**3GPP TSG RAN WG1 Meeting #101-e R1-** **200xxxx**

**e-Meeting, 25th May – 5th June 2020**

**Title: [101-e-NR-NR\_UE\_Pow\_Sav-WUS-01]**

**Agenda item: 7.2.7.1**

**Source: CATT**

**Document for: Discussion**

**Email Discussions**

[101-e-NR-NR\_UE\_Pow\_Sav-WUS-01] Email discussion/approval regarding collison of DCP and RAR

during RAR monitoring window:

* Discussion on issue raised in RAN2 LS [R1-2003260](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2003260.zip). The discussion will also include information from contributions in AI-5
  + [R1-2003353](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2003353.zip) Discussion on DCP Open Issues vivo
  + [R1-2003484](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2003484.zip) Draft reply LS on DCP Open Issues ZTE
  + [R1-2003485](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2003485.zip) Discussion on collision between DCP and RAR ZTE
  + [R1-2003587](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2003587.zip) Draft LS reply on DCP open issues CATT
  + [R1-2003852](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2003852.zip) Draft reply LS on RAN2 DCP open issues Samsung
  + [R1-2004113](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2004113.zip) Reply LS on RAN2 DCP Open Issues OPPO
  + [R1-2004625](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2004625.zip) Draft reply LS on RAN2 DCP Open Issues Huawei, HiSilicon
  + [R1-2004626](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_101\Docs\R1-2004626.zip) Discussion on the collision between DCP and RAR addressed to C-RNTI Huawei, HiSilicon
* UE PDCCH monitoring by other RNTI in combination with PS-RNTI outside Active Time
  + If agreed, whether TP is needed for TS38.202

