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

**e-Meeting, Aug 17th – 28nd, 2020**

**Title: [draft] LS on evaluation methodology for connected mode UE power saving enhancements**

**Response to:**

**Release:** Release 17

**Work Item:** NR\_UE\_pow\_sav\_enh

**Source:** vivo, RAN1

**To:** RAN2

**Cc:** RAN4

**Contact Person:**

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**Attachments:** None

**1. Overall Description:**

In response to WID of Rel-17 UE power saving enhancements, RAN1 is expected to inform RAN2 about the evaluation methodology updates related to enhancements on power saving techniques for connected-mode UE.

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| 1. Specify enhancements for idle/inactive-mode UE power saving, considering system performance aspects [RAN2, RAN1]
	1. Study and specify paging enhancement(s) to reduce unnecessary UE paging receptions, subject to no impact to legacy UEs [RAN2, RAN1]
* NOTE: RAN1 to check and update, if needed, evaluation methodology in RAN1 #102-e meeting
	1. Specify means to provide potential TRS/CSI-RS occasion(s) available in connected mode to idle/inactive-mode UEs, minimizing system overhead impact [RAN1]
* NOTE: Always-on TRS/CSI-RS transmission by gNodeB is not required
1. Study and specify, if agreed, enhancements on power saving techniques for connected-mode UE, subject to minimized system performance impact [RAN1, RAN4]
	1. Study and specify, if agreed, extension(s) to Rel-16 DCI-based power saving adaptation during DRX Active Time for an active BWP, including PDCCH monitoring reduction when C-DRX is configured [RAN1]
* **NOTE: Rel-15 and Rel-16 available power saving solutions should be supported by the UE and included in the evaluation. RAN1 will ask the confirmation from RAN2 that Rel-15 and Rel-16 available power saving solutions are properly utilized.**
	1. Study the feasibility and performance impact of relaxing UE measurements for RLM and/or BFD, particularly for low mobility UE with short DRX periodicity/cycle, and specify, if agreed, relaxation in the corresponding requirements [RAN4]
* NOTE: Supplementary RAN2 work, if needed, can be triggered by RAN4 LS
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Accordingly, RAN1 would like to inform RAN2 the following related agreements for connected mode:

Agreements:

* Reusing power model in TR38.840 for evaluation of DCI-based power saving adaptation schemes.
	+ Note: company reporting additional power model for missing state or update is not precluded.

Agreements:

* Company should report assumptions used for periodic measurement activities for the Rel-17 DCI-based power saving adaptation evaluation.
	+ The periodic activities defined in TR38.840 can be reused.
	+ Measurement for RLM/BFD every C-DRX cycle can be optionally modelled

Agreements:

* The performance metrics described in TR38.840 section 8.2 is reused for power saving evaluation of Rel-17 DCI-based power saving adaptation during ActiveTime.
* The following Rel-15 / 16 features is recommended of the power consumption as reference for baseline. Company can report the feature(s) being used in the baseline.
	+ DRX
		- C-DRX cycle 40msec for VoIP
			* 10ms IAT, 8ms On-duration
			* Assume max two packets bundled
		- C-DRX cycle 160msec for FTP
			* Alt 1: 20 msec IAT, 8ms On-duration
			* Alt 2: short DRX
				+ 20 ms [or 40ms as optional] IAT, 8ms On-duration
				+ 20 ms for short DRX cycle, 4 cycles
			* Note: 100 msec IAT, 8ms On-duration can also be used with sufficient justifications that available Rel-15/16 Techniques being used to reduce UE power saving
	+ DCP for DRX adaptation,
		- DCP offset  to DRX ON = 2 ms, other values are not precluded
	+ Cross-slot scheduling adaptation
		- Minimum K0 can be adapted from 0 to 1 for FR1, 0 to [4] for FR2
	+ BWP switching, including
		- MIMO layer adaptation,
			* Max # of MIMO layer can be adapted from 4 layer to 2 layer for FR1, 2 layer to 1 layer for FR2
		- PDCCH monitoring period adaptation
			* PDCCH monitoring period can be adapted from per slot monitoring to X slot monitoring
				+ X = [2] for FR1 and [8] for FR2
		- Bandwidth adaptation
			* Bandwidth can be adapted from 100MHz to 20MHz for FR1,FFS for FR2
		- Note:
			* BWP transition time type 2 is assumed, BWP transition duration is
				+ 5 slot @ 30kHz SCS for FR1,
				+ 18 slot@120kHz SCS for FR2
				+ the slot-average power level for BWP transition duration is according to TR38.840
				+ BWP transition time type 1 can be optional modelled
			* BWP switching is Y (ms) after last packet/data burst.
				+ Y = [8], other values are not precluded
			* Whether BWP switching is modeled depends on the assumed UE capability and evaluated schemes.
	+ Scell dormancy assumption for CA capable UEs
		- FR1 & FR2: SCell dormancy with [160 ms] periodic CSI measurement and reporting
* Other settings
	+ CA assumption if configured for CA capable UEs
		- For FR1, FFS
		- For FR2, 4\*100MHz can be considered.
	+ Assumptions for scheduler
		- For FR1, no restriction on the beam assumptions being used in each slot
		- For FR2, up to each company, e.g., gNB equally schedule the slots for UEs targeting to different beams.
		- Note: the assumptions does not necessary mean to restrict or precluded any implementation. Other assumptions are not precluded and can be reported by companies.
	+ Company to report the used assumption for the interruption and also power savings impact due to presence/absence of interruptions .

Agreements:

Legacy traffic models in TR38.840 can be considered for Rel-17 DCI-based power saving adaptation evaluation, other traffic models can be optionally modelled and company report which traffic model(s) is used.

**2. Actions:**

**To RAN2:**

RAN1 respectfully asks RAN2 to take the above evaluation methodology for the connected-mode into account . And ask for reply if there is significant concerns regarding the assumptions of RAN2 related power saving solutions.

**3. Date of Next RAN1 Meetings:**

TSG-RAN WG1 Meeting 103-e 26 October – 13 November 2020 e-Meeting

TSG-RAN WG1 Meeting 104 01 – 05 March 2021 Athens, Greece