3GPP TSG-RAN2 Meeting #119-e R2-220xxxx

eMeeting, 15-26 August 2022

Agenda Item: 8.9.2.2 Control and Procedure details

Source: Ericsson

Title: Summary of [AT119-e][028][ePowSav] PDCCH Skip

Document for: Discussion and Decision

# Introduction

This report provides a summary of the following offline discussion:

* [AT119-e][028][ePowSav] PDCCH Skip (Ericsson)

Scope: Treat [R2-2208090](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119-e/Docs/R2-2208090.zip), Determine agreeable parts. Capture agreeable part in MAC CR.

Can do one more round of treatment for [R2-2208089](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_119-e/Docs/R2-2208089.zip), identify critical arguments if any, prepare for CB.

Intended outcome: Report, Agreed MAC CR

Deadline: In time for online CB W2 Thu if required otherwise EOM

The deadline for providing comments is **10:00 UTC Wednesday 24th August** so that it is possible to comeback online, if needed.

# Contact information

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# Discussion

## PDCCH skipping in 38.300 and 38.321 ([R2-2208089](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208089.zip))

The following motivation is provided to clarify PDCCH skipping in 38.321 [1]:

*Some companies preferred to avoid any impact of PDCCH skipping on 38.321, i.e. 38.321 only refers to 38.213 specification without mentioning PDCCH skipping:*

*2> monitor the PDCCH on the Serving Cells in this DRX group as specified in TS 38.213 [6];*

*Dormant BWP, similar as PDCCH skipping, is a L1 function which does not impact Active Time. However the UE is not required to monitor PDCCH on a dormant BWP, which is captured in 38.321:*

***Dormant BWP:*** *The dormant BWP is one of downlink BWPs configured by the network via dedicated RRC signaling. In the dormant BWP, the UE stop monitoring PDCCH on/for the SCell, but continues performing CSI measurements, Automatic Gain Control (AGC) and beam management, if configured.*

**Proposal 1**: Clarify in 38.321 that when PDCCH skipping is configured by RRC the UE does not monitor PDCCH for a duration as specified in TS 38.213:

When PDCCH skipping is configured by RRC the UE does not monitor PDCCH for a duration as specified in TS 38.213 [6].

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes (proponent) | We think that the readability of 38.321 is improved with this minor clarification, i.e. the reader is informed that the Active Time is not the only function that determines whether the UE is required to monitor PDCCH. |
| vivo | No | In our understanding, the text “monitor the PDCCH on the Serving Cells in this DRX group as specified in TS 38.213” includes the case for PDCCH skipping.  We are not sure about the motivation for this change. Anything missing in TS 38.321 or TS 38.213? If this is already clear in TS 38.213, we prefer not to capture duplicated description in TS 38.321. We would like to hear more justification for this change. |
| CATT | No | We agree with vivo. The reference to 38.213 already covers that. If possible, we would prefer to keep PDCCH skipping feature in RAN1 spec only. |
| OPPO | No | We think it is already clearly captured in TS 38.213. PDCCH skipping mechanism is invisible to MAC, so no need to capture it in MAC spec. |
| Huawei, HiSilicon | No | We agree with vivo. |
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The following motivation is provided to move the stage 3 requirements for PDCCH skipping from 38.300 to 38.321 [1]:

*PDCCH skipping is a L1 function (captured in section 10.4 in 38.213) that is configured via L3 (see pdcch-SkippingDurationList in 38.331) using UE capability (see pdcch-SkippingWithoutSSS and pdcch-SkippingWithSSSG in 38.306).*

*There is a stage 2 description in chapter 11 in 38.300:*

*UE power saving may also be achieved through PDCCH monitoring adaptation mechanisms when configured by the network, including skipping of PDCCH monitoring and Search space set group (SSSG) switching. In this case UE does not monitor PDCCH during the PDCCH skipping duration or monitors PDCCH according to the search space sets applied in SSSG. However, in the following cases, UE ignores PDCCH skipping:*

*- on all serving cells of the corresponding Cell Group when SR is sent and is pending;*

*- on SpCell while contention resolution timer is running;*

*- on SpCell during monitoring of the RAR/MsgB window.*

*However these stage 3 details are typically not captured in 38.300.*

**Proposal 2**: Move the following stage 3 requirements from 38.300 to 38.321:

However, in the following cases, UE ignores PDCCH skipping:

- on all serving cells of the corresponding Cell Group when SR is sent and is pending;

- on SpCell while contention resolution timer is running;

- on SpCell during monitoring of the RAR/MsgB window.

