**3GPP TSG-RAN WG1 Meeting #106-eR1-210XXXX**

e-Meeting, August 16th – 27th, 2021

**Agenda item: 8.3**

**Source: Moderator (Nokia)**

**Title: [Post-106-e-Rel17-RRC-03] Enhanced IIoT and URLLC**

**Document for: Discussion and Decision**

# Introduction

As per chairman’s guidance, the email discussion

* [Post-106-e-Rel17-RRC-03] Enhanced IIoT and URLLC

is planned according to the following guidelines:

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| *As announced during RAN1#106-e, there will be a number of email threads on Rel-17 RRC parameters. For each Rel-17 work item, the work item rapporteur will kick off the email thread. The email discussions on RRC parameters will start from September 1 until September 10 (of course excluding the weekend). The purpose of these email discussions is to initiate our preparations to send the first LS to RAN2 on Rel-17 RRC parameters in October (e.g. tabulate agreed RRC parameters so far and identify ones that RAN1 should discuss whether or not to define).**Please note that RAN1 will NOT be making any decision with regards to the Rel-17 RRC parameters during the email discussions. Intention is to have the work item rapporteurs provide their initial assessment and collect company views if there are any. I am hoping that this discussion will help companies better prepare for RAN1#106bis-e. For each email thread, the rapporteur is to provide a tdoc collecting company views along with a draft list of RRC parameter at the end of the email discussion.* |

This document is there to support the RAN1 email discussion on the RRC parameter list for the Rel-17 URLLC/IIoT WI. Companies are encouraged to provide their comments on the latest version of the RRC parameter sheet in the respective AI specific drafts folder and the changes to the RRC parameter sheet will only be done by the AI moderator based on the received comments in each round or iteration of email discussions on this issue.

**This document is structured as follows:**

* Section 2 contains the email discussion for HARQ-ACK enhancements (AI 8.3.1.1)
* Section 3 contains the email discussion for CSI enhancements (AI 8.3.1.2)
* Section 4 contains the email discussion for NR-U enhancements (AI 8.3.2)
* Section 5 contains the email discussion for Intra-UE periodization enhancements (AI 8.3.3)
* Section 6 contains the email discussion for Other / Propagation delay compensation (AI 8.3.4)

# HARQ-ACK enhancements (AI 8.3.1.1)

VOID

# CSI enhancements (AI 8.3.1.2)

VOID

# NR-U enhancements (AI 8.3.2)

* 1. Channel occupancy initiated by UE

The RRC parameter ‘ue-SemiStaticChannelAccessConfig’ that includes periodicity and offset of periodic channel occupancy initiated by UE is introduced to enable UE-initiated COT inRel-17. The parameter is UE-specific and configured per cell. More details are provided in the Excel sheet where the main descriptions are shown below:

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| --- | --- | --- |
| **Parameter name in the spec** | **Description** | **Value range** |
| ue-SemiStaticChannelAccessConfig | The configuration is conditional on presence of *SemiStaticChannelAccessConfig-r16*. If *SemiStaticChannelAccessConfig-r16* is absent, this configuration is ignored. When the configuration is applicable, the UE operates in semi-static channel access mode and can initiate a channel occupancy periodically as described in TS37.213 [Clause x.x]. | (ue-Period, ue-Offset) |
| ue-Period | Added in ue-SemiStaticChannelAccessConfig. ue-Period is the period of a channel occupancy that the UE can initiate as described in TS37.213 [Clause x.x]. ue-Period can be configured independently from *period* configured in *SemiStaticChannelAccessConfig-r16* if the UE indicates the corresponding capability. Otherwise, ue-Period shall be confiugred with a value that is the same, or integer multiple of, or inter factor of the value configred for *period* in *SemiStaticChannelAccessConfig-r16*. | {1ms, 2ms, 2.5ms, 4ms, 5ms, 10ms} |
| ue-Offset | Added in ue-SemiStaticChannelAccessConfig. ue-Offset is the number of symbols from the beginning of the closest even indexed radio frame to the start of the first period that the UE can initiate a channel occupancy as described in TS37.213 [Clause x.x]. The maximum ue-Offset value is 279, 559 and 1119 symbols for 15, 30 and 60 kHz subcarrier spacing, respectively. | INTEGER(0..1119) |

### 1st Round

Please review the description of the RRC parameter ‘ue-SemiStaticChannelAccessConfig’ in the Excel sheet and provide your comments, if any in the table below.

