**3GPP TSG RAN WG1 Meeting #100bis-e R1-** **20xxxxx**

**e-Meeting, 20th – 30th , April 2020**

**Title: NR-UE-pow-sav-WUS-01**

**Agenda item: 7.2.7.1**

**Source: CATT**

**Document for: Discussion**

# DCI format 2\_6 monitoring and related procedures

* **The minimum time gap value**

The minimum time gap values 1 and 2 are based on majority view from the proposal of each contribution. The range is not derived from any specification or formula.

**Proposal 1:  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 as follows,**

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

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| **Company** | **Support/Not** | **Comments** |
| Ericsson | Support |  |
| Vivo | Support | For value 1 and 2, although our preference in our contribution is to align with the value provided by BWP switching type 1 and 2 respectively, but we can compromise to the current proposal 1 for the sake of progress. |
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* **Inconsistent information from more than on DCI format 2\_6 decoding output**

**Proposal 2:**

**Question 1: How would the clarification be captured?**

* **Alt 1: In the spepcfication**
* **Alt 2: In the conclusion of RAN1#100b-e**

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| **Company** | **Support/Not** | **Comments** |
| Ericsson | Neither | Handling of inconsistent information is already specified in 38.213(as shown below), so we don’t see a need to add more clarification. *If a UE detects a DCI format with inconsistent information, the UE discards all the information in the DCI format.* |
| Vivo | Alt 1 | As Sasaki-san said, the sentence “ *If a UE detects a DCI format with inconsistent information, the UE discards all the information in the DCI format*“ inconsistency is checked within a PDCCH. The inconsistency check among PDCCHs (or search spaces within a MO) looks out of scope of the agreement. Relevent agreement is from RAN1#94b.Moreover, I think UE will never (or very seldom) has a chance to ‘discard’ since UE has the freedom to stop decoding for the next.Since no one denies the spec shall provide the freedom for the UE to skip decoding the rest of the other MOs in other slots for the next DRX cycle, we think reasonable assumptions which are captured in the spec should be provided in order to allow UE to do so. |
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**Question 2: The preferred sentence**

* Alt-1(a): UE is not required to continue decoding PDCCH with CRC scrambled by PS-RNTI once UE decodes a DCI Format 2-6 with successful CRC check.
* Alt-1(b): UE can stop monitoring PDCCH with DCI Format 2-6 once the UE has detected one
* Alt-2(a): UE expects each of the more than one DCI formats 2\_6 to indicate a same information for the next DRX cycle
* Alt-2(b): UE does not expect to receive different wake-up indication(s) or different dormancy indication(s) from the DCI formats 2\_6 detected on monitoring occasions for the next DRX cycle.
* Alt-3: UE wakes up at the next DRX cycle if at least one DCI format 2\_6 indicates the UE to wake up

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| **Company** | **Support/Not** | **Comments** |
| Ericsson | None of the above | Alt-2(a) seems to add an expectation based on which UE could soft-combine across multiple DCIs. We don’t see a need for such behavior. Alt-1(a) or 1(b) seem to be plausible without needing such expectation.  |
| Vivo | Alt 2(b)  | In principle we are OK with both Alt 2(a) or 2(b). Considering some concerns on whether Alt 2(a) impose network to transmit DCI multiple times, we can accept Alt 2(b). Instead of saying “UE expects….”, the updated proposal 2 saying “UE does not expecting……” provides a better description and it is fine for us.Alt-3 is vague for our understanding since it does not address any assumption on whether UE need to continue perform decoding since we are not preferrable on this.Alt 1 (a)/(b) is a little bit restrictive since Alt 1 (a)/(b) is a consequence of the UE assumption described in Alt 2(b). Hence, we are more preferrable on Alt 2(b) |
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* **Excluding DCI format 2\_6 for DCI size budget for DCI size alignment**

**Proposal 3:**

TP for subclause 7.3.1.0 of 38.212 to exclude DCI format 2-6 from the maximum number of DCI sizes per cell.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Begin Text Proposal \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Step 3:

- If both of the following conditions are fulfilled the size alignment procedure is complete

- the total number of different DCI sizes configured to monitor is no more than 4 for the cell

- the total number of different DCI sizes with C-RNTI configured to monitor is no more than 3 for the cell

- DCI format 2-6 size is not counted as one of the 4 different DCI sizes configured per cell.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of Text Proposal \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

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| **Company** | **Support/Not** | **Comments** |
| Ericsson  | Support | It seems the common understanding is that DCI 2-6 size is not counted in the budget. Then, it seems also reasonable to capture it as a conclusion and update the spec.  |
| Vivo | Support | A shorter DCI size, which can be configured by RRC, is preferred to achieve a low code rate to ensure high detection reliability for WUS. If DCI format 2-6 is counted as one of 3+1 DCI size budget, it will be padded to align with other DCI format in CSS. On the other hand, it will not be monitored at the same time instance as other PDCCH with UE specific RNTI during DRX active time, only one DCI size is monitored if the SI, paging PDCCH is not considered. In this case, it is not necessary to align the DCI size of WUS with other DCIs. Therefore, we support DCI format 2-6 size is not counted as one of the 4 different DCI sizes configured per cell |
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# Appendix: Summary from R1-2002698

## DCI format 2\_6 Monitoring and Related Procedures

### Minimum time gap – values

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| **RAN1#99 agreements**Agreements: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**

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During RAN1#100e email discussion, most companies prefer to determine the minimum time gap without considering the SCell dormancy/non-dormancy transition delay. The exact values of minimum time gap will be determined at RAN1#100bis-e.

