**3GPP TSG-RAN WG2 Meeting #109e R2-20xxxxx**

**Online, 24th February – 6th March 2020**

**Agenda Item: 6.11.1**

**Source: MediaTek Inc. (Rapporteur)**

**Title: Email discussion summary on running 38.331 CR for Power Saving**

**Document for: Discussion and decision**

Introduction

This document lists out the open issues identified within various sections of the running RRC CR. The aim of this discussion is to provide recommendations to resolve them.

Discussion

#### 5.3.5.9 Other configuration

The term ‘release request’ has been consistently used in our agreements. However during the Phase 1 discussions, it was pointed out that the term ‘request’ may be misleading as the gNB is not required to respond to the message.

*Q1. What is your preference on the name of the new UE assistance IE to transition out of connected mode? The following variants have been suggested:*

*Option 1: releaseRequest (no change to the running CR)*

*Option 2: releasePreference*

*Option 3: releaseIndication*

*Option 4: Other (please add to this list)*

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| --- | --- | --- |
| **Company** | **Preference** | **Comments (if any)** |
| Ericsson | 2 or 3 | As indicated already, this is not a request, i.e. gNB is not required to respond. This view is inline with the rapporteur of 38.331. |
| CATT | 2 | This would also be aligned with the possibility to indicate a preference not to release anymore. |
| Huawei | 2 or 3 |  |
| OPPO | 2 or 3 | We agree with Ericsson. |
| MediaTek | 2 | Agree with CATT |
| Qualcomm | 2 or 3 |  |
| Apple | 2 or 3 |  |
| Samsung | 2 or 3 |  |
| Intel | 2 or 4 | We prefer *releasePreference* or *rrcReleasePreferenceConfiguration* |
| LG | 2 or 3 | No strong view. |
| Xiaomi | 2 |  |
| vivo | 3 | In our understanding, all UE assistance informations are UE preference. Thus, there is no need to point out the preference in the IE. |
| ZTE | 3 | In UMTS, the signaling connection release indication procedure can be triggered by UE to request UTRAN to initiate transition to a battery efficient RRC state, which is quite similar to the UE assistance here. So we prefer to follow the name we used before and call it “releaseIndication”. |

*Rapporteur’s summary*

The term ‘releasePreference’ has the most support and there are no strong opinions voiced against it.

releaseRequest: None

releasePreference: 11 out of 13

releaseIndication: 9 out of 13

rrcReleasePreferenceConfiguration: 1 out of 13

**Proposal 1: The UE assistance IE to transition out of connected mode is named ‘releasePreference’**

#### 5.3.7.2 Initiation

*No Open Issues*

#### 5.3.13.2 Initiation

It was pointed out in the Phase 1 discussions that it is not essential to release the UE assistance configuration for power savings during the resume procedure, as RRC Inactive state aims at reducing signaling by storing configurations. Only the preferred values should be released.

*Q2. Should the UE assistance configuration for power savings be released during the RRC connection resume procedure?*

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (if any)** |
| Ericsson | Yes | UE may re-select to a gNB not supporting UE assistance for power saving, i.e. UE should not report UE assistance on such gNB, i.e. I assumed the intention is to continue reporting on (new) gNB without explicity signalling from the gNB?  During phase 1 review it was commented that UE should perhaps delete its preferred value. I understood this as to enable the UE to indicate its preference on the (new) gNB. But the UE preference is included in the context transferred to the (new) gNB, and the UE can indicate a change in preference, provided that prohibit timer is not running. In the resume the prohibit timer is stopped, i.e. UE can indicate a new preference on the (new) gNB. But anyways, in our view the UE should release the configuration, and would thus also signal its preference if configured after resume to report UE assistance. |
| CATT | Yes | The existing UE assistance configurations, including *delayBudgetReportingConfig* and *overheatingAssistanceConfig,* are released from the UE Inactive AS context during the initiation of RRC resume procedure. The behaviours for handling the UE assistance configurations during RRC resume procedure should be aligned. |
| Huawei | Yes | Agree with Ericsson that UE may re-select to a gNB not supporting UE assistance for power saving. |
| OPPO | Yes | UE could provide UE assistance information for power saving only if it is configured to do so by gNB. Since UE may resume RRC connection to a gNB different from the last serving gNB, the UE assistance configuration for power savings would be reconfigured by the new serving gNB. So in our understanding, UE should release UE assistance information for power savings during the resume procedure, which is similar as *delayBudgetReportingConfig* and *overheatingAssistanceConfig*. |
| MediaTek | Yes |  |
| Qualcomm | Yes | Agree with Ericsson |
| Apple | Yes | Agree with Ericsson that UE may reselect another gNB not supporting this feature. |
| Samsung | Yes |  |
| Intel | Neutral | Our 1st prefrenece is getting the best benefit out of RRC\_INACTIVE (which aims reducing siganling by storing configurations that could be reused after getting back RRC\_CONNECTED). In our understanding, it is not essential that these configurations are released in each RRC state transition. Therefore, UE could keep the new UE assistance configuration while releasing the preferred value (in UE and network side), if it was previously provided by the UE to the network. When changing gNBs, our understanding is that networks nodes of the same release should be able to at least release any funcitionality defined in that given release (even when this feature is not supported by the gNB).  If majority of companies prefer not releasing the value, we agree that the release of the configuration would be required when moving into RRC\_INACTIVE or when resuming the RRC connection (depending on the modeling of 38.331). |
| LG | Yes | We have same view with Ericsson. There may be a case that UE reselects to gNB not supporting UE assistance for power saving or to gNB not having the same capability for power saving. |
| Xiaomi | Yes | It can be handled the same way as other existing UE assistance configurations. |
| vivo | Yes | We agree with Ericsson that UE may reselect to another cell not supporting UE assistance any more. |
| ZTE | Yes | For UE in inactive, the UE assistance configuration was received from the source cell where the UE was released from connected to inactivemode. UE may select a different cell when initiating the RRC resume procedure and it is better not to apply the UE assistance configuration from the source cell. So we prefer UE to release the UE assistance configuration during the RRC connection resume procedure and follow the new configuration from the current cell, if any. |

*Q3. If the answer to Q2 is ‘no’, the UE behaviour on resume needs further discussion. What is the preferred UE behaviour on resume?*

*Option 1: The same as on receiving a new configuration of UE assistance for power savings, i.e. the UE provides all its preferences to the gNB*

*Option 2: The UE only provides UE assistance information to the gNB if there is a change in its preferences from the last report (i.e. from when it was earlier in connected mode).*

*Option 3: Other (please add to this list)*

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| --- | --- | --- |
| **Company** | **Preference** | **Comments (if any)** |
| Ericsson | - | We do not specify “change in UEpreference”, i.e. it is up to UE implementation to trigger this. |
| Intel | Option 3 | Assuming that the release of the value were aggreable in previous Q2. The value of the *releasePreference* IE should only be associated with a current ongoing RRC connection. Therefore, a given value of the *releasePreference* IE should always be discarded (or released) after UE moves into RRC\_IDLE or RRC\_INACTIVE or when resuming the connection (i.e. when getting back into RRC\_CONNECTED). That way when UE is back to be RRC\_CONNECTED, it can indicate to the network when it recognizes its preference to move out of RRC\_CONNECTED or into RRC\_IDLE or into RRC\_INACTIVE (instead of having to indicate its preference to stay RRC\_CONNECTED that is unnecessary). |
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*Rapporteur’s summary*

12 out of 13 companies indicate their preference to release the UE assistance configuration for power savings during the RRC resume procedure.

