**3GPP TSG RAN WG1 Meeting #102-e R1-** **200xxxx**

**e-Meeting, 17 th – 28th August 2020**

**Title: Summary of NR UE Power Saving**

**Agenda item: 7.2.7**

**Source: CATT**

**Document for: Discussion**

# Final Summary of Email Discussions and Agreements

# Email Discussion [102e-NR\_UE\_Pow\_Sav\_01]

# Email Discussion during Preparation[102e-Prep\_NR\_UE\_Pow\_Sav]

|  |  |  |
| --- | --- | --- |
| **Company** | **Supporting Issues** | **Comments** |
| Nokia | Issue #1 and #2 | Given time, also issue #4 and #5-2 could be discussed.  For issue #3, it has been visisted few times in earlier meetings and we have not been able to agree upon it, thus discussing it again would not seem as a good use of our time.  To an extent issue #5-1 seems editorial, but now sure if the addition is needed. No strong view here.  On issue #5-3, we somewhat a different understanding. RAN4 already provide relaxation for BFD procedure in case of DRX as well for candidate selection if DRX cycle is >320ms. Once link re-establisment procedure has been started, it should be carried out without further delay. Delaying it could result RLF, resulting higher power consumption in the end.  Issue #5-4 appear as editorial, thus if no concerns raised, it could be accounted in Editors CR.  On issue #5-5, only place where the ‘long’ is needed would in our view be when the monitoring occasion (based on *ps-Offset*) is determined.  For issue #5-6, it could be discussed if this restriction would be done part of as UE feature? |
| MediaTek | OK to discuss Issue #1, #2, #4, #5-1, #5-2, #5-4, #5-5 and #5-6 | Issue #3: No need to discuss it again. The AL restriction is an optimization but not an essential issue. Network has the freedom to configure the proper ALs to achive reliable performance.  Issue #5-3: When beam failure happens, it is better for UE to resume normal data reception/transmission status. Therefore, there is no need to further consider power saving during BFR procedure. |
| Ericsson | OK to discuss Issues 1, 2 (see comment), 5-1, 5-5, 5-6 (see comment) | Issue 2 – should avoid changes unrelated to UE power savings (such aspects should be discussed in generic Rel-15/16 maintenance session).  Issue 3 - No need to discuss again.  Issue 4 – No need to discuss (spec is clear already –subclause 10.3 of 38.213, 1st line).  Issue 5-2 – No need to discuss (spec is clear already – subclause 5.1.2.1 of 38.214, per RAN1#98bis agreement).  Issue 5-3 – We don’t see a need to make changes to BFR procedure.  Issue 5-4 – Editorial (can be handled in editor CR).  Issue 5-6 – This aspect was also mentioned in Ericsson contribution (R1-2006662). We are OK to discuss here if any spec change is needed for 38.214; however UE feature related part should be discussed in UE feature discussion. In our view, adding a new component to FG 19-2 would be sufficient and no spec change may be needed. |
| Intel | Fine to discuss Issue 1, Issue 2, Issue 4, Issue 5-1, Issue 5-2, Issue 5-3, Issue 5-4, Issue 5-5 | Agree with MediaTek and Nokia’s views on Issue 3, and Nokia’s comment on Issue # 5-6  In response to Nokia and MediaTek’s comments on Issue #5-3, this needs to be discussed as this is related to Issue 2, which covers what combination of RNTIs are monitored outside active time. If UE continues to monitor PDCCH candidates after RAR is received even if the UE is outside active time, this will have implications on RNTIs combinations we target to capture in 38.202 for outside active time. In our view, after recovery is complete by detecting RAR, we do not see strong need to continue monitoring if the UE is in outside active time. UE can resume monitoring during active time. Otherwise, BFR trigger is no different than a wake up signal and it would increase power consumption. |
| Huawei, HiSilicon | OK to discuss Issue#1, Issue#2, Issue#4, Issue#5-1, Issue#5-2, Issue#5-5, Issue#5-6 | Issue#3: we had discisson on this issue before and this was actually not agreed. No need to repeat the discussion in maintenance phase.  Issue#5-3: we share similar view with MTK and Ericsson. BFR procedure should not be impacted by power saving.  Issue#5-4: This seem not controversial and we think it could be directly handled by the spec editor.  Regardign Ericsson’s comments on Issue#5-2, the proposed change is regarding the application delay when BWP switching is triggered by a timer or RRC configuration. This was not captured in 5.1.2.1 of 38.213. |
| Qualcomm | Issue #1, #2, #5-6 | Issue #3 can also be discussed, but the importance compared to other issues is not high.  Issue #4 can also be discussed, but seems to be a minor issue.  Issue #5-3: In the current specification, monitoring C-RNTI outside Active Time is limited within the RAR window. Further PDCCH monitoring (outside the RAR window) is still controlled by DRX operation. Thus, in our view, the current speficifation is clear and we don’t see a need for change.  Issue #5-4: The editor may handle this. |
| ZTE | OK to discuss Issue #1, #2, #4, #5-1, #5-5 and #5-6 | Agree with MediaTek and Nokia’s views on Issue 3, no more discussion is needed. A flexible AL is helpful to adapatation to channel condition variant, more restriction is not necessary.  Regarding issue 5-2, the current spec is clear.  Regarding issue 5-3, we don’t see a need to modify the current BFR procedure.  Regarding issue 5-4, it can be handled by editor. |