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| *Company* | *Comments* |
| Lenovo, Motorola Mobility | Thanks for providing the RRC list.1. Should it be mentioned ‘ue-SemiStaticChannelAccessConfig’ is configured for FR1 only?
2. For ue-Offset, maybe we should clarify:

” ue-Offset is the number of symbols ~~from~~ between the beginning of the closest even indexed radio frame prior to the start of the first period that the UE can initiate a channel occupancy and the start of the first period “We understand there are ”from”, and ”to” in the current definition, but we think a clarification could help avoiding any confusion on whether the closest even indexed radio frame is before/after the start of the first period. |
| Intel | Many thanks for providing the RRC list. We also have similar comments as Lenovo/Motorola regarding the description of ue-Offset, and we are OK with the suggested text: given the offset value should be always positive, the term “prior” should be included within the description of “ue-Offset”. |
| ZTE | Thanks for providing the RRC list.We have the following comments:1. For these parameter names, we think the parameter ue-SemiStaticChannelAccessConfig may need to add the suffix “-r17”, which is similar to SemiStaticChannelAccessConfig-r16 in Rel-16.
2. Given that maximum ue-Period is 10ms, according to the highlighted part in the agreement below, the maximum ue-Offset value should be 139, 279 and 559 symbols for 15, 30 and 60 kHz subcarrier spacing, respectively. The comment part in excel document “1120 is the maximum number of symbols in two radio frames with 60 kHz subcarrier spacing.” may need to be revised to avoid confusion.

Agreement:* In semi-static channel access mode:
* An FFP period for UE-initiated COT is configured as the same, integer multiple of, or inter-factor of the FFP period configured for gNB-initiated COT
* FFP period for UE-initiated COT can be configured independently from FFP period of gNB-initiated COT, if the UE indicates the corresponding capability
* FFP offset for UE-initiated COT is the starting point of first UE FFP relative to the radio frame X boundary.
	+ The offset value range is 0 ≤ offset ＜FFP period of UE-initiated COT
		- FFS on X (e.g. X=0, or X= even index number)
1. There are some typos in description of ue-Period, e.g. “confiugred” and “configred” should be changed to “configured”
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| Moderator | Thanks for the careful review and valuable inputs. Please find some comments and updates below: **@Len/MOT:** * On 1st comment (FR1), the indication for only FR1 applicability and in particular, unlicensed spectrum is addressed in UE feature discussion. Therefore, that information is not needed for RRC.

**@ZTE:** * On 1st comment: “-r17” added in xls v002. In general, these can be handled by RAN2 but for consistency, let’s do the same for this sub-agenda.
* On 2nd comment: Thanks for highlighting the restriction. Updated accordingly. **Interestingly, this implies that a first UE FFP cannot be started in odd indexed subframes** 😊 I kind of missed that. I undated accordingly.
* On 3rd comment: Thanks. Fixed 😊

**@Intel/Len/MOT (2nd comment):*** This description was not easy 😊 To explain the proposed formulation, please note that I have used “ ue-Offset is the number of symbols from the beginning of the closest even indexed radio frame to the start of the first period that the UE can initiate a channel occupancy”. In my understanding that implicitly covers “prior” even indexed frame boundary. Also, considering the comment from ZTE, the UE FFP can only be started in the frame with the even index boundary, there won’t be a need for “prior”. Also, the offset can be 0 as well when it starts “at” even index framed boundary.
* On addition of text: “and the start of the first period” it was not clear to me why it should be added again. Please note that the UE may be configured with UE FFP, but never initiates a COT. “ue-Offset is the number of symbols from the beginning of the closest even indexed radio frame to the start of the first period that the UE can initiate a channel occupancy”.
* If it is still preferred to use “between”, I can make the following change:

“ue-Offset is the number of symbols ~~from~~ between the beginning of the closest even indexed radio frame ~~to~~ and the start of the first period that the UE can initiate a channel occupancy”.Please let me know if I have misunderstood your comment or you still have concern to the latest update and prefer above alternative or similar.**@All: Based on the comments, the following changes are considered in xls v002. Please comment if there is a concern.**