**Proposal 2: The UE assistance configuration for power savings is released during the RRC resume procedure.**

### 5.7.4 UE Assistance Information

#### 5.7.4.1 General

*No Open Issues*

#### 5.7.4.2 Initiation

The release request was introduced to address the WID objective of a mechanism for the UE to indicate its preference of transitioning out of RRC\_CONNECTED state. At the R2-108 meeting, we extended the mechanism with the following agreement:

*The UE can report the following:*

*a. UE can report release only (i.e. no state preference)*

*b. Indicate explicit state preference*

*c. The UE wants to remain in connected mode*

However during the Phase 1 discussion, the trigger conditions for the UE to report that it prefers to remain in connected mode was unclear.

*Q4. What trigger condition(s) do companies support for the reporting of preference to remain in connected mode? The following triggers were raised during Phase 1:*

*Trigger 1: UE sends ‘connected’ following an earlier request to leave connected state, to cancel the earlier preference*

*Trigger 2: UE sends ‘connected’ following an earlier request to leave connected state, to cancel the earlier preference, regardless of whether the prohibit timer is running*

*Trigger 3: UE sends ‘connected’ when it expects more data to sent/received after having sent BSR=0*

*Trigger 4: UE sends ‘connected’ upon configuration of UE assistance*

*Trigger 5: Other (please add to this list)*

|  |  |  |
| --- | --- | --- |
| **Company** | **Preference(s)** | **Comments (if any)** |
| Ericsson | None | First about the RAN2 agreements: for option b it does not explicitly state that UE can send preferred state **only**, while for option a it says so explicitly. In other words, I am not sure if RAN2 agreements are clearly specified in all the signalling details.  We have a clear preference to keep the release assistance simple. In our view the UE should indicate only that it would like to be released (i.e. baseline functionality), and in this indication the UE can optionally indicate preferred state (i.e. piggyback preferred state). We do not see the need for the UE to signal a change in preferred state only, or cancellation of release indication. But UE should be allowed to send preferred state upon configuration, i.e. it is possible the NW releases the UE first, before UE sends preference to be released, and in such case it may be beneficial for NW to know the preferred state.  In case companies insist that preferred state change only signalling should be kept, and UE can cancel a release indication, then we propose that we make this dependent on NW configuration, i.e. I assume that companies can agree that if the NW is not interested to receive such information, the UE should not send it.  The release assistance feature is a simple feature (compared to DCP for example) that can give power saving benefits in our view, i.e. we are interested to make this feature work. Whether this feature will work in practice or not, strongly depends on whether the UE can do a good prediction that it can be released, and in our view discussions should focuss on that, and not on the enhancements that are discussed in addition.  We do not understand how cancellation works, i.e. if NW implements this feature, then NW typically releases the UE immediately upon receiving release indication, i.e. there is nothing for the UE to cancel. It is also not clear for how long the UE would like to remain in connected, which should then be discussed and clarified. |
| CATT | trigger1 | UE can change its preference and wish to remain in connected mode after the prohibit timer expires due to new UL activity e.g. user driven. To answer the argument that this would never happen because the NW is expected to address the UE’s release request timely, this may not be the case if NW expects DL traffic that UE is not aware of in which case it will not address the UE’s request. And to answer the argument that a non-zero BSR can be sufficient trigger to cancel a previous release request, we think this is an RRC message while BSR is a MAC message. Thus it is not obvious, especially in a CU/DU split that MAC will inform RRC about every received BSR. |
| Huawei | Not 1 and 2  Open to 3 | The arrival of UL data is dynamic and we cannot assume that the “leaving RRC\_CONNECTED” is a continuous preference. NW can consider it as a temporary preference from the UE and if NW decides not to release the UE (e.g. considering DL data transmission), this “leaving RRC\_CONNECTED” request is not valid anymore from NW perspective (e.g. if the prohibit timer expires, the “leaving RRC\_CONNECTED” request can be considered as invalid since the UE can provide its new preference again, of course this is just a way of implementation). So it is unnecessary to cancel the previous preference. If we consider the case that UE changes their mind in a really short time, when the “leaving RRC\_CONNECTED” request is still valid, then I would say it’s really a bad UE implementation and it should be avoided.  Considering we already have the agreement that “*The UE wants to remain in connected mode*”, “connected-preference” means that UE expects more data to sent/received and prefer to stay connected\_state is valuable. The NW can maintain the RRC connection longer after receiving this “connected-preference”. For the question of how long the UE stays in connected time, at least it can up to NW implementation, or more assistance information can be indicated by the UE. |
| OPPO | Trigger 1 or Trigger 3 |  |
| MediaTek | Trigger 1 | Largely agree with CATT’s comments. The scenario we’re trying to address is this:   * UE sends the release request as it has (and expects) no more activity in the near future * NW does not release the UE as the NW is aware that there is more (DL) data * After some time has elapsed, new UL activity takes place and the UE would like to cancel the earlier release request   Huawei’s comments are unclear to us. UE assistance is always a continuous preference. This is why the UE only sends a new message when something changes from the previously indicated preference. If a new message is not sent, the previously indicated preference from the UE holds true (regardless of whether the gNB has acted upon that preference or not). |
| Qualcomm | Trigger 1 | Agree with CATT |
| Apple | Trigger 1 | Agree with CATT |
| Samsung | Trigger 2 | Since UL data activity is driven by user, UL data arrival would suddenly happen after UE sends release preference to NW. If NW accepts the request and releases the connection, new RRC establishment should be triggered to carry the UL data.  It would result in unnecessary signaling and latency. We understand it’s the intention of ‘remain in connected’ to avoid the drawback.  Accordingly, when UL data arrival happens after UE sends the release preference, UE should be able to send ‘remain in connected’ regardless of whether any prohibit timer is running.  Upon sending ‘remain in connected’, UE will start a prohibit timer, and the transmission of other preferences, e.g. (a) UE can report release only or (b) Indicate explicit state preference, are not allowed until the timer expires. Therefore, frequent transmissions would be still avoided. |
| Intel | Trigger 1, 2, 3, 4 | We understand that there is no reason to restrict any of the triggers described above. |
| LG | Trigger 2 | The case of reporting "connected" is when the previous preference in releaseRequest should be canceled. Considering that the network is likely to respond to the releaseRequest, there may be no chance to cancel previous preference if the UE cannot report "connected" while the prohibit timer is running. Thus, we think Option 1 is useless solution to cancel the previous preference.  In addition, if the UE cannot cancel the previous preference in releaseRequest due to prohibit timer, the UE should move out of RRC\_CONNECTED and then try to establish RRC CONNECTION again. We think this is not good impact on delay of data transmission and power consumption. |
| Xiaomi | Trigger 1 | It seems that trigger1 is a reasonable case. |
| vivo | Trigger 1/3/4 | We agree with Intel that ther is no reason to restrict any of the triggers described above. But we also tink the any UE assistance information should be controlled by prohibit timer.  Can I further clarify whether the motivation for this question is to capture some similar description in the specification? |
| ZTE | None | We do not think “connected” is needed as UE preference.  For trigger 1 and trigger 2, no clear use case or benefits are foreseen in using "connected" as a preferred RRC state to cancel a previous release request. UE should not send the release indication if there is upcoming data in the near future.  For trigger 3, if UE expects more data to sent after having sent BSR=0, UE can trigger another BSR to request UL grant. Futhermore, BSR is used to provide the serving gNB with information about UL data volume in the MAC entity, NW will take both the UL and DL data volume into consideration to decide whether to release the RRC connection and it is unlikely that NW will release the RRC connection immediately upon receiving BSR=0.  For trigger 4, the use case is not clear to us. Why UE send “connected” upon configuration of UE assistance? What is the expected NW behavior upon receiving a “connected”? |

*Rapporteur’s summary*

To answer vivo’s question, the motivation of the question is to capture the trigger conditions for the release preference IE, similar to other IEs for UE assistance.