by 5/28, with potential TPs by 6/3

|  |  |  |
| --- | --- | --- |
| **Company** | **Supporting Issue 2** | **Comments** |
| LG | Support (RAR should be prioritized over DCP) | The BFR procedure can be based on CFRA and/or CBRA. For a CFRA case, either Type3-CSS or USS can be configured for monitoring RAR scrambled by C-RNTI. If a USS is used for RAR monitoring, and if RAR monitoring occasion is fully or partially overlapped with monitoring occaison for DCI format 2\_6, a UE skips RAR monitoring by priority rule defined in TS38.213. In our view, BFR procedure should be prioritized rather than wake up signaling. So, we support RAN2’s understanding mentioned in RAN2 LS, i.e., RAR addressed all RNTIs should be prioritized over DCP by the UE. (Or, at least, USS configured for montiroing RAR should be prioritized over DCP.) |
| Samsung | Not support | The BFR search space can be either Type3-CSS or USS. Therefore, the priortization between DCP and RAR addressed to C-RNTI can be fully controlled by gNB. Therefore, we think current prority rule is sufficient and do not see any need of introducing additional priority rule. |
| ZTE | Support (RAR should be prioritized over DCP) | The search space set provided by *recoverySearchSpaceId* is only monitored after beam failure recovery is triggered. If it collides with DCP and UE prioritizes DCP, it is probable that the CRC check would be failed due to the deteriorated beam link maintenance. What’s more, the likelihood that network sends a not-wake-up indication in this case is low. Hence, it costs additional power for UE to detect the DCP.  From the perspectives of UE power saving and link maintenance, RAR should be prioritized over DCP. |
| CMCC | Support  (RAR should be prioritized over DCP) | When beam failure is happened, the monitoring of BFR response should be guaranteed to realize fast beam failure recovery. Therefore, when DCP collides with RAR, RAR with CRC scrambled by C-RNTI should be prioritized over DCP. |
| Nokia | Support (RAR should be prioritized over DCP) | Like discussed in our paper, due to the restrictions that are applied to *recoverySearchSpaceId* SS set configuration, collision between DCP and RAR monitoring can result DCP being prioritized over RAR. To avoid unwanted consequences, we would support capturing behavior to handle this in RAN1 or RAN2 spesification. |
| Huawei, HiSilicon | No need to have specification impact. | We share similar view with Samsung. gNB can configue the *RecoverySearchSpace* as type3-CSS or USS. Therefore, the gNB can handle the collision between DCI format 2\_6 and RAR addressed to C-RNTI.  Also, in our view this is not a new issue in Rel-16. It is not necessary to define the new priority between the DCI format 2\_6 scrambled by PS-RNTI and the RAR addressed to C-RNTI. |
| Panasonic | Not support | Based on the current priority rule and BFR SS configuration flexibility for RAR addressed to C-RNTI, network is able to control the UE behavior and avoid issue by implementation. Thus we see no issue so far. Even if USS is used for RAR and it is possible that UE may skip RAR monitoring due to DCP, potential delay is forseen but this is also within preparation of gNB as it configures as such. So if this is deemed an issue that needs to address for beam management, it could be discussed in Rel.17. |
| Qualcomm | Support | We agree with RAN2’s view in LS R1-2003260 that RAR addressed all RNTIs should be prioritized over DCP by the UE. At least for RAR addressed RA-RNTI or MsgB-RNTi, the RAR prioritization is already clear according to the following text in TS 38.213, Section 10.1:   |  | | --- | | For single cell operation or for operation with carrier aggregation in a same frequency band, a UE does not expect to monitor a PDCCH in a Type0/0A/2/3-PDCCH CSS set or in a USS set if a DM-RS for monitoring a PDCCH in a Type1-PDCCH CSS set does not have same QCL-TypeD properties [6, TS 38.214] with a DM-RS for monitoring the PDCCH in the Type0/0A/2/3-PDCCH CSS set or in the USS set, and if the PDCCH or an associated PDSCH overlaps in at least one symbol with a PDCCH the UE monitors in a Type1-PDCCH CSS set or with an associated PDSCH. |   In other words, monitoring of RAR addressed RA-RNTI or MsgB-RNTI (Type1-PDCCH CSS) is proiritized over all other PDCCHs in Type0/0A/2/3 CSS or USS, not just for DCP. Although RAN2 only mentioned DCP in the LS, it seems that the intent is enabling the same level of prioritization as RA-RNTI or MsgB-RNTI monitoring for RAR addressed C-RNTI. In this regard, the spec test above can be revised as follow:   |  | | --- | | For single cell operation or for operation with carrier aggregation in a same frequency band, a UE ~~does not expect~~ is not required to monitor a PDCCH in a Type0/0A/2/3-PDCCH CSS set or in a USS set if a DM-RS for monitoring a PDCCH in a Type1-PDCCH CSS set, or for monitoring a PDCCH in the search space set provided by *recoverySearchspaceId* according to the procedure described in Clause 6, does not have same QCL-TypeD properties [6, TS 38.214] with a DM-RS for monitoring the PDCCH in the Type0/0A/2/3-PDCCH CSS set or in the USS set, and if the PDCCH or an associated PDSCH overlaps in at least one symbol with a PDCCH the UE monitors in a Type1-PDCCH CSS set, or with a PDCCH the UE monitors in the search space set provided by *RecoverySearchSpaceId* according to the procedure described in Clause 6, or with an associated PDSCH. |   According to the above changes, the UE may not be “required” to monitor DCP when it collides with RAR address C-RNTI (during BFR), and it is reagareded as one of the invalid DCP monitoring occasions as described in Section 10.3 in TS 38.213. Thus, no changes in Section 10.3 in TS 38.213 is needed. |
| According to the suggested TP above, the following changes are suggested in TS 38.202:   1. Table 6.2-1:  |  |  |  |  |  | | --- | --- | --- | --- | --- | | D0 | PDCCH+PDSCH | RA-RNTI or Temporary C-RNTI or MsgB-RNTI or C-RNTI, MCS-C-RNTI | DL-SCH | Note 3, Note 6 | | ⁞  Note 6: C-RNTI and MCS-C-RNTI are received in a random access response window. | | | | |   Note: the intention is to cover the RAR addressed all RNTI in reception type D0.   1. Table 6.2-2:  |  |  | | --- | --- | | PCell | PSCell | | 3. RRC\_CONNECTED | | | (A + C0 + (B and/or (D0 or (m1\*D1+m2\*D2))) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + [L0 + L1 + M]) or (~~(~~A+~~B+~~C0+B and/or (~~[~~D0~~])~~ ~~[~~and/or~~]~~ N)) | (A + (D0 or (m1\*D1+m2\*D2)) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + [L0 + L1 + M]) or ((A+~~B+C0+~~ (~~[~~D0~~]) [~~and/or~~]~~ N)) |   Note:   * For PCell, B (SI-RNTI), D0 (RAR), and N (DCP) can be simultaneously received if their QCL-TypeD properties are the same. * For PSCell, B and C0 are not received (PCell only). |
| Intel | Support (RAR should be prioritized over DCP) | **Regarding LS response**  In our view, SS set prioritization rules that were captured in Section 10.1 of 38.213 mostly applies to active time , although not explicitly captured. We agree with Nokia, ZTE that to avoid unwanted consequences on link performance/maintenance, RAR should be prioritized over DCP.  **Regarding combination of RNTIs monitored outside active time**  Currently in Table 6.2-2 of 38.802, the following is captured as combination of RNTIs outside active time in connected mode.  ((A+B+C0+[D0]) [and/or] N)  Where  Table 6.2-1: Downlink "Reception Types"   |  |  |  |  |  | | --- | --- | --- | --- | --- | | "Reception Type" | Physical Channel(s) | Monitored RNTI | Associated Transport Channel | Comment | | A | PBCH | N/A | BCH |  | | B | PDCCH+PDSCH | SI-RNTI | DL-SCH | Note 1 | | C0 | PDCCH | P-RNTI | N/A | Note 1, Note 2 | | D0 | PDCCH+PDSCH | RA-RNTI or Temporary C-RNTI or MsgB-RNTI | DL-SCH | Note 3 | | D1 | PDCCH+PDSCH | C-RNTI, CS-RNTI, MCS-C-RNTI | DL-SCH |  | | N | PDCCH | PS-RNTI | N/A |  |   **Regardless of whether RAR addressed to C-RNTI is prioritized over DCP or not, it seems clear that RAR addressed to C-RNTI can be received outside active time and the combination** ((A+B+C0+[D0]) [and/or] N) **does not include RAR addressed to C-RNTI**. “Reception Type” D1 can represent RAR addressed to C-RNTI. A note can be added in Table 6.2-1 in this regard. Hence, one way to update the combination is ((A+B+C0+(D0 or D1)) [and/or] N), since at a given either time RAR addressed to C-RNTI or RAR addressed to RA-RNTI/MsgB-RNTI is expected. |
| OPPO | Not needed | The current priority rule for PDCCH minotoring is sufficient with proper gNB configuration. When WUS is configurd for the UE, *recoverySearchSpaceId* can be configured as Type-3 SS with the ID smaller than that for WUS. |
| vivo | Not needed, no specification impact | PDCCH monitoring for RAR dropping due to different QCL properties can be avoided by proper network implementation. No additional UE behaviors need to be specified.  The PDCCH monitoring CSS is prioritized over that in USS, and SS set with lower index is prioritized over the higher ones in the same type of SS set. If PDCCH monitoring in RAR search spaces would be prioritized, it can be configured with lower SS set index than the CSS for WUS. Similarly, for RAR PDCCH monitoring occasions in BFR procedure, the recoverySearchspace can be link to a CSS with lower index compared to that for WUS, to make sure PDCCH monitoring in recoverySearchspace prioritized.  Furthermore, network have the flexibility to configure PDCCH monitoring occasions for WUS and RAR in TDM manner. In this case, PDCCH monitoring for RAR dropping due to different QCL properties can be avoided by proper network implementation. |
| MediaTek | Support (RAR should be prioritized over DCP) | We agree that the PDCCH monitoring priority rule is clear in current specification and gNB can prioritize the RAR monitoring by proper configuration. However, we are not sure whether it can be handled by network easily. On the other hand, if WUS/DCP has higher priority than RAR monitoring, it is very likely that UE cannot detect WUS/DCP succussfully due to the deteriorated beam quality. So, monitoring WUS/DCP in this case is not beneficial for both power saving and link maintainence. In order to ensure the performance, we prefer prioritizing RAR monitoring over WUS/DCP. |
| NTT DOCOMO | Support (RAR should be prioritized over DCP) | We think that RAR should be prioritized over DCP. In our understanding, the case of monitoring RAR in type-1 PDCCH CSS, i.e., regular RA and BFR CBRA, is already specified in the current spec so that RAR is prioritized over DCP. More precisely, in such case, monitoring type-1 PDCCH CSS is prioritized over other CSS/USS. Other remaining case is BFR CFRA, and also in this case, RAR should be prioritized similarly as RAR in other cases.  Above consideration, we also support the proposal by Qualcomm, i.e., RAR is prioritized over all other PDCCHs in Type0/0A/2/3 CSS or USS, not just for DCP. |
| Ericsson | Support  (RAR should be prioritized over DCI 2\_6) | Collision between DCI 2\_6 and RAR monitoring can result in 2\_6 being prioritized over RAR. However, we agree with the RAN2 understanding that RAR should be prioritized over DCI 2\_6. We prefer to address this issue through specification instead of adding more NW scheduling restrictions. In our view, the principle should be that link maintainence procedures such as BFR should be prioritized over DCI 2\_6 which anyways may not be functional if link is in failure and is under recovery. We prefer to capture behavior in RAN1 and/or RAN2 specs. |
| InterDigital | Support |  |
| Apple | Support  (RAR should be prioritized over DCI 2\_6), not clear that specification is needed. | We support the prioritization of RAR for BFR over DCP. However, prioritization of RAR for BFR over DCP can be handled by the current proritization rules in Rel-15. The recoverySearchSpaceId can be configured as a Type-3 SS with an ID smaller than that the ID for the Type-2 SS fort he WUS. As such, gNB configuration should be able to handle this. |
| SONY | Support  (RAR should be prioritized over DCI 2\_6) | We agree with the RAN2 understanding that RAR should be prioritised over DCP. As stated by other companies, if beam failure recovery is triggered, the reliability of DCP is liklely to be low in any case. The UE could / should take the safe option and wake up anyway if it doubts the reliability of DCP. We think that the proportion of times that a RAR / DCP conflict occurs will be low and hence the power consumption impact of the UE taking the “safe option” and waking up is minimal.  While the BFR search space can be configured as either CSS or USS, we don’t see why a network would want to configure the BFR search space as CSS just to deal with this issue. However, if network vendors are OK with this limitation, then appropriatey configuring the BFR search space as CSS would be an alternative. |