# Summary from contributions reviews

## Summary of Open Issues

* **Issue 1:** remove reference Clause 5.7 of TS38.321 on the invalid monitoring occasions in Clause10.3 of TS38.213 based on RAN2 LS R1-2005210
  + RAN2 LS asked RAN1 to remove the reference of TS38.321 in Clause 10.3 of TS38.213as it is redundant
    - Proposed by ZTE, NEC, DoCoMo, Nokia, NSB
    - Object by vivo
* **Issue 2:** The additional channel combination in Clause 6.2 of TS38.202 is needed after discussion in RAN1#101-e for UE decoding RAR in RACH Msg2 and RACH Msg B addressed to C-RNTI/MCS-C-RNTI when UE monitors DCI format 2\_6 outside Active Time. It is noticed that CS-RNTI (for dynamic scheduling of configured grant) would not be the RNTI for RACH Msg 2 and RACH Msg B in USS outside Active Time
  + Proposed by **-** ZTE, CATT, Intel, Nokia, NSB,
* **Issue 3:** Since DCI format 2\_6 is monitored in Type 3 CSS with multi-user multiplexing, restriction of AL for DCI format 2\_6 was proposed as the common channel to achieve the target miss-detction rate at 10-3.
  + Proposed by – CATT, Qualcomm
* **Issue 4:** PS-RNTI is monitored at PCell for CA or SpCell for DC. The procedure in Clause 10.1 of 38.213 needs to be corrected
  + **Proposed by:** Huawei, HiSilicon, Samsung
* **Issue 5: Individual proposal with clarification and editorial change**
  + **Issue 5-1** (Huawei) – Clarification on RRM measurements for mobility “outside Active Time” in Proposal 2 of R1-2005804.
  + **Issue 5-2** (Huawei) – For timer or RRC signaling based BWP switching, the applicable K0min/K2min on the new BWP is applied immediately from the slot where the UE can receive or transmit as defined by the BWP switching delay, and adopt TP2 in TS 38.214 in Proposal 3 of R1-2005804
  + **Issue 5-3** (Intel): After detecting RAR addressed to C-RNTI in recovery search space outside active time, UE continues to monitor PDCCH candidates in the recover search space only after active time starts
  + **Issue 5-4** (NEC): Editorial correction at 38.212 to change higher layer parameter *PS-RNTI* to *ps-RNTI*
  + **Issue 5-5** (Samsung): clarification on DCI monitoring for long DRX and not for short DRX
  + **Issue 5-6** (Qualcomm): In the specification (TS 38.214, Section 5.2.1.5.1 and Section 5.2.1.5.1a), it should be clarified that the extended set of aperiodic CSI-RS triggering offsets is applied only to the UEs supporting the Rel-16 cross-slot scheduling adaptation feature.