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| --- | --- | --- |
| **Parameter name in the spec** | **Description** | **Value range** |
| ue-SemiStaticChannelAccessConfig-r17 | The configuration is conditional on presence of *SemiStaticChannelAccessConfig-r16*. If *SemiStaticChannelAccessConfig-r16* is absent, this configuration is ignored. When the configuration is applicable, the UE operates in semi-static channel access mode and can initiate a channel occupancy periodically as described in TS37.213 [Clause x.x]. | (ue-Period, ue-Offset) |
| ue-Period | Added in ue-SemiStaticChannelAccessConfig-r17. ue-Period-r17 is the period of a channel occupancy that the UE can initiate as described in TS37.213 [Clause x.x]. ue-Period-r17 can be configured independently from *period* configured in *SemiStaticChannelAccessConfig-r16* if the UE indicates the corresponding capability. Otherwise, ue-Period shall be configured with a value that is the same, or integer multiple of, or inter factor of the value configured for *period* in *SemiStaticChannelAccessConfig-r16*. | {1ms, 2ms, 2.5ms, 4ms, 5ms, 10ms} |
| ue-Offset | Added in ue-SemiStaticChannelAccessConfig-r17. ue-Offset is the number of symbols from the beginning of the closest even indexed radio frame to the start of the first period that the UE can initiate a channel occupancy as described in TS37.213 [Clause x.x]. The maximum ue-Offset value is 139, 279 and 559, symbols for 15, 30 and 60 kHz subcarrier spacing, respectively. | INTEGER(0..559) |

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| LG | Thanks FL for providing (and updating) the RRC list.We are fine with the latest update in above, except for one clarification.As ZTE quoted earlier, we had agreed to limit the range of offset value according to the configured FFP period value as below.* + The offset value range is 0 ≤ offset ＜FFP period of UE-initiated COT

So, wouldn’t the above be necessary to be captured in RRC description? Or, would it be proper to be captured in RAN1 spec? |
| Nokia | On the unlicensed part, we are generally ok with the description in v03. Just one note: to our understanding, limiting the starting offset to less than 10 ms  does not imply that a UE FFP could not be initiated in an odd indexed radio frame. Since the starting position of the UE FFP repeats periodically, and the period is less than or equal to 10 ms, with any configuration there is at least one UE FFP starting point in every radio frame. |
| Moderator | **@LG:** I agree. It is better to include that restriction in description.**@Nokia:** I have the same understanding as you I realized in my statement above, I missed to mention “first UE FFP”. **a first UE FFP cannot be started in odd indexed subframes. The subsequent ones can have starting point be in any follow-up radio frame.****@All:** Please find xls ~~v004~~ v003where ue-Offset description is updated by highlighted text as follows:Added in ue-SemiStaticChannelAccessConfig-r17. ue-Offset is the number of symbols from the beginning of the closest even indexed radio frame to the start of the first period that the UE can initiate a channel occupancy as described in TS37.213 [Clause x.x]. The maximum ue-Offset value is 139, 279 and 559, symbols for 15, 30 and 60 kHz subcarrier spacing, respectively and its duration in time is less than the corresponding configured ue-Period. |
| Sony | On the description of UE Offset, I think Moderator’s original description is fine. I also agree with the Moderator that typically the word “between” goes with “and” rather than “to”. We cannot find v004 of the Excel spreadsheet, at least at this point, the latest version is v003, which seems to have taken the corrections highlighted above into account. |
| Huawei, HiSilicon | Many thanks to Moderator for providing the list of RRC parameters.The latest updates in v003 have already addressed our main comments and we also think that Moderator’s description of the ue-Offset parameter is accurate. Some further comments though:* For the description of the semiStraticChannelAccessConfig-r17, shouldn’t we capture the other constraints in the following agreement from RAN1#103-e?