**Summary of Preparation**

The common view is to further discuss 4 issues after the email discussion. The discussion also include the issue of collision of DCP and RAR addressed by C-RNTI from RAN2 LS R1-2003260. The reply LS to RAN2 would also be discussed. During email discussion, the issues of the monitoring RNTI in combination with PS-RNTI outside Active Time in Table 6.2-2 of TS38.202 were raised to be incosnsitent with RAN2 specifcation. The monitoring RNTI in combination with PS-RNTI would be discussed with collision of DCP and RAR together. If additional combination were agreed, TP to TS38.202 will be discussed subsequently.

Two email threads are proposed as follows,

[101-e-NR-NR\_UE\_Pow\_Sav-WUS-1] Collison of DCP and RAR

* Issue 2: Collision of RAR and DCP during RAR monitoring window (section 3.2)
  + Discussion on issue raised in RAN2 LS R1-2003260 and reply LS by 5/28. The discussion will also include information from contributions in AI-5
    - R1-2003353 Discussion on DCP Open Issues vivo
    - R1-2003484 Draft reply LS on DCP Open Issues ZTE
    - R1-2003485 Discussion on collision between DCP and RAR ZTE
    - R1-2003587 Draft LS reply on DCP open issues CATT
    - R1-2003852 Draft reply LS on RAN2 DCP open issues Samsung
    - R1-2004113 Reply LS on RAN2 DCP Open Issues OPPO
    - R1-2004625 Draft reply LS on RAN2 DCP Open Issues Huawei, HiSilicon
    - R1-2004626 Discussion on the collision between DCP and RAR addressed to C-RNTI Huawei, HiSilicon
  + UE PDCCH monitoring by other RNTI in combination with PS-RNTI outside Active Time
    - If agreed, whether TP is needed for TS38.202