## Proposed TPs for the open issues

### Proposed TP for Issue 1

----------------------------------------------- Beginning of TP of TS 38.213 --------------------------------------------------------

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

**\*\*\* Unchanged text is omitted \*\*\***

If a UE is provided search space sets to monitor PDCCH for detection of DCI format 2\_6 in the active DL BWP of the PCell or of the SpCell and the UE

- is not required to monitor PDCCH for detection of DCI format 2\_6, as described in Clauses 10, 11.1 and 12 for all corresponding PDCCH monitoring occasions outside Active Time prior to a next long DRX cycle, or

- does not have any PDCCH monitoring occasions for detection of DCI format 2\_6 outside Active Time of a next long DRX cycle

the physical layer of the UE reports a value of 1 for the Wake-up indication bit to higher layers for the next long DRX cycle.

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

### Proposed TP for Issue 2

-----------------------------------------------Beginning of TP of 38.202---------------------------------------------------------------

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| <Text omitted >  **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 | | C1 | PDCCH+PDSCH | P-RNTI | PCH | Note 1 | | 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 |  | | D1a | PDCCH+PDSCH | C-RNTI, MCS-C-RNTI | DL-SCH |  | | D2 | PDCCH | C-RNTI, CS-RNTI, MCS-C-RNTI | DL-SCH |  | | E | PDCCH | C-RNTI | N/A | Note 4 | | F0 | PDCCH | Temporary C-RNTI | UL-SCH | Note 3 | | F1 | PDCCH | C-RNTI, CS-RNTI, MCS-C-RNTI | UL-SCH |  | | G | PDCCH | SFI-RNTI | N/A |  | | H | PDCCH | INT-RNTI | N/A |  | | J0 | PDCCH | TPC-PUSCH-RNTI | N/A |  | | J1 | PDCCH | TPC-PUCCH-RNTI | N/A |  | | J2 | PDCCH | TPC-SRS-RNTI | N/A |  | | K | PDCCH | SP-CSI-RNTI | N/A |  | | L0 | PDCCH | SL-RNTI | SL-SCH |  | | L1 | PDCCH | SLCS-RNTI | SL-SCH |  | | M | PDCCH | SL Semi-Persistent Scheduling V-RNTI | SL-SCH | Note 5 | | N | PDCCH | PS-RNTI | N/A |  | | O | PDCCH | AI-RNTI | N/A |  | | Note 1: These are received from PCell only.  Note 2: In some cases UE is only required to monitor the short message within the DCI for P-RNTI.  Note 3: These are received from PCell or PSCell.  Note 4: This corresponds to PDCCH-ordered PRACH.  Note 5: This corresponds to PDCCH scheduling LTE PC5. | | | | |   **Table 6.2-2: Downlink "Reception Type" combinations**   |  |  |  |  | | --- | --- | --- | --- | | **Supported Combinations** | | | **Comment** | | **PCell** | **PSCell** | **SCell** | | 1. RRC\_IDLE | | | | | A + (B and/or C1 and/or D0) + F0 |  |  | Note 1 | | 2. RRC\_INACTIVE | | | | | A + (B and/or C1 and/or D0) + F0 |  |  | Note 1 | | 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+~~[~~D0 or D1a~~]~~) ~~[~~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 or D1a~~]~~) ~~[~~and/or~~]~~ N) | m1\*D1 + m2\*D2 + E + n\*F1 + G + H  + J0 + J1 + J2 + K + O + [L0 + L1 + M] | Note 2, Note 3, Note 4, Note 5, Note 6, Note 7, Note 8 | | Note 1: UE is not required to decode more than two PDSCH simultaneously, and decoding prioritization when more than two are received is up to UE implementation.  Note 2: For PCell, UE is not required to decode SI-RNTI PDSCH simultaneously with C-RNTI PDSCH, unless in FR1.  Note 3: Supported combinations are subject to UE capabilities for dual connectivity, carrier aggregation, receiving of group TPC commands, pre-emption indication and dynamic SFI monitoring.  Note 4: The values of m2 ≥ 0 and n≥ 0 in the supported combinations are subject to the UE capability.  Note 5: Support of monitoring PDCCH with SL-RNTI, SLCS-RNTI, SL Semi-Persistent Scheduling V-RNTI are subject to UE capability.  Note 6: The values of m1 ≥ 1 in the supported combinations are subject to the UE capability.  Note 7: In Active time, a UE is not expected to monitor the DCI format for the PDCCH scrambled by PS-RNTI.  Note 8: The PDCCH scrambled by PS-RNTI can only be configured on the PCell and PSCell. | | | | |