Companies’ preferences on the trigger conditions for the UE to report its preference to stay in connected mode are summarised below.

Trigger 1: 8 out of 13

Trigger 2: 3 out of 13

Trigger 3: 4 out of 13

Trigger 4: 2 out of 13

Two companies indicate that they would prefer to revert the earlier agreement on the UE’s ability to report ‘connected mode’ as a preferred state. One company indicated that they do not support trigger conditions 1 and 2.

Given that trigger condition 1 has the most support, and this was the condition discussed widely at the previous meeting, we can attempt to agree on trigger condition 1.

**Proposal 3: If a UE wants to cancel an earlier indicated preference to leave connected mode, the UE can transmit a release preference IE with a connected mode state preference, when not prevented by a prohibit timer**

#### 5.7.4.3 Actions related to transmission of *UEAssistanceInformation* message

From R2#108, the following open issue remains:

*FFS SCell and Aggregated BW can refer to any value within the UE capability for the purpose of power saving*

The issue identified above relates to the range of the reported values of UE assistance for power savings. When referring to reduced BW, or reduced number of cells or reduced MIMO layers, is it reduced from:

Option 1: the current active configuration (i.e. currently active aggregated BW, current number of activated carriers or currently configured number of maxMIMO-layers in an active BWP) or;

Option 2: the value signaled in the UE’s capability (i.e. maximum supported aggregated BW, maximum number of active cells or maximum number of MIMO layers) independent of current active configuration.

*Q5. What is your preferred option for the range of reduced number of SCells, reduced aggregated bandwidth and reduced number of MIMO layers reported in UE assistance for power saving?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Preference** | **Additional comments (if any)** |
| Ericsson | 1 | In our view additional BW/SCells cannot really be motivated for power saving reasons, i.e. this should not be discussed under power saving. Furthermore we are generally reluctant to follow UE guidance to configure additional NW resources, i.e. if UE indication is not reliable NW resources are wasted. |
| CATT | Option 2 | 5G smartphones are expected to provide the end-user a large flexibility in configuring the device power consumption, for example by configuring it for “maximizing the performance” (e.g. for gaming) or, on the opposite, for minimizing power consumption, which can be automatically turned on by the device power management when the battery level gets low. Given the high power consumption resulting from operating in FR2 bands, it then makes sense that each UE should be able to report its own preference on FR1 and FR2 usage for a given application based on the above information which NW cannot be aware of, and this independently of its current active configuration. For example, the UE is only configured a small bandwidth on FR1 and a large bandwidth on FR2. For power saving, the UE can indicate a preferred higher maximum aggregated bandwidth on FR1 while a reduced (can be zero) maximum aggregated bandwidth on FR2.  Reporting early the desired *absolute* configuration upon new DRB setup prevents the NW to allocate a maximum configuration first and then the UE to report a *reduced* configuration afterwards. This allows saving all UE power spent unnecessarily in the meantime in tracking and measuring FR2 SCells (and associated beams) it does not need. |
| Huawei | Option 2 | If “reduce” is interpreted as reducing the configuration compared with current config, how does the UE indicate it prefers to recover the configuration? If the UE prefers to go back to the original configuration, UE needs to indicate the higher value instead of “reduced” value. So in our view, the UE preferred value can be independent with current config but should be restricted by the UE capability. For example, UE supports max 4 DL MIMO layers (capability), if the current configured DL MIMO layer is 1, UE can indicate the preferred reduced DL MIMO layers are 2. The NW does not need to adjust the configuration since it satisfies UE’s requirement, and NW will not configure the DL MIMO layers more than 2. |
| OPPO | Option 2 | In our opinion, UE should be allowed to report any value within the UE capability, as long as the reported configuration is benefical for power saving. For example, even UE reports a prefered aggregated BW larger than the current configuration, if the traffic transmission time can be reduced, UE power consumption could be reduced as well. |
| MediaTek | Option 2 | The most important consideration for UE power consumption is the amount of time that the UE is awake.  Transferring large amounts of data over a small BW will increase the time that the UE is awake, and therefore increase its power consumption. It is more power efficient to use a large BW to transfer large amounts of data. However, when low amounts of data is expected, monitoring a large BW adversely affects power consumption.  Combining the above consideration with the UE’s knowledge of the ongoing activity in the device, option 2 is the clear choice for UE feedback on power consumption. |
| Qualcomm | Option 2 | Agree with most of the arguments from the companies that support Option 2. |
| Apple | Option 2 | Agree that option 2 is the preferred choice for UE taking into account both power consumption and performance. |
| Samsung | Option 2 | Sharing with CATT’s view. It could be beneficial for UE power saving, e.g. when increasing FR1 SCells while reducing FR2 SCells. |
| Intel | Option 2 | Our understanding is that from power consumption point of view, it can be more benefitial at a given moment to have larger configuration than the one currently used for example, when expecting large amount of data to be transmitted, UE can save power while increasing the active aggregated BW instead of using smaller one during larger amount of time. |
| LG | Option 2 | The preferred value is beneficial for power saving, any value can be reported within UE capabilitiy. It would be good to give flexibility to report any value to UE.  However, give that higher power consumption is required on FR2, from power saving point of view, we think that it is not desirable to request to increase value of the aggregated BW of FR2. |
| Xiaomi | Option1 | Intuitively speaking, reducing the configuration compared with current configuration saves power. Some people may argue that it increases the time that the UE is awake, and therefore increases its power consumption. But currently we do not have time to get some simulations to prove this. So it is hard to tell.  Currently we would like to make it simple. |
| vivo | Option 2 | UE should be allowed to report any preferred value within the capability. While how the network configures / activates the Scell or aggregated BW is up to network implementation by considering the UE preference. Thus, there is no need to restrict the UE reporting. |
| ZTE | Option 1 | In our understanding, reduced active aggregated BW, number of activated carriers or number of MIMO layers compared to the current configuration may be helpful in saving power at UE side. It is not clear to us why UE wants to be configured with higher values for power saving purpose. |

*Rapporteur’s summary*

10 out of 13 companies indicate that reported values of UE assistance for power savings can range up to the value signaled in the UE’s capability (i.e. maximum supported aggregated BW, maximum number of active cells or maximum number of MIMO layers) and is independent of current active configuration.

**Proposal 4: The reported values of UE assistance on reduced bandwidth, cells and MIMO layers for power savings can range up to the corresponding value in the UE’s capability, and is independent of the current active configuration.**

Another issue raised during the Phase 1 discussion was whether the UE can report a preferred aggregated bandwidth for a frequency range (FR1/FR2), even if it is not configured with serving cells operating on that frequency range.