[101-e-NR-NR\_UE\_Pow\_Sav-WUS-2] Specification clarification

* Issue 1: Whether to confirm Working Assumption of minimum time gap values (section 3.1)
* Issue 3: Specification alignment and text proposals (Section 3.3)
* Issue 4: DCI size budget for DCI format 2\_6 (Section 3.4)
  + Clarification of the specification for DCI size alignment for DCI format 2\_6 outside Active Time

Summary from contributions reviews

## Minimum time gap – values

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RAN1#99 agreements**  Agreements:s  The minimum time gap between the end of the slot of last DCI format 3\_0 monitoring occasion and the start of the DRX ON is a UE capability based on subcarrier spacing.   * The reporting is per SCS in units of slots of the respective SCS   + The reported value for a SCS is taken from two possible values per SCS   + The largest value of minimum time gap in UE capability is no more than the number of slots equal to [3]ms * FFS impact of dormancy/non-dormancy transition   **RAN1#100-e agreements**  **Agreements**  PS\_offset range from {0.125ms to 15 ms} for all SCS.  **Agreements**  The PS\_offset resolution is 0.125 ms.  **Agreements**  **Candidate values for the minimum time gap are specified by RAN1 and shared with RAN4**  ·       **Minimum time gap is no more than 3 ms for all SCSs**  ·       **Two values of minimum time gap for each SCS are proposed as**   * SCS 15kHz: {TBD, TBD} slots * SCS 30kHz {TBD,  TBD} slots * SCS 60kHz {TBD, TBD} slots * SCS 120kHz {TBD, TBD} slots   **RAN1#100bis-e agreements**  Proposal 1:   * The value of minimum time gap is decoupled with SCell dormancy indication. * Working assumption: Two values of minimum time gap in terms of slots per SCS are specified based on the assumption that PDCCH carrying DCI format 2\_6 can be at any symbol of the slot indicated by *monitoringSymbolsWithinSlot* of SearchSpace IE as follows,      |  |  |  | | --- | --- | --- | | SCS (kHz) | Minimum Time Gap TminimumTimeGap(slots) | | | Value 1 | Value 2 | | 15 | 1 | 3 | | 30 | 1 | 6 | | 60 | 1 | 12 | | 120 | 2 | 24 | |

During RAN1#100bis-e email discussion, working assumption was made to have the value of minimum time gap is decoupled with SCell dormancy indication and two values of minimum time gap.

Proposals from companies

* Confirmation of working assumptions – CATT, MediaTek, Samsung, CMCC, OPPO, Ericsson, Nokia
* New values – Huawei, Qualcomm, DoCoMo
  + Huawei

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NR Slot length (ms) | Capability Type 1 | | Capability Type 2 |
| UE not report pdcch-MonitoringAnyOccasions | UE reports pdcch-MonitoringAnyOccasions |
| 0 | 1 | 0 | 1 | 1 |
| 1 | 0.5 | 0 | 1 | 2 |
| 2 | 0.25 | 1 | | 4 |
| 3 | 0.125 | 2 | | 8 |

* + Qualcomm
    - SCS 15kHz: {1, 3} slots
    - SCS 30kHz: {2, 6} slots
    - SCS 60kHz: {3, 12} slots
    - SCS 120kHz: {6, 24} slots
  + DoCoMo

|  |  |  |
| --- | --- | --- |
| SCS (kHz) | Minimum Time Gap TminimumTimeGap(slots) | |
| Value 1 | Value 2 |
| 15 | 1 | 3 |
| 30 | 1 | 5 |
| 60 | 1 | 9 |
| 120 | 2 | 18 |

**Proposal: Confirm the working assumptions**

* The value of minimum time gap is decoupled with SCell dormancy indication.
* Working assumption: Two values of minimum time gap in terms of slots per SCS are specified based on the assumption that PDCCH carrying DCI format 2\_6 can be at any symbol of the slot indicated by *monitoringSymbolsWithinSlot* of SearchSpace IE as follows,

|  |  |  |
| --- | --- | --- |
| SCS (kHz) | Minimum Time Gap TminimumTimeGap (slots) | |
| Value 1 | Value 2 |
| 15 | 1 | 3 |
| 30 | 1 | 6 |
| 60 | 1 | 12 |
| 120 | 2 | 24 |

## Collisoin of DCP and RAR

RAN2 LS in [18] would like to ask RAN1 how to resolve the collision between the DCP and the RAR addressed to C-RNTI with different quasi-collocated property during BFR.

|  |
| --- |
| **1. Collision between DCP and RAR addressed to C-RNTI**  RAN2 has discussed UE behavior when a DCP monitoring occasion overlaps with the *ra-ResponseWindow* or *msgB-ResponseWindow*. RAN2 understanding is that according to current TS 38.213 prioritization rules, if DCP collides with RAR addressed to C-RNTI (e.g. during BFR) and the search spaces are not quasi-collocated, DCP will be prioritized as it is type-3 CSS and thus impacting legacy RAR behavior.  RAN2 would like to ask RAN1 the following:   * To confirm RAN2 understanding that if DCP and RAR search spaces are not quasi-collocated, a collision between DCP and RAR addressed to C-RNTI will impact legacy RAR handling.   + From RAN2 point of view, the understanding is that RAR addressed all RNTIs should be prioritized over DCP by the UE. * RAN2 would like to ask if RAN1 has any concerns with the understanding above? If RAN1 doesn’t have any concerns, what is RAN1 preference on where to capture this behavior e.g. TS 38.213 or in TS 38.321 via a DCP monitoring exception rule similar to overlap with DRX Active time? |