 The definition of the minimum time gap was proposed to be clarified for SCell dormantcy indication by vivo

* *Proposal 2: Further clarification of the minimum time gap for Scell dormancy indication, down-select from the following,*
	+ *Alt 1: between the end of the slot of last DCI format 2\_6 monitoring occasion and the start of the DRX ON*
	+ *Alt 2: between the end of the slot of last DCI format 2\_6 monitoring occasion and the start of the time when the dormancy indication applies*

Since MAC controls the start of DRX for all cells, which include PCell and SCells, in the same time, the two alternatives of SCell dormancy indication is the same.

The proposed values of minimum time gap in terms of number of slots for all SCS are as follows,

* SCS = 15 kHz
	+ Low –
		- 0 – Huawei, HiSilicon, Sony, MediaTek,
		- 1 – ZTE, OPPO, Intel, CATT, Samsung, Nokia, NSB, Ericcson, DoCoMo, Qualcomm
	+ High –
		- 2- Samsung,
		- 3 - Huawei, HiSilicon,ZTE, OPPO, Sony, MediaTek, Intel, CATT, Nokia, NSB, Ericcson, DoCoMo, Qualcomm
* SCS = 30 kHz
	+ Low –
		- 0 – Huawei, HiSilicon, Sony, MediaTek,
		- 1 – ZTE, OPPO, Intel, CATT, Samsung, Ericcson, DoCoMo
		- 2 - Nokia, NSB, Qualcomm
	+ High –
		- 4 - Samsung,
		- 5 – ZTE, Intel, CATT, Nokia, NSB, DoCoMo,
		- 6 - Huawei, HiSilicon, OPPO, Sony, MediaTek, Ericcson, Qualcomm
* SCS = 60 kHz
	+ Low –
		- 0 - Sony
		- 1 – Huawei, HiSilicon, ZTE, OPPO, MediaTek, Ericcson,
		- 2 - Intel, CATT, Samsung, DoCoMo,
		- 3- Nokia, NSB, Qualcomm
	+ High –
		- 8 - Samsung,
		- 9 - ZTE, Intel, CATT, Nokia, NSB, DoCoMo,
		- 12 - Huawei, HiSilicon, OPPO, Sony, MediaTek, Ericcson, Qualcomm
* SCS = 120 kHz
	+ Low –
		- 0 - Sony
		- 1 – ZTE, OPPO, MediaTek,
		- 2 – Huawei, HiSilicon, Intel, Ericcson,
		- 4 - CATT, Samsung, DoCoMo,
		- 6 - Nokia, NSB, Qualcomm
	+ High –
		- 16 - Samsung,
		- 18 - ZTE, Intel, CATT, Nokia, NSB, DoCoMo,
		- 24 - Huawei, HiSilicon, OPPO, Sony, MediaTek, Ericcson, Qualcomm

**Proposal: Regardless the processing time of BWP switching is needed or not for SCell dormancy indication, two values of minimum time gaps in terms of slots per SCS are 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 |

### DCI format 2\_6 Monitoring

#### Monitoring occasions and and conflict of information in the DCI format 2\_6

##### **UE behaviour on conflict wakeup indication from more than one DCI decoding -** – Companies had discussed the UE behaviour on inconsistent wakeup information from the contents of DCI format 2\_6 by multiple DCP monitoring occasions (Huawei, HiSilicon, MediaTeck, )

**Proposal:** **These are implementation issues.**

##### **UE behaviour on SCell dormancy with miss-detection or conflict information from the contents of DCI format 2\_6** – Companies had discussed the UE behaviour on SCell dormancy when DCI format 2\_6 was miss-detected (Huawei, HiSilicon, ZTE, ) or conflict information of power saving information in DCI format 2\_6, such as UE not to wake up to SCell in non-dormancy and monitoring occasions (Huawei, HiSilicon, vivo, MediaTek). One company (ZTE) would like to limit the detection of DCI format 2\_6 for SCell dormancy indication only for CORESET at first 3 symbols of slot.

**Proposal: UE behaviour on the SCell dormancy with miss-detection or conflict information from the contents of DCI format 2\_6 should be discussed in AI-7.2.10.3 MR-DC/CA feature**

#### Additional Invalid monitoring occasion –

A couple of companies (vivo, Nokia, NSB) discussed additional invalid monitoring occasions when the monitoring occasions of DCI format 2\_6 PS-RNTI collide with monitoring of RA-RNTI or TC-RNTI in case of CBRA or monitoring C-RNTI in search space given recoverySearchSpaceId for CFRA based BFR and intra-frequency RRM, RLM, BFD, CBD and L1-RSRP measurement defined in TS 38.133. These issues had been discussed in RAN1#100e and understood by most companies that current specifications captured these invalid scenarios.