*Q6. Can a UE report a preferred aggregated bandwidth for a frequency range even if it is not configured with serving cells on that frequency range?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (if any)** |
| Ericsson | No, but… | Some view as for Q5, i.e. UE should not indicate additional resources.  PS: we are not sure if further discussion is needed for MR-DC use cases, e.g. for EN-DC, UE should be able to indicate that it does not require the NR leg. |
| CATT | Yes | Using similar arguments as for Q5, a UE may not be configured with any FR2 SCell in first place, but if it is unable to indicate a preferred amount of aggregated BW in FR2, the NW may choose (as in current early 5G deployments) to configure one or more FR2 SCells to address the UE’s new DRB setup with, by default, the largest BW to provide a maximum performance, although overkill wrt UE’s actual needs. Alternately, given its profile (eMBB DRBs), the UE may not be configured with any serving cell on FR1. But for power saving, the UE can prefer a maximum aggregated bandwidth DL/UL on FR1 and a reduced maximum aggregated bandwidth DL/UL on FR2. |
| Huawei | Yes |  |
| OPPO | Yes | See our reply to Q5. |
| MediaTek | Yes |  |
| Qualcomm | Yes | The same reasons for Q5 |
| Apple | Yes |  |
| Samsung | Yes |  |
| Intel | Yes |  |
| LG | Yes | Please find our view in Q5 |
| XIaomi | No | The same reasons for Q5 |
| vivo | Yes | Same reason for Q5. |
| ZTE | No | More power is consumed in generating such a preferred aggregated bandwidth for non-serving frequency and it is not helpful in reducing the current power consumption at UE side. |

*Rapporteur’s summary*

10 out of 13 companies indicate that a UE can report a preferred aggregated bandwidth for a frequency range even if it is not configured with serving cells on that frequency range.

**Proposal 5: A UE can report a preferred aggregated bandwidth for a frequency range, even if it is not configured with serving cells on that frequency range.**

### 6.2.2 Message definitions

#### – *RRCReconfiguration*

*No Open Issues*

#### – *UEAssistanceInformation*

For the reporting of parameters for *overheatingAssistance*, it is optional whether the UE reports for FR1 or FR2 or both. The same has been copied over in the draft CR for power savings. Similarly for the release request, we have agreed that the UE can report release only, and therefore *preferredRRC-State* is marked as optional.

*Q7. Should any remaining parameters (e.g. related to DRX or minimum scheduling offset) for UE assistance be optional? Please provide the value from the running CR along with your reasons.*

|  |  |  |
| --- | --- | --- |
| **Company** | **Parameter** | **Comments** |
| *e.g. Company* | *e.g. P1* | *Justification* |
| *e.g. P2* | *Justification* |
| Ericsson |  | In the current running CR the UE is required to provide:   * All preferred DRX parameters in case of preferred DRX * Both reducedCCsDL and reducedCCsUL in case of maxCC * Both preferredK0 and preferredK2 in case of preferred scheduling offset   In case the UE always signals all preferences, then we do not need to discuss what it means with (some) preferences are omitted, which is an advantage. |
| CATT | Short DRX Cycle and timer | To address the case where UE only wishes to be configured with Long DRX. |
| Huawei | The sub-IEs of DRX-Preference and MinSchedulingOffsetPreference | The sub-IEs of DRX-Preference (i.e. preferredDRX-InactivityTimer, preferredDRX-LongCycle, preferredDRX-ShortCycle, preferredDRX-ShortCycleTimer) and sub-IEs of MinSchedulingOffsetPreference (i.e. preferredK0, preferredK2) would better be optional. For example, only the Long DRX cycle is configured, UE can only report the preference value for preferredDRX-LongCycle. It is more flexible and reduces the signaling overhead. If UE reports a new DRX-Preference or MinSchedulingOffsetPreference, the network can replace the previous one, we don’t think we need to use “delta” way here. |
| OPPO | Parameters related to DRX | We think all the DRX related parameters could be marked as optional. Since sometimes we may have preference on some of the parameters but have no preference on others, then UE does not need to report all the parameters. |
| MediaTek | preferredK0-SCS-120kHz | In UE assistance, FR2 related parameters are optional as FR2 operation is optional for a UE. Following the same line of reasoning, we suggest keeping parameters related to 120kHz SCS as optional, as they are only used in FR2 operation. |
| preferredK2-SCS-120kHz | Same reasoning as above |
| Apple | Short DRX related parameters | Same reasoning as OPPO |
| Apple | DRX-Preference  MinSchedulingOffsetPreference | Same reasoning as HW. |
| Intel | All parameters | We do not think that a UE should be mandated to provide its preference to all the possible parameter but instead to those that their changes are expected to provide a desirable improvement on its performance/operation. Therefore, we suggest that new UE assistance sub-information is defined as optional e.g. within DRX-Preference-r16 (i.e. preferredDRX-InactivityTimer-r16, preferredDRX-LongCycle-r16, preferredDRX-ShortCycle-r16, preferredDRX-ShortCycleTimer-r16), or within MinSchedulingOffsetPreference-r16 (i.e. preferredK0, preferredK2). |
| LG | The sub-IEs of DRX-Preference and MinSchedulingOffsetPreference | There may be a case that the UE have preference for some parameters but no preference for others. In this case, UE does not need to report all parameters in the IE. |
| XIaomi | Parameters related to DRX and  MinSchedulingOffsetPreference | Agree with HW, and the text in the draft CR should capture this. |
| vivo | All parameters | In many cases, a UE may have only preference on one/some/all parameters. Thus, it is more flexible to keep all parameters as optional field. If some parameters are modelled as mandatory fields, UE should always report the preferred value even it has no preference. Otherwise, the previous reported preferred values are always valid until the next report. |
| ZTE | preferredDRX-ShortCycle and preferredDRX-ShortCycleTimer | For the case when UE only wishes to be configured with long DRX, the short DRX related IEs can be absent. |
| The sub-IEs in MinSchedulingOffsetPreference (e.g. preferredK0, preferredK2) | In this way, UE is able to report one of K0 or K2. The absence of K0 or K2 showing that there is no preference from UE side. |

*Rapporteur’s summary*

The following preferences have been indicated with regards to which parameters can be optionally reported by the UE:

Short DRX parameters: 9 out of 11

All DRX parameters: 7 out of 11

Minimum scheduling offset: 8 out of 11

All parameters: 2 out of 11

None: 1 out of 11

As keeping DRX parameters and minimum scheduling offset parameters as optional have the most support, we propose the following.

**Proposal 6: All fields in the DRX-Preference IE in the UE assistance information message are optional fields.**

**(Alternative to P6) Proposal 7: preferredDRX-ShortCycle and preferredDRX-ShortCycleTimer in the UE assistance information message are optional fields.**

**Proposal 8: All fields in the MinSchedulingOffsetPreference IE in the UE assistance information message are optional fields.**

During Phase 1, there have been some discussion on the structure of the release request IE. We have the following agreements from R2#108:

*The UE can report the following:*

*a. UE can report release only (i.e. no state preference)*

*b. Indicate explicit state preference*

*c. The UE wants to remain in connected mode*

The following alternatives have been suggested for the structure of the release request IE:

Option 1: Reporting preferred state is optional, and can indicate idle, inactive and connected, i.e.

preferredRRC-State-r16 ENUMERATED {idle, inactive, connected} OPTIONAL

Option 2: Preferred state is always reported, and indicates idle, inactive, connected and out of connected, i.e.

preferredRRC-State-r16 ENUMERATED {idle, inactive, connected, out of connected}

Option 3: Release indication and preferred RRC state are separately indicated, i.e.

