2.56 s cycle (e.g., potential power saving gain vs monitoring shortest of configured cycles, the aspect with emergency notifications, etc). Agree with Apple that it would be very good to have the potential power saving gains captured – but there seems to be no analysis provided.See suggestions in paragraph below:“The latter solution (2nd bullet) is consistent with the LTE solution, but a default broadcasted DRX value of 2.56 seconds is ~~expected seldom~~ not widely used ,e.g., in existing deployments supporting smartphones and would require~~s~~ configuring ~~on top~~ a UE-specific ~~RAN~~ paging cycle for each ~~such smartphones~~ UE intended to follow a shorter paging cycle.”See suggestions in paragraph below:For example a simple solution ~~consists in considering~~ is that RedCap Ues that need to receive emergency broadcast services ~~are not expected to be configured~~ do not request to be configured with eDRX, and no specific handling/configuration is required for those Ues. But then, such REDCAP Ues do not benefit from any specific eDRX power saving.On the last paragraph starting “other solutions…”, it is not true that the power saving aspect is not considered for the last of the listed solutions – in that case the UE can be configured with any eDRX cycle, and the frequency which the UE uses to receive ETWS/CMAS notifications would be up to the UE.  |
| Convida | Yes | Agree with Ericsson’s text proposal |

**Summary:**

All companies agree with the TP, with some suggested changes that rapporteur addressed.

**Proposal 2b: Agree the above TP on eDRX lower bound and emergency broadcast reception with power saving.**

# Proposal 4: TP on eDRX upper bound

In today’s GTW session the proposal 3 in Section 3.1.3 was agreed as follows:

Agreements:

1. Capture in TR the following solutions to assist triggering neighbour RRM relaxation in RRC\_CONNECTED.

 • Solution 1: UE reports “stationary” status to network in Msg5;

 • Solution 2: Network provides (e.g. low mobility, not-at-cell-edge) evaluation parameters to UE via dedicated signalling;

 • Solution 3: AMF sends “stationary” indication to gNB (based on UE subscription);

 • Solution 4: UE reports “stationary” in UE Assistance Information to network;

1. Capture in the TR that it is recommended to support eDRX value up to 10485.76 s for RRC Idle, unless RAN4 indicates such eDRX value requires UE to perform RRM on serving cell outside PTW

Given the associated TP (proposal 4) was pending this agreement and got wide support (21/23), it is proposed to agree the TP with the above addition from agreement 2: “unless RAN4 indicates such eDRX value requires UE to perform RRM on serving cell outside PTW”.

**Proposal 4 (21/23): Agree the below TP on eDRX upper bound.**

 Section 8.3.1:

|  |
| --- |
| From RAN2 perspective, extended DRX can be specified and configured for RedCap Ues so that eDRX cycles can be used in RRC\_IDLE and in RRC\_INACTIVE states.  |

Other Section (up to TR rapporteur):

|  |
| --- |
| For the upper bound, the eDRX cycle should support up to 10485.76s, since the upper limit of the H-SFN (10bit) already is 10485.76 seconds, and CN already supports eDRX values up to 10485.76 seconds. Although little power saving gain has been observed beyond 2621.44 seconds (simulation results show that the gain is saturated at around 40 minutes), there is no reason to artificially limit without technical concern, unless RAN4 indicates such eDRX value requires UE to perform RRM on serving cell outside PTW.  |

# Phase II conclusions

It is proposed to agree the following:

**Proposal 2: Capture in the TR the below five options allowing REDCAP Ues to reduce paging power consumption and/or receive emergency broadcast services (and resulting recommended eDRX lower bound) and the associated pros/cons.**

**Option 1:** eDRX supports a lower bound of 2.56s.

**Option 2:** For RedCap UEs, if the NAS configures the UE with a 2.56 DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter. eDRX lower bound can be kept to baseline 5.12s.

Options 1-2 pros/cons:

Pros

* It enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them.
* Specifically to option 2, it allows lower power consumption for page reception without any change to lower bounds of eDRX

Cons:

* This solution assumes such REDCAP Ues do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles, thus resulting in network not being able to reach such RedCap Ues by using default broadcasted paging cycles and/or UE-specific RAN paging cycles. This may result e.g. in a potential risk of UE missing SI change indicator.
* Specifically for Option 2, it requires a different way to determine the UE DRX cycle for REDCAP Ues in both the UE and the gNB.

**Option 3:** gNB can configure 2.56s default broadcasted DRX cycle for those RedCap Ues that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for Ues with tighter latency requirements (e.g. smartphones). eDRX lower bound can be kept to baseline 5.12s.

Pros

* Consistent with the LTE solution.
* Solution based on Network implementation and there is no additional impact.
* RedCap UEs can benefit from lower power consumption, as well as receive emergency broadcast.

Cons:

* A default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones requiring changes to the paging cycle in existing deployments and configuring on top a UE-specific RAN paging cycle for each such smartphones.
* A default broadcasted DRX value of 2.56s is expected seldom used in existing deployments supporting smartphones, requiring changes to the paging cycle in existing deployments and configuring on top a UE-specific RAN paging cycle for each such smartphones

**Option 4:** RedCap Ues that need to receive emergency broadcast services are not expected to request to be configured with eDRX, and no specific handling/configuration is required for those Ues. eDRX lower bound can be kept to baseline 5.12s.