**Proposal: The proposed additional invalid monitoring occasions had been covered by current specification.**

#### DCI format 2\_6 not counting in the DCI size budget

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 (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, InterDigital, Ericsson) have proposals in excluding DCI format 2\_6 account for the total budget of DCI format sizes.

Proposal: TP for subclause 7.3.1.0 of 38.212 to exclude DCI format 2-6 from the maximum number of DCI sizes per cell.

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Step 3:

- If both of the following conditions are fulfilled the size alignment procedure is complete

- the total number of different DCI sizes configured to monitor is no more than 4 for the cell

- the total number of different DCI sizes with C-RNTI configured to monitor is no more than 3 for the cell

- DCI format 2-6 size is not counted as one of the 4 different DCI sizes configured per cell.

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## RAN1 and RAN2 Alignment -

### Feature Interaction between WUS and Secondary DRX group

RAN2 had sent a LSt to RAN1[20] on the secondary DRX group for UE power saving with the following agreements as Rel-16 TEI.

Conditional on R1 acceptance:

* A separate *drx-InactivityTimer* and *drx-onDurationTimer* can be configured for the secondary DRX group. R2 understands that this has zero or almost zero impact in R1 and R4
* The combination of cross-carrier scheduling and secondary DRX group is not supported
* FFS if timers for FR2 DRX configuration are shorter than timers for FR1 DRX configuration.
* The intention is to apply secondary DRX configuration to FR2 and existing DRX configuration to FR1

The secondary DRX group is used for UE configured with CA, which contains carriers on both FR1 and FR2 cells. FR2 Cell has larger SCS than that of FR1 cell. The shorter *drxInactivityTimer* and *OnDurationTimer* can be configured for FR2 to enable the FR2 cells to go to sleep more quickly and thereby reduce power consumption. During the email discussion in LS during RAN1#100e, there is no consensus on the RAN1 impacts and no LS reply had sent back to RAN2. Several companies (Intel, CATT, Qualcomm) had discussed the feature interaction between UE adaptation to DRX and Secondary DRX group. There are two proposals to minimize the specification impacts

* Seconddary DRX group is not configured with UE adaptation to DRX in Rel-16 – vivo, Intel, CATT
* Investigating and identify RAN1 specification impacts and change when seconddary DRX group is configured with UE adaptation to DRX - Qualcomm

### Clarification the interaction between PHY and MAC layers

RAN2 sent a LS [19] to RAN1 on the MAC-PHY interactions for DCP (DCI with CRC scrambled by PS-RNTI) monitoring and the start of drx-onDurationTimer. The following understanding regarding how to capture DCP between MAC and PHY was agreed from RAN2 point of view:

**MAC specification:**

1. MAC specifies the start of drx-onDurationTimer and Active Time, including:
* MAC should start drx-onDurationTimer according to indication provided by PHY
* MAC should start drx-onDurationTimer in case DCP is overlapped with Active time, measurement gap and BWP switching period
* MAC should start drx-onDurationTimer in case ps-Wakeup is set to true and no DCP indication is received from PHY

**PHY specification:**

1. PHY specifies DCP monitoring, including:
* When to start the monitoring (ps\_offset) and stop the monitoring (minimum gap based on UE capability)
* In case DCP is considered invalid from PHY perspective (scenarios FFS in RAN1), PHY should not monitor DCP and indicates to MAC to start the drx-onDurationTimer for the next DRX cycle
1. PHY indicates to MAC whether a received DCP indicates to start the drx-onDurationTimer for the next DRX cycle or not.
2. PHY should not specify the start of drx-onDurationTimer and Active Time.

Several companies (Huawei, HiSilicon, NEC, Nokia, NSB, Spreadtrum) had discussed the general procedures of UE adaptation to the DRX operation with DCP (DCI format 2\_6 with CRC scrambled by PS-RNTI) captured in RAN1 and RAN2 specification. Several companies had text proposals on the alignment of RAN1 and RAN2 specification regarding the DRX ON.

**Proposal: TP in replacing “start the drx-onDurationTimer” in Clause 10.3 of TS38.213**

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

<text omitted>

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

~~- the UE starts the~~ *~~drx-onDurationTimer~~* ~~for the next long DRX cycle when a value of the Wake-up indication bit is '1'~~

<text omitted>

If a UE detects DCI format 2\_6

- if the value of the Wake-up indication bit is '0' and the UE is provided *ps-WakeupOrNot*, the UE is indicated by *ps-WakeupOrNot* whether the UE sends indication to higher layers for the next DRX cycle

- if the UE is not provided *ps-WakeupOrNot*, and value of the Wake-up indication bit is '1', the UE shall send an indication to higher layers for the next DRX cycle

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 does not detect DCI format 2\_6

- if the UE is provided *ps-WakeupOrNot*, the UE is indicated by *ps-WakeupOrNot* whether the UE sends indication to higher layers ~~may not start or whether the UE shall start the~~ *~~drx-onDurationTimer~~*for the next DRX cycle

~~- if the UE is not provided~~ *~~ps-WakeupOrNot~~*~~, the UE may not start Active Time indicated by~~ *~~drx-onDurationTimer~~* ~~for the next DRX cycle~~

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, 12, and in Clause 5.7 of [14, TS 38.321] for all corresponding PDCCH monitoring occasions outside Active Time prior to a next DRX cycle, or

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

the UE shall send the indication to higher layers ~~start the~~ *~~drx-onDurationTimer~~* for the next DRX cycle if the UE is not provided *ps-WakeupOrNot* or the *ps-WakeupOrNot* is set to *false*.