The collision of DCP and RAR monitoring were discussed with proposals as follows,

* RAR is prioritized over DCP –
  + gNB implementation with current specification - vivo, Huawei, Samsung
  + RAR with CRC scrambled by C-RNTI over DCP – CATT, Intel, LG, Ericsson, Nokia,ZTE,CMCC

**Proposal:**

**RAR is prioritize over DCP during RAR monitoring window. Discuss further**

* **RAN2 LS reply**
* **Any RAN1 specification change**

## Spcification Alignment - Clarification the interaction between PHY and MAC layers

|  |
| --- |
| **RAN1#100bis-e agreements**  **Proposal 1:**  L1 procedure of DCI format 2\_6 detection   * Successful decoding of DCI format 2\_6   + L1 sends a positive indication to MAC when the value of wakeup indication bit is “1”   + L1 sends a negative indication to MAC when the value of wakeup indication bit is “0” * Miss-detection - all CRC checks fails on DCI format 2\_6   + L1 does not send any indication to MAC * All invalid monitoring occasions – following legacy behavior to wakeup   + L1 sends a positive indication to MAC    TP was approved and captured in [19] |

The proposed TP was agreed to capture the general behavior. However, the editor of 38.213 deos not capture the TP exactly as those were agreed in [19]. There were discussions (ZTE, CATT, AsusTek, Spreadtrum) to clarify the exact text of the decoding bit value ‘1’ and ‘0’ from DCI format 2\_6 associated with Wake-up and no-Wake-up indication. In addition, RRC parameters *ps-PositionDCI-2-6 and sizeDCI-2-6*are updated.

**Proposal:**

**TP to capture value ‘1’ and ‘0’ from DCI format 2\_6 associated with Wake-up and no-Wake-up indication**

-----------------------------------------------------Start of TP of 38.213----------------------------------------------------------

***10.3 PDCCH monitoring indication and dormancy/non-dormancy behaviour for SCells***

A UE configured with DRX mode operation [11, TS 38.321] can be provided the following for detection of a DCI format 2\_6 in a PDCCH reception on the PCell or on the SpCell [12, TS 38.331]

- a PS-RNTI for DCI format 2\_6 by *ps-RNTI*

- a number of search space sets, by *dci-Format2-6*, to monitor PDCCH for detection of DCI format 2\_6 on the active DL BWP of the PCell or of the SpCell according to a common search space as described in Clause 10.1

- a payload size for DCI format 2\_6 by *~~SizeDCI\_2-6~~ sizeDCI\_2-6*

- a location in DCI format 2\_6 of a Wake-up indication bit by *~~PSPositionDCI2-6~~* *ps-PositionDCI-2-6*, ~~where~~

~~- the UE may not start the~~ *~~drx-onDurationTimer~~* ~~for the next long DRX cycle when a value of the Wake-up indication bit is '0', and~~

* a value ‘0’ of Wake-up indication bit is the no-Wake-up indication
* a value ‘1’ of Wake-up indication bit is the Wake-up indication
* ~~the UE starts the~~ *~~drx-onDurationTimer~~* ~~for the next long DRX cycle when a value of the Wake-up indication bit is~~ '1'

-----------------------------------------------------End of TP of 38.213---------------------------------------------------------------

RAN2 also reach agreements on the update parameters name in [18]

**Agreements**

1 RAN2 confirms that the flags ps-TransmitPeriodicL1-RSRP and ps-TransmitPeriodicCSI are defined per cell group

2 The flags ps-TransmitPeriodicCSI and ps-TransmitPeriodicL1-RSRP are independent, and it is possible to control UE to report all types of periodic CSI apart from L1-RSRP (i.e. cri-RSRP and ssb-Index-RSRP)