releaseIndication-r16 ENUMERATED {connected, out-of-connected} OPTIONAL,

preferredRRC-State-r16 ENUMERATED {idle, inactive} OPTIONAL

*Q8. Which option is preferred for the reporting of RRC state preference?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Preference** | **Comments (if any)** |
| Ericsson | 3 | Preferred RRC state and release/cancel are different issues, i.e. UE should be able to indicate these preferences simultaneously.  FYI: our preference is (which is not inline with current RAN2 agreements, I know):  ReleaseAssistance-r16 ::= SEQUENCE {  releasePreference ENUMERATED {true} OPTIONAL,  preferredRRC-State-r16 ENUMERATED {idle, inactive} OPTIONAL  } |
| CATT | Option 2 | With Option 1, when *preferredRRC-State* IE is not included, it means UE wants to leave RRC Connected without preferred state. However, the enumerated list already takes 2 bits + another bit for the optional. Compared with Option 2, one more bit is required with Option 3. With Option 2, we just code it as mandatory on 2 bits to carry the exact same information. Option 2 is clear with the least signaling overhead. The name ‘preferredRRC-State-r16’ can be changed to ‘preferredReleaseIndication-r16’ if it is felt more appropriate. |
| Huawei | Maybe Option 2 | As our comments for Q4, we don’t think it is necessary to cancel the previous preference. So the simple structure can be  ReleaseAssistance-r16 ::= SEQUENCE {  preferredRRC-State-r16 ENUMERATED {idle, inactive} OPTIONAL  }OPTIONAL  If the UE includes field field ReleaseAssistance, it means UE prefers to leave RRC\_connected state, if IE preferredRRC-State is not included, it means UE dose not have the preferred state.  Considering we already have the agreement that “*The UE wants to remain in connected mode*”, if the “connected” shall be captured, Option 2 is preferred. |
| OPPO | Option 3 | preferredRRC-State-r16 is optionally repoted if the value of releaseIndication-r16 is out-of-connected.  preferredRRC-State-r16 is absent if the value of releaseIndication-r16 is connected. |
| MediaTek | Option 1 | The UE behaviour with option 1 is clear to the reader. We do not think that optimizing 1 bit for a UE feedback message that is (typically) sent once per connection is the most important discussion to have. |
| Qualcomm | Option 3 | Option 1 and 2 do not allow UE to indicate its preferred RRC state when request “out of connected”. State preference has to be indicated separately. |
| Apple | Option 3 | Option 3 allows better granularity |
| Samsung | Option 2 | There is no reason to use even 1-bit more. |
| Intel | Option 2 | We prefer option 2 that clearly cover the agreed cases.  If companies prefer using the OPTIONAL case, we suggest considering the following option 4. Reporting preferred state is optional when wants to stay RRC\_CONNECTED, and can indicate idle, inactive and **out of connected**, i.e.  preferredRRC-State-r16 ENUMERATED {idle, inactive, out of connected} OPTIONAL  In addition, for this option 4, the procedural text shall clarify the allowed operation to indicate UE’s preference of staying RRC\_CONNECTED by adding an explicit statement similarly as it is done with overheading e.g.  2> if the UE has a preferred RRC state on transmission of the UEAssistanceInformation message:  3> include preferredRRC-State in the ReleaseRequest IE;  3> set preferredRRC-State to the desired RRC state on transmission of the UEAssistanceInformation message.  2>else (prefers moving out of RRC\_CONNECTED):  3> do not include preferredRRC-State in the ReleaseRequest IE; |
| LG | Option 2 | Option 2 is clear and simple from readability and signaling point of view. |
| XIaomi | Option 3 | Option3 is clear. |
| Vivo | Option 2 | It seems that all preference can be included by option 2. |
| ZTE |  | We share the same understanding with Huawei and the following structure would be sufficient:  ReleaseAssistance-r16 ::= SEQUENCE {  preferredRRC-State-r16 ENUMERATED {idle, inactive} OPTIONAL  }OPTIONAL |

*Rapporteur’s summary*

The following preferences have been indicated with regards to structure of the release request message:

Option 1: 1 out of 13

Option 2: 5 out of 13

Option 3: 5 out of 13

Other (UE does not report preference for connected state): 2 out of 13

There is no clear majority for any option. Between options 2 and 3 (which had the most support), option 2 reverts the agreement that the UE can report release only. For this reason, option 3 is likely the more acceptable way to go.

**Proposal 9: The releasePreference IE optionally contains a releaseIndication field (connected or out of connected) and a preferredRRC-State field (idle or inactive).**

When reporting aggregated bandwidth in the overheating indication, the value of 0 mHz is not allowed for FR1. During the Phase 1 discussion, it was suggested to remove this restriction, to allow indicating the preference to only use FR1 or FR2.

*Q9. Should the restriction on reporting an aggregated bandwidth of 0 mHz for UE assistance for power savings be removed?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (if any)** |
| Ericsson | Yes |  |
| CATT | Yes | In general “0 MHz” is the only way for the UE to report, as a very minimum, that it wishes to operate on FR1 only, or FR2 only. Thus we think it should also be supported for FR1. |
| Huawei | Yes | It it benefical that UE indicates preference of only operating on FR1. Although we don’t see the requirement of only using FR2, this flexibility in spec is acceptable to us. |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes | Agree with CATT and HW. This would be beneficial for UE. |
| Samsung | Yes | Can agree with high flexibility |
| Intel | Yes |  |
| LG | No | Given that FR2 requires higher power consumption, we think there is no reason to operate on FR2 only from power saving point of view. Therefore, we think the restriction not to allow 0 MHz for FR1 should be kept. |
| Xiaomi | Yes |  |
| Vivo | Yes |  |
| ZTE | Yes |  |

*Rapporteur’s summary*

12 out of 13 companies indicate that the restriction on reporting an aggregated BW of 0 mHz for UE assistance for overheating can be removed for power savings.

**Proposal 10: A UE can report a preference of 0MHz aggregated bandwidth for power savings.**

For the DL, the minimum number of MIMO layers that can be currently reported is two layers. A question raised during Phase 1 was whether this can be reduced to one layer.

*Q10. Can the UE report a preference of one layer as the minimum of preferred MIMO layers for the downlink?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (if any)** |
| Ericsson | Yes | Not sure why this restriction exists for overheating. But NW can configure one layer in DL, i.e. UE should also be allowed to indicate such preference.  PDSCH-ServingCellConfig:  maxMIMO-Layers INTEGER (1..8) OPTIONAL, -- Need M |
| CATT | No | The field *MIMO-LayersDL* from IE *MIMO-Layers* currently takes values {twoLayers, fourLayers, eightLayers} and is commonly used by IEs *FeatureSetDownlinkPerCC*, *OverheatingAssistance* and the new IE *MaxMIMO-LayerPreference-r16*. Given the former IE is for UE capability, oneLayer is not supported as minimum value. We have no strong view but since it didn’t appear to be worth defining a new field specifically for overheating, we may choose to also keep the same *MIMO-LayersDL* field for *MaxMIMO-LayerPreference-r16*. |
| Huawei | Yes | It is a valid value and UE may have this preference. |
| OPPO | No | Based on our understanding, the motivation for UE to report the minimum number of DL MIMO layer is to reduce the DL RF chains. In NR, the typical minimum DL RF chain number is 2. In order to ensure the performance, UE should not report a preference of one layer as the minimum of preffered DL MIMO layer. |
| MediaTek | Yes | In our view, this is not a very important problem to solve. However, given that 1 layer can be configured in DL, it stands to reason that having feedback of 1 MIMO layer should be allowed. |
| Qualcomm | Yes | In RRC configuration for MIMO DL MIMO layer can take value of 1,2,3 or 4. So, UE should be allowed to reduce MIMO layers to 1. Also, this make sense for FR2, since by default FR2 have 2 layers. Reducing the configuration to 1 layer for power saving is expected. |
| Apple | Yes | It is reasonable for the UE to fallback to 1 DL MIMO layer as it is a valid configuration. |
| Samsung | No | Prefer to reuse the existing IE, MIMO-LayersDL for consistency. |
| Intel | Yes | As it is already explained by other companies. |
| LG | Yes | Since the minimum value of MIMO layer is 1, "oneLayer" cab be taken into account for the minimum value of preferred DL MIMO layers. |
| Xiaomi | No | Agree with CATT to reuse the same filed in *OverheatingAssistance.* |
| Vivo | Yes | As we discussed above, UE can report any values in capability. There is also no need to restrict the UE preference here for MIMO layer. Thus, we prefere this flexibility. |
| ZTE | No | Agree with CATT and Samsung that the existing IE should be reused.  For the same amount of DL data, it takes more time for the data transmission if one MIMO layer is configured, which means UE will be kept activated for a longer time. If more MIMO layers are configured, the data transmission will finish earlier and UE can be configured with DRX or transited to idle mode to reduce the power consumption. We are not sure whether configuring one DL MIMO layer would really be benifitial for power saving. |

*Rapporteur’s summary*

8 out of 13 companies indicate that the UE report a preference of one layer as the minimum number of MIMO layers for the downlink. We propose the following based on the opinion of the majority.