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### RAN2 LS on configuration of L1 Measurements –

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| **RAN1#99**Agreements:When drx\_OnDurationTimer does not start, RAN1 agrees the following report(s) are impacted by the WUS indication* SP L1-RSRP reporting
* SP-CSI
* SRS

Except:* by configuration, whether or not for periodic L1-RSRP reporting
* by configuration, whether or not for periodic CSI
* By default, both the above two are also impacted by the WUS indication

Note: for the above two bullets (under Except), no additional RAN1 impact is expected in Rel-16**RAN1#100e**Agreement: P-CSI and L1-RSRP reports are independently configured and to allow UE only to report periodic CSI apart from L1-RSRP. |

#### RAN2 LS on L1-RSRP and P-CSI configuration

RAN2 sent a LS [19] to RAN1 on the configuration on the measurement configuration of L1-RSRP and P-CSI reporting when drx-onDurationTimer is not running due to DCP. There are two options to interpret the two options in the configuration of L1-RSRP as follows,

* Option 1:
	+ ps-TransmitPeriodicCSI = TRUE: Report all types of periodic CSI, including L1-RSRP (i.e. cri-RSRP and ssb-Index-RSRP)
	+ ps-TransmitPeriodicL1-RSRP = TRUE: Only report L1-RSRP (i.e. cri-RSRP and ssb-Index-RSRP)

In this option, the two flags cannot both be set to TRUE and it is not possible to control the UE only to report periodic CSI apart from L1-RSRP.

* Option 2:
	+ ps-TransmitPeriodicCSI = TRUE: Report all types of periodic CSI apart from L1-RSRP (i.e. cri-RSRP and ssb-Index-RSRP)
	+ ps-TransmitPeriodicL1-RSRP = TRUE: Only report L1-RSRP (i.e. cri-RSRP and ssb-Index-RSRP)

In this option, the two flags are independent and it is possible to control the UE only to report periodic CSI apart from L1-RSRP.

RAN1 discussed two options in RAN1#100-e with the agreement that P-CSI and L1-RSRP reports are independently configured and to allow UE only to report periodic CSI apart from L1-RSRP.

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**Proposal: Reply to RAN2 that RAN1 has concluded that the option 2 given in LS [19] is the assumed behaviour.**

#### L1-SINR

RRC parameters PS-Periodic\_CSI\_TransmitOrNot and PS\_Periodic\_L1-RSRP\_TransmitOrNot were introduced to allow P-CSI and L1-RSRP feedback at the configured UL resource when UE is indicated not to wakeup by DCI format 2\_6. In Rel-16, L1-SINR was also introduced as an additional measurement that UE can report. Three companies (CATT, Ericsson, and Qualcomm) has proposed to report L1-SINR even if drx-OndurationTimer is not started. This can be done by introducing a new RRC parameter (like above for L1-RSRP) or by reusing the existing parameter (PS\_Periodic\_L1-RSRP\_TransmitOrNot). Since it is instructed to have no new RRC parameter, reusing existing parameter (PS\_Periodic\_L1-RSRP\_TransmitOrNot) with updated description is proposed.

 **Proposal:**

* **Rel-16 L1-SINR is supported as an alternative measurement report of L1-RSRP using the RRC parameter PS\_Periodic\_L1-RSRP\_TransmitOrNot.**
	+ **Rel-16 L1-SINR use existing RRC parameter PS\_Periodic\_L1-RSRP\_TransmitOrNot**
* **TP on 5.2.2.5 of TS38.214**

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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-Periodic\_CSI\_TransmitOrNot*] to report CSI with the higher layer parameter *reportConfigType* set to ‘periodic’ 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. When the UE is configured to monitor DCI format 2\_6 and if the UE configured by higher layer parameter [*PS\_Periodic\_L1-RSRP\_TransmitOrNot*] to report L1-RSRP or L1-SINR with the higher layer parameter *reportConfigType* set to ‘periodic’ when *drx-onDurationTimer* is not started, the UE shall report L1-RSRP or L1-SINR during the time duration indicated by *drx-onDurationTimer* also outside active time according to the procedure described in clause 5.2.1.4.

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#### TP on reporting quantities

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| **RAN1#100-e****Agreements:** Text Proposal to TS 38.213

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| **5.1.6.1           CSI-RS reception procedure****\*\*\* Unchanged text is omitted \*\*\***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-Periodic\_CSI\_TransmitOrNot]  to report CSI with the higher layer parameterreportConfigType set to ‘periodic’ 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\_Periodic\_L1-RSRP\_TransmitOrNot] to report L1-RSRP with the higher layer parameterreportConfigType set to ‘periodic’ andreportQuantity 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.
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| **5.2.2.5 CSI reference resource definition****\*\*\* Unchanged text is omitted \*\*\***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-Periodic\_CSI\_TransmitOrNot] to report CSI with the higher layer parameterreportConfigType set to ‘periodic’ when drx-onDurationTimer is not started, the UE shall report CSI during the time duration indicated bydrx-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\_Periodic\_L1-RSRP\_TransmitOrNot] to report L1-RSRP with the higher layer parameterreportConfigType 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. |

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RAN1#100e agrees the text proposals in TS38.214 to include the L1-RSRP/P-CSI measurements when UE is configured with DCI format 2\_ 6 for UE power saving which the configured L1-RSRP and CSI measurements would not be performed outside Active Time if the UE is indicated not to wake up at the next DRX ON. The L1-RSRP and P-CSI reports would be outdated and not useful when UE feedbacks to the gNB. Several companies (ZTE, Samsung) had text proposals on the addition of reporting quantities on the text proposal.

