**3GPP TSG RAN WG1 #108-e R1-220XXXX**

**e-Meeting, February 21st – March 3rd, 2022**

**Agenda Item: 8.7**

**Source: Moderator (MediaTek)**

**Title: Summary of email discussion on Rel-17 RRC parameters for UE power saving**

**Document for: Discussion and Decision**

# Reference List of RRC Parameters

After RAN1 #107bis-e, RAN1 sent a LS on updated Rel-17 LTE and NR higher-layers parameter list [1], including the sheet of updated RRC parameters for Rel-17 UE power saving enhancements. In this RAN1 meeting (#108-e), companies are invited to further check the necessary update(s) to the RRC parameters, taking into account the following information:

* Chair’s guidance:

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| For RRC parameters, **we will need to send an LS to RAN2 on the February 25 so that they can reflect our input into their specs on Week2 of the RAN2 meeting. All RRC relevant decisions should be made before this deadline**. However, if there are any RRC relevant decisions in RAN1 after February 25, these will be conveyed to RAN2 in another LS after RAN1#108-e. This is not an open invitation for proposals with RRC impact. It’s only for those situations where it is absolutely essential. Note that **the input we provide to RAN2 in the second LS will likely not be part of the March spec**. |

* Cross-WG alignment:
  + RAN2 draft CR to TS 38.331 [2]: [Initial submission to RAN2 #117-e (R2-2203058)](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203058.zip)
* RAN1 agreements:
  + [Collection of agreements up to RAN1#107bis-e (R1-2200817)](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_107b-e/Docs/R1-2200817.zip) [3]
  + Additional agreements during RAN1#108-e

# Review and Suggested Change(s) on RRC Parameters for Rel-17 UE Power Saving Enhancements

* 1. **Cross-WG Alignment**

In [1], the description for *peiSearchSpace* is regarded as a search space set configuration with entries and values analogous to those of a *SearchSpace* IE, as quoted below for ease of reference:

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| **Parameter name in the spec** | **Description** | **Value range** |
| peiSearchSpace | Dedicated search space configuration for PEI: 1) Can be configured to one of up to 4 common SS sets configured by commonSearchSpaceList with SearchSpaceId > 0 2) [SearchSpaceId = 0 can be configured for the case of CORESET multiplexing pattern 2 or 3] ~~2)~~ 3) The CCE aggregation levels and maximum number of PDCCH candidates per CCE aggregation level follows Table 10.1-1 of TS38.213. Actual aggregation levels and PDCCH candidates are provided by ‘peiSearchSpace’ configuration in SIB. | searchSpaceId: {1, 2, 3, 4, …, maxNrofSearchSpaces-1}  nrofCandidates SEQUENCE { aggregationLevel4 ENUMERATED {n0, n1, n2, n3, n4},  aggregationLevel8 ENUMERATED {n0, n1, n2},  aggregationLevel16 ENUMERATED {n0, n1} }  Reuse the value ranges in IE SearchSpace for other entries |

On the other hand, in RAN2 draft CR to TS 38.331 [2], *peiSearchSpace* is defined as an ID that can be used to reference one of the common SS sets (up to 4) in SIB1 or SS#0 for the case of CORESET multiplexing pattern 2 or 3, as quoted from [2] for ease of check:

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| *PEI-Config* field descriptions |
| ***pei-SearchSpace***  ID of dedicated search space for PEI. It can be configured to one of up to 4 common SS sets configured by *commonSearchSpaceList* with *SearchSpaceId* > 0. The CCE aggregation levels and maximum number of PDCCH candidates per CCE aggregation level follows Table 10.1-1 of TS38.213 [13]. [SearchSpaceId = 0 can be configured for the case of CORESET multiplexing pattern 2 or 3]. |

From existing RAN1 agreements [3], as quoted below for ease of check, **moderator would like invite companies to provide views on whether** *peiSearchSpace* **should be a dedicated search space set in TS 38.331 or it is just an ID (i.e., as defined by current RAN2 draft CR).** Please kindly input your view(s)/comment(s) to **Table 1** below.