**Proposal 11: A UE can report a preference of one layer as the minimum number of preferred MIMO layers for the downlink.**

The DRX-Config IE has a restriction that a configured long DRX cycle should be a multiple of the configured short DRX cycle, as below. We have not discussed if such a restriction should also apply to the reported UE preferences on DRX.

*If drx-ShortCycle is configured, the value of drx-LongCycle shall be a multiple of the drx-ShortCycle value.*

*Q11. Should the reported long DRX cycle preference be a multiple of the reported short DRX cycle preference?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (if any)** |
| Ericsson | Yes | The configuration restriction should obviously be kept.  The NW may not configure short DRX, but UE should indicate preference for both.  Here the assumption is that UE has the same preference for Long DRX, with or without Short DRX. Perhaps it should be discussed if the UE can signal a Long DRX cycle preference separately with and without Short DRX? |
| CATT | Yes | Not sure how a non-multiple configuration would make sense. |
| Huawei | Yes | It is easier for network to adjust the C-DRX configuration. |
| OPPO | Yes |  |
| MediaTek | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| Samsung | Yes |  |
| Intel | Yes |  |
| LG | Yes | The basic principle that Long DRX cycle is a multiple of Short DRX cycle should be kept. |
| Xiaomi | Yes |  |
| vivo | Yes | Otherwise, the assistance information may confuse the network. |
| ZTE | Yes | The resitriction should be kept if UE provide preference for both the short DRX cycle and the long DRX cycle. |

*Rapporteur’s summary*

All companies agree that the reported long DRX cycle preference be a multiple of the reported short DRX cycle preference

**Proposal 12: The reported long DRX-cycle preference is a multiple of the reported short DRX-cycle preference.**

### 6.3.1 System information blocks

#### – *SIB2*

*No Open Issues. The range of the configuration (S-searchDeltaP and T-searchDeltaP) is to be discussed as part of email discussion 108#79*

### 6.3.2 Radio resource control information elements

#### – *PDCCH-Config*

*No Open Issues*

#### – *PDSCH-Config*

*No Open Issues*

#### – *PhysicalCellGroupConfig*

There remains an open issue on whether the flags ps-TransmitPeriodicL1-RSRP and ps-TransmitPeriodicCSI are defined per cell group or per CSI configuration. However, this issue needs to be resolved in RAN1.

#### – *PUSCH-Config*

*No Open Issues*

#### – *SearchSpace*

The Rel-15 structure of the search space IE does not allow the inclusion of new DCI formats as part of the common search space type. In order to introduce the search space for the DCP, its RRC configuration needs to be discussed. The first question to answer is if the search space can be independently configured from Rel-15 search spaces.

*Q12. Can the search space for DCP be configured independent of search spaces for Rel-15 DCIs?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Preference** | **Comments (if any)** |
| Ericsson | Yes | In our understanding, if the UE supports DCP, the new DCI format 2-6 for common search space can be configured together with a legacy DCI format on a common search space or on a separate search space. The new REL-16 DCI format 2-6 is not different in that aspect from REL-15 DCI formats, where one or more DCI formats can be configured on the same search space.  The ASN.1 signalling via searchSpacesToAddModList as proposed in the running CR enables to add DCI format 2-6 to an existing search space or configure DCI format 2-6 on a separate search space. Perhaps SearchSpace-v16xy should be extended to include the other new REL-16 DCI format for common search space (e.g. dci-Format2-5-v16xy). The DCI formats for the UE specific search space is extentable, i.e. can be used for new DCI format for UEspecific search space.  PS: the nonCriticalExtension added just after dci-Format2-6 should be added at the end of the SearchSpace-v16xy, i.e. non-critical extensions are at the end by definition. |
| CATT | Yes | As the Rel-15 structure of the search space IE does not allow the inclusion of new DCI formats as part of the common search space type, the search space for DCP can be extended in parent IE and configured independently of search space for Rel-15 DCIs. |
| Huawei | Yes | We agree the search space for DCP is independent of search spaces for other DCI formats based on RAN1 conclusion, but we don’t think we need to define a search space only for DCP. Actually before RAN2 #108, when RAN1 sent LS to RAN2 summarizing related RRC parameters, the common understanding is that no special search space (e.g., ‘SearchSpacePS’) will be introduced. From the asn.1 design perspective, the new introduced search space in Rel-16 is a normal extension of that in Rel-15, which should be shared by all new introduced Rel-16 DCI formats, e.g. dci-Format2-4, dci-Format2-5 and dci-Format2-6. So in the final text of 38.331 for Rel-16, the extension of SearchSpace should cover all new DCI formats in Rel-16 instead of the extension for DCP only.  However, from the configuration perspective, once a search space with SearchSpaceID=n is configured to a UE for DCP, it should be used for DCP only as we explain in Q13. It is NW implementation to configure the search space for DCP by setting the format to monitor dci-Format2-6 only. |
| OPPO | Yes | We think ellipsis could be added both after dci-Format2-6 and at the end of the SearchSpace-v16xy. |
| MediaTek | Yes | It should be left to NW implementation to configure the search space for DCP independent of search spaces for other DCIs |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| Samsung | Yes | Agree with the independency. In ASN.1 aspect, it seems natural to have either SearchSpace-v16xy or SearchSpace-r16. Since all fields in SearchSpace-v16xy are duplicated compared to the original SearchSpace IE, it is slightly preferable to Introduce the new SearchSpace-r16. |
| Intel | Yes | RAN2 can take an assumption based on RAN1’s inputs on R1-1913674 and confirm with RAN1. In our understanding, search space for DCP can be configured independent of search spaces for Rel-15 DCIs, it is left up to network implementation. |
| LG | Yes | Since the extension for new DCI format is not possible in Rel-15 structure of common search space, we are ok with the independent configuration for Rel-16. |
| Xiaomi | Yes |  |
| Vivo | Yes | We think the search space for DCP should be independent from the search spaces for other DCI formats based on RAN1 conclusion. |
| ZTE | Yes | We share the same understanding with Ericsson that if the UE supports DCP, the new DCI format 2-6 for common search space can be configured together with a legacy DCI format on a common search space or on a separate search space. |

As a corollary to the question above, we need to decide if we allow the configuration of the search space for DCP such that it is shared with legacy DCIs.