3 The flag ps-TransmitPeriodicCSI is renamed to ps-TransmitOtherPeriodicCSI

**TP for Clause 5.1.6.1 and 5.2.2.5 of TS 38.214.**

|  |
| --- |
| **5.1.6.1 CSI-RS reception procedure**  <omitted text>  If the UE is configured with DRX,  - if the UE is configured to monitor DCI format 2\_6 and configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* *~~ps-TransmitPeriodicCSI~~* to report CSI with the higher layer parameter *reportConfigType* set to ‘periodic’ and *reportQuantity* set to quantities other than ‘cri-RSRP’ and ‘ssb-Index-RSRP’ when *drx-onDurationTimer* is not started, the most recent CSI measurement occasion occurs in DRX active time or during the time duration indicated by *drx-onDurationTimer* also outside DRX active time for CSI to be reported;  - if the UE is configured to monitor DCI format 2\_6 and configured by higher layer parameter *ps-TransmitPeriodicL1-RSRP* to report L1-RSRP with the higher layer parameter *reportConfigType* set to ‘periodic’ and *reportQuantity* set to cri-RSRP when *drx-onDurationTimer* is not started, the most recent CSI measurement occasion occurs in DRX active time or during the time duration indicated by *drx-onDurationTimer* also outside DRX active time for CSI to be reported;  - otherwise, the most recent CSI measurement occasion occurs in DRX active time for CSI to be reported.  <omitted text> |
| **5.2.2.5 CSI reference resource definition**  <omitted text>  When DRX is configured, the UE reports a CSI report only if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement in DRX Active Time no later than CSI reference resource and drops the report otherwise. When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitOtherPeriodicCSI* *~~ps-TransmitPeriodicCSI~~* to report CSI with the higher layer parameter *reportConfigType* set to ‘periodic’ and *reportQuantity* set to quantities other than ‘cri-RSRP’ and ‘ssb-Index-RSRP’ when *drx-onDurationTimer* is not started, the UE shall report CSI during the time duration indicated by *drx-onDurationTimer* also outside active time according to the procedure described in Clause 5.2.1.4 if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer outside DRX active time or in DRX Active Time no later than CSI reference resource and drops the report otherwise. When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter *ps-TransmitPeriodicL1-RSRP* to report L1-RSRP with the higher layer parameter *reportConfigType* set to ‘periodic’ and *reportQuantity* set to ‘cri-RSRP’ or ‘ssb-Index-RSRP’ when *drx-onDurationTimer* is not started, the UE shall report L1-RSRP during the time duration indicated by *drx-onDurationTimer* also outside active time according to the procedure described in clause 5.2.1.4 and when reportQuantity set to ‘cri-RSRP’ if receiving at least one CSI-RS transmission occasion for channel measurement and CSI-RS and/or CSI-IM occasion for interference measurement during the time duration indicated by drx-onDurationTimer outside DRX active time or in DRX Active Time no later than CSI reference resource and drops the report otherwise.  <omitted text> |

## DCI size budget for DCI format 2\_6

Currently the DCI format size budget per UE is determined without separation for the capability between CONNECTED or IDLE/INACTIVE, nor between outside active time and inside active time. The only separation is done via defining the RNTIs for UE monitoring. There are RNTIs (C-RNTI, P-RNTI, SI-RNTI, RA-RNTI) that UE may need to monitor outside active time which the corresponding DCI formats are accounted in DCI-format size budget. The intent of the DCI format 2\_6 outside active time use would NOT be counted in the total budget of DCI format sizes. Several companies (vivo, CATT, MediaTek, Ericsson, Qualcomm) have proposals in counting DCI format 2\_6 outside Active Time sepeartely and how to account for the total budget of DCI format sizes.

Proposal: DCI format 2-6 size is aligned to the DCI size budget outside Active Time.

## Others

* The starting time of BWP switching after dormancy indication received from DCI format 2\_6 –
  + Inconsistent power saving information (vivo) – no-Wakeup and non-dormant SCell indications for a UE
  + More than one DCI format 2\_6 are received (vivo, Huawei) –
  + No DCI format 2\_6 monitoring during BWP switching
* Valid moniotoring occasion when more than one avalailable moniotoring occasions in a search space set (LG)
* No restriction on minimum time gap without UE capability feedback (Qualcomm)