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes (proponent) | These are stage 3 requirements that belong in 38.321. |
| vivo | No | This issue was discussed in RAN2#117e meeting. In that meeting, an LS was sent to RAN1 with below question:  ***Question 2:*** *RAN2 would like to know if RAN1 prefers to capture the above agreements in RAN1 specification or prefer these to be captured in MAC specification.*  In RAN2#118e meeting, there is a reply LS R2-220446/R1-2202905 from RAN1. It is clearly said:  ***Answer 2:***  *RAN1 would discuss and conclude how to capture the above RAN2 agreements in RAN1 specification.*   * *It is RAN1 understanding PDCCH skipping is not applied to perform PDCCH monitoring during RAR window/MsgB window/contention resolution timer or when SR is pending.*   As far as I know, this part has been already captured in RAN1 specification (TS 38.213). We prefer not to capture any duplicated description in both RAN1 and RAN2 specifications. |
| CATT | No | We agree this is stage 3 description but also agree with vivo that we would prefer to keep it captured in RAN1 spec. |
| OPPO | Yes | OPPO |
| Huawei, HiSilicon | No | For stage 3 description, we understand all will be captured in RAN1 spec, so this part does not need to be duplicated in MAC spec. |
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A draft CR for 38.321 is provided for information.

## Configuration of PDCCH skipping and C-DRX ([R2-2208089](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208089.zip))

In [2] it is proposed that PDCCH monitoring skipping can only be configured when C-DRX is configured. There is some history on this topic, which is presented first for information [2]:

**History**

*The WID clearly states that PDCCH monitoring adaptation is only used when C-DRX is configured [3]:*

1. *Study and specify, if agreed, enhancements on power saving techniques for connected-mode UE, subject to minimized system performance impact [RAN1, RAN4]*
   1. *Study and specify, if agreed, extension(s) to Rel-16 DCI-based power saving adaptation during DRX Active Time for an active BWP, including PDCCH monitoring reduction when C-DRX is configured [RAN1]*

*In RAN2#118-e it was discussed whether PDCCH monitoring adaptation can only be configured when C-DRX is configured [4, 5], but most companies preferred to leave this decision to RAN1 [6]:*

***Summary****: 12 out of 14 companies prefer to wait for RAN1 conclusion.*

***Proposal 4 (12 out of 14): Whether PDCCH monitoring adaptation mechanisms can only be configured when DRX is configured is up to RAN1.***

*Configuration of PDCCH monitoring adaptation and C-DRX was discussed during RAN1#109-e [7]:*

***Proposal 8: As the work item determines the scope to be DRX Active Time, it should be confirmed that Rel-17 PDCCH monitoring adaptation is configured only together with C-DRX.***

*In email discussion PowSav-02 [8] all companies, except the proponent, indicated to disagree that this is an issue and that this does not need to be discussed:*

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| *14* | *Adding restriction to Rel-17 PDCCH monitoring adaptaion which can be only used when C-DRX is configured.* | *[13, Nokia, P8]* | *[13, Nokia, P9]* |

***Please provide your view below. “Y” to acknowledge it is an issue and need to discuss, “N” to disagree it is an issue and not need to discuss.***

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| ***Company*** | ***14*** |
| *Huawei* | *N* |
| *Spreadtrum* | *N* |
| *CATT* | *N* |
| *vivo* | *N* |
| *ZTE* | *N* |
| *xiaomi* |  |
| *Samsung* |  |
| *OPPO* |  |
| *Panasonic* |  |
| *Apple* |  |
| *DOCOMO* |  |
| *Nokia* | *Y* |
| *LG* | *N* |
| *MediaTek* |  |
| *Nordic* | *N* |
| *Intel* | *N* |
| *InterDigital,* |  |
| *Ericsson* |  |
| *Qualcomm* |  |

**Motivation and proposal**

In [2] the following motivation is provided to configure PDCCH skipping only when C-DRX is configured:

***Observation 1****: If C-DRX is not configured, and a short skipping duration is configured then the NW has to frequently send skipping commands via DCI to enable power saving in the UE when there is no traffic, which increases the NW power consumption.*