Pros

* No specification or configuration impact.

Cons:

* Those REDCAP Ues do not benefit from eDRX power saving.

**Option 5:** REDCAP UE can request an eDRX configuration while still monitoring in between (by implementation) for ETWS and CMAS. eDRX lower bound can be kept to baseline 5.12s.

Pros

* No specification impact, no impact on network side.
* Uses existing LTE baseline.
* UE can be configured with long eDRX cycle for power saving. It is up to UE implementation how often it monitors for ETWS/CMAS information

Cons:

* Those REDCAP UEs do not benefit from eDRX power saving.

**Proposal 2b: Agree the below TP on eDRX lower bound and emergency broadcast reception with power saving.**

|  |
| --- |
| For the lower bound of the eDRX cycle, one motivation to support down to 2.56 seconds is that (at least some) RedCap UEs should be able to support the reception of emergency broadcast services (e.g. ETWS primary notification) within the required delay budget (of 4 seconds), while still saving power, which is not possible with 5.12 seconds eDRX cycle lengths. However other solutions exist allowing RedCap UEs to receive emergency broadcast services without requiring eDRX to support lower cycle values than legacy LTE (5.12s), while also saving power: * For RedCap UEs, if the NAS configures the UE with a 2.56 seconds DRX cycle, the RedCap UE follows this DRX even when the RAN paging cycle is shorter.
* gNB can configure 2.56 seconds default broadcasted DRX cycle for those RedCap UEs that need to receive emergency broadcast services and a shorter UE-specific RAN paging cycle for UEs with tighter latency requirements (e.g. smartphones)

The former solution is similar to supporting eDRX cycle of 2.56 seconds in that the UE does not need to follow shorter RAN (dedicated or default) paging cycle, and therefore has the same pros/cons: it enables a mix of smartphones and wearables in the network, with an appropriate paging cycle configured for each of them. However, these solutions assumes such RedCap UEs do not need to monitor gNB configured default broadcasted paging (and UE-specific RAN paging) cycles, thus resulting in network not being able to reach such RedCap UEs by using default broadcasted paging cycles and/or UE-specific RAN paging cycles. This may result e.g. in a potential risk of UE missing SI change indicator. Specifically for the solution in the first bullet, it requires a different way to determine the UE DRX cycle for RedCap UEs in both the UE and the gNB.The latter solution (2nd bullet) is consistent with the LTE solution, but a default broadcasted DRX value of 2.56 seconds is expected not widely used, e.g. in existing deployments supporting smartphones, requiring changes to the paging cycle in existing deployments and configuring a UE-specific paging cycle for each UE intended to follow a shorter paging cycle.Other solutions also exist that do not consider the power saving aspects for UEs receiving emergency broadcast services. For example a simple solution is that RedCap UEs that need to receive emergency broadcast services do not request to be configured with eDRX, and no specific handling/configuration is required for those UEs. But then, such RedCap UEs do not benefit from any specific eDRX power saving. Alternately, a RedCap UE could request an eDRX configuration while still monitoring in between for ETWS and CMAS. |

**Proposal 4 (21/23): Agree the below TP on eDRX upper bound.**

 Section 8.3.1:

|  |
| --- |
| From RAN2 perspective, extended DRX can be specified and configured for RedCap Ues so that eDRX cycles can be used in RRC\_IDLE and in RRC\_INACTIVE states.  |

Other Section (up to TR rapporteur):

|  |
| --- |
| For the upper bound, the eDRX cycle should support up to 10485.76s, since the upper limit of the H-SFN (10bit) already is 10485.76 seconds, and CN already supports eDRX values up to 10485.76 seconds. Although little power saving gain has been observed beyond 2621.44 seconds (simulation results show that the gain is saturated at around 40 minutes), there is no reason to artificially limit without technical concern, unless RAN4 indicates such eDRX value requires UE to perform RRM on serving cell outside PTW.  |

# Reference

1. R2-2008193 Summary of offline 111 - DRX aspects; CATT
2. R2-2008216 Summary of offline 111 - DRX aspects - second round; CATT
3. R2-2101242 Summary of email discussion 154 - eDRX cycles CATT
4. RAN2-113-e - R16 eMIMO-CLI-PRN-RACS - R17 NTN-REDCAP (Sergio)\_2021\_01\_27\_445
5. R2-2009364 Summary of email discussion 915 - UE power saving features; CATT
6. R2-2101460 2.56 sec non-eDRX operation for RedCap, Apple Inc, MediaTek Inc, Facebook Inc
7. R2-2100984 RAN2 update to TR38875, Ericsson
8. R2-2007346 Discussion on eDRX for RRC\_INACTIVE and RRC\_IDLE; Huawei, HiSilicon
9. R2-2006748 Use cases target to extend paging DRX cycle and relax measurements for stationary devices; Intel Corporation
10. R2-2009116 Further considerations for eDRX; MediaTek Inc.
11. R2-2009247 Discussion on eDRX for Redcap UE; ZTE Corporation, Sanechips
12. R2-2009363 On eDRX for NR RRC Inactive and Idle; CATT
13. R2-2009532 Support of 2.56 eDRX cycle and emergency broadcast reception for RedCap UEs; Apple, Facebook
14. R2-2009620 RedCap power saving enhancements; Ericsson