# Contributions summary and proposals

|  |  |
| --- | --- |
| vivo[1] | * Proposal 1: PDCCH monitoring for RAR dropping due to different QCL properties can be avoided by proper network implementation. No additional UE behavior need to be specified.   + Send LS to RAN2 to inform above decisions. * Proposal 2: UE is not expected to be indicated by PDCCH WUS not to wake up while SCell group is indicated to non-dormancy state. Capture TP in Appendix 1 in [R1-2003403](file:///E:\My%20Documents\3gpp\wg1-101%20e-meeting\R1-2003403.zip) for TS38.213. * Proposal 3: The starting point of BWP switching of Scell dormancy should be defined from the following alternatives,   + Alt 1: the starting of BWP switching of Scell dormancy is after the last valid monitoring occasion for DCI format 2-6   + Alt 2: the starting of BWP switching time of Scell dormancy is n slot prior to DRX ON, where n is the Scell dormancy/non-dormancy switching time. * Proposal 4: The size of DCI format 2-6 is not restricted by the existing DCI size budget (3+1) in Rel-15 which is used in Active Time. Capture TP in Appendix 2 in R1-2003043 for TS38.212. |
| ZTE [2] | * Proposal 1: The following TP of L1 procedure of the detection of DCI format 2\_6 is proposed (wakeup bit). * Proposal 2: Adopt the following TP for Clause 5.1.6.1 and 5.2.2.5 of TS 38.214. (*ps-TransmitOtherPeriodicCSI)* |
| Huawei, HiSilicon [3] | * Proposal 1: Confirm the working assumption made in RAN1#100b-e that the value of minimum time gap is decoupled with SCell dormancy indication. * Proposal 2: The values of minimum time gap during which the detection of DCI format 2\_6 is not required prior to the start of ON Duration Timer are determined per SCS according to the reported capability type of UE as the following table.  |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | NR Slot length (ms) | Capability Type 1 | | Capability Type 2 | | UE not report pdcch-MonitoringAnyOccasions | UE reports pdcch-MonitoringAnyOccasions | | 0 | 1 | 0 | 1 | 1 | | 1 | 0.5 | 0 | 1 | 2 | | 2 | 0.25 | 1 | | 4 | | 3 | 0.125 | 2 | | 8 |  * Proposal 3: Further discuss and narrow down between Alt.1, Alt.2 and Alt. 3 for UE behaviour when dormancy indication is configured. * Proposal 4: Adopt TP1 in TS 38.214 to clarify UE behaviour of RRM measurement when DCI format 2\_6 is configured. |
| CATT [4] | * Proposal 1: The working assumption is confirmed. Two values of minimum time gap in terms of slots per SCS are specified based on the assumption that PDCCH carrying DCI format 2\_6 can be at any symbol of the slot indicated by monitoringSymbolsWithinSlot of SearchSpace IE as follows,      |  |  |  | | --- | --- | --- | | SCS (kHz) | Minimum Time Gap TminimumTimeGap(slots) | | | Value 1 | Value 2 | | 15 | 1 | 3 | | 30 | 1 | 6 | | 60 | 1 | 12 | | 120 | 2 | 24 |  * Proposal 2: RAR indicated by PDCCH with CRC scrambled by C-RNTI or MCS-C-RNTI should be prioritized over DCP by the UE outside Active Time, especially when they have different QCL-TypeD properties. * Proposal 3: The detected value of the Wake-up indication bit from DCI format 2\_6 needs to be defined clearly to have ‘1’ associated with Wake-up indication and ‘0’ associated with no-Wake-up indication. * Proposal 4: DCI format 2\_6 is not counted in the DCI size alignment. |
| MediaTek[5] | * Proposal 1: Confirm the working assumption for minimum time gap in RAN1 #100b.   + The value of minimum time gap is decoupled with SCell dormancy indication.   + Two values of minimum time gap in terms of slots per SCS are specified based on the assumption that PDCCH carrying DCI format 2\_6 can be at any symbol of the slot indicated by *monitoringSymbolsWithinSlot* of SearchSpace IE as follows,  |  |  |  | | --- | --- | --- | | SCS (kHz) | Minimum Time Gap TminimumTimeGap(slots) | | | Value 1 | Value 2 | | 15 | 1 | 3 | | 30 | 1 | 6 | | 60 | 1 | 12 | | 120 | 2 | 24 |  * Proposal 2: DCI format 2\_6 is not counted in the DCI size budget. * Proposal 3: Adopt the TP in TS 38.213 as follows (prior to). |
| Intel [6] | * Proposal 1: If the DCI format 2\_6 monitoring occasion overlaps with ra-ResponseWindow or msgB-ResponseWindow, the UE does not monitor for DCI format 2\_6. * Proposal 2: Adopt the following TP |
| Samsung [7] | * Proposal #1: Confirm the working assumption for the values of the minimum time gap * Observation #1: The specifications with respect to the size of DCI format 2\_6 are complete. The Rel-15 DCI format size budget is not exceeded. The size of DCI format 2\_6 should be counted towards the maximum number of DCI format sizes as for every other DCI format. * Observation #2: There is no need for any specification impact with respect to monitor ‘RAR’ scheduled by a DCI format with a C-RNTI or an MCS-C-RNTI. |
| NEC [8] | * Using the unified wording “PCell or PSCell” is also recommended instead of “PCell or SpCell”. |
| CMCC [9] | * Proposal 1. Support to confirm the working assumption   + The value of minimum time gap is decoupled with SCell dormancy indication.   + Two values of minimum time gap in terms of slots per SCS are specified based on the assumption that PDCCH carrying DCI format 2\_6 can be at any symbol of the slot indicated by *monitoringSymbolsWithinSlot* of SearchSpace IE as follows,  |  |  |  | | --- | --- | --- | | SCS (kHz) | Minimum Time Gap TminimumTimeGap(slots) | | | Value 1 | Value 2 | | 15 | 1 | 3 | | 30 | 1 | 6 | | 60 | 1 | 12 | | 120 | 2 | 24 |  * Proposal 2. DCI format 2\_6 should be transmitted in only one monitoring occasion or all monitoring occasions. |
| Spreadstrum[10] | * Proposal 1: For P-CSI/L1-RSRP measurement/report, consider to adopt TP in Appendix 5.1. * Proposal 2: To clarify the real starting of monitoring is the beginning of the 1st full “duration”, consider to adopt TP in Appendix 5.2. * Proposal 3: To align parameters in RAN2, such as ps-Wakeup, ps-PositionDCI-2-6 and sizeDCI-2-6, consider to adopt TP in Appendix 5.2 and 5.3. |
| LG [11] | * Proposal 1: At least for CFRA, the SS set related to BFR procedure has a higher priority than SS set to be monitored for DCI format 2\_6. * Proposal 2: The monitoring occasion which has at least one actually monitored candidate is regarded as a valid monitoring occasion. * Proposal 3: A UE monitors DCI format 2\_6 in the first available full duration within a monitoring window. |
| OPPO [12] | * Proposal 1: Confirm the working assumption.   + The value of minimum time gap is decoupled with SCell dormancy indication.   + Two values of minimum time gap in terms of slots per SCS are specified based on the assumption that PDCCH carrying DCI format 2\_6 can be at any symbol of the slot indicated by monitoringSymbolsWithinSlot of SearchSpace IE as follows,  |  |  |  | | --- | --- | --- | | ***SCS (kHz)*** | ***Minimum Time Gap TminimumTimeGap(slots)*** | | | ***Value 1*** | ***Value 2*** | | ***15*** | ***1*** | ***3*** | | ***30*** | ***1*** | ***6*** | | 60 | 1 | 12 | | 120 | 2 | 24 |  * Proposal 2: when the UE is configured scell dormancy operation, the UE doesn’t need to monitor WUS during its BWP switching delay before DRX ON. |
| AsusTek[13] | * Proposal: RAN1 adopts either TP1 or TP2 to avoid discrepancy on interaction between PHY and MAC on wake up indication |
| Ericsson [14] | * Proposal 1 UE is not required to monitor DCI 2-6 in monitoring occasions that overlaps with the ra-ResponseWindow or beam-failure recovery procedure. * Proposal 2 RAN1 to provide the following response to RAN2 LS (R1-2003260)   + RAN1 does not have a concern with the RAN2 understanding and asks RAN2 to capture in 38.321 that the UE wakes up in an upcoming ON duration when a DCI 2-6 monitoring occasion overlaps the ra-ResponseWindow or beam-failure recovery procedure. * Proposal 3 RAN1 to confirm the minimum time gap values in the WA as well as the decoupling of minimum time gap values from Scell dormancy indication. * Proposal 4 DCI sizes in the budget calculation are counted separately for the cases of within Active time and outside Active time. * Proposal 5 Adopt TP1 for 38.212 subclause 7.3.1.0 DCI sizes in the budget calculation are counted separately for the cases of within Active time and outside Active time. |
| NTT DoCoMo [15] | * Proposal 1: Two candidate values of UE reported minimum time gap for each SCS are:  |  |  |  | | --- | --- | --- | | SCS (kHz) | Minimum Time Gap TminimumTimeGap(slots) | | | Value 1 | Value 2 | | 15 | 1 | 3 | | 30 | 1 | 5 | | 60 | 1 | 9 | | 120 | 2 | 18 | |
| Qualcomm[16] | * Proposal 1: For consistency, the lower set of values for the minimum time gap should not be smaller than the Z values (i.e., {1, 1, 2, 2}) for the application delay of the minimum scheduling offset restriction. * Proposal 2: For the reported UE capability on the minimum time gap, the following sets of values can be considered:   + SCS 15kHz: {1, 3} slots   + SCS 30kHz: {2, 6} slots   + SCS 60kHz: {3, 12} slots   + SCS 120kHz: {6, 24} slots * Proposal 3: For the reported UE capability on the minimum time gap, adding a third option of ‘No restriction’ can be considered. The third option can be implicitly signaled by omitting the capability report for the minimum time gap. * Proposal 4: For the aggregation level and the number of PDCCH candidates for DCI format 2\_6, reuse those for DCI format 2\_0. * Proposal 5: Separate sets of DCI format sizes are accounted for within and outside the Active Time. The size of DCI format 2\_6 is counted in the DCI size budget for “outside Active Time”. |
| Nokia, NSB [17] | * Proposal 1: When monitoring occasions of DCI format 2\_6 overlaps with PDCCH monitoring in search space given recoverySearchSpaceId as described in Section 6 of 38.213, UE should follow the legacy DRX operation. * Proposal 2: Send a LS to RAN2 indicating that RAN1 agrees that there could be impact to the legacy RAR monitoring configuration and that the behaviour related to DCP and RAR monitoring could be captured to RAN2 specification. * Proposal 3: Confirm the working assumption take in the RAN1#100bis-e:   working assumption:   * The value of minimum time gap is decoupled with SCell dormancy indication. * Two values of minimum time gap in terms of slots per SCS are specified based on the assumption that PDCCH carrying DCI format 2\_6 can be at any symbol of the slot indicated by *monitoringSymbolsWithinSlot* of SearchSpace IE as follows,      |  |  |  | | --- | --- | --- | | SCS (kHz) | Minimum Time Gap TminimumTimeGap(slots) | | | Value 1 | Value 2 | | 15 | 1 | 3 | | 30 | 1 | 6 | | 60 | 1 | 12 | | 120 | 2 | 24 | |