***Observation 2****: When PDCCH skipping without C-DRX it is expected to perform worse from a UE power saving perspective compared to C-DRX without PDCCH skipping because with long sleep periods the UE needs to constantly wake-up.*

***Observation 3****: PDCCH skipping is not an alternative for C-DRX but it can complementary enable micro sleep*

**Proposal 3**: Capture in 38.331 that PDCCH monitoring adaptation can only be configured when C-DRX is configured.

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes (proponent) | For both UE and NW products C-DRX is the baseline for UE power saving, and we would not like to change this.  We also only see negative effects if PDCCH monitoring can be configured without C-DRX. |
| vivo | No | As rapporteur mentioned, this issue was discussed in RAN2#118e meeting:  ***Proposal 4 (12 out of 14): Whether PDCCH monitoring adaptation mechanisms can only be configured when DRX is configured is up to RAN1.***  PDCCH skipping is a RAN1 led feature, and all designs are determined in RAN1. If companies proposed to restrict PDCCH skipping into C-DRX, how about SSSG switching? Should the same restriction be introduced? We think it is better to leave RAN1 to make such restriction for either PDCCH skipping or SSSG switching.  In our understanding, this issue was discussed in RAN1 (with no consensus) and will be further discussed in this meeting. We should avoid the duplicated discussion between RAN1 and RAN2.  We have different views with rapporteur on observation 1 and 2. Even in study phase, we don’t identify the pros to introduce the restriction or cons to not introduce the restriction. Thus, from RAN2 perspective, we don’t see motivation to have such restriction.  Anyway, it is up to network configuration whether/how to configure PDCCH skipping with C-DRX. Thus, there is no need to capture anything addition in RAN2 specification. |
| CATT | Yes | In absence of clear conclusion from RAN1 we are OK to follow the WID. |
| OPPO | No | C-DRX and PDCCH skipping are separate features. It is up to NW to decide whether to configure PDCCH skipping together with C-DRX, we see no need to introduce such configuration restriction. |
| Huawei, HiSilicon | No | There is no clear conclusion in RAN1 that PDCCH monitoring adaptation is configured only together with C-DRX, and there is no such restriction in current RAN1 spec. For the possible negative effects of combination, anyway it is up to NW configuration, NW can decide which function(s) to use considering UE power saving and NW power consumption / signalling overhead. |
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A draft CR for 38.331 is provided for information.

# Summary of email discussion

TBD

# Conclusions

TBD

# References

1. [R2-2208090](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208090.zip), *PDCCH skipping in RAN1 and RAN2 specifications*, Ericsson, DISC, RAN2#119-e
2. [R2-2208089](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_119-e/Docs//R2-2208089.zip), *PDCCH monitoring adaptation and C-DRX (RIL V146),* Ericsson, DISC, RAN2#119-e
3. [RP-220748](http://www.3gpp.org/ftp//tsg_ran/TSG_RAN/TSGR_95e/Docs//RP-220748.zip), *Revised WID UE Power Saving Enhancements for NR*, MDTK, ZTE, WID, RAN#95-e
4. [R2-2204732](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_118-e/Docs//R2-2204732.zip), *Discussion on PDCCH skipping*, OPPO, DISC, RAN2#118-e
5. [R2-2205024](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_118-e/Docs//R2-2205024.zip), *Remaining issues on PDCCH adaptation*, Nokia, DISC, RAN2#118-e
6. [R2-2206487](http://www.3gpp.org/ftp//tsg_ran/WG2_RL2/TSGR2_118-e/Docs//R2-2206487.zip) *Report of [AT118-e][074][ePowSav] PDCCH skipping,* Samsung, Report, RAN2#118-e
7. [R1-2204605](http://www.3gpp.org/ftp//tsg_ran/WG1_RL1/TSGR1_109-e/Docs//R1-2204605.zip), *Open issues on PDCCH monitoring adaptation for UE power saving*, Nokia, DISC, RAN1#109-e
8. [R1-2205278](http://www.3gpp.org/ftp//tsg_ran/WG1_RL1/TSGR1_109-e/Docs//R1-2205278.zip), *FL summary#2 of DCI-based power saving adaptation*, Moderator (vivo), Report, RAN1#109-e