*Q13. Can the search space for DCP be configured such that it is also used to monitor other Rel-15 DCIs?*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (if any)** |
| Ericsson | Yes | See answer to Q12. |
| CATT | Yes | There is no RAN1 agreement or CR that prevents from this. Based on the ASN.1 signalling for search space for DCP in the running CR, *searchSpacesToAddModList-r16* includes a new search space IE list which re-defines all parameters for a search space. Thus, *SearchSpace-v16xy* is *SearchSpace-r16*. In *SearchSpace-r16*, *searchSpaceType-r16* is introduced which includes legacy Rel-15 DCIs and the new common DCI format 2-6. |
| Huawei | Yes | RAN1 had an agreement that “Support UE-specific configuration of the search space set(s) dedicated to the PDCCH-based power saving signal/channel for UE to monitor outside Active Time”. In our understanding, if a search space with SearchSpaceID=n is configured for DCP, UE shall not monitor other DCI formats, including the Rel-15 DCI formats and other new Rel-16 DCI formats, in the search space with SearchSpaceID=n.  *[Indicated via email: after further discussed with our RAN1 colleagues, we would like to correct our answer to “Yes” instead of “No”, that is, the search space for DCP can be shared with other DCI formats]* |
| MediaTek | Yes | It should be left to NW implementation to share a search space configuration for DCP with other DCIs. |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| Samsung | Yes | There is no restriction from RAN1 |
| Intel | Yes | In our understanding, search space for DCP be configured such that it is also used to monitor other Rel-15 DCIs based on RAN1 agreements. Therefore, same search space can be used outside and insider the active time, being up to network implementation. |
| LG |  | We think this needs to be check with RAN1 whether search space for DCP can be shared with legacy DCI. |
| Xiaomi |  | Check with RAN1 |
| Vivo | Yes | We understand the network conclusion has no such restriction. But we are fine to duble confirm with RAN1. |
| ZTE | Yes | See our answer to Q12 |

*Rapporteur’s summary*

All companies agree that the search space for DCP be configured independent of search spaces for Rel-15 DCIs. 10 out of 12 companies agree that the search space for DCP can be shared with search spaces for Rel-15 DCIs. Two companies indicate that this needs to be checked by RAN1.

Given the majority view on the RRC configuration, we propose the following.

**Proposal 13: The search space for DCP be configured independent of search spaces for Rel-15 DCIs.**

**Proposal 14: The search space for DCP be configured such that it is also used to monitor other Rel-15 DCIs.**

### 6.3.4 Other information elements

#### – *OtherConfig*

With regards to the prohibit timer values, we have reached the following agreements:

*Minimum K0/K2 value is signalled as UE assistance. Value of infinity can be configured for the prohibit timer.*

Examples of existing prohibit timer values are:

delayBudgetReportingProhibitTimer: 0s, 0.4s, 0.8s 1.6s, 3s, 6s, 12s, 30s

overheatingIndicationProhibitTimer: 0s, 0.5s, 1s, 2s, 5s, 10s, 20s, 30s, 60s, 90s, 120s, 300s, 600s

*Q14. What is the range of values for the following prohibit timers? If there are any additional considerations, please add your comments in the table further below.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Company** | **DRX assistance** | **Maximum aggregated BW** | **Maximum number of CCs** | **Maximum MIMO layers** | **Minimum K0/K2 values** | **Release request** |
|  | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 600s, ∞} |
| CATT | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 600s} |
| Huawei | {0s, 0.5s, 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 20s, 30s} | {0s, 0.5s, 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 20s, 30s} | {0s, 0.5s, 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 20s, 30s} | {0s, 0.5s, 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 20s, 30s} | {0s, 0.5s, 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 20s, 30s} | {0s, 0.5s, 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 20s, 30s} |
| MediaTek | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 600s, ∞} |
| Qualcomm | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s, 60s, 90s, 120s, ∞} |
| Apple | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s } |
| Intel | {0s, …, 30s} | Same as DRX | Same as DRX | Same as DRX | Same as DRX | Same as DRX, plus infinity |
| LG | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 120s, ∞} |
| Xiaomi | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 30s} | {0s, …, 600s, ∞} |
| vivo | {0s, 0.4s, 0.8s 1.6s, 3s, 6s, 12s, 30s } | {0s, 0.4s, 0.8s 1.6s, 3s, 6s, 12s, 30s } | {0s, 0.4s, 0.8s 1.6s, 3s, 6s, 12s, 30s } | {0s, 0.4s, 0.8s 1.6s, 3s, 6s, 12s, 30s } | {0s, 0.4s, 0.8s 1.6s, 3s, 6s, 12s, 30s } | {0s, 0.4s, 0.8s 1.6s, 3s, 6s, 12s, 30s, infinity } |
| ZTE | {0s, 0.5s, 1s, 2s, 5s, 10s, 20s, 30s, 60s, 90s, 120s, 300s, 600s} | {0s, 0.5s, 1s, 2s, 5s, 10s, 20s, 30s, 60s, 90s, 120s, 300s, 600s} | {0s, 0.5s, 1s, 2s, 5s, 10s, 20s, 30s, 60s, 90s, 120s, 300s, 600s} | {0s, 0.5s, 1s, 2s, 5s, 10s, 20s, 30s, 60s, 90s, 120s, 300s, 600s} | {0s, 0.5s, 1s, 2s, 5s, 10s, 20s, 30s, 60s, 90s, 120s, 300s, 600s} | {0s, 0.5s, 1s, 2s, 5s, 10s, 20s, 30s, 60s, 90s, 120s, 300s, 600s} |

|  |  |
| --- | --- |
| **Company** | **Additional considerations (if any)** |
| Ericsson | We think we can have the same range for all UE assistance, except for release assistance, which in our view typically is configured “one-shot” or with a long value to avoid uncessary signalling.  The UE preference for the other UE assistance features can perhaps change more frequently, e.g. when new services are started. |
| CATT | We agree with Ericsson that longer values can be used for release request. |
| Huawei | We prefer finer granularity for the values between 1s~10s. |
| MediaTek | Agree with Ericsson |
| Qualcomm | In 3G WCDMA, T323 was defined for the same purpose as prohibit timer for Release Request. The maximum of T323’s values is 120 sec. As we have not seen any evidence of change in the statistics of the duration of RRC connections, we think we should reuse this maximum value of 120sec. |
| Apple | Agree with HW, we prefer finer granularity. |
| LG | We have same view with Qualcomm. |
| Xiaomi | Agree with Ericsson |
| vivo | Longer values for release request is also acceptable for us. |
| ZTE | We prefer to reuse the value range for overheating indication in power saving. Specially, the upper bound of the power saving assistance prohibit timer should not be smaller than the upper bound of the overheating prohibit timer.  From network’s perspective, the overheating indication is more urgent than the power saving indication and requires immediate action at network side.  In addition, sending the power saving indication frequenctly consumes more power at UE side and we would prefer to configure a relatively longer prohibit timer. |

*Rapporteur’s summary*

10 out of 11 companies indicate that the prohibit timers for UE assistance on DRX, aggregated BW, number of cells, MIMO layers and the minimum scheduling offset should go up to 30s.

With regards to the prohibit timer for the releasePreference, the following suggestions were made:

Option 1 - up to 30s: 4 out of 11

Option 2 - up to 120s: 2 out of 11

Option 3 - up to 600s: 5 out of 11

As option 3 above covers all the other options as well, we propose the following. (Please note that we have already agreed to be able to configure a value of infinity as the prohibit timer for the releasePreference)

**Proposal 15: The prohibit timer for UE assistance on DRX, aggregated bandwidth, number of cell, number of MIMO layers and minimum scheduling offset for power savings can be configured up to 30s.**

**Proposal 16: In addition to the value of infinity, the prohibit timer for the releasePreference UE assistance for power savings can be configured up to 600s.**

## 6.4 RRC multiplicity and type constraint values

### – Multiplicity and type constraint definitions

*No Open Issues*

### 7.1.1 Timers (Informative)

*No Open Issues*

11.2 Inter-node RRC messages

An open issue was raised in R2-1916278 on the impact of the WUS on MR-DC. In order to avoid additional UE power consumption due to misaligned DRX configurations on the MN and the SN, DRX configurations can be exchanged between the nodes (MN <> SN, CU <> DU) using inter-node RRC messages. Similar alignment between the nodes on the DCP configuration is potentially useful to bring down the UE’s power consumption.