-----------------------------------------------------End of TP of 38.202---------------------------------------------------------------

### Proposal for Issue 3

**For the aggregation level and the number of PDCCH candidates for DCI format 2\_6, reuse those for DCI format 2\_0.**

### Proposed TP for Issue 4

----------------------------------------------- Beginning of TP of TS 38.213 --------------------------------------------------------

**10.1 UE procedure for determining physical downlink control channel assignment**

A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets

- a Type0-PDCCH CSS set configured by *pdcch-ConfigSIB1* in *MIB* or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a SI-RNTI on the primary cell of the MCG

- a Type0A-PDCCH CSS set configured by *searchSpaceOtherSystemInformation* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a SI-RNTI on the primary cell of the MCG

- a Type1-PDCCH CSS set configured by *ra-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a RA-RNTI, a MsgB-RNTI, or a TC-RNTI on the primary cell

- a Type2-PDCCH CSS set configured by *pagingSearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a P-RNTI on the primary cell of the MCG

- a Type3-PDCCH CSS set configured by *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by INT-RNTI, SFI-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, TPC-SRS-RNTI, or CI-RNTI, ~~or PS-RNTI~~ and, only for the primary cell, C-RNTI, MCS-C-RNTI, ~~or~~ CS-RNTI(s), or PS-RNTI and

- a USS set configured by *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), SL-RNTI, SL-CS-RNTI, or SL-L-CS-RNTI.

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

### Proposed TP for Issue 5-1

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| ----------------------------------Beginning of Text Proposal in TS.38.214-----------------------------------------  5.1.6.1.3 CSI-RS for mobility  < Unchanged text is omitted >  If the UE is configured with DRX, the UE is not required to perform measurement of CSI-RS resources other than during the active time for measurements based on *CSI-RS-Resource-Mobility*. When the UE is configured to monitor DCI format 2\_6, the UE is not required to perform measurements other than during the active time and during the timer duration indicated by *drx-onDurationTimer* also outside active time based on *CSI-RS-Resource-Mobility*.  If the UE is configured with DRX and DRX cycle in use is larger than 80 ms, the UE may not expect CSI-RS resources are available other than during the active time for measurements based on *CSI-RS-Resource-Mobility*. If the UE is configured with DRX and configured to monitor DCI format 2\_6 and DRX cycle in use is larger than 80ms, the UE may not expect that the CSI-RS resources are available other than during the active time and during the time duration indicated by *drx-onDurationTimer* also outside active time for measurements based on *CSI-RS-Resource-Mobility.* Otherwise, the UE may assume CSI-RS are available for measurements based on *CSI-RS-Resource-Mobility*.  < Unchanged text is omitted >  ------------------------------------------------ End of Text Proposal 1----------------------------------------------- |

### Proposed TP for Issue 5-2

--------------------------------------- Start of Text Proposal in TS38.214------------------------------------------

< Unchanged parts are omitted >

**5.3.1 Application delay of the minimum scheduling offset restriction**

When the UE is scheduled with DCI format 0\_1 or 1\_1 with a ‘Minimum applicable scheduling offset indicator’field in slot *n*, it shall determine the *K*0min and *K*2min values, if configured respectively, to be applied, while the previously applied *K*0min and/or *K*2min values are applied until the new values take effect. If the DCI in slot *n* also indicates an active DL (UL) BWP change for a serving cell, the indicated *K*0min (*K*2min) value in the new active DL (UL) BWP, if configured, is applied from the slot indicated by the slot offset value of the time domain resource assignment field in the DCI. Otherwise, change of applied minimum scheduling offset restriction indication carried by DCI in slot *n*, shall be applied in slot *n*+*X* of the scheduling cell. The UE does not expect to be scheduled with DCI format 0\_1 or 1\_1 with ‘Minimum applicable scheduling offset indicator’ field indicating another change to *K*0min or *K*2min for the same active BWP of the scheduled cell before slot *n+X* of the scheduling cell.