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| **RAN1 #106-bis-e Meeting**  Agreement  Support configuration of a dedicated search space (‘peiSearchSpace’) for PEI   * FFS: Configuration details and whether and how to reuse legacy search space sets, including *pagingSearchSpace* and *searchSpaceSetZero* |
| **RAN1 #107-e meeting**  **Agreement**  The CCE aggregation levels and maximum number of PDCCH candidates per CCE aggregation level for PEI PDCCH monitoring occasion are given as the following table. Actual aggregation levels and PDCCH candidates are provided by ‘peiSearchSpace’ configuration in SIB.   |  |  | | --- | --- | | **CE Aggregation Level** | **Number of Candidates** | | 4 | 4 | | 8 | 2 | | 16 | 1 |   **Agreement**  *‘peiSearchSpace’* can be configured to one of up to 4 common SS sets configured by commonSearchSpaceList with *SearchSpaceId*> 0 |
| **RAN1 #107-bis-e Meeting**  **Working assumption**   * *SearchSpaceId = 0* can be configured for*peiSearchSpace* for the case of CORESET multiplexing pattern **2 or** 3 |

**Table 1: Companies’ views on whether peiSearchSpace is a SearchSpace configuration or an ID to reference a common SS set or SS#0**

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| Company name | Company View(s)/Comment(s) |
| Qualcomm | Since the PEI PMO location is determined by the frame-level and symbol-level offsets other than SS #0 in a pattern described in the agreement below, the only essential information provided by the PEI search space configuration is the number of symbols for each PMO which is essentially provided by associated CORESET. Therefore, we think an ID should be sufficient.  Agreement  For unlicensed operation,  A PEI-O is a set of 'S\*X ' consecutive PDCCH monitoring occasions where 'S' is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in *SIB1* and X is the *nrofPDCCH-MonitoringOccasionPerSSB-InPO* if configured or is equal to 1 otherwise. The [x\*S+K]th PDCCH monitoring occasion for PEI in the PEI-O corresponds to the Kth transmitted SSB, where x=0,1,…,X-1, K=1,2,…,S.   * If X > 1, when the UE detects a PEI within its PEI-O, the UE is not required to monitor the subsequent monitoring occasion(s) associated with the same PEI-O   Note: The QCL reference is SSB |
| Apple | Our understanding has always been that it is a search space ID pointing to one of the common SSSs or SSS#0, as the first agreement says “*‘peiSearchSpace’* can be configured to one of up to 4 common SS sets configured by commonSearchSpaceList with *SearchSpaceId*> 0”. |
| Huawei, HiSilicon | According to the first agreement made in RAN1 #106-bis, our understanding is a dedicated search space (‘peiSearchSpace’) configuration for PEI is supported. If RAN2 or the group prefer to use ID to cite to a CSS, a way can be to increase one more CSS supported in the *commonSearchSpaceList*. |
| MediaTek | From the agreement RRC parameter sheet, our interpretation is a dedicated SearchSpace configuration for PEI. But, for better analogy with paging related setting, including analogous definition as *pagingSearchSpace*, the proposal by HW&HiSi looks a good way forward we can suggest RAN2. |
| Samsung | Our understanding aligned with RAN2 draft CR. It’s a search space set ID, so that NW has the flexibility to share a CSS set between *peiSearchSpace* and other *CSS.* NW can configure a ID dedicated to *peiSearchSpace* if needed. |
| Intel | Our view is it refers to a search space id which can map to a CSS or SS#0. If needed, we can perhaps revise *peiSearchSpace to peiSearchSpaceID?* We can take note of the example for recoverySearchSpaceId as follows, captured in Section 6 of 38.213.  **“….**  For the PCell or the PSCell, a UE can be provided a CORESET through a link to a search space set provided by *recoverySearchSpaceId,* as described in clause 10.1, for monitoring PDCCH in the CORESET….” |
| Nokia | This is aligned with our understanding, i.e. similar as ‘*pagingSearchSpace*’. |
| Ericsson | Our understanding is that it is an ID to reference a common search space. |
| ZTE, Sanechips | In our understanding, similar as paging search space, an ID is sufficient. |
| CATT | Our understanding of *peiSearchSpace* is a SearchSpaceID configured in the *PDCCH-ConfigCommon* IE in RRC similar to *pagingSearchSpace.* |
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* 1. **Other Necessary Update(s)/Revision(s) to RRC Parameters**

In the following **Table 2**, companies are invited to provide any necessary update(s)/revision(s), if available, to the following reference RRC parameter table:

<https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_108-e/Inbox/drafts/8.7/RRC_Parameters/1st_Round/RRC_parameters_R17_ePowSav_post_RAN1_107bis-e.xlsx>

**Table 2: Companies’ suggested update to the above reference RRC parameter table post RAN1#107bis-e**

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| Company name | Company suggested update(s), if available |
| Ericsson | Row 9, column K : TBD can be removed. Value range is captured in description column J, which can be moved to column K.  Row 11, column M (editorial) : can update “per TRS-ResourceSet” to “per TRS resource set” |
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# Reference

1. R1-2200700, “LS on updated Rel-17 NR higher-layers parameter list”, RAN1, Ericsson, RAN1#107bis-e
2. R2-2203058, “38331\_CR2924\_(Rel17) Introduction of ePowSav in TS 38.331”, RAN2#117-e
3. R1-2200817, “Collection of RAN1-related agreements for UE power saving enhancements for NR”, RAN1#107bis-e