# Reference

1. R1-2003403 Maintenance of PDCCH-based power saving signal vivo
2. R1-2003486 Remaining issues on WUS PDCCH ZTE
3. R1-2003518 Remaining issues on PDCCH based power saving Huawei, HiSilicon
4. R1-2003630 Remaining issues on the Power Saving Signals/Channels CATT
5. R1-2003664 Remaining issues on PDCCH-based power saving signal MediaTek Inc.
6. R1-2003745 Remaining details of PDCCH-based power saving signal/channel Intel Corporation
7. R1-2003884 Remaining issues for PDCCH-based power saving signal Samsung
8. R1-2003924 TP for further alignment with RAN2 specifications NEC
9. R1-2003957 Remaining issues on power saving signal/channel CMCC
10. R1-2003999 Clarification on power saving signal Spreadtrum Communications
11. R1-2004025 Remaining issues on PDCCH-based power saving signal/channel LG Electronics
12. R1-2004101 Remaining issues for Power saving signal OPPO
13. R1-2004320 Wake up indication for ON duration timer ASUSTeK
14. R1-2004357 Remaining issues for WUS Ericsson
15. R1-2004398 Maintenance for PDCCH-based power saving signal/channel NTT DOCOMO, INC.
16. R1-2004467 Remainign issues in power saving signal/channel Qualcomm Incorporated
17. R1-2004577 On open issues related to DCI format 2\_6 Nokia, Nokia Shanghai Bell
18. R1-2003260 LS on RAN2 DCP Open Issues, RAN2 InterDigital.
19. R1-2003177 TR38.213 CR 0105 Corrections on UE power savings Samsung