When the DCI format 0\_1 or 1\_1 with ‘Minimum applicable scheduling offset indicator’field indicating a change to the applied *K*0min or *K*2min is contained within the first three symbols of slot *n*, the value of application delay *X* is determined by, where *K*0minOld is the currently applied *K*0min value of the active DL BWP in the scheduled cell and is zero, if *minimumSchedulingOffsetK0* is not configured for the active DL BWP in the scheduled cell, *Zµ* is determined by the subcarrier spacing of the active DL BWP in the scheduling cell in slot *n*, and given in Table 5.3.1-1, and *µ*PDCCH and *µ*PDSCH are the sub-carrier spacing configurations for PDCCH of the active DL BWP in the scheduling cell and PDSCH of the active DL BWP in the scheduled cell, respectively, in slot *n*. After indication of a change to the applied *K*0min or *K*2min of the scheduled cell in slot *n* of the scheduling cell, if there is an active DL BWP change in the scheduling cell before slot *n+X*, the new *K*0min and/or *K*2min values are applied from the first slot no earlier than the start of slot *n+X* based on the sub-carrier spacing configuration of the active DL BWP in the scheduling cell in slot *n*.

When the UE changes an active DL BWP due to a BWP inactivity timer expiration, the *K*0min value in the new active DL BWP is applied from the slot where the UE can receive or transmit as defined by the BWP switching delay [11, TS 38.133]. When the UE changes an active DL (UL) BWP due to RRC signalling, the *K*0min (*K*2min) value in the new active DL (UL) BWP is applied from the slot where the UE can receive or transmit as defined by the BWP switching delay [11, TS 38.133].

< Unchanged parts are omitted >

-------------------------------------------- End of Text Proposal 2-----------------------------------------

### Proposed TP for Issue 5-3

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| Section 6, 38.213  \*\*\*Other texts omitted\*\*\*  For the PCell or the PSCell, the UE can be provided, by *PRACH-ResourceDedicatedBFR*, a configuration for PRACH transmission as described in Clause 8.1. For PRACH transmission in slot *n* and according to antenna port quasi colocation parameters associated with periodic CSI-RS resource configuration or with SS/PBCH block associated with index *q*new provided by higher layers [11, TS 38.321], the UE monitors PDCCH in a search space set provided by *recoverySearchSpaceId* for detection of a DCI format with CRC scrambled by C-RNTI or MCS-C-RNTI starting from slot *n* + 4 within a window configured by *BeamFailureRecoveryConfig*. For PDCCH monitoring in a search space set provided by *recoverySearchSpaceId* and for corresponding PDSCH reception, the UE assumes the same antenna port quasi-collocation parameters as the ones associated with index *q*new until the UE receives by higher layers an activation for a TCI state or any of the parameters *tci-StatesPDCCH-ToAddList* and/or *tci-StatesPDCCH-ToReleaseList*. After the UE detects a DCI format with CRC scrambled by C-RNTI or MCS-C-RNTI in the search space set provided by *recoverySearchSpaceId*, the UE continues to monitor PDCCH candidates in the search space set provided by *recoverySearchSpaceId* during active timeuntil the UE receives a MAC CE activation command for a TCI state or *tci-StatesPDCCHToAddList* and/or *tci-StatesPDCCH-ToReleaseList*.  \*\*\*Other texts omitted \*\*\* |

### Proposed TP for Issue 5-4

----------------------------------------------- Beginning of TP of TS 38.212 --------------------------------------------------------

7.3.1.3.7 Format 2\_6

DCI format 2\_6 is used for notifying the power saving information outside DRX Active Time for one or more UEs.

The following information is transmitted by means of the DCI format 2\_6 with CRC scrambled by PS-RNTI:

- block number 1, block number 2,…, block number *N*

where the starting position of a block is determined by the parameter *ps-PositionDCI-2-6* provided by higher layers for the UE configured with the block.

If the UE is configured with higher layer parameter *ps-RNTI* and *dci-Format2-6*, one block is configured for the UE by higher layers, with the following fields defined for the block:

- Wake-up indication - 1 bit

- SCell dormancy indication – 0 bit if higher layer parameter *Scell-groups-for-dormancy-outside-active-time* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to higher layer parameter *Scell-groups-for-dormancy-outside-active-time,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *Scell-groups-for-dormancy-outside-active-time,* with MSB to LSB of the bitmap corresponding to the first to last configured SCell group.