**Proposal: TP for Clauses of 5.1.6.1 and 5.2.5.2 of TS 38.214 V16.1.0**

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**5.1.6.1           CSI-RS reception procedure**

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

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-Periodic\_CSI\_TransmitOrNot*] 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\_Periodic\_L1-RSRP\_TransmitOrNot] 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.

**5.2.2.5 CSI reference resource definition**

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

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-Periodic\_CSI\_TransmitOrNot*] 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\_Periodic\_L1-RSRP\_TransmitOrNot*] 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.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End Text Proposal \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

# Contributions summary and proposals

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Huawei, HiSilicon [1] | * Proposal 1: The capability values for minimum time gap between DCI format 2\_6 monitoring occasions and ON Duration Timer are determined per SCS as the following table.

|  |  |  |  |
| --- | --- | --- | --- |
|  | NR Slot length (ms) | Type 1 | Type 2 |
| 0 | 1 | 0 | [3] |
| 1 | 0.5 | 0 | [6] |
| 2 | 0.25 | 1 | [12] |
| 3 | 0.125 | 2 | [24] |

* Proposal 2: Further discuss and narrow down between Alt.1 and Alt. 3 for UE behavior when dormancy indication is configured.
* Proposal 3: The dormancy adaptations indicated by different DCI(s) on different monitoring occasions before the ON duration trigger the same BWP switching delay, which starts from the slot of the last monitoring occasions where dormancy indication(s) can be transmitted.
* Proposal 4: UE may assume the Wake-up indication for one DRX cycle in multiple DCI format 2\_6 monitoring occasions, if any, is consistent. Adopt the TP1 in TS 38.213.
* Proposal 5: Adopt the TP2 in TS 38.213 to align with the RAN2 suggestions.
 |
| ZTE [2] | * Proposal 1: If the WUS PDCCH indicating dormancy behavior on the activated SCells outside Active Time is not detected and the UE is configured to wake up by higher layer signaling, UE should switch to non-dormancy behavior for the activated SCells.
* Proposal 2: RAN1 clarifies whether DCI format 1\_1/0\_1 and DCI format 2\_6 indicating SCell dormancy change are to be limited within the first 3 symbols of one slot.
	+ TP: A UE expects to detect a DCI format 2\_6, DCI format 1\_1 or DCI format 0\_1 indicating SCell dormancy change, as described in Clause 10.3, only if a corresponding PDCCH is received within the first 3 symbols of a slot.
* Proposal 3: Adopt the following text- and reportQuantity set to quantities other than cri-RSRP and ssb-Index-RSRP
* Proposal 4: Type 2 BWP switching delay can be taken as one of the two candidate values of minimum time gap.
* Proposal 5: The value of 1 slot should be defined as another candidate value of minimum time gap. If the minimum time gap is not signaled by UE, the default value is 0.
 |
| vivo[3] | * Proposal 1: The UE capability on minimum time gap between last monitoring occasion of DCI format 2\_6 and DRX On should be separated reported for with/without scell dormancy indication.
	+ the BWP switching delay capability is reported to indicate the minimum time gap for WUS with Scell dormancy indication.
	+ A new minimum time gap capability is reported to indicate the minimum time gap for WUS without Scell dormancy indication. As a starting point, the values can reuse the values for BWP switching delay.
* Proposal 2: Further clarification of the minimum time gap for Scell dormancy indication, down-select from the following,
	+ Alt 1: between the end of the slot of last DCI format 2\_6 monitoring occasion and the start of the DRX ON
	+ Alt 2: between the end of the slot of last DCI format 2\_6 monitoring occasion and the start of the time when the dormancy indication applies
* Proposal 3: If UE is configured with different SCS for different serving cells and DL/UL BWPs, the switching delay should be determined by
	+ the longer one between values corresponding to SCS before and after switching, and
	+ the longest one among the values corresponding to SCS of the serving cells.
* Proposal 4: The size budget of power saving DCI is not restricted by the existing DCI size budget (3+1) in Rel-15 which is used in Active Time. Capture TP in Appendix 1 in R1-2001682 for TS38.212.
* Proposal 5: If monitoring occasion of DCI format 2-6 is not valid, due to scheduling availabilities for intra-frequency RRM, RLM, BFD, CBD and L1-RSRP measurement defined in TS 38.133, UE should start the drx-onDurationTimer for the next DRX cycle.
	+ Capture TP in Appendix 2 in R1-2001682 for TS38.213.
* Proposal 6: UE assumes the indication in multiple MOs in a DRX cycle for DCI format 2-6 is consistant.
* Proposal 7: Among the N MO(s) before On Duration,
	+ If all MOs are invalid, UE should wake up for the next DRX cycle;
	+ If UE does not detect WUS on all WUS valid MO, UE should follow RRC configured UE behaviors (i.e., by RRC configured parameter ps-WakeupOrNot)
	+ If any PDCCH WUS in a valid MO pass CRC, UE behavior should follow the indication by WUS.
* Proposal 8: Clarify that if UE detects DCI format 2-6 with Wake-up indication bit '0',
	+ UE does not report SP-CSI/L1-RSRP, and
	+ UE does not report P-CSI/L1-RSRP if configured by RRC signaling not to.
	+ And Capture TP in Appendix 3 in R1-2001682 for TS38.214.
* Proposal 9: 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 4 in R1-2001682 for TS38.213.
* Proposal 10: In Rel-16 TEI, only consider the case where secondary DRX group is not configured simultaneously with DCP or SCell dormancy for a UE.
* Proposal 11: The interaction with DCP or SCell dormancy indication for secondary DRX group, if needed, can be further considered in Rel-17, e.g. in the UE power saving enhancement WI.
 |
| OPPO [4] | * Proposal 1: Two values of minimum time gap for each SCS are proposed as
	+  15kHz: {1, 3} slots
	+  30kHz {1, 6} slots
	+  60kHz {1, 12} slots
	+  120kHz {1, 24} slots
 |
| Sony[5] | * Proposal 1: The minimum time gap capabilities for the different SCS are:
	+ SCS 15kHz: {0,3} slots
	+ SCS 30kHz {0,6} slots
	+ SCS 60kHz {0,12} slots
	+ SCS 120kHz {0,24} slots
* Proposal 2: Minimum time gap capability does not account for dormancy / non-dormancy BWP switch in an Scell.
* Proposal 3: UE can signal preferred minimum time gap as UE assistance information.
 |
| MediaTek[6] | * Proposal 1: Two candidate values of UE capability on minimum time gap are defined as follows:

|  |  |  |
| --- | --- | --- |
| μ | NR slot length (ms) | Minimum time gap (slots): the number of slots between the end of the slot of last monitoring occasion of wake-up signal and the first slot of *drx-onDurationTimer* |
| Candidate Value 1 | Candidate Value 2 |
| 0 | 1 | 0 | 3 |
| 1 | 0.5 | [0] | 6 |
| 2 | 0.25 | 1 | 12 |
| 3 | 0.125 | 1 | 24 |

* Proposal 2: If DCI format 2\_6 including SCell dormancy indication is not detected by a UE and *ps-Wakeup* is set to true, the following alternatives can be considered.
	+ Alt 1: SCell(s) is in non-dormancy behaviour in the corresponding DRX on-duration.
	+ Alt 2: SCell(s) is in dormancy behaviour in the corresponding DRX on-duration.
	+ Alt 3: Higher layer signaling on “dormancy or non-dormancy behaviour”. UE switches to (or stays in) dormant or non-dormant SCell(s) according to the signaling. Default is “non-dormancy behaviour”.
* Proposal 3: UE does not expect to detect more than one DCI format 2\_6 in multiple monitoring occasions with inconsistent DCI contents before a DRX cycle.
 |
| LG [7] | * Proposal 1: The monitoring occasion which has at least one actually monitored candidate is regarded as a valid
 |
| Intel [8] | * Observation 1: RAN1 impact of supporting secondary DRX can be minimal if separate WUS is not configured for secondary DRX group.
* Proposal 1. Candidate two values of minimum time gap per SCS are
	+ SCS 15kHz: {1, 3} slots
	+ SCS 30kHz {1, 5} slots
	+ SCS 60kHz {2, 9} slots
	+ SCS 120kHz {2, 18} slots
* Proposal 2: No change of invalid monitoring occasions in 10.3 of TS38.213 is needed.
* Proposal 3: Support Option 2 in RAN2 LS R2-2002201 for CSI reporting
	+ Option 2:
	+ ps-TransmitPeriodicCSI = TRUE: Report all types of periodic CSI apart from L1-RSRP (i.e. cri-RSRP and ssb-Index-RSRP)
	+ ps-TransmitPeriodicL1-RSRP = TRUE: Only report L1-RSRP (i.e. cri-RSRP and ssb-Index-RSRP)
* Proposal 4: Keep configuration of PS\_Periodic\_L1-RSRP\_TransmitOrNot and PS-Periodic\_CSI\_TransmitOrNot parameters per cell group.
* Proposal 5: Existing SCell state remains valid if UE starts drx-ONduration-timer without receiving WUS indication.
 |
| CATT [9] | * Proposal 1: Two values of minimum time gap for each SCS are proposed as:
	+  15kHz: {1,3} slots
	+  30kHz: {1, 5} slots
	+  60kHz: {2, 9} slots
	+  120kHz: {4, 18} slots
* Proposal 2: For each SearchSpace set, UE monitors DCI format 2\_6 only in the 1st full “duration” of valid monitor occasion at or after the PS\_offset, but before the DRX on-duration.
* Proposal 3: Rel-16 L1-SINR could be considered to feedback indicated by the existing RRC parameter PS\_Periodic\_L1-RSRP\_TransmitOrNot.
* Proposal 4: The feature interaction between UE power saving with DRX adaptation and secondary DRX needs to be analyzed in detail with justification of the additional power saving gain before the support of both features in the same time.
* Proposal 5: If secondary DRX group is configured, the UE adaptation to DRX should be disabled in Rel-16.
 |
| Samsung [10] | * Proposal #1: Support two UE capabilities of minimum time gap for each SCS with values determined by the Table below:

Table 1: Minimum Time Gap between the end of the slot of last monitoring occasion of wake-up signal and the first slot of next DRX ON duration

|  |  |  |
| --- | --- | --- |
|  | NR Slot length (ms) | Minimum Time Gap TminimumTimeGap (slots) |
| Type 1Note 1 | Type 2Note 1 |
| 0 | 1 | 1 | 2 |
| 1 | 0.5 | 1 | 4 |
| 2 | 0.25 | 2 | 8 |
| 3 | 0.125 | 4 | 16 |
| Note 1: Depends on UE capability. |

* Proposal #2: When DCI format 2\_6 is configured to indicate dormancy/non-dormancy transition, the sum of UE reported minimum gap value and UE reported BWP switching delay value shall be applied for determining the closest position for UE to detect format 2\_6 before DRX ON.
* Proposal #3: Wake-up indication in DCI format 2\_6 indicates whether or not to start drx-onDurationTimer associated with all configured DRX groups.
* Proposal #4: UE doesn’t expect to monitor DCI format 2\_6 during extended Active Time corresponding to the drx-InActivitityTimer from primary cell.
* Proposal #5: If the UE is configured with two DRX groups, the most recent CSI measurement occasion occurs in DRX active time for each DRX group overlapped with the DRX active time for CSI to be reported.
* Proposal #6: Periodic CSI report associated with ps-TransmitPeriodicCSI includes all report quantities except ‘cri-RSRP’ and ‘ssb-index-RSRP’.
 |
| NEC [11] | * We are fine to confirm agreements in RAN2 LS in R1-2001507 LS on DCP RAN2, Huawei
 |
| CMCC [12] | * Proposal 1. Either alternative 2 or 3 could be considered for minimum time gap value. We slightly prefer Alt 2 as the minimum time gap design principle.

Alt 1. Both of the two values of minimum time gap take into account the SCell dormancy/non-dormancy transition delayAlt 2. Neither of the two values of minimum time gap takes into account the SCell dormancy/non-dormancy transition delayAlt 3. The smaller value of minimum time gap does not take into account the SCell dormancy/non-dormancy transition delay and the larger one takes into account the SCell dormancy/non-dormancy transition delay |
| Nokia, NSB [13] | * Proposal 1: If the monitoring occasions of DCI format 2\_6 PS-RNTI collide with monitoring of RA-RNTI or TC-RNTI in case of CBRA or monitoring C-RNTI in search space given recoverySearchSpaceId for CFRA based BFR, UE should assume the legacy DRX operation (i.e. start the following drx-onDurationTimer).
* Proposal 2: Capture the following text proposal to Section 10.3 of 38.213 Section 10.3 that monitoring occasions of DCI format 2\_6 overlapping with RA-RNTI or TC-RNTI monitoring or monitoring C-RNTI in search space given recoverySearchSpaceId with are invalid and UE should follow the legacy DRX operation, based on following text proposal:
* Proposal 3: The capability values for minimum gap between DCI format 2\_6 monitoring and onDurationTimer could be determined per SCS as
	+ 15kHz: {1 or 3} slots
	+ 30kHz {2 or 5} slots
	+ 60kHz {3 or 9} slots
	+ 120kHz {6 or 18} slots
* Proposal 4: Reply to RAN2 that RAN1 has concluded that the option 2 given in LS [1] is the assumed behaviour.
* Proposal 5: Adopt following text proposal to Section 10.3 in 38.213 and provide feedback with alignment of RAN1 and RAN2 specs not regarding onDurationTimer controlled by MAC.
 |
| Spreadstrum[14] | * Proposal 1: For P-CSI/L1-RSRP measurement/report, consider to adopt TP in Appendix 5.1.
* Proposal 2: The larger value of the minimum time gap can be 3ms, and the smaller value of the minimum time gap can be 1ms and is an optional capability.
* Proposal 3: To clarify the real starting of monitoring is the beginning of the 1st full “duration”, consider to adopt TP in Appendix 5.2.
* Proposal 4: 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.
 |
| InterDigital [15] | * Proposal 1: Aggregation levels of the PDCCH-based power saving signal are limited to {4, 8, 16}.
* Proposal 2: DCI format 2\_6 is not counted in the DCI format size budget.
 |
| Ericsson [16] | * Proposal 1 Adopt theTP1 for 38.213 in subclause 10.3 to clarify the interaction between PHY and MAC layers.
* Proposal 2 Value range for parameter SizeDCI\_2 is 0 to maxSizeDCI\_2-6.
* Proposal 3 Two values of minimum time gap for each SCS are proposed as
	+ SCS 15kHz: {1, 3} slots
	+ SCS 30kHz {1, 6} slots
	+ SCS 60kHz {1, [12]} slots
	+ SCS 120kHz {2, [24]} slots