Agreements:* In semi-static channel access mode, a single FFP (periodicity and offset) is associated to an initiating device (gNB or UE) at a given time which can be used for the purpose of channel occupancy. The FFP configuration that is used for initiating channel occupancy purposes, is such that it shall not be changed for at least 200ms

 * Editorial in the description of ue-Period: “Otherwise, ue-Period shall be configured with a value that is the same as, ~~or~~ integer multiple of, or inter factor of the value configured for period in SemiStaticChannelAccessConfig-r16.”

 * After correcting the value range for the ue-Offset, we think that comment “1120 is the maximum number of symbols in two radio frames with 60 kHz subcarrier spacing.” becomes irrelevant
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| Moderator | Sorry for creating confusing. Latest version was indeed “v003”. I made a mistake in the email I sent out. Thanks for pointing that out **Shin and Mohammed**!**@HW/HiSi:** Thanks for the comments.* 1) I thought about the highlighted condition as well. At least it appeared to me that RAN2 has to take care of that since the restriction also involves the time when UE receives reconfigurations. I also thought maybe it could be left to gNB implementation. The reason is that the same condition is applied for gNB FFP and in Rel-16, there is no mention of that in spec to my knowledge which means gNB has to respect it. One can argue that could be the same. I suggest we all give it some thought and also discuss with our RAN2 colleagues to figure out by next meeting how to capture it. I hope that sounds reasonable.
* 2) Editorial: Thanks. I will add “as”, but keep “or”, for the reason that although more accurate in English to remove “or”, but when it comes to spec/agreements, any such changes may create more confusion.
* 3) On 1120: Indeed. I remove in v004.

**@All:** Please find xls v004 where ue-Offset description is updated by adopting last two comments from HW (see above). |
| Huawei, HiSilicon 2 | Thanks to Moderator for addressing our earlier comments.On capturing the highlighted conditions for FFP configuration in the agreement from RAN1#103-e, we understand that the group agreed to extend these conditions to apply as well to the gNB FFP configuration in Rel-16 for which we did not have such an agreement before. So, we understand that the intention was to capture such conditions somehow in the spec.For now, we suggest to add the agreement from RAN1#103-e in the comments column P to make RAN2 mindful of RAN1’s decision. Nevertheless, we would like to kindly remind the group that these agreed timing conditions are more concerned with the actual use of the FFP configuration to initiate a CO rather than the time when UE receives reconfigurations, which meanwhile appears to be something to capture in RAN1 channel access procedures. Agreements:* In semi-static channel access mode, a single FFP (periodicity and offset) is associated to an initiating device (gNB or UE) at a given time which can be used for the purpose of channel occupancy. The FFP configuration that is used for initiating channel occupancy purposes, is such that it shall not be changed for at least 200ms

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| Moderator | **@HW/HiSi:** I add the agreement to the comment. Yes, the timing is for the actual usage. This was clarified during the GTW when the agreement was made (hence using text such as “is used for initiating…”. The comment for reconfiguration was related to the fact that now we can configure UE only with one UE-FFP at a time which was not the understanding at the beginning when this agreement was made. Hence, to change the period of the UE FFP for initiating a CO, a new configuration is needed to be provided first, and when it is provided the time between changing the UE FFP period at use, should be at least 200ms. **@All:** The agreement cited above is added in the column in Excel spreadsheet v005. |
| CATT | Thanks so much to Moderator for providing the list of RRC parameters on NR-U of Rel-17 URLLC.I want to clarify whether period and offset on UE-FFP is configured per cell or per UE in “M column” in Excel spreadsheet v005?Based on our agreement in RAN1#104bis-e as below, in our understanding, these two parameters can be configured per UE because UE is already in connection mode, * Support explicit RRC configuration for the UE-FFP parameters including period and offset in RRC connected mode.
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| Moderator | **@CATT:** Thanks for the question. The parameters are UE-specific and provided when UE is in connected mode, but configuration is per cell based on the following agreement. Please let me know if that is still unclear.Agreements:* The gNB configures a UE to initiate semi-static CO in an unlicensed channel(s) only if the gNB configures the UE also with the higher layer parameters of the gNB’s initiating semi-static CO in the same channel(s).
	+ Note: UE initiated FBE configuration is configured per serving cell
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1. Intra-UE multiplexing & priorization enh. (AI 8.3.3)

VOID

1. Propagation delay compensation (AI 8.3.4)

VOID