The size of DCI format 2\_6 is indicated by the higher layer parameter *sizeDCI-2-6*, according to Clause 10.3 of [5, TS 38.213].

----------------------------------------------- End of TP of TS 38.212 --------------------------------------------------------

### Proposed TP for Issue 5-5

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| **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]  […]  - an offset by *ps-Offset* indicating a time, where the UE starts monitoring PDCCH for detection of DCI format 2\_6 according to the number of search space sets, prior to a slot where the *drx-onDuarationTimer* for long DRX cycle would start on the PCell or on the SpCell [11, TS 38.321]  - for each search space set, the PDCCH monitoring occasions are the ones in the first slots indicated by *duration*, or slot if *duration* is not provided, starting from the first slot of the first slots and ending prior to the start of *drx-onDurationTimer* for long DRX cycle.  On PDCCH monitoring occasions associated with a same long DRX Cycle, a UE does not expect to detect more than one DCI format 2\_6 with different values of the Wake-up indication bit for the UE or with different values of the bitmap for the UE.  The UE does not monitor PDCCH for detecting DCI format 2\_6 during Active Time and short DRX cycle [11, TS 38.321].  If a UE reports for an active DL BWP a requirement of X slots prior to the beginning of a slot where the UE would start the *drx-onDurationTimer* for long DRX cycle, the UE is not required to monitor PDCCH for detection of DCI format 2\_6 during the X slots, where X corresponds to the requirement of the SCS of the active DL BWP in Table 10.3-1. |

**Proposed TP for Issue 5-6**

----------------------------------------------- Beginning of TP of TS 38.214 --------------------------------------------------------

##### 5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology

<omitted text>

When aperiodic CSI-RS is used with aperiodic reporting, the CSI-RS offset is configured per resource set by the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffsetExt-r16.* The CSI-RS triggering offset has the values of {0, 1, 2, 3, 4, 5, 6, …, 15, 16, 24} slots if the UE is configured with *minimumSchedulingOffsetK0-r16* for any DL BWP or *minimumSchedulingOffsetK2-r16* for any UP BWP, and {0, 1, 2, 3, 4, 16, 24} slots, otherwise. If the UE is not configured with *minimumSchedulingOffsetK0-r16* for any DL BWP ~~or~~and *minimumSchedulingOffsetK2-r16* for any UL BWP and if all the associated trigger states do not have the higher layer parameter *qcl-Type* set to 'QCL-TypeD' in the corresponding TCI states , the CSI-RS triggering offset is fixed to zero. The aperiodic triggering offset of the CSI-IM follows offset of the associated NZP CSI-RS for channel measurement.

<omitted text>

##### 5.2.1.5.1a Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have different numerologies

<omitted text>

Aperiodic CSI-RS timing:

- When the aperiodic CSI-RS is used with aperiodic CSI reporting, the CSI-RS triggering offset *X* is configured per resource set by the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffsetExt-r16,* including the case that the UE is not configured with *minimumSchedulingOffsetK0-r16* for any DL BWP ~~or~~and *minimumSchedulingOffsetK2-r16* for any UL BWP and all the associated trigger states do not have the higher layer parameter *qcl-Type* set to 'QCL-TypeD' in the corresponding TCI states. The CSI-RS triggering offset has the values of {0, 1,…,31} slots when the µPDCCH < µCSIRS ~~and~~. When µPDCCH > µCSIRS, the CSI-RS triggering offset has the value of {0, 1, 2, 3, 4, 5, 6, …, 15, 16, 24} slots if the UE is configured with *minimumSchedulingOffsetK0-r16* for any DL BWP or *minimumSchedulingOffsetK2-r16* for any UP BWP, and {0, 1, 2, 3, 4, 16, 24} slots ~~when the µ~~~~PDCCH~~ ~~> µ~~~~CSIRS~~, otherwise. The aperiodic CSI-RS is transmitted in a slot , if UE is configured with ca-SlotOffset for at least one of the triggered and triggering cell, and *Ks* = , otherwise, and where

*- n* is the slot containing the triggering DCI, *X* is the CSI-RS triggering offset in the numerology of CSI-RS according to the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffsetExt-r16*,

- and are the subcarrier spacing configurations for CSI-RS and PDCCH, respectively,

- and are the and the, respectively, which are determined by higher-layer configured ca-SlotOffset for the cell receiving the PDCCH respectively, and   are the and the, respectively, which are determined by higher-layer configured ca-SlotOffset for the cell transmitting the CSI-RS respectively, as defined in [4, TS 38.211] subclause 4.5

- If the µPDCCH < µCSIRS, the UE is expected to be able to measure the aperiodic CSI RS, if the CSI-RS starts no earlier than the first symbol of the CSI-RS carrier’s slot that starts at least *Ncsirs* PDCCH symbols after the end of the PDCCH triggering the aperiodic CSI-RS.