The same value is used regardless of whether Scell dormancy indication is configured or not in DCI format 2-6.* Proposal 4 Adopt TP2 for 38.212 subclause 7.3.1.0 to exclude DCI format 2-6 from the maximum number of DCI sizes per cell.
* Proposal 5 Rel-16 L1-SINR is supported in addition to L1-RSRP using the RRC parameter PS\_Periodic\_L1-RSRP\_TransmitOrNot.
* Proposal 6 Adopt TP3 for subclause 5.2.2.5, 38.214 to allow support for L1-SINR in addition to L1-RSRP using the RRC parameter PS\_Periodic\_L1-RSRP\_TransmitOrNot.
 |
| NTT DoCoMo [17] | * Proposal 1: Update value range of PS\_offset in RRC parameter list.
	+  Value range of PS\_offset: 0.125, 0.25, 0.375, 0.5, …, 15ms
* Proposal 2:
* When DCI format 2\_6 is configured to indicate dormancy/non-dormancy transition:
	+ - the UE reported minimum gap value shall be applied for determining the closest position for UE to detect format 2\_6 before DRX ON. UE follows the behavior of BWP switching in Rel-15 on SCells if dormancy behavior change is indicated.
* When DCI format 2\_6 is configured only to indicate UE wakeup or not (i.e., indicate to higher layer whether to start the drx-onDurationTimer or not):
	+ - the UE reported minimum gap value shall be applied for determining the closest position for UE to detect format 2\_6 before DRX ON.
* Proposal 3: Two candidate values of UE reported minimum time gap for each SCS are:
	+  15kHz: {1, 3} slots
	+  30kHz {1, 5} slots
	+  60kHz {2, 9} slots
	+  120kHz {4, 18} slots
 |
| Qualcomm[18] | * [Proposal 1: For the reported UE capability on the minimum time gap, the following sets of values can be considered:](#_Toc37443660)
	+ SCS 15kHz: {1, 3} slots
	+ SCS 30kHz: {2, 6} slots
	+ SCS 60kHz: {3, 12} slots
	+ SCS 120kHz: {6, 24} slots
* [Proposal 2: If a UE is configured to monitor DCI format 2\_6, it can also be configured to report L1-SINR during the time duration indicated by drx-onDurationTimer outside DRX Active Time.](#_Toc37443661)
* [Proposal 3: UE reports periodic or semi-persistent CSI for any reported carrier(s) only when the reporting carrier for the CSI is in DRX active time, unless that CSI can be multiplexed in an overlapping PUSCH resource (as in legacy).](#_Toc37443662)
* [Proposal 4: PDCCH-WUS can be configured together with DRX groups and the existing RAN1 and RAN2 agreements on PDCCH-WUS are applied without any changes. More specifically, when DRX groups are configured,](#_Toc37443663)
* PDCCH-WUS is configured only on SpCell and UE does not monitor PDCCH-WUS if SpCell is in DRX Active Time;
* If a PDCCH-WUS occasion is not monitored because UE is already in Active Time on SpCell, UE starts DRX on duration timer of both DRX groups at their respective next occurrence;
* If a PDCCH-WUS occasion is monitored, upon a wakeup indication, UE starts DRX on duration timers of both DRX groups at their respective next occurrence;
* If no PDCCH-WUS is detected, UE follows configuration of ps-WakeupOrNot for both DRX groups at their respective next occurrence of DRX on duration.
 |

# Reference

1. R1-2001539 Remaining issues on PDCCH based power saving Huawei, HiSilicon
2. R1-2001583 Remaining issues on WUS PDCCH ZTE
3. R1-2001682 Maintenance of PDCCH-based power saving signal vivo
4. R1-2001768 Remaining issues for Power saving signal OPPO
5. R1-2001819 Remaining issues on PDCCH-based WUS Sony
6. R1-2001843 Remaining issues on PDCCH-based power saving signal MediaTek Inc.
7. R1-2001943 Remaining issues on PDCCH-based power saving signal/channel LG Electronics
8. R1-2002008 Remaining details of PDCCH-based power saving signal/channel Intel Corporation
9. R1-2002093 Remaining issues on the Power Saving Signals/Channels CATT
10. R1-2002142 Remaining issues for PDCCH-based power saving signal Samsung
11. R1-2002189 TP to address RAN2 LS on DCP NEC
12. R1-2002215 Remaining issues on minimum time gap for PDCCH-based power saving signal/channel CMCC
13. R1-2002218 On open issues related to DCI format 2\_6 Nokia, Nokia Shanghai Bell
14. R1-2002261 Clarification on power saving signal Spreadtrum Communications
15. R1-2002366 Remaining Issues for PDCCH-based Power Saving Signal/Channel InterDigital
16. R1-2002414 Remaining issues for WUS Ericsson
17. R1-2002451 Maintenance for PDCCH-based power saving signal/channel NTT DOCOMO, INC.
18. R1-2002555 Remaining issues for PDCCH-based power saving channel Qualcomm Incorporated
19. R1-2001507 LS on DCP RAN2, Huawei
20. R1-2000165, LS on secondary DRX group, RAN2, Ericsson.