*Q15. Should parameters relating to the DCP configuration be exchanged between network nodes as an inter-node RRC message? If yes, please also indicate the applicable mode of operation (e.g. NR-DC, EN-DC, NE-DC…).*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments (if any)** |
| Ericsson | No | In our understanding there is not a strong need for coordination, i.e. the possible UE power saving is low. Furthermore any coordination would only be applicable between NR nodes where DCP is configured, i.e. NR-DC? The intention would be to have a similar DCP offset? But we think the possible power savings is low. |
| CATT | Yes | Similar as coordination for DRX configurations, UE power consumption can be reduced if parameters relating to the DCP configuration are exchanged between network nodes as inter-node RRC message. For example:  If *ps-Offset-r16* is exchanged, the starting of monitoring DCP between MN and SN can be aligned. Then the UE can wake up to monitor DCP sent by MN and SN at the same time. UE power consumption can be reduced.  If *ps-WakeUp-r16* is exchanged, the same consistent behavior can be achieved in the UE side when DCP is not detected outside active time.  If *ps-TransmitPeriodicL1-RSRP-r16*/*ps-TransmitPeriodicCSI-r16* are exchanged, the RAN node can be aware of beam management policy with DCP mechanism in the other RAN node and set *ps-TransmitPeriodicL1-RSRP-r16*/ps-TransmitPeriodicCSI-r16 with suitable values.  In addition, even if the CG is not configured with DCP, there is also some benefit if it can be aware that DCP is used in the other CG. E.g. If the MCG can be aware that DCP is used in SCG, the MCG can make appropriate decisions on bearer type selection and decide not to establish a SCG bearer if the rate of data arrival is high in each DRX on-duration.  DCP is introduced only in NR. Hence, the DCP configuration exchanged between network nodes is applicable to NR-DC scenario. |
| Huawei | No | For EN-DC and NE-DC, DCP is not configured in the LTE side, so the coordination between MN and SN seems not necessary. For NR-DC, based on the capability reported by UE, we don’t think there is a serious problem. |
| OPPO | No | Since the power consumption for DCP monitoring is low, there is no need to allign the DCP configuration between network nodes. |
| MediaTek | No | We do not see a strong need to align the DCP configuration between network nodes. |
| Qualcomm | No | It only potentially matters in NR-DC. But typical deployment of ND-DC is FR1+FR2. FR1 and FR2 typically have different ps\_offset. So network either have to align DCP occasions between two CGs, or align start time of DRX cycles in two CGs. The wakeup (circuits going from sleep to active) power consumption in the latter case is much higher. Therefore, it is not efficient to align DCP occasions. |
| Apple | No | We agree with other companies on the following points  1) Inter-node coordination is unnecessary for EN-DC/NE-DC case, since DCP is only in NR CG;  2) Inter-node coordination is no much benefical for FR1+FR2 NR-DC, since *ps-Offset-r16* seems to be different for FR1 and FR2; |
| Samsung | No |  |
| Intel | No |  |
| LG | No | Given that power consumption for DCP monitoring is low, we think there are not much gain from aligning the DCP configuration between network nodes. |
| Xiaomi | No | Aligned DRX configurations for NR-DC case is enough. |
| Vivo | No | I suppose only NR-DC/NE-DC will have such DCP in NR leg. Thus, there is no need to coordinate between nodes. |
| ZTE | No | AS mentioned by Ericsson, CATT and Huawei, the DCP can only be configured by NR node thus the applicable mode for DCP configuration coordination is NR-DC. We also think the power saving gain would be quite limited while the complexity in implementation would increase a lot at network side for such coordination. |

*Q16. If the answer to Q15 above is yes, which parameters should be included in the inter-node RRC message?*

*Option 1: DCP-Config IE (from PhysicalCellGroupConfig)*

*Option 2: Other (please list parameters to be included)*

|  |  |  |
| --- | --- | --- |
| **Company** | **Preference** | **Comments (if any)** |
| CATT | Option1 | See comments in Q15, UE power consumption can be reduced if *ps-Offset-r16, ps-WakeUp-r16, ps-TransmitPeriodicL1-RSRP-r16,* and *ps-TransmitPeriodicCSI-r16* can be exchanged via the inter-node RRC message. These parameters are in *DCP-Config* IE (from *PhysicalCellGroupConfig*). To simplify, we can exchange the whole parameters for DCP in *PhysicalCellGroupConfig*. |
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*Rapporteur’s summary*

12 out of 13 do not see a need to exchange parameters relating to the DCP configuration between network nodes as an inter-node RRC message. Given the majority view on this topic, no proposals are made to address this issue.

Conclusion

13 companies participated in the email discussion. The following proposals are based on the responses provided.

The following proposals have a high level of consensus (10 or more companies) and should be easily agreeable:

***Proposal 1: The UE assistance IE to transition out of connected mode is named ‘releasePreference’***

***Proposal 2: The UE assistance configuration for power savings is released during the RRC resume procedure***

***Proposal 10: A UE can report a preference of 0MHz aggregated bandwidth for power savings***

***Proposal 12: The reported long DRX-cycle preference is a multiple of the reported short DRX-cycle preference***

***Proposal 13: The search space for DCP be configured independent of search spaces for Rel-15 DCIs***

***Proposal 15: The prohibit timer for UE assistance on DRX, aggregated bandwidth, number of cell, number of MIMO layers and minimum scheduling offset for power savings can be configured up to 30s***

The following proposals have some consensus (7 or more) and may be agreeable:

P4 and P5 below are agreeable to 10 out of 13 companies that responded. During the summary review, one company indicated that the UE behaviour regarding the reporting of larger values is not well understood. Both proposals are clarifications by nature, and if not agreed, the current status is that the UE can report any value that can be signalled in RRC.

With regards to P3, two companies have indicated their preference to revert the earlier agreement on the UE being able to report a preference to remain in connected mode, and 1 company indicated that they do not prefer P3

***Proposal 3: If a UE wants to cancel an earlier indicated preference to leave connected mode, the UE can transmit a release preference IE with a connected mode state preference, when not prevented by a prohibit timer***

If P6 is not agreeable, P7 may be agreeable as more companies indicate that short DRX assistance information should be optionally reported by the UE.

***Proposal 6: All fields in the DRX-Preference IE in the UE assistance information message are optional fields***

***(Alternative to P6)Proposal 7: preferredDRX-ShortCycle and preferredDRX-ShortCycleTimer in the UE assistance information message are optional fields***

***Proposal 8: All fields in the MinSchedulingOffsetPreference IE in the UE assistance information message are optional fields***

***Proposal 11: A UE can report a preference of one layer as the minimum number of preferred MIMO layers for the downlink***

The following proposals are from split opinions (5 companies) in the email discussion:

***Proposal 9: The releasePreference IE optionally contains a releaseIndication field (connected or out of connected) and a preferredRRC-State field (idle or inactive)***

We need to decide on a range for the prohibit timer configuration. P16 below combines the range preference indicated by all companies.

***Proposal 16: In addition to the value of infinity, the prohibit timer for the releasePreference UE assistance for power savings can be configured up to 600s***