- If the µPDCCH > µCSIRS, the UE is expected to be able to measure the aperiodic CSI RS, if the CSI-RS starts no earlier than at least *Ncsirs* PDCCH symbols after the end of the PDCCH triggering the aperiodic CSI-RS.

Table 5.2.1.5.1a: *Ncsirs* as a function of the subcarrier spacing of the triggering PDCCH

|  |  |
| --- | --- |
| ***µPDCCH*** | ***Ncsirs* [symbols]** |
| 0 | 4 |
| 1 | 5 |
| 2 | 10 |
| 3 | [14] |

<omitted text>

----------------------------------------------- End of TP of TS 38.214 --------------------------------------------------------

# Contributions summary and proposals

|  |  |
| --- | --- |
| vivo[1] | * Observation 1: gNB and UE may have different understanding on running state of bwpInactivityTimer of a scell, if scell dormancy indication is configured for DCI format 2-6, and multiple monitoring occasions for DCI format 2-6 are configured before DRX ON. * Proposal 1: The starting point of BWP switching of Scell dormancy and bwpInactivityTimer should be defined as the later one between the last valid monitoring occasion for DCI format 2-6 and n slot prior to DRX ON, where n is the Scell BWP switching time.   + Send LS to RAN2(also cc RAN4) * Proposal 2: Further clarification is needed that minimum time gap is determined based on the SCS of active DL BWP of Pcell or PScell where DCI format 2\_6 is monitored.   + Capture TP in Appendix 1 in R1-2005356 for TS38.213   <Note by Moderator> The switching delay of SCell dormancy had been agreed in RAN4 in R4-2008607 and R4-2008608  [vivo]  For proposal 1: It is not about BWP switching delay. It is about when to start BWP switching if there is multiple DCI format 2-6 transmitted in different monitoring occasions indicating Scell BWP switching(to non-dormant BWP). gNB is not aware of in which occasion WUS is detected by UE, hence gNB and UE may have different understanding on BWP switching time, i.e, when the bwpInactivityTimer starts, and may lead to ambiguity in UE behavior  For proposal 2: It is not about the BWP switching delay, it is about the how to determine min gap. The min gap is determined based on SCS of active DL BWP. However, it is not clear which active DL BWP is used for min gap determination, if UE is configured with multiple serving cells with active BWPs with different SCS. |
| ZTE [2] | * Proposal 1: The TP on the downlink reception in TS 38.202 is shown as follows: * Proposal 2: Adopt the following TP on TS 38.213. |
| CATT [3] | * Observation1: DCI size alignment will degrade miss detection performance of DCI format 2\_6 more than 2dB in AWGN channel for 12bits DCI size. * Proposal 1: TP to Clause 6.2 of TS 38.202 for the channel combination of DCP and PDCCH+PDSCH addressed by either RA-RNTI or C-RNTI * Proposal 2: Only 4,8,16 can be configured as the number of aggregation levels each with at most two PDCCH candidates for the DCI format 2\_6. |
| Huawei, HiSilicon [4] | * Proposal 1: UE ignores the dormancy indication bits if a DCI format 2\_6 is received on a monitoring occasion partially or fully overlapping with the time location which is BWP switching delay prior to the ON duration.   <Note by moderator> This was discussed in RAN1#101-e. There is no consensus to conclude that UE to start monitoring PDCCH of SCell at the beginning of DRX ON after SCell dormancy indication.   * Proposal 2: Adopt TP1 in TS 38.214 to clarify UE behavior of RRM measurement when DCI format 2\_6 is configured. * Proposal 3: For timer or RRC signaling based BWP switching, the applicable K0min/K2min on the new BWP is applied immediately from the slot where the UE can receive or transmit as defined by the BWP switching delay, and adopt TP2 in TS 38.214. * Proposal 4: Make a conclusion in RAN1 that UE may use N Rx antennas for the reception of PDSCH on the DL BWP when the per-BWP configured maxMIMO-Layers for a DL BWP is N.   < Note by moderator> This was discussed that the power saving gain with reduced number of received antenna for maximum MIMO layer adaptation is UE implementation.   * Proposal 5: Adopt the TP3 in TS 38.213. |
| Intel [5] | * Proposal 1: Update the Table of Downlink "Reception Type" combinations in 38.202 as follows: * Proposal 2: After detecting RAR addressed to C-RNTI in recovery search space outside active time, UE continues to monitor PDCCH candidates in the recover search space only after active time starts. * Proposal 3. Update Section 6 of 38.213 as follows. |
| NEC [6] | * Proposal 1: Correct “slot” to “subframe” where *drx-onDurationTimer* starts as specified in TS 38.321   <Note by Moderator> TS38.321 “start *drx-onDurationTimer* after *drx-SlotOffset* from the beginning of the subframe” has the *drx-SlotOffset* to indicate the starting time of *drx-onDurationTimer* at the slot level.   * Proposal 2: Move description of Wake-up indication bit to an appropriate paragraph where UE behavior upon reception of Wake-up indication bit is described   < Note by Moderator> This was discussed in RAN1#101-e   * Proposal 3: Remove reference to RAN2 spec for invalid higher layer DCP occasions as requested by RAN2 * Proposal 4: Adopt TP for TS38.213 and TS 38.212 provided in Annex |
| Samsung [7] | * TP for long DRX * TP for ps-RNTI |
| Spreadstrum [8] | * TP for “When DRX is configured”   < Note by Moderaotr> Need justification for the correction |
| Ericsson [9] | * Observation 1: RRC parameter name update to reflect UE power savings agreement on A-CSI triggering offset value range extension is already reflected in by current specification (38.214-g20) in subclauses 5.2.1.5.1 and 5.2.1.5.1a |
| DoCoMo [10] | * Proposal 1: Following text proposal is applied to section 10.3 in TS 38.213. |
| Qualcomm[11] | * Proposal 1: For the aggregation level and the number of PDCCH candidates for DCI format 2\_6, reuse those for DCI format 2\_0. * Proposal 2: In the specification (TS 38.214, Section 5.2.1.5.1 and Section 5.2.1.5.1a), it should be clarified that the extended set of aperiodic CSI-RS triggering offsets is applied only to the UEs supporting the Rel-16 cross-slot scheduling adaptation feature. |
| Nokia, NSB [12] | * Observation 1: Based on MAC specification procedures UE may need to monitor C-RNTI (and MCS-RNTI) also outside active time. * Proposal 1: Adopt following to Section 6.2 of 38.202 * Observation 2: Text “, and in Clause 5.7 of [11, TS 38.321]” is unnecessary in PHY specification. * Proposal 2: Adopt following test proposal to 38.213 Section 10.3: * Observation 3: there appears to be some additional overlap in RAN1 and RAN2 specifications in terms of UE behaviour, but no contradiction in terms of expected outcome/UE behaviour. |

# Reference

1. R1-2005356 Remaining issues for Rel-16 UE power saving vivo
2. R1-2005519 Remaining issues on Rel-16 power saving ZTE
3. R1-2005680 Remaining issues on UE Power Saving CATT
4. R1-2005804 Remaining issues on PDCCH based power saving Huawei, HiSilicon
5. R1-2005854 Remaining issues on UE Power Saving for NR Intel Corporation
6. R1-2005957 TP on DRX adaptation for alignment NEC
7. R1-2006119 On maintenance of UE power saving Samsung
8. R1-2006289 Remaining issues on UE power saving Spreadtrum Communications
9. R1-2006662 Maintenance for UE power savings Ericsson
10. R1-2006702 Maintenance for UE power saving NTT DOCOMO, INC.
11. R1-2006783 Remainign issues in Rel-16 UE power saving Qualcomm Incorporated
12. R1-2006894 On open issues related to Rel-16 UE power saving Nokia, Nokia Shanghai Bell
13. R1-2005505 Discussion on reply LS on DCP vivo